No. 707,934.

Patented Aug. 26, 1902.

W. LATHAM.

PROJECTING KINETOSCOPE.

(Application filed June 1, 1896.)

(No Model.)

4 Sheets—Sheet 1.

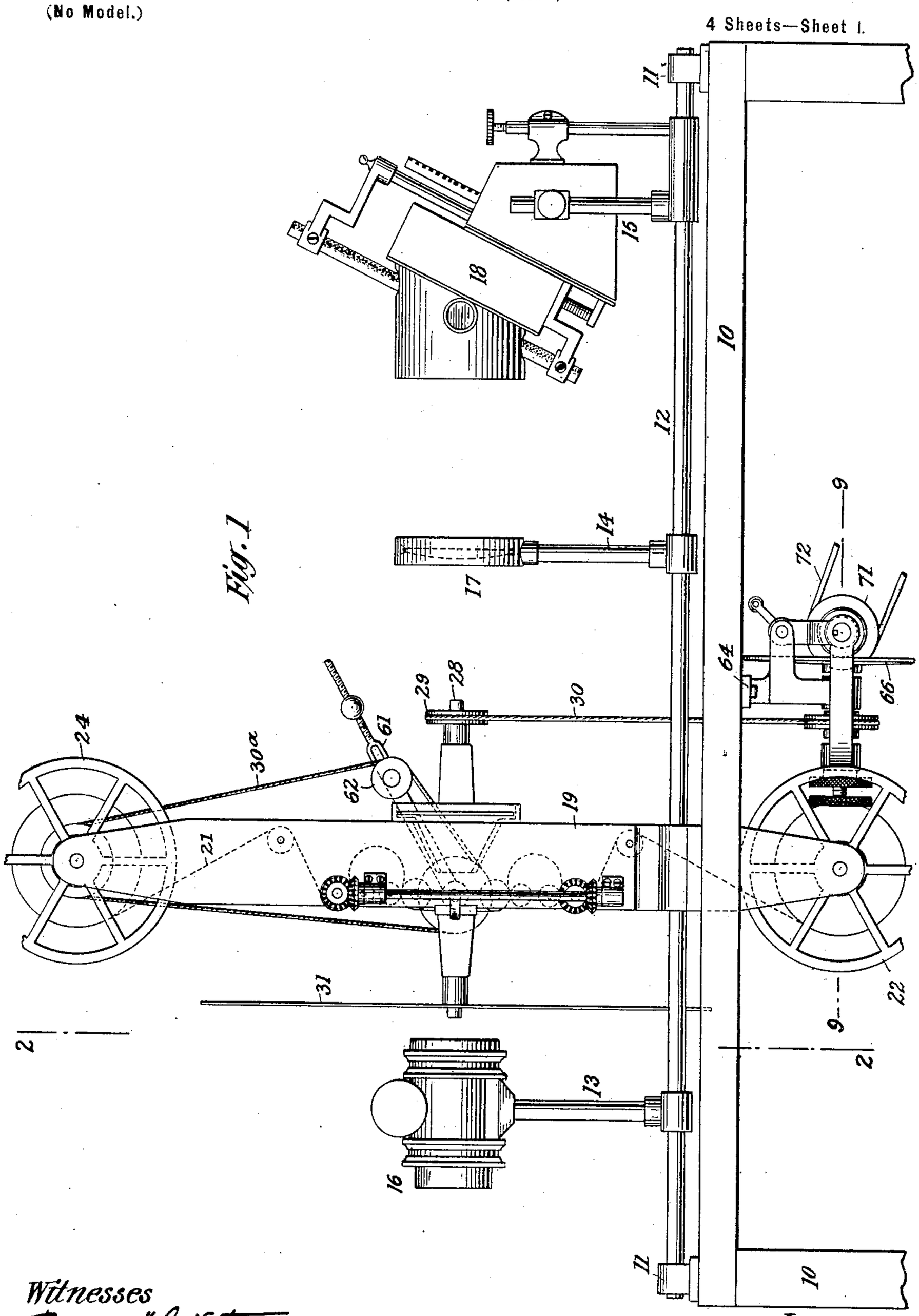

Fig. 1.

