(No Model.) 3 Sheets—Sheet 1.

E. UNGER & P. F. KRUG.

KINETOGRAPHIC CAMERA.

No. 596,687. Patented Jan. 4, 1898.

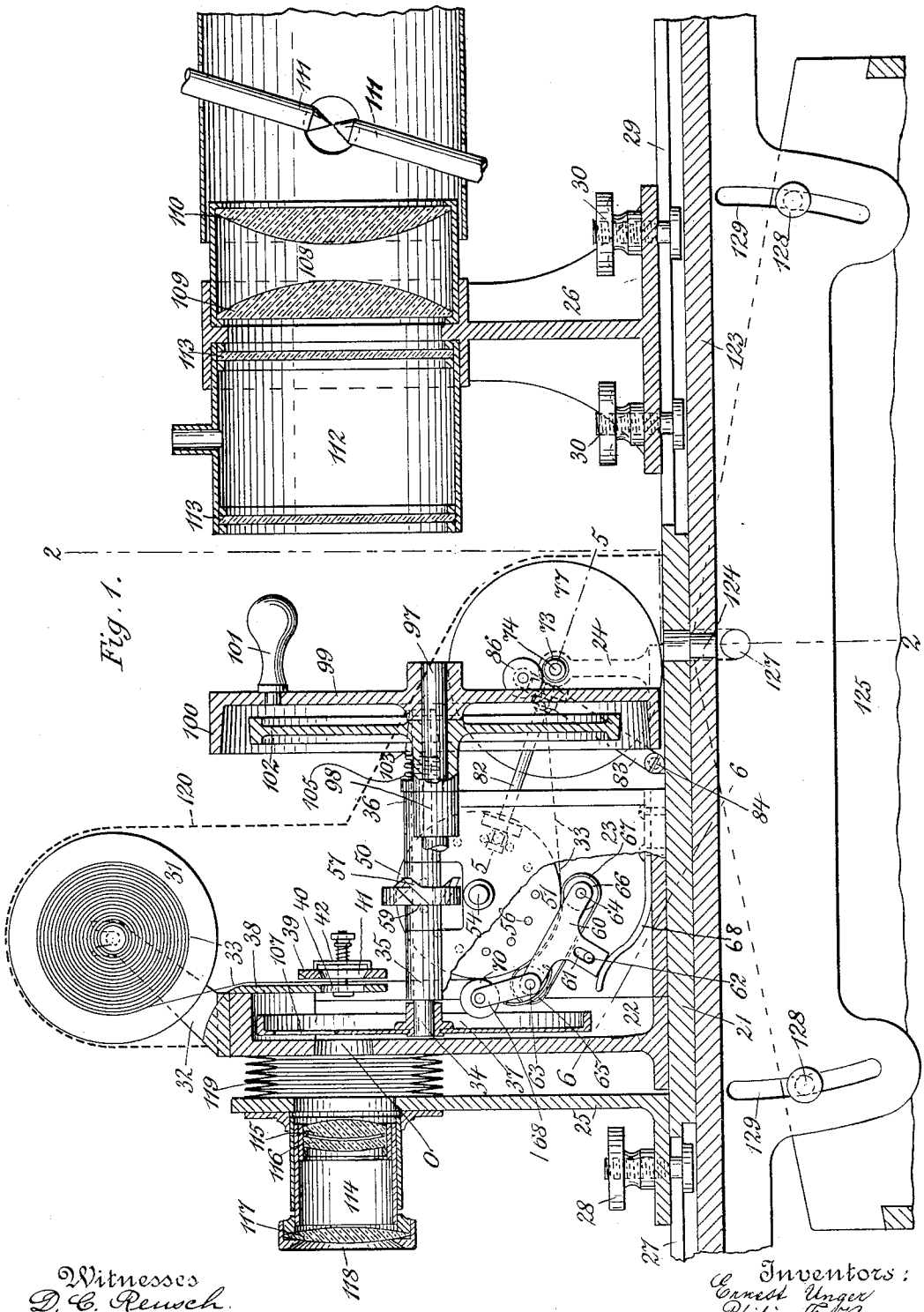


Fig. 1.

