Jan. 6, 1925. 1,522,395

W. M. THOMAS

MOVING PICTURE INSTRUMENT

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Fig. 1.

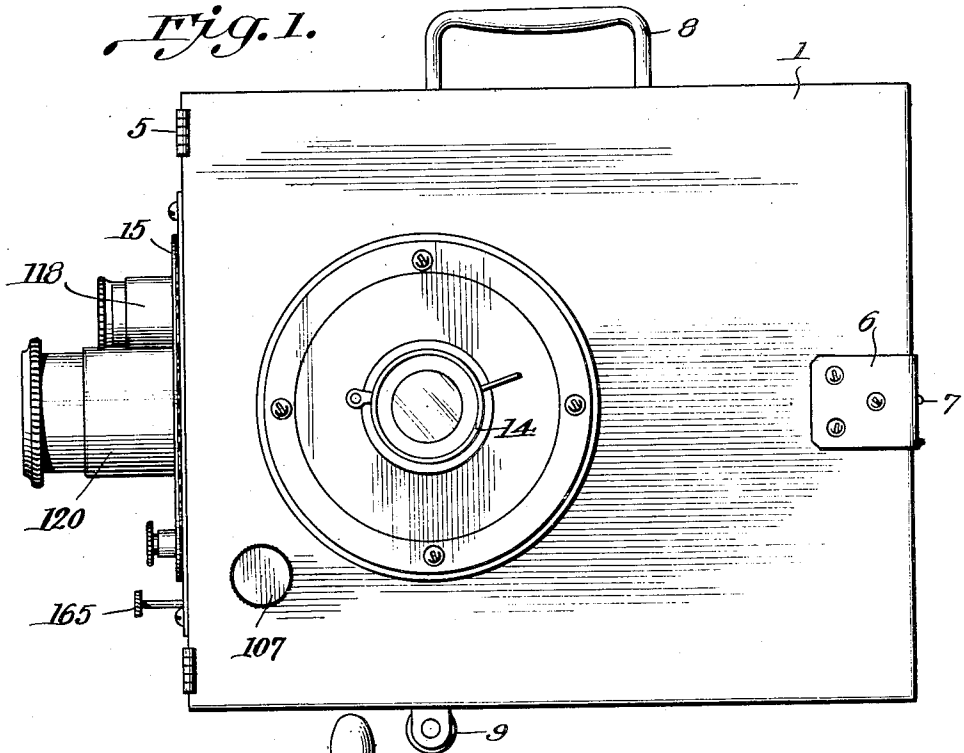
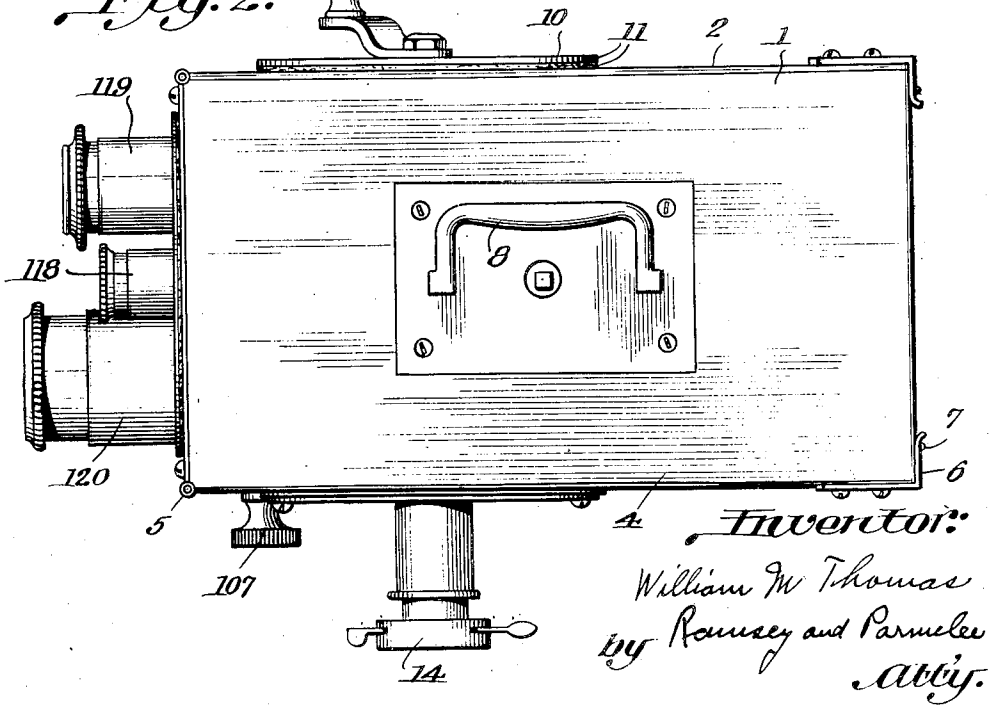


Fig. 2.



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Fig. 3.

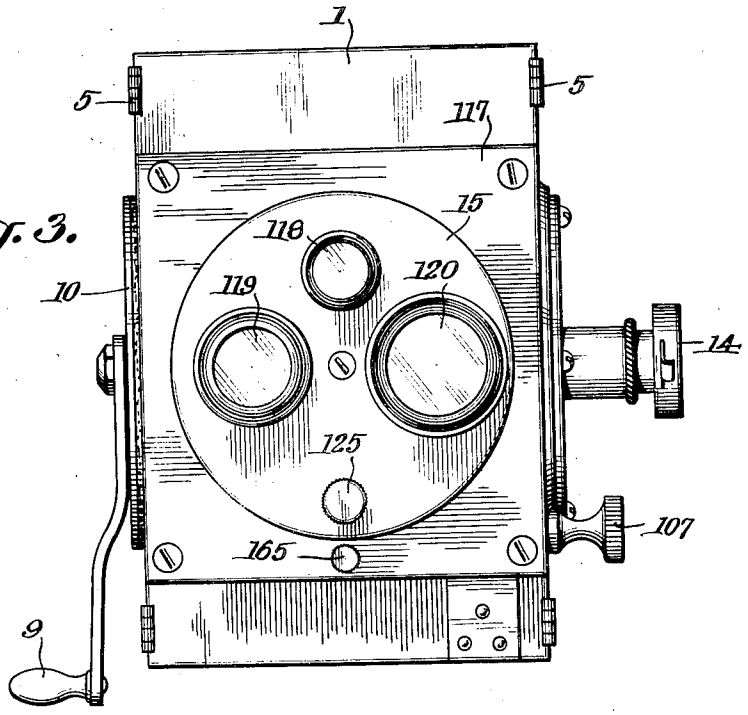
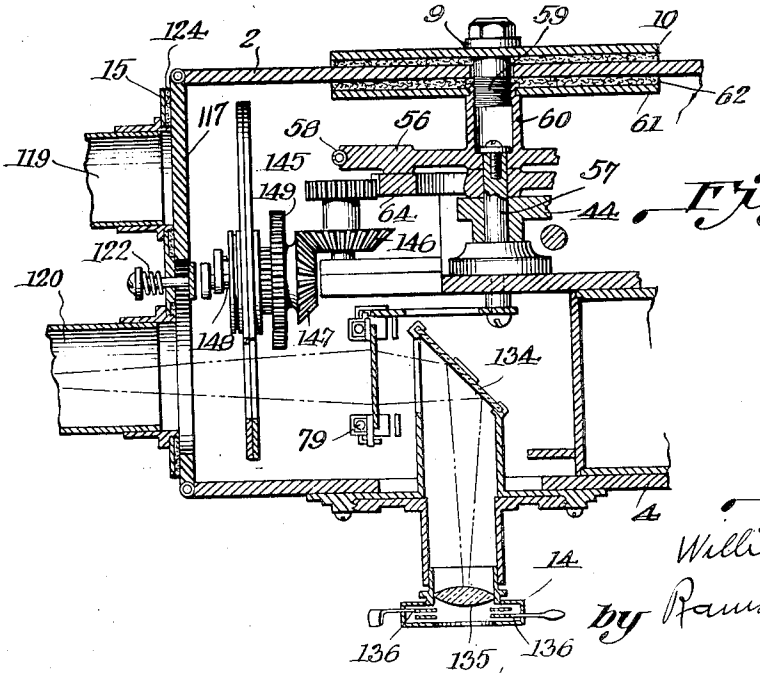


Fig. 12.



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W. M. THOMAS

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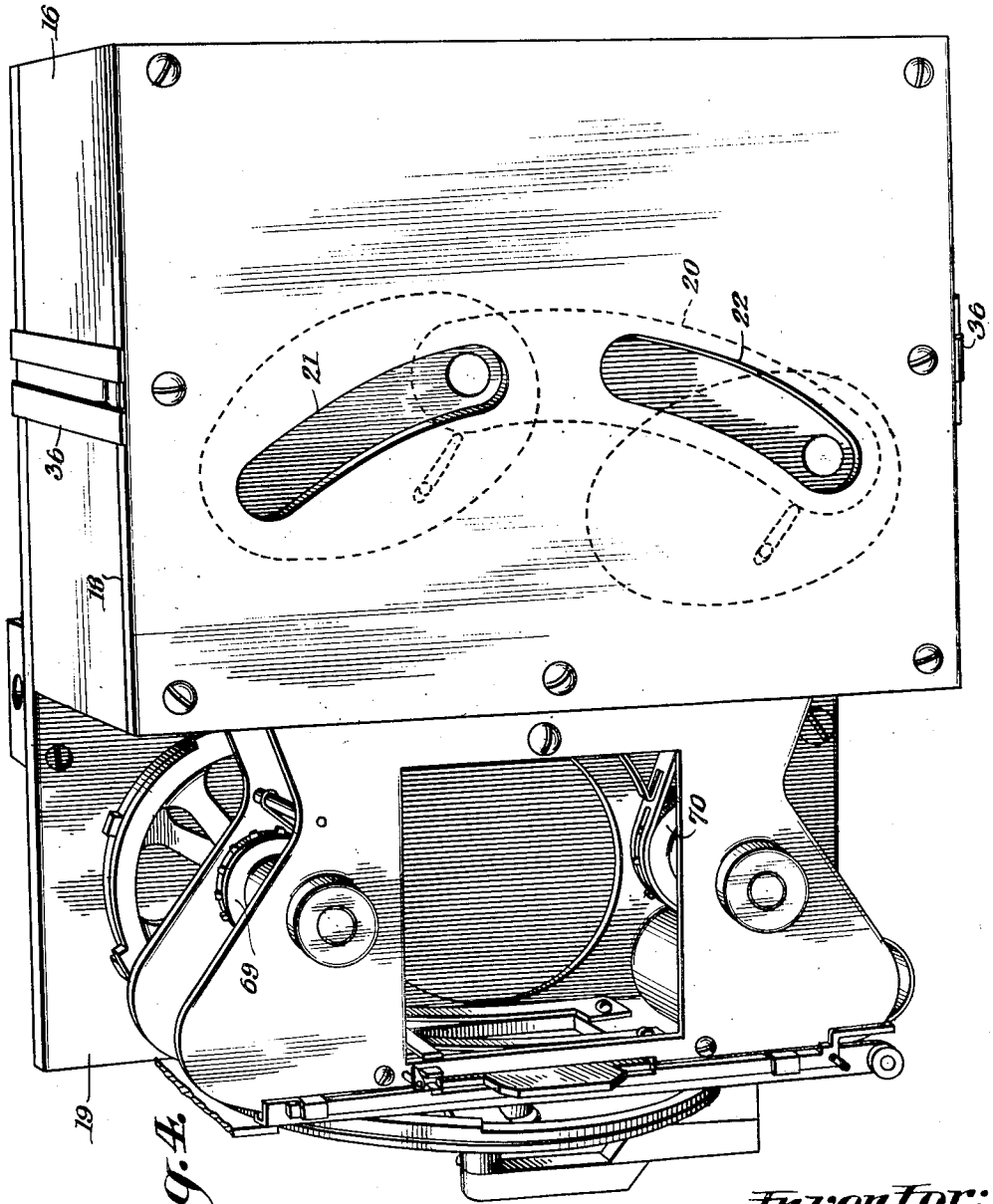


Fig. 4.