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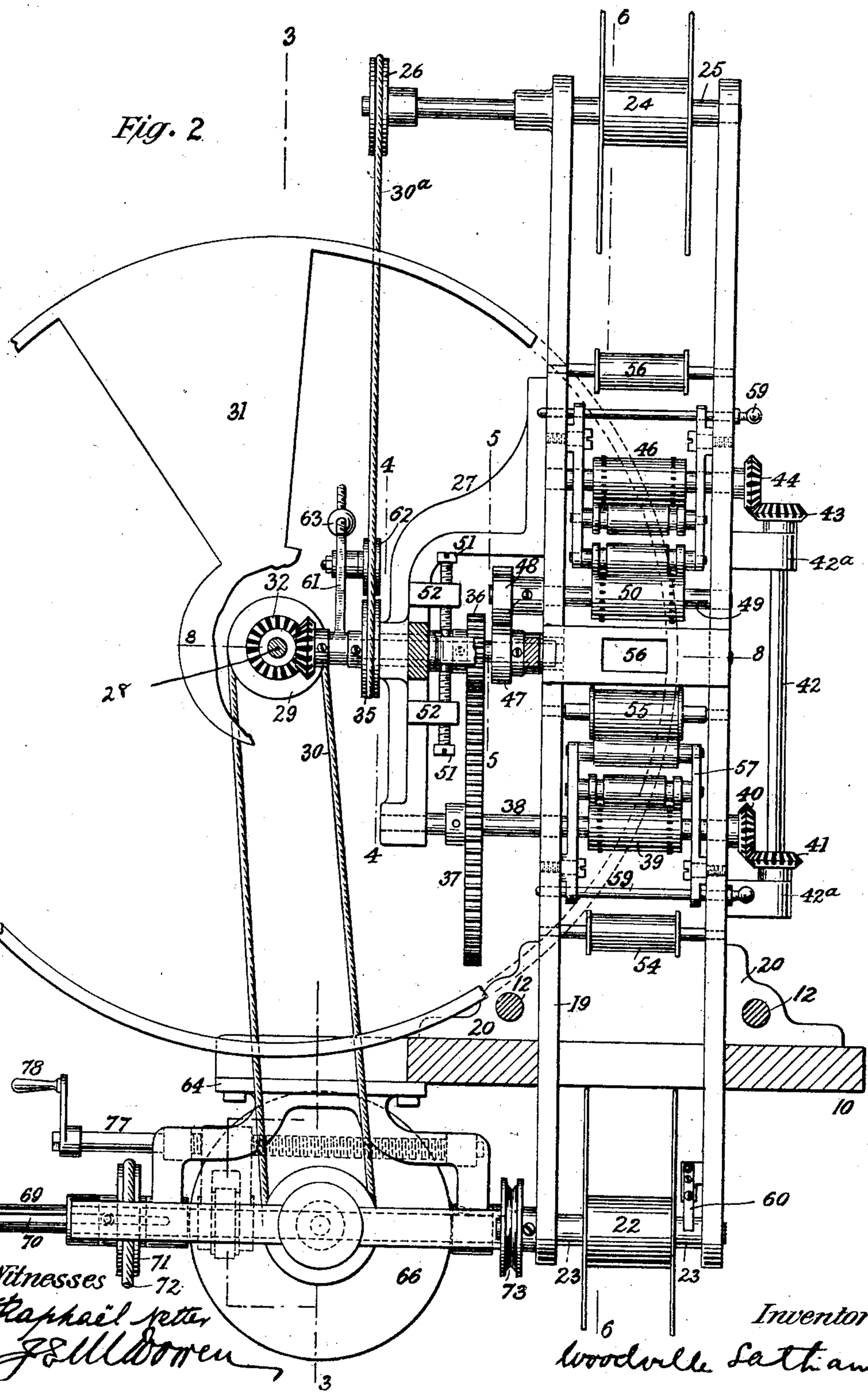
4 Sheets—Sheet 2.

Fig. 2



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(No Model.) 4 Sheets—Sheet 3.