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Fig. 3.

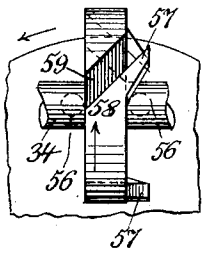


Fig. 4.

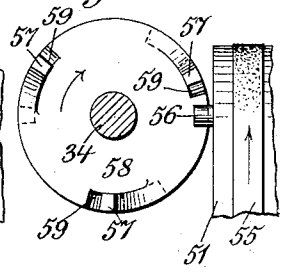


Fig. 10.

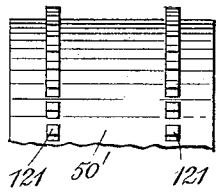


Fig. 2

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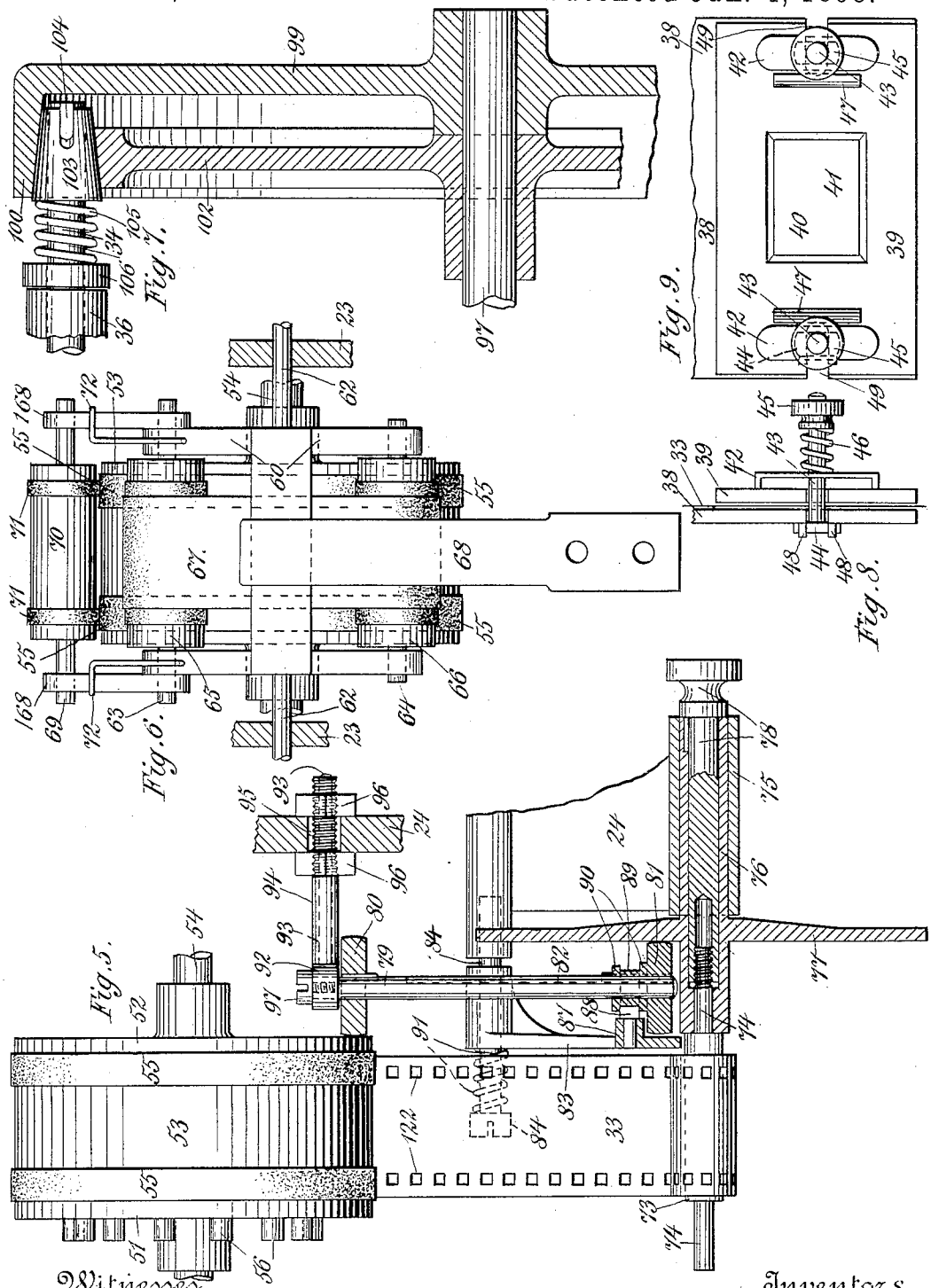


Fig. 4.