Inventor:
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Fig. 5.

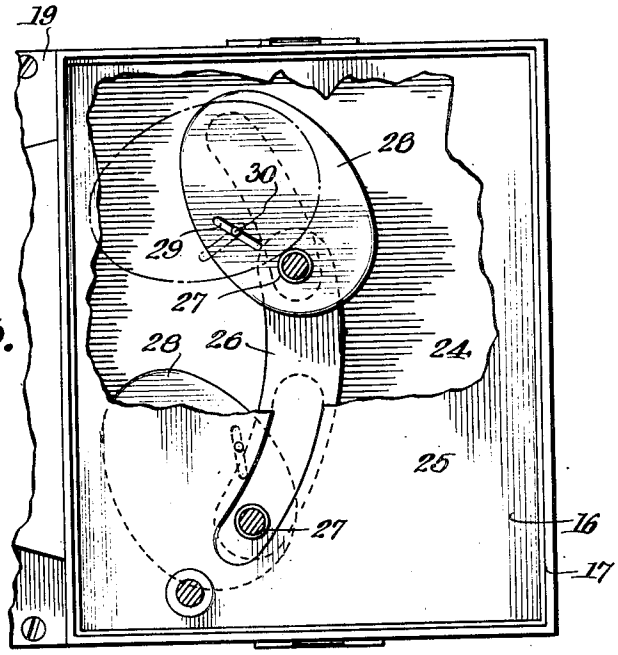
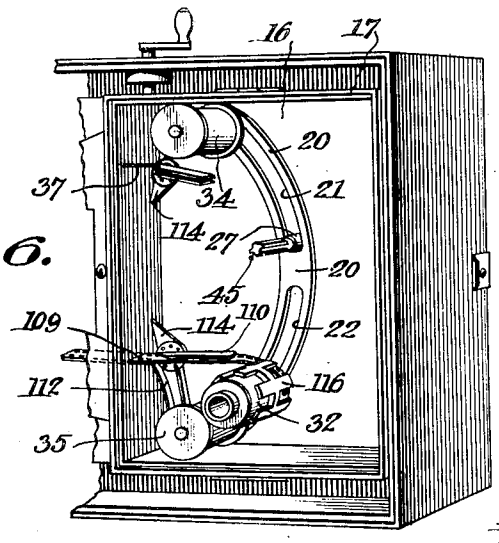


Fig. 6.



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Atty.

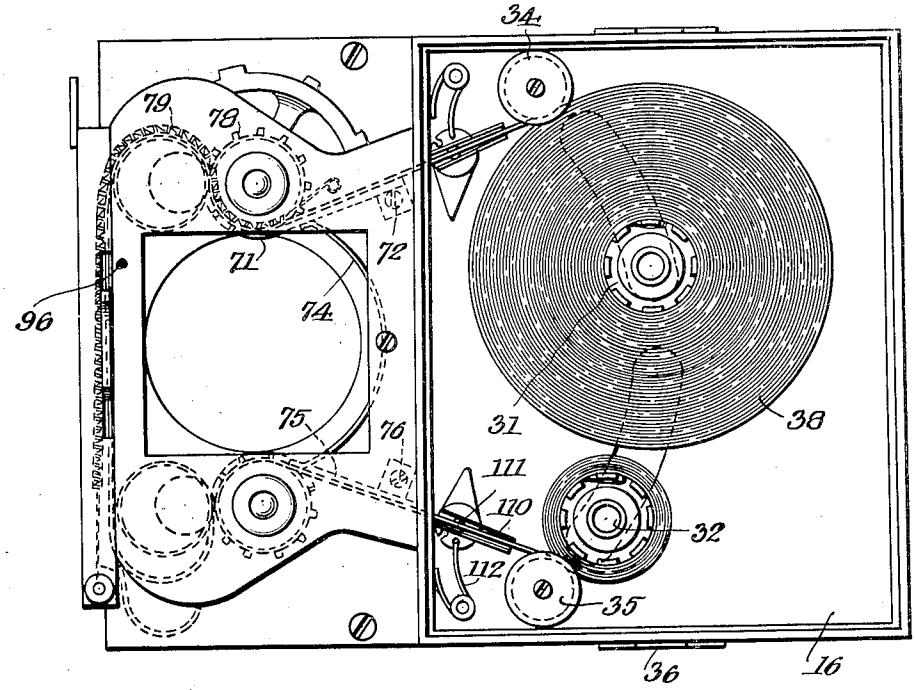
Jan. 6, 1925. 1,522,395

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Fig. 8.



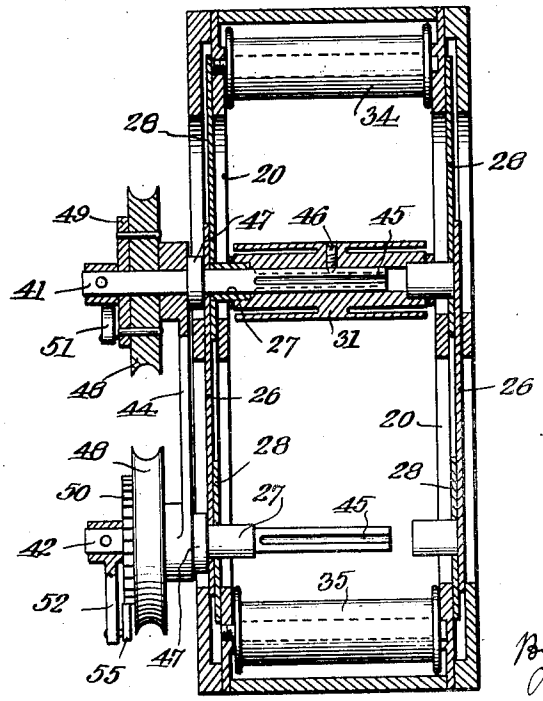


Fig. 7.

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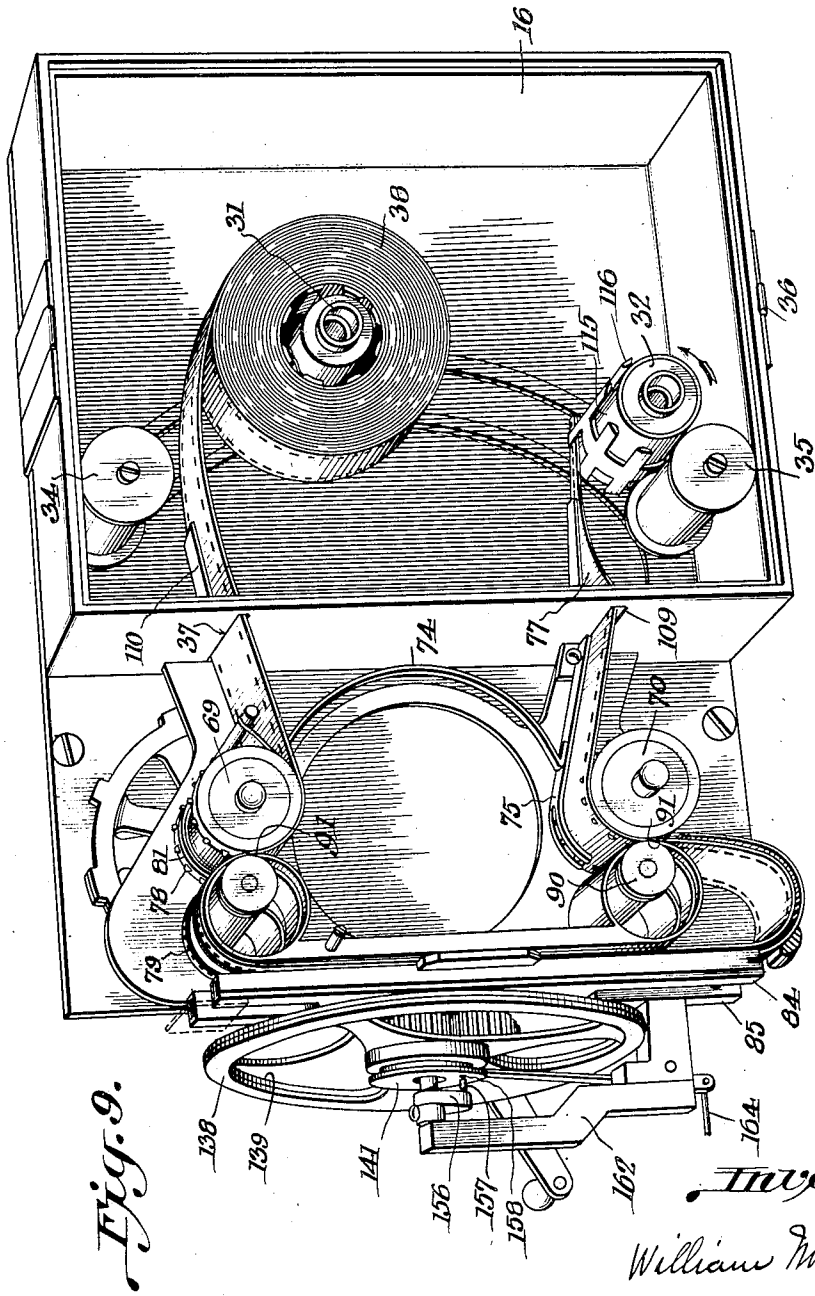


Fig. 9.

Inventor:
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W. M. THOMAS

MOVING PICTURE INSTRUMENT

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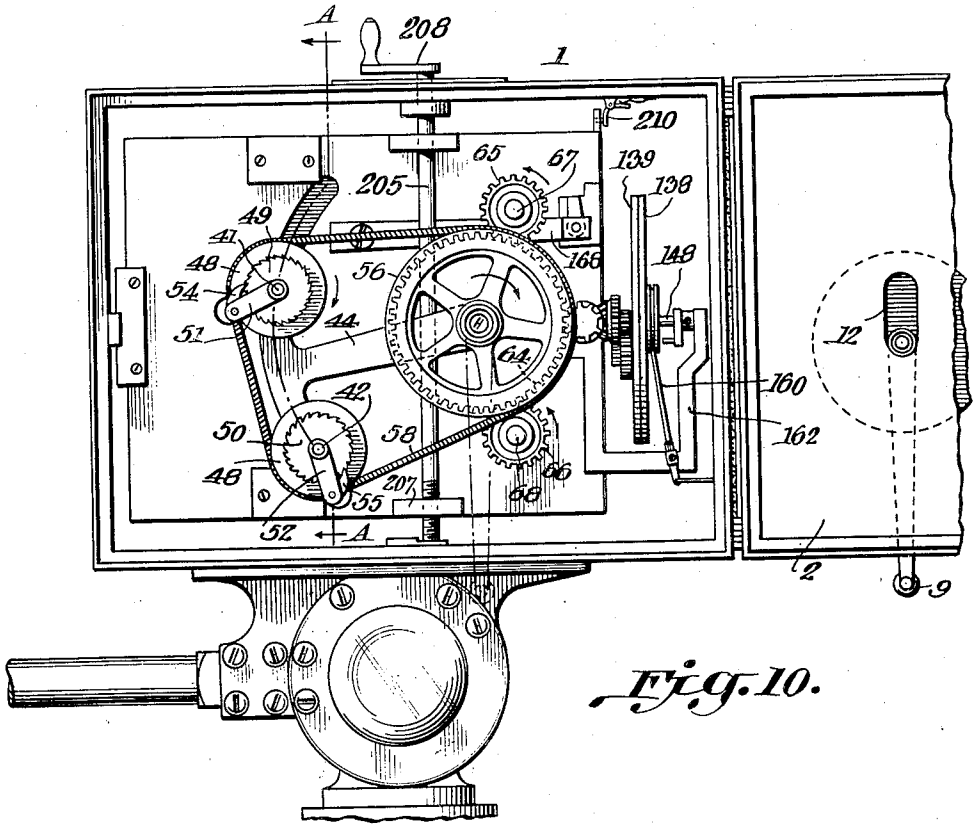
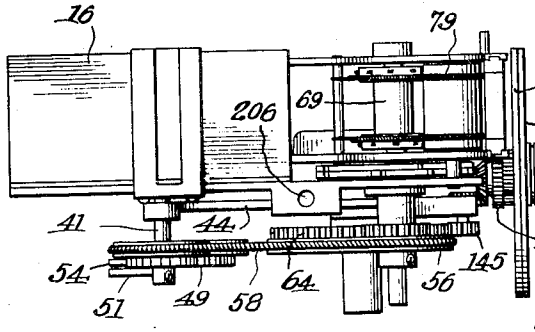


Fig. 10.