Fig. 3

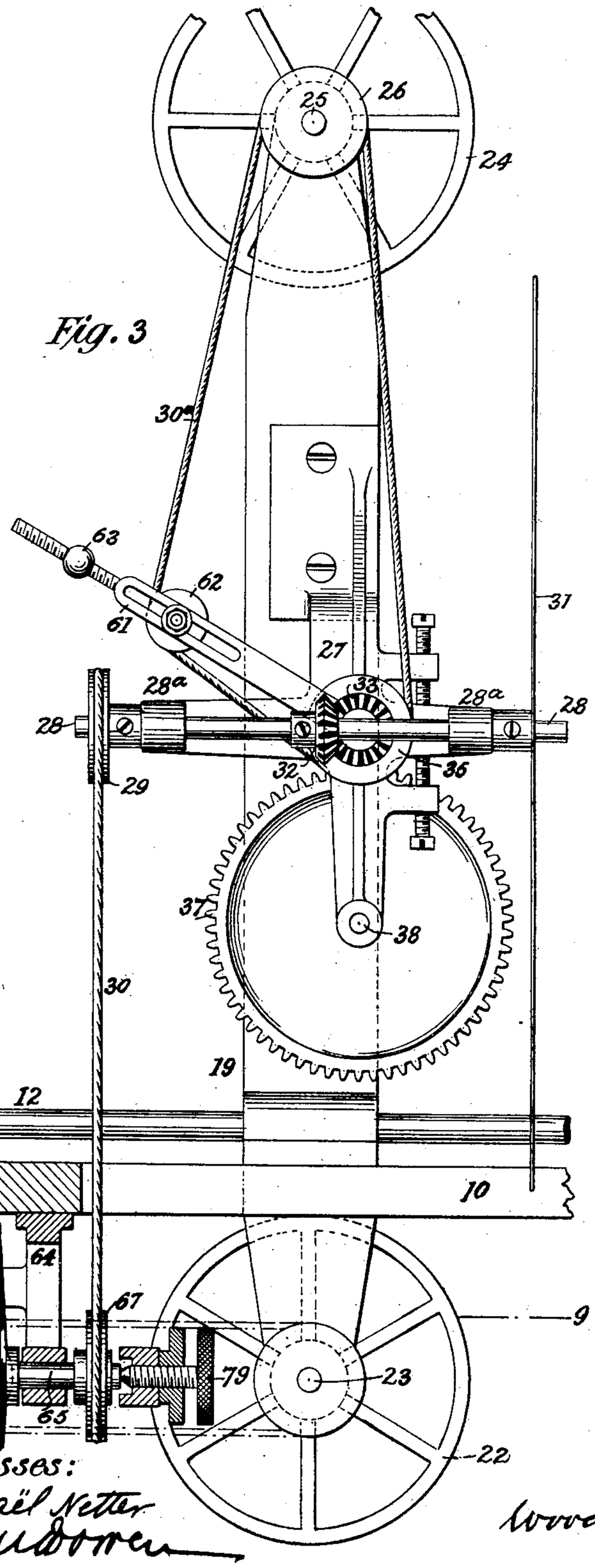


Fig. 4

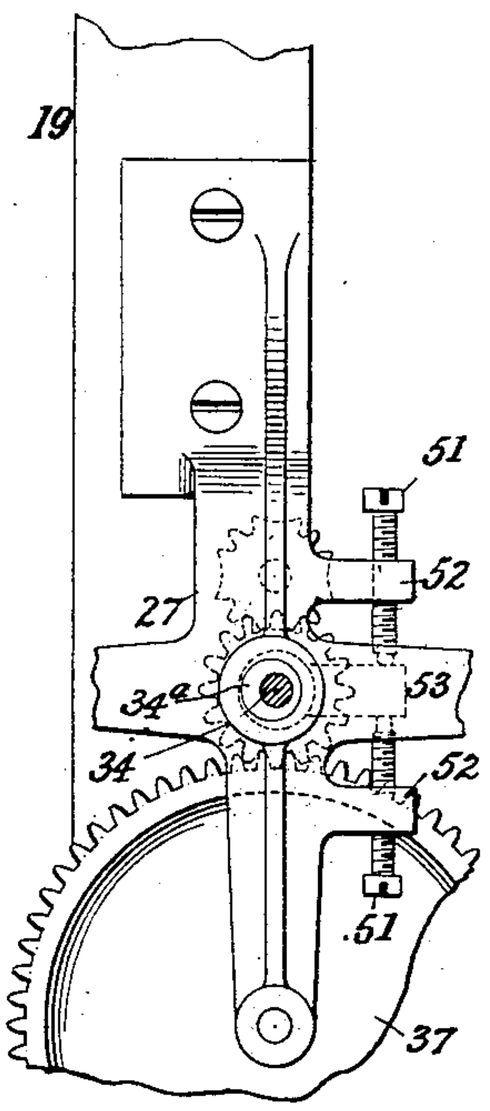
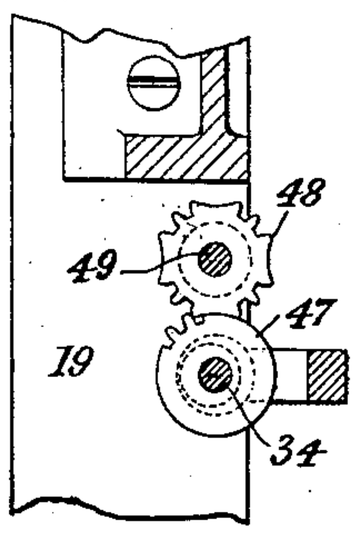


Fig. 5



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(No Model.) 4 Sheets—Sheet 4.