Fig. 9.

Fig. 8.

Fig. 6.

Fig. 5.

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UNITED STATES PATENT OFFICE.

ERNEST UNGER AND PHILIP F. KRUG, OF NEW YORK, N. Y.

KINETOGRAPHIC CAMERA.

SPECIFICATION forming part of Letters Patent No. 596,687, dated January 4, 1898.

Application filed December 10, 1896. Serial No. 615,106. (No model.)

To all whom it may concern:

Be it known that we, ERNEST UNGER and PHILIP F. KRUG, citizens of the United States, and residents of the city of New York, county of New York, and State of New York, have invented certain new and useful Improvements in a Combined Camera and Projecting Apparatus, of which the following is a specification.

By the use of the combined camera and projecting apparatus invented by us photographs or other pictures representing bodies in positions occupied by them in quick succession may be reproduced upon a screen in like succession, so as to thereby give to the observer the impression that he is looking upon such bodies while in continuous motion, and our apparatus may also be employed in taking such photographs upon a properly-prepared film.

The objects of our invention are to so construct a combined camera and projecting apparatus that the principal parts of it may be utilized either in reproducing pictures or in taking pictures, also to employ suitable mechanical movements in the apparatus, whereby upon revolving the main actuating-shaft at a slow speed rapid intermittent motion of the film may be produced.

Further objects are to secure proper contact between the film and a guide-drum over which it is made to pass, also to so adjust the speed of the reel which receives the film after it has been passed through the apparatus that pulling on the portion of the film which is in transit through the apparatus may be avoided.

We accomplish these and other useful objects by the means hereinafter described, and set forth more particularly in the claims.

In the accompanying drawings, forming part of this specification, Figure 1 represents a vertical section of an apparatus constructed according to our invention, such section being laid principally along its main axis, driving-disk 99 and idler 102, however, being also shown in a central vertical section. Fig. 2 is a vertical cross-section along line 2 2 in Fig. 1, looking toward the left, portions of the main driving-disks being broken off, so as to expose the mechanism in their rear. The remaining figures represent details drawn to an enlarged scale, Fig. 3 representing a side view, and Fig. 4 an end view, of a mechanical movement for producing intermittent movement of the film. Fig. 5 is a section along line 5 5 in Fig. 1, showing also a plan of guiding-drum 50. Fig. 6 is a section along line 6 6 in Fig. 1, looking upward, with special reference to appliances for maintaining and enforcing contact between the film and guiding-drum 50. Fig. 7 is a section through the main driving-disks and connecting portions of the mechanism for operating the apparatus. Fig. 8 is a side view, and Fig. 9 an end view, of a plate for guiding the film and a tension-plate and of the devices connecting the same, while Fig. 10 shows a modification of the guiding-drum, which is particularly applicable at the time when the apparatus is being used for taking pictures.

Corresponding letters and numerals of reference throughout the different views refer to corresponding parts.

21 is a base-plate on which are mounted frames 22, 23, 24, 25, and 26. Frame 25 is adapted to move along a slot 27 in base-plate 21 in the direction of the main axis of the apparatus and to be secured in a desired position by set-screw 28, while frame 26 is adapted to move along a similar slot 29 and to be secured in its proper position by set-screws 30 30.

31 is a reel mounted upon a forked support 32, which latter is attached to the top of frame 22.

33 is a film made of properly-prepared celluloid or other suitable material upon which the negatives of pictures which are to be reproduced are contained or upon which such negatives are to be produced.

34 is a shaft revolubly mounted in bearings 35 and 36 on frame 23 and carrying at its left end a disk 37.