Fig. 11.



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Fig. 13.

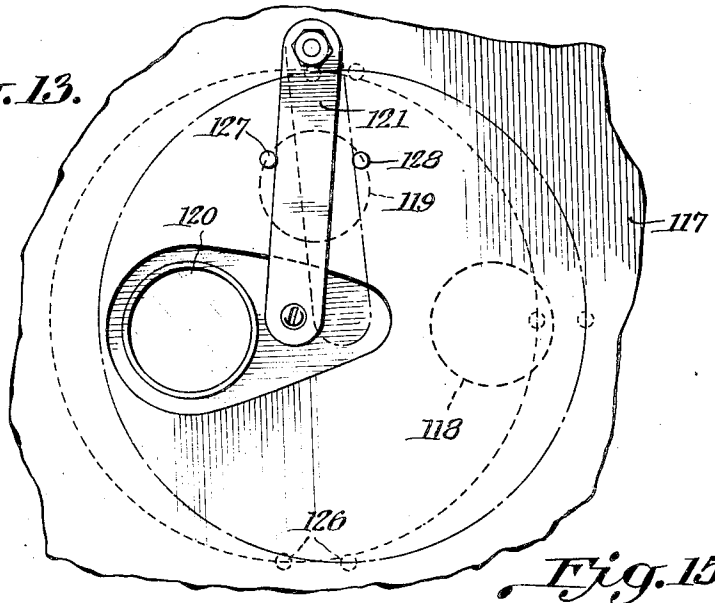
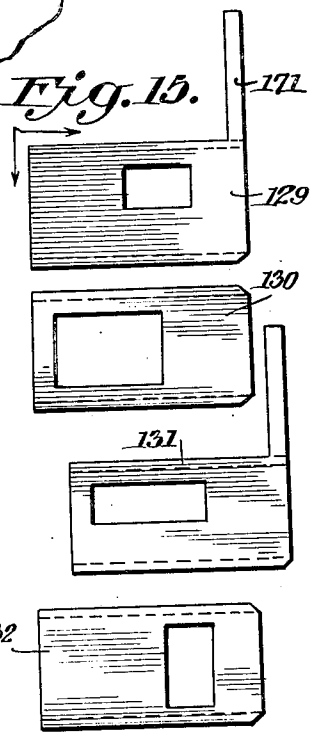


Fig. 15.



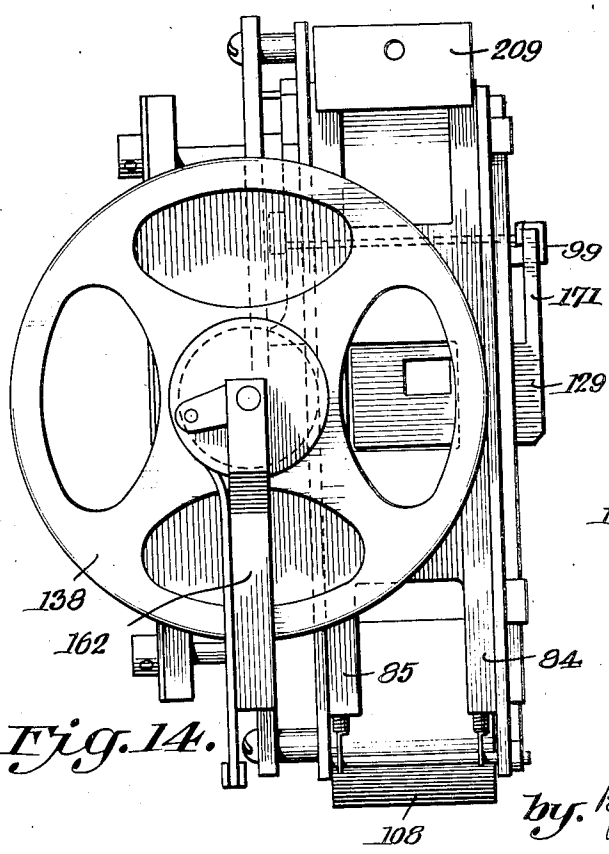


Fig. 14.

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Jan. 6, 1925.

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MOVING PICTURE INSTRUMENT

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Fig. 16.

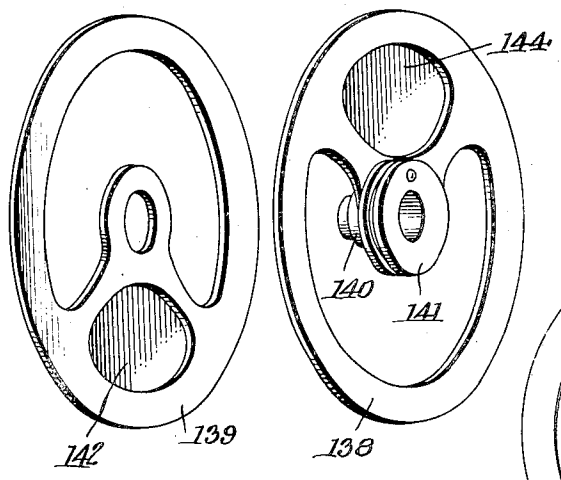


Fig. 17.

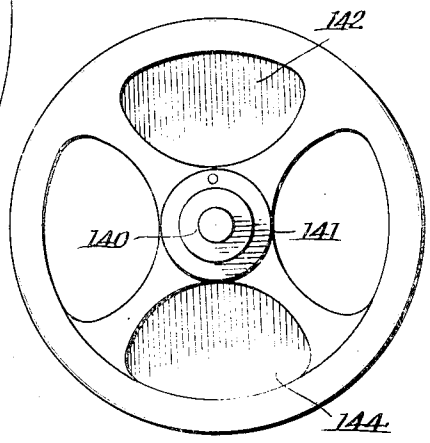
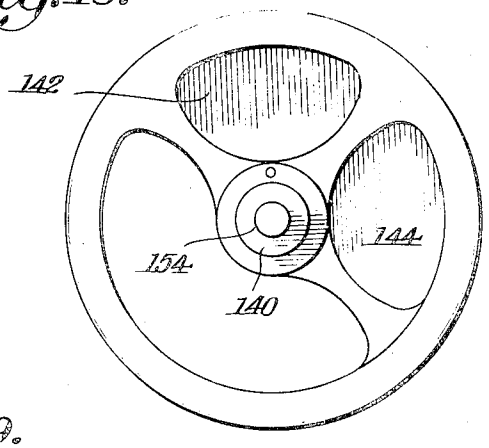


Fig. 18.



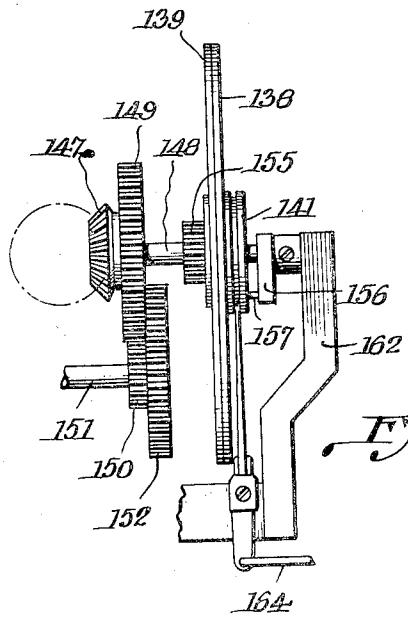


Fig. 19.

Inventor:
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MOVING PICTURE INSTRUMENT

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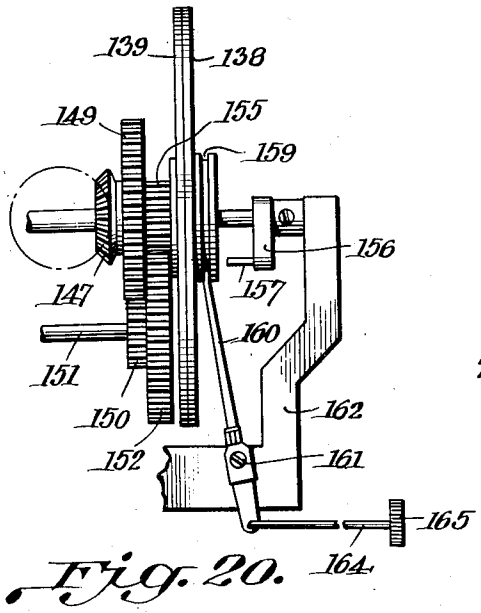


Fig. 20.

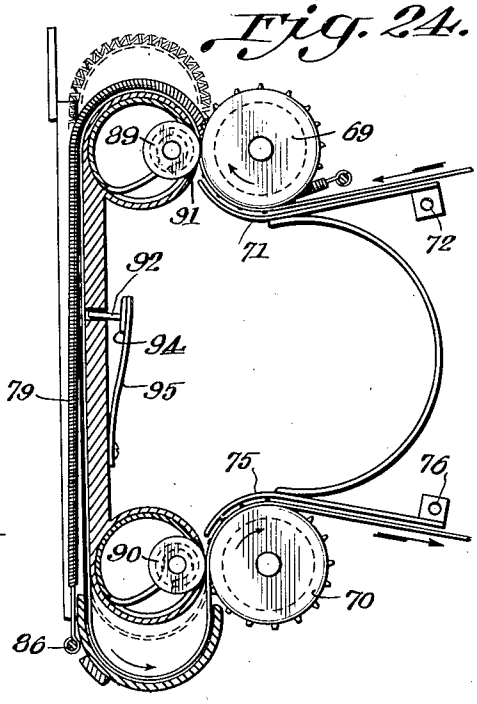


Fig. 24.

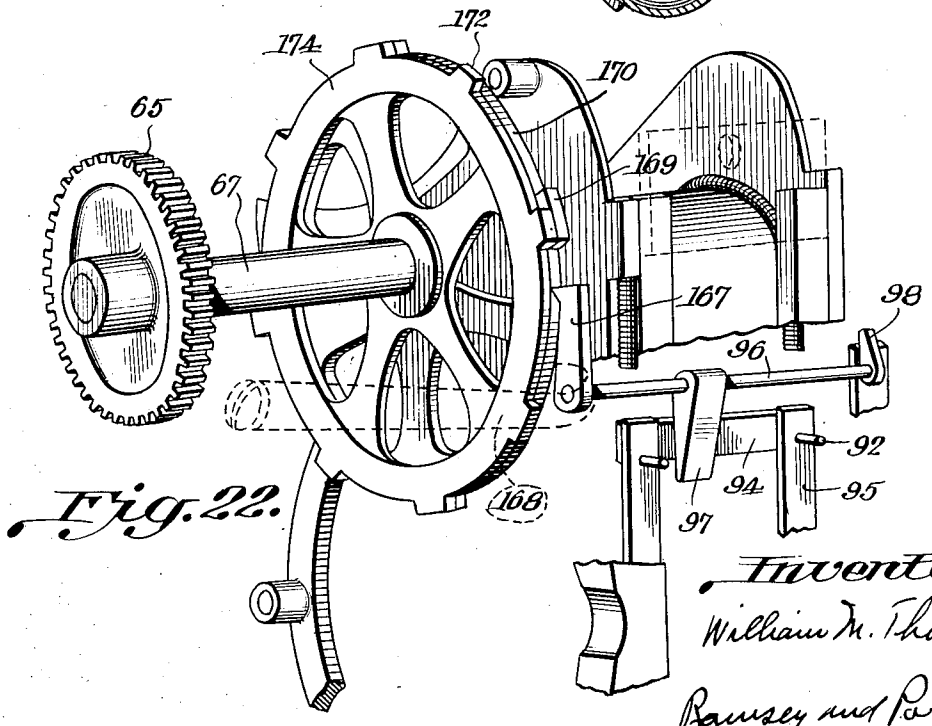


Fig. 22.