Fig. 7

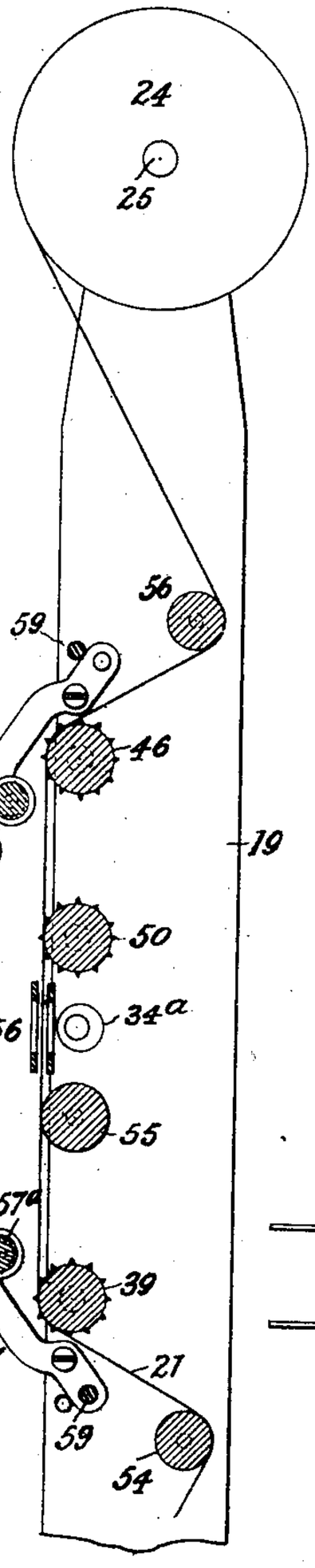


Fig. 9

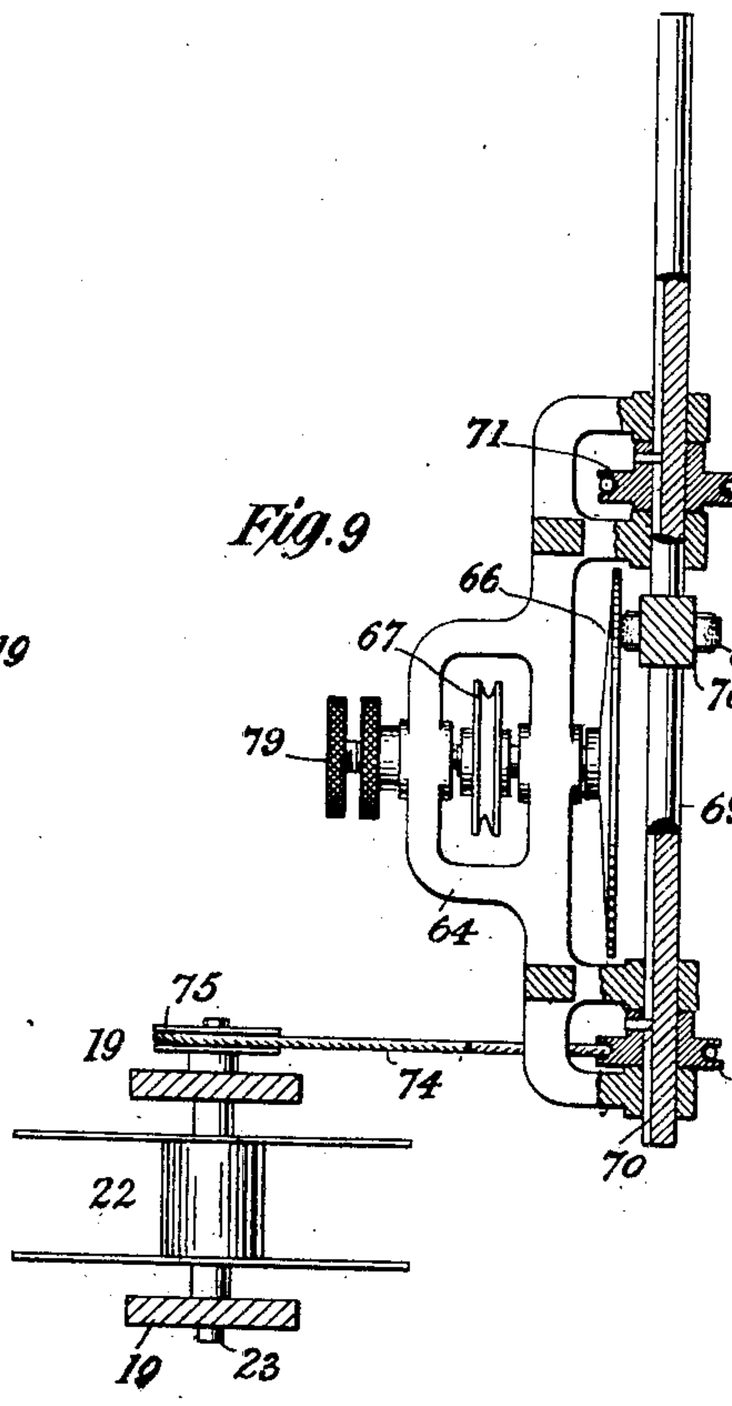


Fig. 6

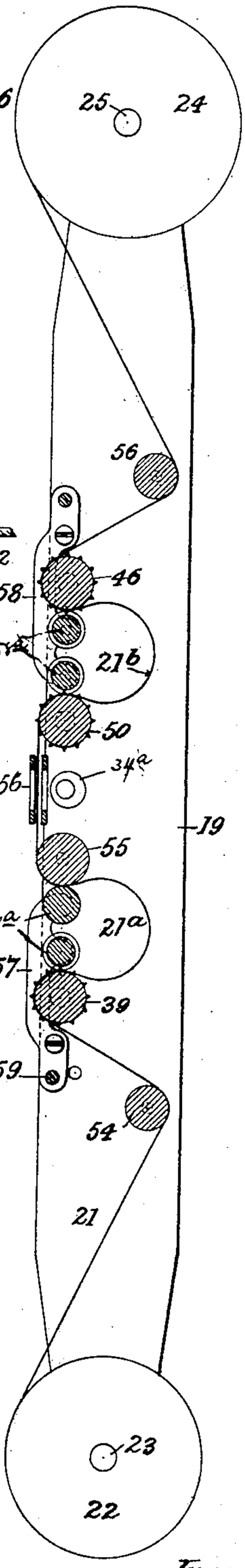
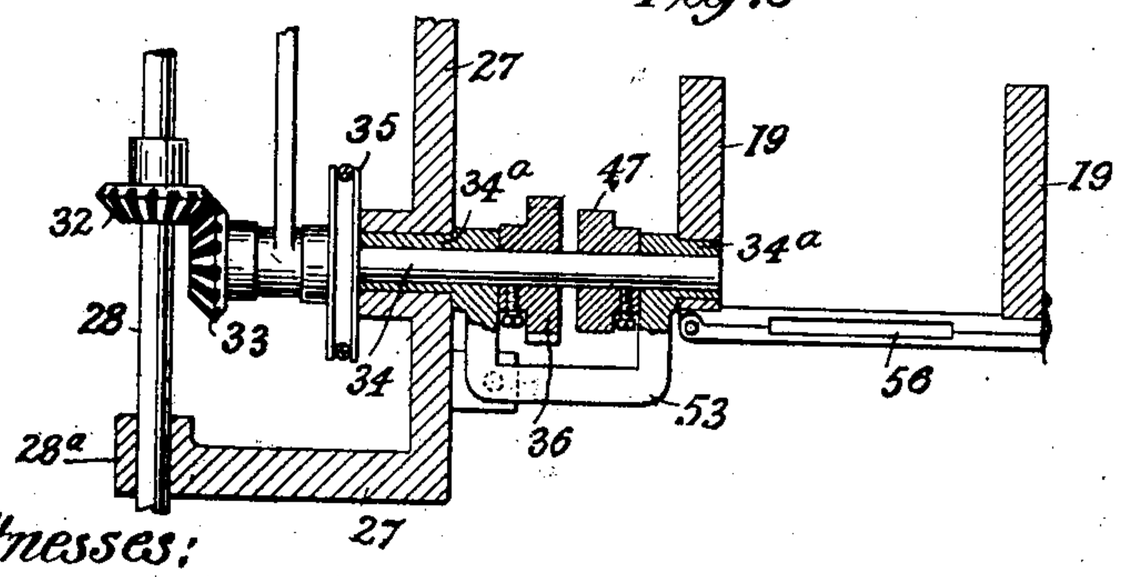


Fig. 8



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UNITED STATES PATENT OFFICE.

WOODVILLE LATHAM, OF NEW YORK, N. Y., ASSIGNOR, BY MESNE ASSIGNMENTS, TO E. & H. T. ANTHONY & CO., OF NEW YORK, N. Y., A CORPORATION OF NEW YORK.

PROJECTING-KINETOSCOPE.

SPECIFICATION forming part of Letters Patent No. 707,934, dated August 26, 1902.

Application filed June 1, 1896. Serial No. 593,747. (No model.)

To all whom it may concern:

Be it known that I, WOODVILLE LATHAM, a citizen of the United States, and a resident of New York, in the county and State of New York, have invented certain new and useful Improvements in Projecting-Kinetoscopes, of which the following is a specification.

The present invention has reference to apparatus for projecting successively and at frequent intervals on a screen or other plane surface an extended series of photographs of moving objects, whereby the movement of the objects may be accurately exhibited.

The purpose of the invention is to provide an apparatus capable of continuously projecting or exhibiting upon a suitable surface a great number of pictures taken from moving objects and arranged upon a strip or film of great length, whereby each picture in the strip is brought to rest at the moment of projection, so that there is given to the eye an impression of objects in motion in a manner now well understood.