38 is a plate for guiding film 33. Said guide-plate is secured to the upper portion of frame 22.

39 is a tension-plate yieldingly mounted on plate 38. Film 33 is drawn along and between said two plates in manner hereinafter described.

40 is an aperture within plate 38, and 41 an aperture within plate 39. These two apertures are of corresponding positions and are

located directly opposite to that portion of film 33 containing the picture which is to be reproduced.

42 42 are oblong caps resting upon the ends of plate 39, and 43 43 screw-threaded studs passing through caps 42 and plates 39 and 38. These studs are provided with oblong heads 44 and with nuts 45. 46 are spiral springs placed around said studs and interposed between nuts 45 and caps 42.

47 47 are abutments on plate 39, which prevent caps 42 from moving inward toward each other, while 48 48 are pins on the other side of plate 38, which prevent heads 44 from moving outward. 49 are lateral slots in said plate 38, running toward its outer edges, within which studs 43 may be moved.

It will be seen that after proper tension has been applied to springs 46 through nuts 45 abutments 47 and pins 48 will confine studs 43 in the positions indicated in the drawings, and springs 46 will then force tension-plate 39 toward guide-plate 38 under elastic pressure, while if it be desired to remove said tension-plate this can be done by pushing nuts 45 toward plate 39 sufficiently to cause heads 44 to clear pins 48, when it will be possible to slide said studs, together with their heads 44, nuts 45, springs 46, and caps or washers 42, outward along slots 49 and to thereby entirely detach said studs, together with caps 42, from contact with the tension-plate, whereupon the latter will be freed and become detached from the apparatus.

After passing between plates 38 and 39 film 33 is conducted around about one-quarter of the surface of a drum 50. This drum consists of two head-plates 51 and 52 and a connecting-shell 53 and is provided with an axle 54, mounted in suitable bearings upon frame 23. 55 55 are two rubber bands encircling said drum. They are intended to serve as supports of film 33 while passing around part of the shell of the drum, and by the adhesive quality of the rubber slipping of the film along the circumference of the shell of the drum will be prevented.

56 56 are studs on the front face of drum 50, placed substantially parallel with its axle. The same are adapted to engage with teeth 57 on a disk 58, which disk is secured to and revolves with shaft 34. 59 are grooves in the peripheral surface of said disk of sufficient widths to guide studs 56 and permit the same to travel within said grooves and from one face of said disk to its opposite face while said disk is revolving. Teeth 57 form portions of a steep screw-thread in such a manner that as shaft 34 and with it disk 58 are being turned in the direction of the arrow in Fig. 3 the right face of disk 58 will slide along such stud 56 as may then be in contact with it until such stud reaches the first groove 59. When this occurs, such stud, meeting the rear slanting face of one of the teeth 57, will thereby be guided gradually into and along said groove until it approaches the left-hand face of disk 58 and there passes out of the groove. Prior to its leaving this groove the next adjoining stud 56, which is thus being drawn toward the right-hand face of disk 58, comes in contact with the outer surface of the next tooth 57 and is being guided along the same until it reaches the right-hand face of said disk at the base of said tooth, when it remains stationary until the rear side of the next tooth 57 strikes it, and it likewise is compelled to pass through one of the grooves 59 to the left-hand face of disk 58. By placing studs 56 56 substantially parallel with the axle of drum 50 we are enabled to bring disk 58 opposite to and in close proximity with the face of drum 50, thereby obtaining a very compact and efficient structure. It will be seen that when there are thirteen studs on the face of drum 50, as shown in the drawings, drum 50 will make one-thirteenth of a revolution every time that one of its studs so passes from the right-hand face to the left-hand face of disk 58, and that it will remain stationary during those intervals during which the flat portions of the faces of said disk slide along two of its studs, and that thereby an intermittent revolving motion of said drum is produced, the speed of which depends upon the number of studs provided on its face, the number of teeth and grooves on disk 58, and the speed with which disk 58 and its shaft 34 are being revolved. The movement so given to said drum is imparted by it to film 33 while said film is being held against part of its periphery under yielding pressure, and for this purpose the following means are employed:

60 is a double-T-shaped frame provided with a slot 61, through which passes a detachable pin 62, the ends of which also pass through the walls of frame 23.