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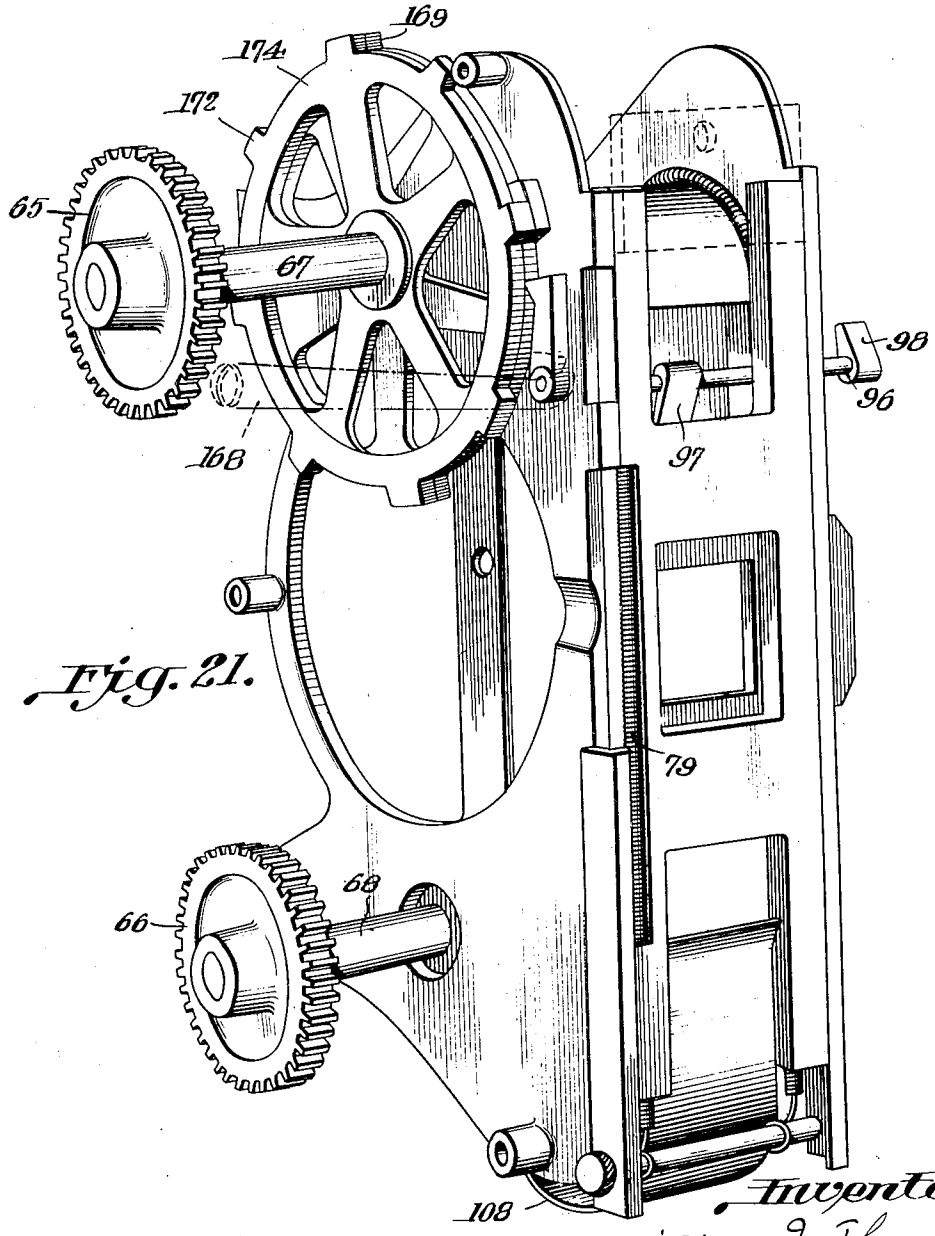


Fig. 21.

Inventor:
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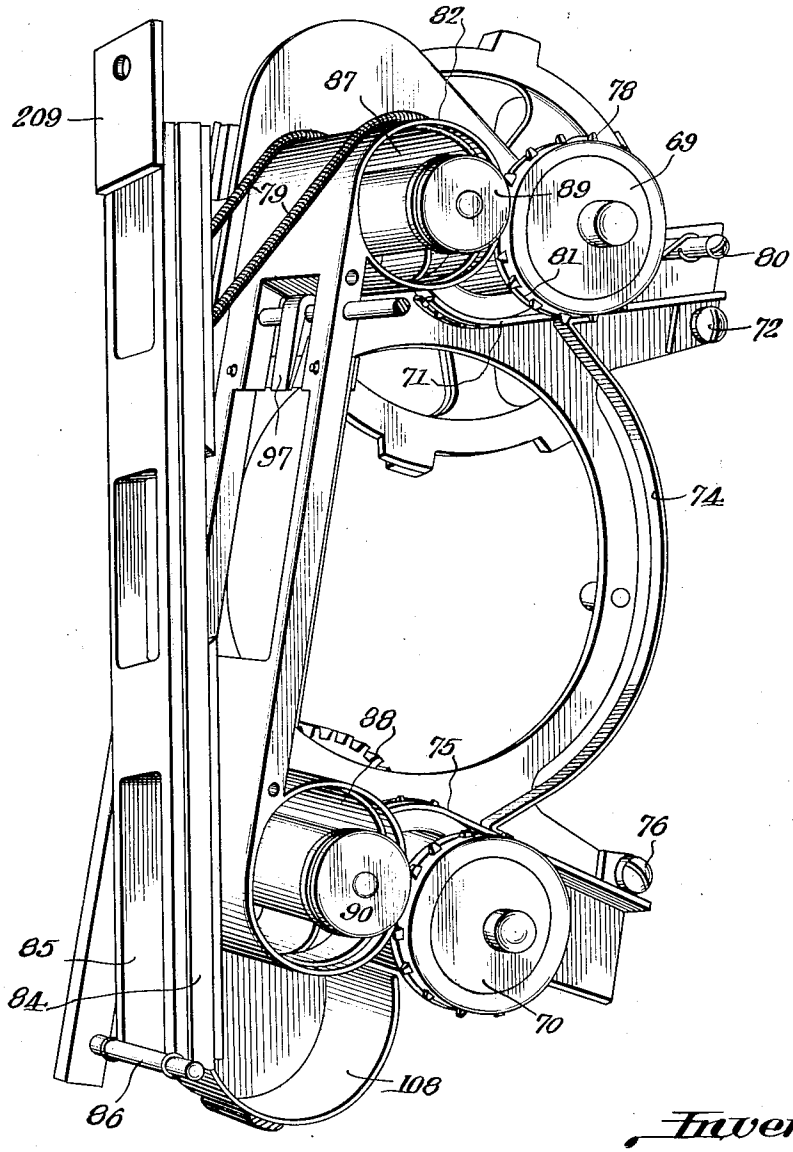
Jan. 6, 1925. 1,522,395

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Fig. 23.



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Jan. 6, 1925. 1,522,395

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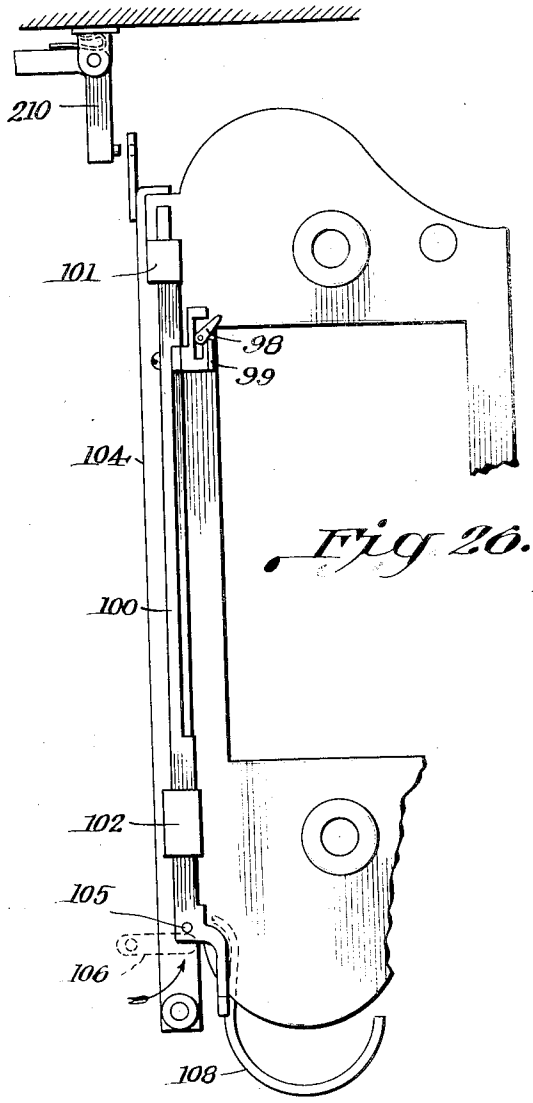


Fig. 26.

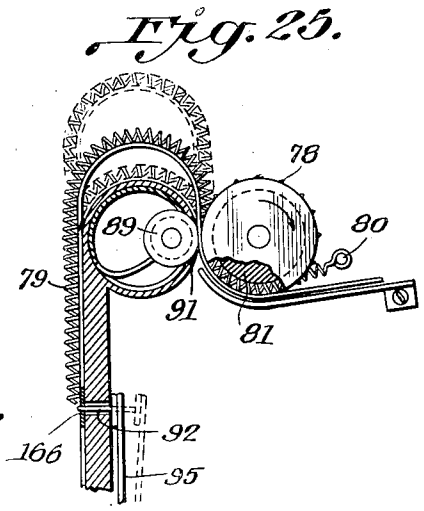


Fig. 25.

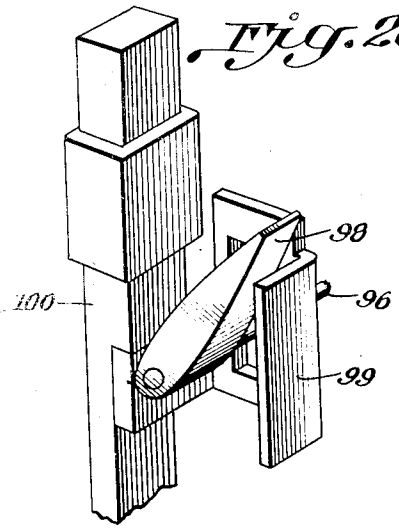


Fig. 28.

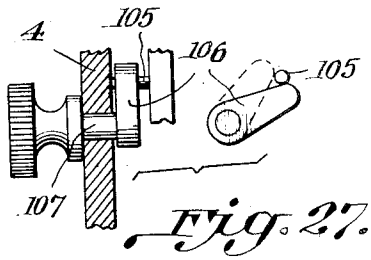


Fig. 27.

Inventor:
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Jan. 6, 1925.