In an apparatus organized so that the picture-bearing strip is caused to move continuously and uninterruptedly across the optical axis a light of very high intensity is necessary to give satisfactory results; but a light of such power is not required for satisfactory projection by means of an apparatus embodying the principle of the present invention. The stoppage of each picture during its exposure permits the requisite quantity of light to pass through the condenser, the picture, and the objective to the screen or plane surface upon which the image is projected when the light employed is only of a moderately-high power.

The invention therefore consists in an apparatus for projecting successively a large number of pictures of moving objects, embodying, among other things, means for bringing each picture to rest at the moment of projection, means for reducing the strain the picture-film would otherwise suffer from the rapid interruption and renewal of its movement, and means for maintaining uniformity of movement of the film as it unwinds from the delivering-reel and as it winds upon the receiving-reel, all as set forth in the claims at the end of this specification.

In the accompanying drawings, which form part of this description, one form of apparatus embodying the invention is illustrated.

In the drawings like features are designated in the several figures by like numerals of reference.

Figure 1 is a side elevation of the apparatus. Fig. 2 is a cross-section on the line 2 2 of Fig. 1, partly broken away. Fig. 3 is a section on broken line 3 3 of Fig. 2 looking toward the machine. Fig. 4 is a fragmentary section on line 4 4 of Fig. 2. Fig. 5 is a similar section on the line 5 5 of Fig. 2. Fig. 6 is a vertical section through the machine, showing the slack in the film, taken on the line 6 6 of Fig. 2. Fig. 7 is a similar section showing the devices for pressing the film into contact with the guide-rollers and drums thrown out of action. Fig. 8 is a sectional view on the line 8 8 of Fig. 2; and Fig. 9 is a section on the line 9 9 of Figs. 1 and 3 through the power-transmitting appliances, showing the relation of the parts when winding back the film to the delivering-reel.

The several parts of the apparatus may be mounted upon an optical bench (indicated in the drawings at 10) of any convenient design. At the ends of the bench 10 are the brackets 11, furnishing supports for the pair of longitudinal rods 12, upon which are mounted the standards 13 14 15, said standards being bifurcated to connect with the rods 12. The standard 13 supports a projecting-lens or an ordinary objective 16, which may be readily adjusted to bring it in proper relation to the picture being projected, and standard 14 supports the condensing lens or lenses 17, while the standard 15 supports the lamp 18, which in this instance is shown as a focusing arc-lamp. The lamp 18 is preferably adjustable on its support both vertically and laterally, and the standards for the condensing-lens and the lamp are so constructed that they may be adjusted longitudinally on the rods 12 so as to obtain the proper relative relation between the lamp and the condenser and the condenser and the picture-strip. The mech-

anism for supporting and propelling the shutter and the picture-bearing strip is arranged above and below the optical bench 10 on standards 19, which extend vertically above the bench and for a short distance beneath and are braced by the brackets 20, which also furnish bearings for the longitudinal rods 12, as seen in Fig. 2. The picture-bearing strip or film, which may be of any desired length without in any way affecting the operation of the machine, is indicated at 21 in the several views. It is wound upon the delivering-reel 22, the shaft of which, 23, is journaled in the lower ends of the standards 19. The receiving-reel 24 is similarly mounted at the top of standards 19, its shaft 25 having bearings in said standards and being extended at one side beyond the standard to receive a pulley 26 for the belt 30^a, transmitting the motion of the driving-shaft to the receiving-reel. The function of these two reels is merely to support the bulk of the film while successive sections of it are subjected to the feeding and exposing mechanism. One of the reels supplies the film for exposure, and the other coils up and takes care of the film after exposure. The picture-bearing strip 21 is conducted through and over its guiding and controlling mechanism, mounted in standards 19, and secured to the hub of reel 24. The said strip when in the position it is caused to assume when the apparatus is projecting has two slack sections contiguous to the sprocketed feed-drums for the purposes presently explained.

To one side of the standards 19 there is fixed a bracket 27, in which the main shaft 28 is mounted in bearings 28^a. At one end of this shaft 28 there is keyed a pulley 29 to receive the driving-belt 30, and at its opposite end is fixed the hub of the shutter 31. On the main shaft 28 is keyed the bevel-gear 32, which meshes with a bevel-gear 33, fixed to the end of shaft 34, which revolves in bearings 34^a in bracket 27 and adjacent standard 19, the revolution of the shaft 28 being thereby transmitted to shaft 34. The shaft 34 has keyed to it a pulley 35, which receives the belt 30^a, transmitting motion to the receiving-reel, and it has also keyed to it the small gear-wheel 36, which engages with the large gear-wheel 37, keyed to shaft 38, having bearings in bracket 27 as well as in standards 19, said shaft carrying the toothed drum 39 and having keyed to its outer end a bevel-gear 40, which meshes with another bevel-gear 41, fixed to the upright shaft 42, supported in brackets 42^a on standard 19, and having at its upper end a bevel-gear 43, which meshes with a like gear 44 on the end of shaft 45, which carries a toothed drum 46 and has bearings in standards 19. By this mechanism the toothed drums 39 and 46 are caused to revolve continuously at a uniform rate when power is communicated to the main shaft 28. It is obvious that other forms of gearing may be employed to drive said toothed drums 39 and 46 in unison. Shaft 34 has also keyed to it broken gear 47, Fig. 5, which is adapted to engage with a broken gear 48, fixed to shaft 49, having bearings and standards 19 and carrying a toothed drum 50. The gear 48 on the shaft of drum 50 is provided with a series of four toothed sections and a series of four plain sections, the surfaces of the latter being made to conform to the toothless portion of the circumference of the broken gear 47, so that while the gear 47 revolves continuously it intermeshes with gear 48 only momentarily as it completes each revolution, moving the gear 48 intermittently, and thus producing momentary stoppage of the drum 50 once with each complete revolution of shaft 34. At the moment of stoppage of the drum 50 the smooth surfaces of the gears are in sliding contact and remain so until the shaft 34 completing another revolution the teeth of the two gears again intermesh, revolving the drum 50 one-fourth of a revolution, and so on continuously, said drum momentarily stopping as the picture-bearing strip is moved through the apparatus the length of one picture, thus bringing each picture to rest at the moment of projection, and hence in a device of the construction described the period of rest of the film is four times greater than its period of movement. To prevent any vibration of the picture at the moment of projection, the smooth surfaces of the broken gears 47 and 48 should preferably be held in close sliding contact, and with this end in view the bearings 34^a 34^a (see Figs. 4, 5, and 8) of the shaft 34 are made eccentric, so that by means of the adjusting-screws 51 51, passing through lugs 52 on bracket 27 and bearing at their points on opposite sides of the yoke 53, connected to or formed with said bearings, the shaft 34 may be slightly raised or lowered, as required. This mode of adjustment has been found in practice to be efficient and to satisfactorily answer the purposes intended.

Because of the rapid interruption and resumption of the movement of the picture-film it is necessary to provide means for reducing the strain on the same to prevent its being ruptured by the teeth of the sprocket-drum 50, which actuates or feeds the film intermittently by engaging in holes at its edges, and it is also necessary or desirable to provide means for maintaining uniformity of tension of the film as it unwinds from the delivering-reel and winds upon the receiving-reel. The manner whereby these objects are effected will now be described.

The numerals 54, 55, and 56 indicate rollers for supporting and guiding the picture-bearing strip 21 and are arranged to freely revolve on fixed shafts supported in the standards 19. The picture-bearing strip or film 21, which has photographically produced upon it a series of pictures representing the successive stages or positions of the moving object or ob-

jects to be reproduced, is conducted from the delivering-reel 22 over the guide-roller 54, toothed or sprocketed drum 39, guide-roller 55, past exposure-window 56ª, which is attached to the standards 19 in the line of the optical axis of the apparatus, toothed drums 50 and 46, and guide-roller 56 to the receiving-reel 24, to the hub of which its end is secured. The strip or film is perforated at regular intervals along its lateral edges to correspond exactly with the sprocket-like teeth arranged on the circumference of the drums 39, 46, and 50, near their ends, respectively.

In Fig. 6 the parts of the mechanism for controlling and guiding the picture-bearing strip or film, as well as the strip itself, are in position for projecting, and in Fig. 7 the parts are shown in the position they are made to assume when the picture-bearing strip is being wound back from the receiving to the delivering reel.

To secure the necessary engagement between the picture-bearing strip 21 and the feeding-drums 39, 46, and 50, so that the strip may be fed or moved with greater accuracy and certainty, the frames 57 and 58, pivoted, as shown, to the standards 19, are provided, and they are supplied with the freely-revolving rollers 57ª and 58ª. (See Fig. 7.) The rollers 58ª, carried by frame 58, are adapted to coöperate with the toothed drums 46 and 50, and they have circumferentially near their ends grooves, as shown in Fig. 2, to receive the teeth or sprockets of said feed-drums when the frame is fixed in the position it occupies when the apparatus is projecting, and the rollers 57ª of frame 57, one of which cooperates with toothed drum 39, are similarly constructed for the same reason, the upper roller 57ª, which coacts with the toothless guide-roller 55, being grooveless on its circumference. The frames 57 58 are held in the two positions which they are adapted to occupy, as in Fig. 6 when projecting or as in Fig. 7 when the picture-bearing strip is released so as to be wound back from the upper to the lower reel by the removable rods which pass through suitable holes in the standards 19 and engage with the ends of the frames, as shown in Figs. 6 and 7. When in the position shown in Fig. 6, the rollers carried by frame 57 are between the sprocket-drum 39 and the guide-roller 55, while the rollers carried by frame 58 are between the sprocket-drums 46 and 50. Within the planes occupied by the two sets of rollers 57ª and 58ª when the apparatus is adjusted for projecting—*i. e.*, when in operation—the film or picture-bearing strip 21 is thrown out in the form of a loop, as shown at 21ª 21ᵇ, one of these slack portions being at one time above window 56ª and the other at another time above the same. The extent of each of said slack portions is preferably that of the height of a picture or slightly more. It will be understood from the description that follows that the loops of slack below and above the exposure-window are alternately thrown out and then taken up by the operation of the sprocket-drums, respectively, and that they produce and take up the slack by their own positive action entirely independent of the film-supporting reels at the extremes of the apparatus. In the operation of the machine the rollers 57ª 58ª hold the strip in proper contact with the respective feed-drums and guide-roller 55, as will be understood from Fig. 6, and insure proper contact between the strip and the respective drums. The picture-bearing strip is carried through the apparatus with great rapidity, and because of the rapid interruption and resumption of its movement it would not be possible for the strip to withstand the strain brought upon it for any considerable time if there were not provision made for the slacks in the film, as just explained. The instant each picture of the strip is brought in the line of the optical axis the toothless surfaces of the broken gears 47 48 are in sliding contact, their respective cogs being out of engagement, with the effect of causing stoppage of revolution of the toothed drum 50 and consequent momentary stoppage of the film between said toothed drum 50 and the toothless roller 55 beneath the optical axis; but the revolution of shaft 38 being continuous the toothed drums 39 and 46, which latter is positively geared from said shaft, as explained, also revolve continuously, taking up the slack 21ᵇ between toothed drums 46 and 50 and also replacing the slack 21ª between toothed drum 39 and roller 55, thus restoring the slack 21ª, to be again taken up when the broken gears 47 48 again momentarily intermesh. It will thus be seen that as the slack 21ᵇ is taken up at the moment of stoppage of the toothed drum 50 the slack 21ª is simultaneously being restored, and this action is continuous and positive and independent of the other parts of the machine while the operation of projection is going on. There is therefore but little, if any, additional strain on the film incident to the rapid interruption and resumption of its movement through the apparatus.