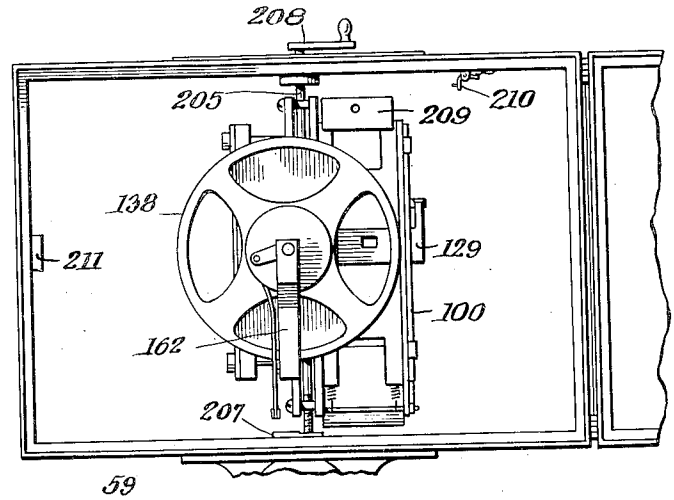
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Fig. 30.



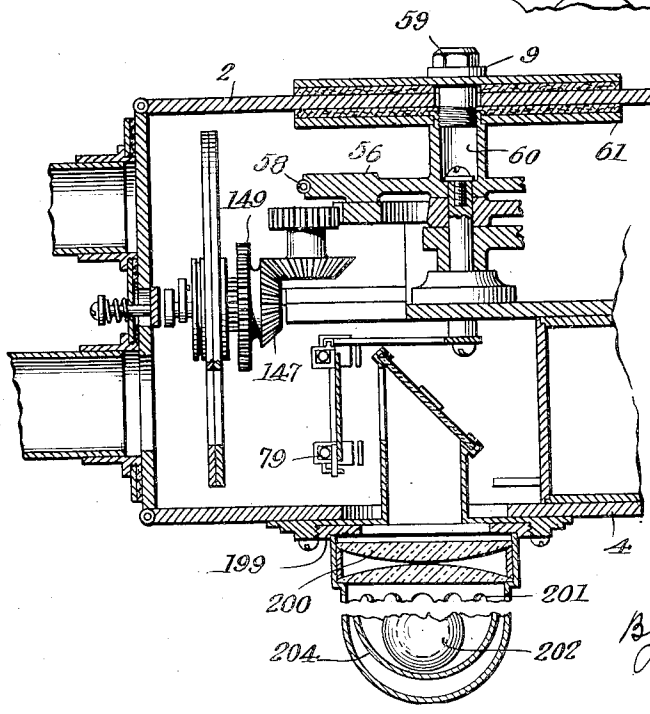


Fig. 29.

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Patented Jan. 6, 1925. 1,522,395

UNITED STATES PATENT OFFICE.

WILLIAM M. THOMAS, OF LOS ANGELES, CALIFORNIA, ASSIGNOR TO THOMAS-OBER-KIRCH COMPANY, LIMITED, A CORPORATION OF NEW YORK.

MOVING-PICTURE INSTRUMENT.

Application filed February 6, 1917, Serial No. 146,916. Renewed July 29, 1922. Serial No. 578,509.

To all whom it may concern:

Be it known that I, WILLIAM M. THOMAS, a citizen of the United States, and a resident of the city of Los Angeles, in the county of Los Angeles, State of California, and whose post-office address is 5246 Lexington Ave., Los Angeles, California, have invented certain new and useful Improvements in Moving-Picture Instruments, of which the following is a specification.

This invention relates to the art of photography and more particularly to means and mechanisms for taking and exhibiting motion pictures.

The invention further includes film moving devices co-operating with lens mounts whereby the lens best suited for taking pictures of a predetermined size series may be properly positioned to produce an image on the film when the device is used as a camera and to be subsequently replaced by suitable lens best adapted to project a particular size series of pictures when the device is being used as a projector.

The invention further includes framing mechanism comprising the mounting of a feeding mechanism upon a support whereby the support may be raised or lowered relatively to the casing carrying the lens and the picture aperture so that in projecting, the pictures may be suitably positioned to cause registry of the pictures and the lens aperture.

The invention also contemplates the mounting of the mechanism in a casing provided with doors adapted to open full upon each side of the casing, and wherein the mechanism is supported in the casing in such manner that the mechanism may be turned upon a pivot relatively to said casing so that the parts may be manipulated or adjusted without interference of the said casing.

The foregoing objects have been delineated more particularly for the purpose of indicating broadly certain various phases of this invention and are not set forth nor intended to be understood as statements limiting the scope of this invention because I fully appreciate that the foregoing statements are inadequate to set forth all the objects of my invention.

Other and further objects of the present invention will in part be obvious and will in part be pointed out hereinafter in the specification following by reference to the accompanying drawings forming a part of this disclosure.

Throughout the drawings like characters will be used to represent like parts in the various figures thereof:

Figure 1 is a side view showing an end view of the finder.

Figure 2 is a plan view looking at the top of the instrument.

Figure 3 is a front view of the instrument.

Figure 4 is a perspective view showing the mechanism removed from the casing.

Figure 5 is a detail view illustrating the operation of the shutters in the sides of the film box.

Figure 6 shows the film box or receptacle with one side removed.

Figure 7 is a sectional view through the film box and driving mechanism taken on line A—A Figure 10.

Figure 8 is an elevational view with one side of the film receptacle removed and showing the displacement of the film spools during the winding and unwinding of the film.

Figure 9 is a perspective view showing the manner of threading the film through the instrument.

Figure 10 is an elevational view showing the driving mechanism and also illustrating the manner of supporting the mechanism within the outer casing.

Figure 11 is a top plan view of the instrument with the outer casing removed.

Figure 12 is a detail sectional view showing the optical principles of the machine and mechanisms for driving the shutter.

Figure 13 illustrates the mechanism for mounting the lens turret to enable the turret to have both a rotary and a sidewise movement.

Figure 14 is a front view showing the relationship of the aperture plates and the rotary shutter.

Figure 15 illustrates the plurality of aperture plates.

Figure 16 is a detail perspective view of the shutter blades.

Figure 17 shows the shutter blades arranged for a single light aperture.

Figure 18 shows the shutter blades arranged for a double light aperture.

Figure 19 shows the shutter in the position to be driven at slow speed relative to the drive mechanism.

Figure 20 shows the shutter moved to position to be driven at high speed relative to the drive mechanism.

Figure 21 is a detail view illustrating a portion of the film feeding mechanism.

Figure 22 is a view similar to Figure 21 with portions broken away to illustrate details of the feed control.

Figure 23 is a perspective view illustrating the mechanism disassembled to further show the film feed mechanisms.

Figure 24 is a diagrammatic sectional view showing the operation of the film feeding devices.

Figure 25 is a detail view illustrating the storing of energy in the film prior to the intermittent feed thereof.

Figure 26 shows the feed mechanism control whereby the intermittent feed mechanism may be rendered inoperative to introduce a film or to run the film backwards for any desired reason.

Figure 27 is a detail view of the button carried in the casing door for operating the film control mechanism in Figure 26.

Figure 28 is a detail view of the film feed control shown in Figure 26.

Figure 29 shows the view finder removed and an electric lamp placed in position to adapt the instrument for projecting.

Figure 30 illustrates the construction whereby the mechanism may be swung relatively to the casing for adjustment, repairs, etc.

General structure.

Heretofore in the moving picture art it has been customary to provide large heavy cameras and very large heavy projecting mechanism for commercial work, since prior to my invention all intermittent film feeding mechanisms comprised intermittently moving metal parts of relatively large mass to engage and move the film periodically. Since these intermittent movements necessarily take place in very short intervals of time considerable vibration is produced by the operation of such machines. In order to simulate perfect registration of the image, either in taking or projecting the picture, rigidity of parts and absence of vibration is substantially essential, and it was found that large weighty masses both in the camera and in the projector tended to absorb these undesirable vibrations, consequently weight, or mass, was considered an essential element.

My invention includes an instrument wherein reciprocating or intermittently moving masses are reduced to a minimum thereby reducing the attendant vibration. In view of this fact mass, for the purpose of producing weight to absorb vibration, is not a primary element of my construction. By the elimination of this factor I am enabled to reduce the size of parts and by providing novel constructions, which will hereinafter be described in detail, I have produced a moving picture instrument of extremely small size. An instrument that will take a great number of small sized pictures (quarter or half size) on a given length of film is very desirable but it frequently becomes necessary while taking a series of relatively small pictures to take full sized pictures of important subjects or occurrences. My invention provides the foregoing desiderata by providing a film feed which is primarily dependent upon a locking and unlocking of the effective portion of the film. Heretofore in the art it has been necessary to provide independent mechanisms for each different length film feed, hence it was not found expedient to construct one member capable of feed modification to take both large size and small size series pictures, since no successful universal film feed has hitherto been developed, therefore, it has not been possible heretofore to take or project varying sized picture series with a single film feed. The instant this portion of the film is stopped, during the operation of my machine, supply of film length for the next picture length begins to change from a latent condition to a potential condition, whereby the instant the locked portion is released, the potential length accumulated during the stoppage is freed and moves forward. Therefore assuming the mechanism to be constructed so that the rate of accumulation is constant, during operation, the amount of film feed, or in other words, the picture length is entirely dependent upon the interval between the locking and releasing of the active portion of the film. The mechanism of my device provides for varying this interval to correspond to different predetermined picture lengths. This enables me to take varying size pictures with substantially the same feeding mechanism wherein only the operating interval is varied.

Heretofore in the art it has not been found expedient to use rotating shutters between the lens and the film, since heretofore the relationship of time required for film

movements and the period of blanketing by a shutter have been such that the shutter must necessarily be of a size too large to be enclosed within the limits provided in the camera casing. Because of the extreme rapidity of film movement to provide picture lengths and the relatively long period of rest in the construction comprising my invention I am enabled to successfully use a rotary shutter of such size as to be conveniently mounted within a camera casing without substantially increasing the width of the casing beyond that required for the film and operating mechanism. This use of a rotary shutter further obviates vibration.

Referring more particularly to Figures 1, 2 and 3 it will be noted that the instrument is mounted within an outer casing 1 which preferably is metallic and suitably covered with leather or other material as is common in the art. Doors 2 and 4 are provided to facilitate inspection and adjustment of the mechanism and preferably are hinged at the front of the casing, as at 5, and are provided with spring latches 6 that clip over pins 7 carried on the rear outer casing. Preferably the top of the casing is provided with a folding handle 8. The door 2 carries the operating crank handle 9 which is mounted upon a metal disk 10 that is provided with a felt pad 11 to constitute a light tight joint where the handle extends through a slot 12 in the door 2 (see Fig. 10). The door 4 carries a view finder 14, which may be removed and a suitable lamp substituted therefor, to enable the instrument to be used for a projector, as will hereinafter be described. The front of the instrument is provided with a lens turret 15 on which is mounted a plurality of lenses of different sizes and character.

Film receptacle.