The construction and operation of the devices which produce and take up the loops of slack film and also those which intermittingly feed or, so to speak, "jerk" the film from picture to picture across the exposure-window or axis of the lens form an exceedingly important part of this invention. It will be noted that they are entirely separate and distinct from the reels which support the weight of the bulk of the film and which are consequently relatively heavy, so that the length and consequent weight of the film may be indefinitely extended without affecting the operation of the machine. The intermittingly-feeding devices, on the other hand, which comprise only the broken gear 48 and the feed-drum 50 with its shaft, are very light, and consequently have very little

inertia, and since also the small portion of the film which this part of the apparatus actuated has scarcely any weight these parts will instantly stop and start with great rapidity and with a minimum of strain or jar upon the mechanism and with the least possible wear on the holes for the sprocket-teeth in the film, and in order that the slack may be formed and the intermittent movements across the optical axis effected with accuracy and certainty it is desirable, although not essential, that the rollers which effect these movements be provided with the sprocket-teeth shown or their equivalent, so that they may positively engage with the film and positively move it without the possibility of any slipping, which is apt to occur when frictional contact alone is relied on, because such slipping will preclude proper registration between the picture and the optical axis. In order that these parts may operate as described, it is essential that the loop of slack film be maintained at all times ready for the intermittingly-acting device and also that the slack-manipulating and the intermittingly-moving devices be positively driven by mechanism which will absolutely insure the presence of the slack and the accurate movement of the film. The reason these parts and their arrangement and method of operation are such important and valuable features of the invention is because their action is necessarily exceedingly rapid, and if the intermittingly-feeding mechanism were heavy, so as to have much inertia, or if any considerable portion of the film or either of the reels which support it were stopped and started at each transition from picture to picture there would be such strain brought to bear on the sprocket-holes in the film as would speedily tear it adjacent to such holes, thus ruining it, and since these films are expensive, a good one being capable of making large profits for its owner, any means which will prolong their life is of great value in this art.

Another feature peculiar to my invention and one which distinguishes it from certain other apparatus is the important fact that the intermitting feed devices and the slack-former being entirely separate and distinct from the other parts are alone relied upon for securing accurate registration of the successive pictures with the axis of the projecting-lens. The supply and coiling reels at the extremes of the machine may operate with only substantial accuracy and still the results will be satisfactory, because they have nothing to do except to properly support and take care of the film, supplying it at one side and taking it away at the other. The intermitting feed devices and the slack-producing devices, on the other hand, which lie between the two reels and immediately adjacent to the exposure-window, control and manipulate that special and limited part of the film which is at that instant relied upon for the desired results, and it is a comparatively easy matter to accomplish exactness in operation when this part of the mechanism is separate and distinct from the other.

Uniformity of tension of the film as it unwinds from the delivering-reel, to prevent the film from buckling and insure its proper entrance to the apparatus, is secured by any suitable friction device applied to the shaft 23 of said reel. In the drawings is shown a metallic strap with an adjusting-screw for this purpose. This friction device is indicated by 60.

The rate of winding of the picture-bearing strip upon the receiving-reel is regulated by automatically controlling the revolution of the reel by means of the idler 61, which is shown loosely journaled on shaft 34. The idler is provided with a slot, as shown, in which is adjustably fixed roller 62, and around this roller is passed the belt 30ª. By adjusting roller 62 in the slot the pressure on the belt is varied. As the reel 24 becomes larger by the winding of the film thereon the idler may be manipulated to loosen the belt 30ª and to cause it to slip on pulley 26 of the reel-shaft. This slipping is or may be a continuous one from beginning to end of the operation of the machine, but it is such a gentle slipping that no appreciable heat is produced and no appreciable wearing of the belt. The outer end of the idler is screw-threaded and provided with a weight 63, by means of which a nicer adjustment of the pressure exerted by the idler is obtained. By this means the rate of revolution of the receiving-reel is automatically maintained in proper correspondence with that of the feed-drum 46.

The shutter 31, carried by the shaft 28, has but a small solid section. Its use is to cover the film during the interval of movement of each picture.

The power may be imparted to the main shaft 28 through a friction regulating and controlling appliance attached to the bottom of the optical bench by means of the bracket 64. In this bracket is journaled the shaft 65, carrying at one end a friction-plate 66 and having keyed to its opposite end a pulley 67, adapted to receive the belt 30, which passes over pulley 29 on the main shaft 28. The friction-plate 66 coöperates with a friction-roller 68, keyed to shaft 69, the said shaft having a longitudinal groove 70 and being provided with pulley 71, receiving the belt 72 to the motor, and also with pulley 73, adapted to receive belt 74, (see Fig. 9,) which is made use of to transmit the power of the motor to the delivering-reel when winding back the film from the receiving-reel, the shaft of said reel being provided with pulley 75 to receive said belt. The pulleys 71 and 73 are connected to shaft 69 by feathers entering the groove of said shaft, as shown in Fig. 9, so that while these pulleys cannot turn on the shaft the shaft can be moved through the hubs of the pulleys, which is done when ad-

justing the friction-roller 68 with relation to the friction-plate 66. The hub of the friction-roller is connected by an arm 76, having a screw-threaded sleeve through which passes screw-threaded shaft 77, supported in bracket 64 and adapted to be turned by crank 78 to permit the adjustment of the friction-roller toward or from the center of the friction-plate to increase or diminish the rate of speed of the friction-plate shaft 65 in a manner well understood, the rate of speed of the main shaft 28, connected to the friction-plate shaft 65 through belt 30, being thus determined and regulated as desired. The pressure of the friction-plate 66 against the friction-roller 68 is regulated by means of the milled-head screw 79, the point of which enters a depression in the end of the friction-plate shaft, as shown in Fig. 3. In Fig. 9 the friction-speed-regulating appliances are shown adjusted for winding back the film from the receiving and delivering reel, the friction-roller 68 having been shifted across the center of the friction-plate so as to reverse the revolution of the shaft 65. When winding back the film, the pulleys 73 and 75 are connected by belt 74 and the frames 57 58 are swung back, as shown in Fig. 7, so as to relieve the film of all binding tension.

The reels may be of size suitable to carry any length of picture-bearing strip that may be desired.

In operating the apparatus power is transmitted from the motor (not shown) by belt 72 and through friction-plate shaft by belt 30 to main shaft 28 of the apparatus. The operation of the gearing and the manner in which the teeth of the feed-drums engage the perforations in the edges of the picture-bearing strip and move it from the delivering to the receiving reel and across the opening 56 in the line of the optical axis of the apparatus, with a momentary stoppage of the film crossing the optical axis as the central portion of each picture is brought in the line of the optical axis, will all be understood from the preceding description. Whenever the central portion of a picture is in the line of the optical axis and the picture comes to rest, the light will pass simultaneously through the condensing-lens, through the picture, and through the objective outward to the screen or other plane surface. The light of course must be so adjusted as to cover the whole of the picture. The pictures are projected successively with such great rapidity, each succeeding picture showing a slightly-advanced stage of motion, that the effect on the eye of the observer is exactly the same as if a moving object or objects were being looked at directly.

It is to be understood that many of the mere details of the apparatus herein described may be varied without departing from the principle of my invention—as, for example, while the mechanism shown and described for forming the slack in the film and causing the picture-bearing strip to travel in such manner that there is a real stoppage of the film as each picture is presented in the line of the optical axis is the form and character preferred by me, it is obvious that the principle of the invention may be retained with differently-organized gearing and the employment of other appliances than those shown and described.

Having described my invention, I claim as new—

1. The combination with devices for supporting the bulk of a flexible film before and after exposure, of feeding mechanisms located between the devices for supporting the film and separate and distinct therefrom, one of said feeding mechanisms being constructed to uniformly feed the film and produce a predetermined supply of slack, and the other adapted to intermittently feed the slack across the exposure-window.

2. The combination with devices for supporting the bulk of the film before and after exposure, of feeding mechanisms located between the devices for supporting the film and separate and distinct therefrom, one of said feeding mechanisms being constructed to uniformly feed the film and produce a predetermined supply of slack, and the other adapted to intermittently feed the slack film across the exposure-window, and constructed also to cause the intervals of rest of the film to exceed its intervals of movement.

3. The combination with devices which support the bulk of the film and supply it for exposure and receive it after exposure, of positively-driven devices separate and distinct from the film-supporting devices, located between them and at opposite sides of the exposure-window, and which respectively engage with and accurately and uniformly feed the film, and which respectively produce and take up slack in it, and an intermittently-acting device located between said last-named devices which intermittently moves the slackened part of the film across the exposure-window.

4. The combination with devices which support the bulk of a flexible strip or film and supply it for exposure and receive it after exposure, of positively-driven devices separate and distinct from the film-supporting devices and which engage the film and accurately compel its movement, and which feed the film by uniform and continuous rotary action, and an intermittently-acting device located between said last-named devices and which moves the slackened part of the film picture by picture across the exposure-window and causes its period of rest to exceed its period of movement.

5. The combination with devices which support the bulk of a flexible film and supply it for exposure and receive it after exposure, of positively-driven devices separate and distinct from the film-supporting devices and located between them at opposite sides of the exposure-window, and which engage the film

and accurately insure its feeding, which last-named devices respectively produce and take up slack in the film, and an intermittently-acting device provided with teeth which engage in holes in the film whereby it feeds the film across the exposure-opening.

6. The combination with devices which support the bulk of a flexible film and supply it for exposure and receive it after exposure, of a positively-driven device entirely disconnected from the said film-supporting devices located between the film-supplying device and the exposure-window and which produces a loop of slack film, and an intermittently-acting device which engages with the film and feeds the slackened part of it across the exposure-window, and causes its period of rest to exceed its period of movement.

7. The combination with devices adapted to support the bulk of a flexible film and supply it for exposure and receive it after exposure, of positively-driven toothed rotary devices located between and entirely disconnected from said supporting devices and at opposite sides of the exposure-window, said toothed devices being adapted to carry and feed the flexible film by the engagement of their teeth with equally-spaced holes made in the edges of the film and to respectively produce and take up slack in the film, and an intermittently-acting rotary feeding device also provided with teeth which engage with the holes in the film, whereby the film is intermittently fed across the exposure-opening.

8. The combination with two reels which support the bulk of a flexible film, one of which supplies it for exposure and the other receives it after exposure, of a positively-driven device separate and distinct from the said reels and located between the supply-reel and the exposure-window and which produces a loop of slack film, and an intermittently-acting device likewise positively driven which moves the film picture by picture into the optical axis at the exposure-window and causes each picture to remain momentarily at rest in the optical axis.

9. The combination with two rotary reels which support the bulk of a flexible film, one of which supplies the film for exposure and the other coils it up after exposure, of two rotary feeding mechanisms located between said reels and separate and distinct from them, one constructed to feed the film intermittently and cause it to move picture by picture across the axis of the lens and to come to rest in said axis, the other constructed to feed the film continuously and uniformly and thus provide a constant supply of slack film and gearing positively connecting the said two feeding mechanisms for maintaining a fixed relation between them.

10. The combination with two rotary reels adapted to support the bulk of a flexible film, one of which supplies the film for exposure and the other receives it after exposure, of two toothed rotary feeding-rollers located between said film-supporting reels and separate and distinct therefrom and adapted to carry and feed the film by the engagement of their teeth with equally-spaced holes in the edges of the film, actuating mechanism and connecting-gearing between said feeding-rollers which positively actuates one of the feeding-rollers so as to feed the film intermittently and cause its interval of rest to exceed its interval of motion and which positively actuates also the other feeding-roller continuously and thus provides a constant supply of slack film.

11. The combination with the main shaft provided with a broken gear mounted in eccentric bearings and a feed-drum whose shaft is provided with a broken gear which meshes with the first-named broken gear, of means for adjusting said bearings to regulate the contact between said gears.

Signed at New York, in the county and State of New York, this 25th day of May, 1896.

WOODVILLE LATHAM.

Witnesses:
J. E. M. BOWEN,
ALEXIS C. SMITH.