Taking up the specific construction of the instrument the film receptacle will be described first, since this portion of the mechanism carries the supply of material being operated upon, namely, the film, and particular reference will be made to Figures 4, 5, 6 and 7. The film receptacle comprises a light tight metallic box 16 having shouldered or beaded edges 17 in the front thereof to receive a suitable side plate 18 which is provided with ribs adapted to be seated in the edge beads to form a light tight joint. The back 19 as well as the side plate is provided with a meniscus shaped plate 20. Curved openings 21 and 22 are provided on the meniscus plate and in the side walls of the back and side plate. Since the construction of the back and side plate is the same, only the back is illustrated (see Fig. 5). Both the back and front plates are provided with double walls 24 and 25. Thin metal shutter plates 26 of meniscus form carry short tubes 27 upon which are mounted oval shaped thin plates 28. These plates are each provided with slots 29 that cooperate with guide pins 30. The thin metal plates 26 and the oval plates 28 are mounted between the walls 24 and 25, and constitute shutters which at all times close the openings 21 and 22. The tubes 27 extend inwardly both from the side plate and the back 19 and constitute movable supports which carry the film spools 31 and 32 (see Fig. 7), with the ends of these spools in contact with or guided by the meniscus shaped plates 20. It will be noted that the foregoing described structure permits the spools to have a movement within the film box, the direction and limit of which movement is determined by the tubes 27 being guided in the openings 21 and 22. A pair of guide spools 34 and 35 are mounted upon fixed axes adjacent the upper and lower limits of the movement of the film spools and are adapted to support and guide the film being wound or unwound from the film spools. It will be noted that the weight of the film brings the lower coil thereof against the guide spool 35 and as this lower coil gradually increases as the film is being wound thereon the center or axis of the lower spool gradually moves upward, thereby lifting the thin metal plates 26 through the short tubes 27 and consequently lifting the upper spool and coil so that the winding and unwinding of the coils automatically controls the displacement of the spools within the receptacle, thereby enabling a relatively small sized container to carry a relatively large amount of film. The side plates 18 may be held in position by suitable catches 36 so that when a roll of film on a suitable spool is positioned on one of the tubes 27 and the end of the film led through a slot 37 in the front of the box 16 and the cover placed in position to bring the co-operating tube 27 within the end of the spool, the film receptacle is loaded and ready to be placed within the instrument. Since the parts are entirely symmetrical it is immaterial which pair of tubes carries the full supply of film since the driving mechanism which passes through the tube and co-operates with the spools, is adaptable to co-operate with either side of the film receptacle, as will hereinafter be described.

Threading and winding mechanism.

The threading and winding mechanism is disclosed more particularly in Figures 6 to 11 inclusive, and this mechanism will now be specifically taken up for description. After the film 38 is placed in the film receptacle 16 and the receptacle closed with one end of the film extending through the

slot 37, the film receptacle is adapted to be positioned on the main frame plate 39 by sliding the catch springs 36 between the guide plates 40 which are carried by and extend outwardly from the main frame plate 39. The driving shafts 41 and 42 are carried by the pivoted frame 44 (Figs. 7, 10 and 11) and extend through the tubes 27 into the film spools 31 and 32. The inner ends of the driving shafts 41 and 42 are provided with slots 45 which are constructed to receive the conical ends of screws 46 mounted in the film spools 31 and 32 so that a rotation of the driving shafts drives and rotates the film spools. The driving shafts carry collars 47 on one side of the pivoted frame 44, and grooved driving wheels 48 on the other side of the said pivoted frame. It is to be noted that the grooved driving wheels are mounted to rotate freely upon the driving shafts and that these driving wheels carry integrally or fixedly attached ratchet wheels 49 and 50. It is to be noted that the teeth of the ratchet wheel 49 are inclined in one direction, whereas the teeth of the ratchet wheel 50 are inclined in the opposite direction. The outer ends of the driving shafts 41 and 42 carry short crank arms 51 and 52 that are riveted or otherwise fixedly secured to the driving shafts. The outer ends of these crank arms are provided with pivoted spring pressed pawls 54 and 55 that are in constant engagement with the ratchet wheels 49 and 50. A main driving wheel 56 is mounted upon the stub shaft 57 (Fig. 12) around which the pivoted frame oscillates. The main driving wheel 56 is likewise a grooved wheel, and a continuous flexible or spring belt 58 operatively connects both of the driving wheels 48 with the main driving wheel 56 and constitutes a friction driving mechanism between the parts. As shown in Fig. 12 the operating handle is provided with a screw threaded extension 59 which screws into an extension 60 on the main driving wheel 56 whereby rotation of the driving crank is transmitted to the main driving wheel. A suitable metal disk 61 and felt pad 62 are provided on the inside of the door 2 to provide a light tight joint where the operating handle extension passes through the door. It will be noted by reference to Fig. 10 that when the operating handle is rotated in a clockwise direction the main driving wheel 56 and the wheels 48 will correspondingly be driven in a clockwise direction, so that the ratchet wheel 49 will be rotated beneath the spring pressed pawl 54, consequently the driving shaft 41 is not driven and may remain idle. Conversely, however, the ratchet wheel 50 will be driven against the operative face of the spring pressed dog 55 thereby rotating the lower driving shaft 42. The main driving wheel 56 carries on its under side a main drive cog wheel 64 (Figs. 10, 11 and 12) which meshes with cogs 65 and 66 that are mounted upon the shafts 67 and 68 upon which the film feeding sprocket wheels 69 and 70 are fixedly secured, so that a rotative movement of the main drive cog wheel in a clockwise direction rotates the film feeding sprocket wheels in an anti-clockwise direction.

After the film receptacle is suitably positioned upon the main frame plate 39 with driving shafts properly positioned in the film supporting spools, the leading end of the film is started in over the upper film guide arm 71 (Figs. 8, 9, 23 and 24) which is preferably pivoted, as at 72, and is spring pressed against one edge of the upper film feeding sprocket wheel 69 by means of the leaf spring 74 which extends between the upper film guide arm 71 and the lower film guide arm 75, that is similarly pivoted, as at 76. It is to be noted (Fig. 9) that the forward end, in fact both ends, of the film is cut to provide a long leading edge, as at 77. After the leading edge of the film is started, as above specified, the arm 71 guides the leading edge directly into the zone of the sprocket teeth 78 on the film feeding sprocket wheel 69 so that if the crank handle 9 is being turned in a clockwise direction the sprocket wheel will engage the perforations in the film and thereby continue the feed of the film. Film energizing springs 79 (Fig. 23) are anchored at one end to the post 80 and pass beneath the sprocket wheel 69 through suitable grooves 81 in the said sprocket wheel, then upwardly over and in contact with the main film guide 82 and downwardly through hollow posts 84 and 85 where the lower ends of the springs are anchored to the crossbar 86. The main film guide 82 is provided on each end with circular openings 87 and 88 in which are positioned idler rolls 89 and 90 that are provided with grooves adapted to accommodate the sprocket teeth 78 on the sprocket wheels 69 and 70. These idler rolls are spring pressed through suitable openings 91 (Figs. 24 and 25) in the walls of the main film guide 82 adjacent the circular openings 87 and 88, to normally rest against the faces of the film feeding sprocket wheels 69 and 70. In view of the foregoing construction it will be noted that the leading edge of the film after coming into engagement with the teeth 78 will be carried between the sprocket wheel 69 and the idler wheel 89, and under the film energizing spring 79 which being lightly drawn over the upper end of the main film guide 82 continues to guide the film until the film reaches the vertical guide-way provided between the hollow posts 84 and 85 and the main film guide 82. When the machine is normally at rest a pair of holding

pins 92 are normally extended into this vertical film guide-way a sufficient distance to block the passage of the film by entering the perforations in the film, or in other words the pins extend entirely across the guideway. These pins are mounted upon a cross-bar 94 that is secured to the upper ends of leaf springs 95 which are fixedly mounted on the back of the main film guide 82 (Figs. 22 and 24). A control shaft 96 is rotatively and slidably mounted in the main film guide 82 and carries an arm 97 which extends downwardly and back of the cross-bar 94. One end of this shaft (Figs. 26 and 28) is provided with a short cam arm 98 which is in the path of a plate 99 carried by the slide post 100 which is suitably mounted in guides 101 and 102 that are carried by the side frame 104. The lower end of the slide post 100 is provided with an outstanding pin 105 which is normally in the path of an arm 106 carried on the thumb button shaft 107 which is supported in the door 4 (Fig. 27), so that when the thumb shaft is turned in one direction the arm 106 engages the pin to slide the post 100 upwardly whereas when the thumb shaft is turned in the other direction the arm 106 engages the pin 105 to move the post 100 in the opposite direction or downwardly. The lower end of the slide post 100 carries the loop forming trough 108 which is normally out of contact with the film when the instrument is in operation and the film is traveling through the various feeding devices. From the foregoing it will be noted that when the post 100 is slid upwardly the plate 99 contacts with the cam arm 98 to rotate the control shaft 96 in such manner that the arm 97 bearing against the cross-bar 94 moves the holding pins 92 to inoperative position (Figs. 23, 24 and 28). At the same time the loop forming trough will be raised adjacent the sprocket wheel 70. Further tracing the path of the film in its initial or threading movement it will be noted that since the pins 92 are withdrawn, there is no opposition to the continued travel of the film and the film travels downwardly until the leading edge engages the loop forming trough 108 which bends the film upwardly and leads the forward end of the film into engagement with the teeth 78 on the sprocket wheel 70, which carries the film upwardly and into engagement with the under side of the lower guide arm 75. The elasticity or resiliency of the film maintains it in contact with this guide arm, and as the guide arm terminates adjacent the slot 109 in the film receptacle, the film is automatically led through this slot 109 and into the lower pivoted trough 110 (Figs. 6, 8 and 9). This pivoted trough is mounted to rotate upon a screw 111 and is provided with a leaf spring 112 that normally maintains the stop 114 against the front wall of the film receptacle. This lower pivoted trough now directs the leading end of the film forward into the zone of rotation of the driven film spool 32, which it will be remembered is driven by the positively driven shaft 42. The film spools 31 and 32 are formed with a cylindrical body portion 115 which carries a grid comprising a plurality of fingers 116 that are preferably substantially parallel to the axis of the film spools that are spaced apart from the body portion of the spool. Since the spool 32 is rotating in an anti-clockwise direction or opposed to the direction of movement of the advancing edge of the film, it will be noted that when the film is directed beneath one of the fingers 116, and as the film spool turns, a loop is formed in the advancing end of the film so that the film is bent upon itself and thereby normally secured to this film spool. As the operating crank is rotated further, the film is now advanced continuously from the upper supply spool to the lower winding spool due to the positive drive of the film by the film feeding sprocket wheels 69 and 70. Any variation between the positive definite drive of the film by the sprocket wheels and winding of the film upon the film spools is accomodated by the flexible belt 58 slipping relatively to the drive wheels 48 and 56. From the foregoing description it is to be noted that after the film is once started into the instrument it is automatically threaded through and automatically connected with the receiving or winding film spool. As it will be hereinafter pointed out this instrument includes an operation wherein it is intended all the films shall be fed in one direction, thereby transferred from one film spool to the other, and the film receptacle is then intended to be removed and reversed top for bottom whereby the film may be again fed through as in the first instance. In view of this fact an upper pivoted trough is also provided, which trough is identical in construction with the trough 110, and which trough is in effect inoperative when it is adjacent the supply film spool. This trough becomes the lower trough when the film receptacle is inverted and replaced. The operations of re-threading are the same as when the film is originally started through in the first instance.

The optical mechanism.

Since this instrument is capable of several classes of work, the next step after the machine has been threaded is to determine the character of work to be done, and this includes the consideration of the optical features. In connection with this structure attention is particularly directed to Figs.

1, 2, 3, 12, 13, 14 and 15. The front plate 117 supports the lens turret 15 which carries lenses 118, 119 and 120. This lens turret is rotatably supported on the lower end of a swinging arm 121 which is mounted in back of the front plate 117. Preferably a short spring 122 (Fig. 12) maintains the turret 15 with a felt backing 124 tightly against the front plate 117. A spring pressed stop 125 is carried upon the lens turret 15 and is adapted to be positioned in any one of the various holes 126 provided in the front plate 117 and indicated in Fig. 13. It is to be noted that there are two series of these holes, one series of which co-operates with the stop 125 when the arm 121 is in the position against the stop pin 127, and the stop 125 co-operates with the other series of holes when the arm 121 is against the other stop pin 128. The holes 126 enable the lens turret 15 to be definitely positioned with any one of the lenses directly centered over the picture opening.

The picture opening is determined by aperture plates 129, 130, 131, and 132 (Figs. 14 and 15). These aperture plates have beveled edges and are adapted to be slid into a suitable opening provided in the rear of the vertical posts 84 and 85 whereby the aperture plates are carried upon the vertical posts in front of the path of the film. The aperture plate 130 is adapted to expose an area of the film equivalent to the standard size commercial picture of today and when this aperture plate is in position, a single series of pictures or exposures is made upon one width of film. Aperture plate 129 exposes an area equivalent to one-quarter the normal size picture and when this plate is in position in the instrument two series of pictures may be taken upon a single width of standard commerical film. Aperture plates 131 and 132 are more particularly adapted for color work. The smaller lens 118 is normally adaptable for taking the smaller size pictures through aperture plate 129. However, if small pictures of tele-photo character are desired the medium sized lens is swung into position by turning the lens turret 15 and swinging the lens turret sidewise to bring the center of this medium sized lens directly over the center of the area of the film exposed through the aperture plate 129. Where it is desired to produce highly magnified tele-photo pictures the larger size lens 120 may be positioned over a center of the area exposed through the aperture plate 129. This lens will produce, so far as the small pictures are concerned, a relatively large image which necessarily means that a relatively small amount of the exposed field in front of the instrument is photographed. Where full sized pictures are desired aperture plate 130 is used and the medium sized lens is ordinarily positioned over the exposed area. This time, however, the turret 15 is swung in the opposite direction in order to bring the center of this lens over the area exposed. If tele-photo pictures of the large size are desired the largest size lens 120 is positioned over the area exposed. As will be more definitely explained under the description of the projecting instrument, the pictures taken through the small sized lens 118 may usually be best projected through one of the larger sized lenses, although, of course, any one of the three lenses may be used in projection work. Where pictures are taken through the largest lens 120 it may be desirable to substitute a still larger lens for projection work. This may be accomplished by removing the largest lens and substituting a different lens tube therefor.

By referring to Figure 12 it will be noted that the image produced by the front objective lens carried in the lens turret on the front of the casing is focused on the same plane as is the image which is projected through the lens 135 and reflected from the mirror 134 (which is preferably a reflector of the surface mirror type) upon the film or light sensitive element. The lens tube carrying the lens 135 is provided with a suitable iris diaphragm (not shown) and a suitable shutter 136. This iris diaphragm and this shutter, as well as the lens 135, are of a type common in the art, ordinarily used with small hand cameras. Since the lenses 118, 119 and 120 on the front of the casing and the lens 135 have a common focal plane, it is evident that images may be formed upon this common focal plane by either the lenses in front or the lens 135 in the side thereof, or if desired both lenses may simultaneously form images on this same focal plane. By this construction it is evident that this instrument may be used for taking moving pictures and by turning the lens turret in such manner as to blanket the opening in the front of the casing, or by capping the front lens positioned over this opening, the lens 135, together with the shutter and diaphragm, becomes operative for taking individual static pictures. The moving picture feed of this machine is of a character wherein a slight clicking or snapping sound is made at each picture feed movement by the film contacting with the main film guide, thereby comprising a signal to the operator indicating that the film has been moved forward a single picture step interval thereby enabling the operator to take individual static pictures and to provide suitable film movements for such pictures. This construction of a plurality of lenses having a comon focal plane also enables the instrument to be used to produce effects that heretofore have required double independent

exposure of the film. For example, it is possible to photograph a moving picture actor directly in front of the camera and at the same time photograph a set scene arranged at the side of the camera and in focus of the side lens 135.

Under certain conditions for certain types of scenes this superposed effect is accomplished in moving picture work without the necessity of a rotary shutter for the background image formed by the side objective lens 135 because the extreme velocity with which the film moves picture lengths renders this interval of movement so short as compared with the interval of time when the film is at rest that the sensitive emulsion on the film is not appreciably light struck during the interval of movement. This construction of a plurality of lenses with a common simultaneous focal plane is capable of many other uses, one of which is that the lens 135 and attendant parts may be used as a view finder whereby the operator may view the image formed by the front objective lens whenever desired. The shutter 136 is normally closed when the lens 135 is not in use.

Shutter mechanism.

After the character of picture desired has been determined, and the suitable required lens has been positioned over the exposure area, the next element to be considered is the shutter mechanism. Various forms of shutter mechanism might be utilized, but a rotary shutter is generally recognized as the most desirable type of shutter. However, heretofore in the art the other elements of the picture machine have not possessed characteristics enabling a small rotary shutter to be used, consequently, heretofore rotary shutters of small size and capable of being mounted entirely within the camera casing without unduly increasing the width of the outer casing, have not been successfully utilized. The other elements making up this instrument permit the adoption and use of a rotary shutter of very small diameter so that the rotary shutter in the present case is of a radius merely sufficient to permit full size openings for full sized commercial pictures. Since, as has been stated, this machine is adaptable for taking various sized pictures, it is desirable to provide a shutter adjustable to operate most efficiently under all conditions, and also since this instrument is adapted to be used as a projector, as will hereinafter be explained, the shutter is constructed to be adjusted to operate efficiently in the projecting operation. In order to reach these desiderata the shutter is formed of two members 138 and 139 which are adapted to be fitted together in such manner that the portion 139 is rotatably mounted upon a stub shaft 140 comprising an extension of the hub 141 of the portion 138, and the parts are constructed to provide sufficient friction to hold the parts in any adjusted position. Since each section 138 and 139 carries a shutter or blind portion 142 and 144, it will be noted that the parts may be rotatably adjusted to provide a shutter having the blinds diametrically oppositely arranged (Fig. 18) thereby providing two exposure openings, or adjusted to have the blinds arranged adjacent thereby providing a single exposure opening. When the feed, which will hereinafter be explained, is arranged to feed the film to take full size pictures, it is desirable, in order to co-ordinate the various operating mechanisms, that the shutter be arranged to provide but a single exposure opening and to be rotated at relatively slow speed. The rotation of the shutter is accomplished through a train of gears comprising a small cog gear 145 which meshes with the main cog drive 64 (Figs. 10 and 12). This small cog gear carries a bevel gear 146 that meshes with a small bevel spur gear 147 that is fixedly secured to the shutter shaft 148. This small bevel gear is fixedly secured to a relatively large cog gear 149 that meshes with a small gear 150 integral with the stub shaft 151 that also carries the gear 152 fixedly mounted thereon. The end of the stub shaft 140 is reduced, as at 154, and carries a small gear 155 which is adapted to directly drive the shutter that is rotatably and slidably mounted on the shutter shaft 148. The forward end of the shutter shaft 148 carries an arm 156 which is provided with a pin 157 that is adapted to enter the opening 158 in the forward end of the hub 141 when the shutter is moved forward in the position illustrated in Fig. 19. When the pin 157 enters the opening 158 the shutter is thereby locked to rotate at the same speed as the rotation of the shutter shaft 148. When the shutter is moved to position illustrated in Fig. 20 it is released from the pin arm 156 and the gear 155 engages the relatively large gear 152 so that in this position the shutter rotates on the shutter shaft 148 and because of the increase in the speed due to the step up chain of gearing the shutter rotates at a speed four times greater than the shutter shaft. In order to facilitate the control of the shutter speeds the forward end portion of the hub 141 is provided with an annular slot 159 which receives the upper end of an operating lever 160 that is fixedly mounted, as at 161, upon the forward shutter shaft bracket 162 and is connected with a push rod 164 that terminates in a push button 165 on the outside of the front part of the casing, so that by pushing or pulling the button 165 the shutter may be slid on the shutter shaft to engage the pin 156

for slow speed (Fig. 19) and the gear 152 for high speed (Fig. 20).

Feed mechanism.

After the foregoing adjustments previously specified have been accomplished the machine is ready to be operated to take the type of picture desired and the film movement is controlled by the feed mechanism. The character of the feed is automatically determined by the foregoing adjustments. Attention is now directed particularly to Figs. 9, 14, and 21 to 28 inclusive. The feed of the film is a combined continuous and intermittent feed, whereby the supply of film leading from the film receptacle and the exposed film leading to the film receptacle is moved under continuous motion, whereas the portion of the film adjacent the exposure opening has an intermittent movement. The turning of the crank 9, as has been previously explained, operates to turn the film feeding sprocket wheel 69 in a counter-clockwise direction and since the film passes beneath this wheel, such movement continuously advances the film. Supposing the slide post 100 to be in its lower position and the holding pins 92 to be extending through a pair of perforations in the edge of the film, and the handle 9 to be turned to cause the sprocket 69 to feed the film, it will be noted that since the film cannot advance downwardly, due to the holding pins, it will rise upwardly to the position indicated in the dotted lines in Fig. 24. The inner end of the control shaft 96 carries a release arm which is normally spring-pressed by the leaf spring 168 to occupy the position wherein the face of the arm will be in the path of the lugs 169 on the inner release wheel 170. This wheel is fixedly mounted on the shaft 67 that carries the film feeding sprocket wheel 69 so that as the sprocket wheel revolves the release wheel 170 correspondingly rotates. When a lug 169 passes under the end of the release arm 167 the control shaft 96 is turned to cause the arm 97 to bear upon the cross-bar 94 and thereby lift the holding pins from the perforations against the pressure of the spring 95. Instantly upon the release of the film the portion which has been raised above the main film guide 82 (indicated in dotted lines Fig. 24) snaps downwardly against the end of the main film guide and the film adjacent the exposure opening has been moved a distance determined by the amount of film fed forward during the time while the film feeding sprocket wheel 69 is rotated through the angle subtended by the chord extending between the advancing edges of adjacent lugs 169 on the wheel 170. Since these lugs are equally spaced apart it will be noted that such angles are equal and that the film will be advanced at equal rates. The spaces between the lugs 169 are so predetermined that the amount of film advanced is exactly the amount required for the normal size commercial picture. When the aperture plate 129 is placed in position it will be seen that the extension 171 contacts with the end of the control shaft 96 and slides this shaft endwise against the pressure of the leaf spring 168 until the release arm 167 is in the path of the lugs 172 on wheel 174 which is likewise secured to the shaft 67. As a matter of fact, if desired, wheels 170 and 174 may be merged into a single entity so that separate wheels are not a necessity. It is to be noted that there are twice as many lugs 172 as there are lugs 169, consequently the angular movement between release periods for wheel 174 is one-half as much as when wheel 170 is effective. The angular movements controlled by lugs are exactly predetermined to advance the film a distance necessary for the small sized exposure through the aperture plate 129. When large sized pictures are being taken the speed, so far as the rotation of the crank handle 9 is concerned, is one-half the speed at which the small size pictures are taken. Consequently, where large size pictures are taken the shutter is adjusted to provide a single blind and a single exposure opening, and conversely when the small size pictures are being taken the handle is turned slower and the shutter is set to provide two blinds and two picture openings (Fig. 14). In taking all pictures the shutter is moved forward to the position illustrated in Fig. 19, whereas in projecting all pictures the shutter is moved rearward to the position illustrated in Fig. 20, in order that the shutter may be driven to coordinate its speed with the relative period speed most efficient. It is further to be noted that the film feed utilizes no reciprocating parts other than very light-weight coiled film energizing springs 79 and a short section of the film itself. Thus substantially all vibration due to the film feed is obviated, since the moving parts are of extremely small mass and the resiliency of the film itself is augmented by the coil springs 79 until the energy stored in the upper loop of the film is sufficient to drive the film forward at great velocity as soon as it is released. It is evident that this mechanism provides a film feed that is very fast and very quick in operation because the inertia of the moving parts is very small. The interval necessary in moving pictures to overcome the reluctance of the normal eye may, therefore, be divided efficiently since a less portion of the period is required to move the film, therefore a greater portion of that period may be used in exposing the film. The result of the foregoing is that the life of the film is lengthened since intermittent motion does not jerk or tear the film perforations,

and clearer and better pictures may be obtained under adverse light conditions, because of the lengthening of the exposure interval, as well as the very great advantage of substantial elimination of vibration due to the reduction of the intermittent moving elements to a minimum mass.

Projection.

It has been stated in the general description of the instrument that it is designed to be utilized as a projector as well as a camera and to this end the entire instrument is preferably constructed of substantially non-inflammable material, and wherein parts usually made of wood have been replaced by metal. To arrange the instrument to be operated as a projector the view finder 14 (Fig. 12) is removed by unscrewing the same from its position on the door 4 and positioning an electric lamp thereon instead (Fig. 29). This electric lamp may be of various constructions, but preferably comprises a screw threaded base 199 which carries a frame for condenser lens 200 adjacent which the supporting frame may be provided with openings, as 201, to permit the ventilation to carry off the heat from the lamp 202 which may be of any type, but preferably for convenience comprises the well-known high power incandescent lamp that is mounted within a suitable reflector, preferably a parabolic reflector 204. When the instrument is used for projecting the small pictures a suitable aperture plate 129 is positioned in the instrument. This automatically changes the feed to move the film suitable distances and the shutter is adjusted to provide two blinds and two light space openings with the gearing set to rotate the shutter at high speed. This arrangement produces the required number of flicker blades to pass during a single exposure thereby reducing the perceptible flicker or variation in the pictures to a minimum. Where full sized pictures are being projected the proper aperture plate 130 is positioned in the instrument and the feed is automatically restored to feed the film proper distances for full sized pictures. Preferably the shutter is arranged with one blind and one light space but is left in position to be driven at high speed. When the shutter is set to be driven at high speed there are four revolutions of the shutter for each picture feed movement. This produces the effect of a suitable number of flicker blades so that visual flicker is substantially eliminated from the projected pictures.

In projecting it is necessary to provide mechanism for suitably framing the pictures being projected and this mechanism is illustrated in Figures 10 and 30. It comprises a supporting rod 205 which passes through the openings 206 (Fig. 11) and is screw threaded in the lower bracket 207. This supporting rod is provided with a suitable head at the upper end to fit a removable crank 208. The hollow posts 84 and 85 being suitably joined together carry a top plate 209 which is provided with a small opening in which the pin on the spring-pressed latch 210 engages so that since the latch 210 is carried by the casing 1, any vertical movement of the main frame relatively to the casing of the camera due to turning of the supporting rod 205 changes the relative position between the holding pins 92 and the opening in the aperture plate which is positioned on the hollow posts 84 and 85. This arrangement enables the operator to suitably frame the picture being projected. Should it become desirable during the projection of a film, or at any other time, to have a section of the film rerun, the film feed is disabled by operating the slide post 100, as hereinbefore described, to move the holding pins 92 from operative to inoperative position and the driving handle 9 may be rotated in an anti-clockwise direction, thereby causing the film to be driven backwardly through the feed mechanism and be rewound upon the upper carrying wheel. Referring to Fig. 30 it will be noted that the instrument mechanism, being supported entirely upon the supporting rod 205, may be turned to occupy various positions within the casing for purposes of adjustment and repairs, by unfastening the main frame latch 211, the spring-pressed latch 210, and the shutter push rod 164, which leaves the construction free to turn upon the supporting rod 205.

Realizing that my inventions may be carried out in structures other than the specific disclosure herewith, I desire that it be understood that the specific disclosure herewith is purely illustrative and not to be taken in the limiting sense.

Having thus described my invention what I claim is:

1. In a motion picture instrument, in combination, an outer casing, a lens mount on said outer casing and adapted to carry a plurality of lenses, a door on each side of said casing and opening substantially the full side of the casing, actuating mechanism supported in said casing upon a single support and around which support the mechanism is adapted to swing, and a driving handle detachably secured to said mechanism and having a portion extending through one of said doors.

2. In a motion picture instrument, in combination, an outer casing, a lens mounted upon said outer casing, a door carried by said outer casing adjacent the front portion thereof and opening substantially the full length of the casing, actuating mechanism supported within said casing upon a single

support adapted to constitute a pivot around which said actuating mechanism may be turned, a latch for normally maintaining said actuating mechanism in a definite position relative to said casing, and means to drive the actuating mechanism.

3. In a motion picture instrument the combination of an outer casing, a lens mounted upon said outer casing, movable sides to said outer casing to permit inspection and adjustment of the actuating mechanism, actuating mechanism pivotally mounted within said casing and adapted to rotate relatively to the casing to facilitate inspection and repairs, and means for operating said actuating mechanism.

4. In a motion picture instrument, in combination, an outer casing, a movable door adapted to close one side of said outer casing and to be movable to facilitate adjustment and inspection of the actuating mechanism, a suitable lens mount, actuating mechanism supported within said casing upon a single support adapted to comprise a pivot upon which said actuating mechanism may be turned to substantially right angles relatively to said casing, and a driving handle adapted to be operable to actuate the said mechanism.

5. In a moving picture instrument, in combination, a casing, a lens carrying member mounted upon said casing, a plurality of lenses mounted upon said lens carrier, means whereby said lens carrier is movable to position any one of said lenses over a predetermined opening in said casing whereby the image formed by the lens so positioned will be focused upon a predetermined optical field, and means whereby the lens may be adjusted when positioned to center the lens over a predetermined portion of said optical field.

6. In a moving picture instrument, in combination, a casing, a lens carrier mounted upon said casing, a plurality of lenses mounted upon said lens carrier in such manner that all of said lenses may be focused upon an optical plane a predetermined definite distance from said lens carrier, means whereby said lens carrier is movable to position any one of said lenses over a predetermined point whereby an image from said lens will be projected upon the said predetermined optical plane, and means whereby the lens may be adjusted when positioned to center the lens over a predetermined portion of said optical plane.

7. In a moving picture instrument, in combination, a casing, a lens carrier carrying a plurality of lenses, lenses mounted in said lens carrier in such manner that all of the said lenses may be focused upon a single predetermined optical plane, each of said lenses being constructed to focus upon said plane a different sized image from a predetermined object, means whereby any one of said lenses may be moved to position over the said optical plane, means for positioning a sensitized member in said optical plane, and means whereby the lens may be adjusted when positioned to center the lens over a predetermined portion of said optical plane.

8. In a moving picture instrument, in combination, a casing, a lens carrier mounted upon said casing, a plurality of lenses mounted upon said lens carrier in such manner that all of said lenses may be focused upon a predetermined focal plane, means for moving any one of said lenses over said predetermined focal plane, means whereby the axis of the lens so positioned may be adjusted relatively to said focal plane, and means for positioning a light sensitive element at said focal plane.

9. In a moving picture instrument, in combination, a suitable casing, a lens turret mounted upon said casing, a plurality of lenses mounted upon said lens turret, and means for supporting said lens turret to enable the same to have both rotary and sidewise movement.

10. In a moving picture instrument, in combination, a suitable casing, a lens turret, a plurality of lenses mounted upon said lens turret in such manner that any one of said lenses may be focused upon a predetermined optical plane, means for mounting said lens turret to permit said turret to have rotatable and slidable movement relative to said predetermined optical plane whereby the axis of any one of said lenses may be aligned with predetermined portions of said optical plane.

11. In a moving picture instrument, the combination of a suitable casing provided with an opening in the front thereof, a lens turret adapted to cover said opening, a plurality of lenses carried by said lens turret, said lenses being mounted in such manner as to all be capable of being focused upon a predetermined focal plane, means for securing said lens turret to said casing in such manner as to permit said turret to be rotatable and movable sidewise, and means for locking said lens turret in adjusted positions.

12. In a moving picture instrument, in combination, a suitable casing provided with an opening in the front thereof, a lens turret mounted to cover said opening, means to permit said lens turret to be rotatably and slidably movable, said casing being provided with two sets of openings, a spring pressed latch adapted to engage one set of openings to lock the turret in position relative to one rotative position of the lens turret, and said spring pressed latch being adapted to co-operate with the

other series of openings to lock the turret in adjusted positions relative to its other path of movement.

13. In a moving picture instrument, in combination, a suitable casing provided with an opening in the front thereof, a lens turret adapted to close said opening, a pivoted lever mounted on said casing, a connection between the free end of said pivoted lever and said lens turret whereby said lens turret is rotatably mounted upon the free end of said lever, stops to limit the swinging movement of said lever, and a latch to secure said lens turret in adjusted positions.

14. In a moving picture instrument, in combination, a suitable casing provided with an opening therein, a lens turret mounted over said opening, a lever pivoted upon said casing, a pivot for the lens turret secured to the free end of the said lever, and a spring carried by said pivot and normally pressing said lens turret against the said casing to provide a light tight joint.

15. In a moving picture instrument, means for positioning a section of film, aperture plates adaptable to be mounted over said film whereby different predetermined areas of the film may be exposed, a plurality of lenses adapted individually to project images upon said film, and means providing a lateral adjustment of the lenses whereby the axes of certain of the lenses in use may be co-ordinated with the particular area of film exposed so that the axes of said lenses may pass through substantially the middle of the exposed area.

16. In a moving picture instrument, in combination, means for positioning a light sensitive element, an objective lens adapted to form an image upon said sensitive element, a shutter constructed to intermittently intercept the light from said objective lens, another objective lens, a reflector member adapted to cause the second objective lens to focus on substantially the same area as is covered by the first mentioned objective lens, and means for periodically moving the exposed portion of said light sentitive element at an extremely high velocity while the second mentioned lens is open.

17. In a moving picture instrument, in combination, means for positioning a light sensitive element, an objective lens adapted to focus an image upon said light sensitive element, a shutter constructed to intercept the rays from said objective lens, means to intermittently move the exposed portion of said light sensitive element at an extremely high velocity, another objective lens, means to normally continuously focus the last mentioned objective lens upon the back of the light sensitive element, and a shutter constructed to intercept the rays of light through the second mentioned objective lens at the will of the operator.

18. An improvement in moving picture instruments, comprising a secondary objective lens, a shutter for said secondary objective lens, means operable at the will of the operator to move a film unit picture lengths, and means for focusing said secondary objective lens upon a sensitive film whereby static pictures may be produced at the will of the operator.

19. In a moving picture instrument, means for taking pictures in motion and including devices for periodically moving the exposed portion of the film in such manner that the operator may stop the film at each picture length if desired, in combination with a secondary objective lens, a manually operated shutter for said secondary objective lens, and means for focusing said secondary objective lens upon the said film whereby individual static pictures may be taken without disorganizing the mechanism for taking moving pictures.

20. In a moving picture instrument, means for photographing pictures in motion and including devices for intermittently moving the exposed portion of the film, in combination with a secondary lens, a snap shutter for said secondary lens, and means independent of said picture mechanism for focusing said secondary lens upon the said film.

21. In a moving picture instrument adapted to be operated at one time as a camera and another time as a projector, a film feed mechanism, a rotary shutter, means to drive said rotary shutter at one speed when said instrument is used as a camera, and additional means to drive said shutter at high speed when said instrument is used for projection without changing the rate of film feed.

22. In a moving picture instrument adapted to be operated at one time as a camera and another time as a projector and comprising means adjustable to take quarter size pictures and also adjustable to take full sized pictures, a rotary shutter, picture length film feeding means, means to adjust the rotary shutter to correspond to the kind of picture being manipulated, means to adjust the picture feed to the kind of picture being manipulated, driving means for rotating the shutter at one speed when the pictures are being taken and means for driving the shutter at a different speed when the pictures are being projected.

23. A moving picture instrument adapted to take and project moving pictures and comprising a suitable casing, lenses carried by said casing, film actuating mechanism within said casing, a support for said film actuating mechanism and upon which said

film actuating mechanism is normally rotatable to swing said mechanism relative to said casing for inspection and adjustment, means outside of said casing for operating said support to move said mechanism within said casing and transversely of the axis of the lens, an aperture plate, means normally connecting said aperture plate to said casing whereby said aperture plate is stationary when said film actuating mechanism is moved by the said support, said last mentioned means including a latch, and a guide for said mechanism when said support is operated to adjust the said mechanism for framing of pictures during projection.

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