63 and 64 are shafts mounted in the arms of frame 60 and carrying rollers 65 and 66, respectively, and 67 an endless belt made of rubber or similar material placed around said rollers.

68 is a leaf-spring fastened to frame 23 and resting against the lower end of lever 60, so as to force the same and rollers 65 66 and band 67 toward the periphery of drum 50 and to thereby confine film 33 in contact with portions of its shell, whereby the intermittent motion of said drum is imparted to said film, and such movement of said film step by step past apertures 40 41 may be produced in such manner that at each step a new picture is made to appear opposite such apertures. To further enforce operative contact between film 33 and the shell of drum 50, we mount double levers 168 on pin 63, and near their upper ends mount upon the same a pin 69, carrying a roller 70, provided on its face with elastic bands 71, placed opposite rubber bands 55 on shell 53, and by means of springs 72 72, secured to lever 60, we so force said levers 168, and with them roller 70, toward film 33 as to hold said film against shell 53. It

will be seen that by withdrawing pin 62 rollers 65, 66, and 70, together with their mountings, may be simultaneously detached from the apparatus.

73 is a reel for receiving film 33 after it has passed along portion of the periphery of drum 50. Its shaft 74 is mounted upon frame 24.

As the films employed in appliances of this kind are frequently of great length, it is of much importance to so regulate the speed of the receiving-reels that as the circumference of the body of film upon such a reel increases its speed may be retarded to avoid pulling upon and possible breaking of such film. To accomplish this we employ the following means:

75 is a bearing on frame 24, and 76 a hollow shaft within said bearing and carrying a friction-disk 77. One end of shaft 74 is provided with a screw-thread serving to secure it to the end of a spindle 78, which spindle is detachably inserted within hollow shaft 76, so as to be made to revolve with said shaft and to be capable of imparting motion of friction-disk 77 to reel 73 and of permitting the removal of said reel when desired.

79 is a shaft having fixedly secured to it near one end a roller 80 in frictional contact with head-plate 52 of drum 50 and carrying nearer its other end a roller 81, so mounted as to be capable of sliding along a longitudinal groove 82, provided on said shaft, and of being held in frictional contact with the face of disk 77 during such movement.

83 is a lever swinging around a pin 84, screwed into frame 24. Near its upper end said lever carries a roller 86, adapted to rest against the surface of film 33 as the same is being wound upon reel 73. Underneath said roller there is provided within lever 83 an eye 87, forming the bearings for the shank of a fork 88.

89 is a neck on roller 81, having two flanges 90 90, between which the two prongs of said fork are placed on both sides of said neck. Spiral spring 91, interposed between the head of pin 84 and lever 83, serves to force said lever toward disk 77 and to thereby produce frictional contact between the latter and roller 81. The upper end of shaft 79 is revolubly mounted within an eye 92 at the end of a spindle 93, which is capable of a slight revolving movement within a tube 94, passing through an opening 95 within frame 24 and held in position by jam-nuts 96 96, secured to its screw-threaded end at both sides of said opening in frame 24. Proper frictional contact between head 52 and roller 80 can be produced with the aid of such screw-thread.

97 is a screw at the head of shaft 79 for holding it in its proper position with reference to its upper bearing.

As the body of film on reel 73 increases in diameter lever 83 will thereby be swung to the left, Fig. 1, carrying with it fork 88, and thereby moving roller 81 along its shaft 79 and producing at the same time a slight swinging motion of said shaft, which is possible on account of the slight revolving motion permitted to spindle 93 within tube 94. Motion is imparted to reel 73 from drum 50 through friction-roller 80, shaft 79, friction-roller 81, friction-disk 77, and shafts 76 and 74, and by carrying friction-roller 81 outward toward the periphery of friction-disk 77 as the diameter of the roll of film upon reel 73 increases, as described above, it will be seen that without varying the movement of drum 50 the speed of reel 73 will be retarded as the diameter of the body of film on said reel increases and that thereby pulling on the film as it passes through the apparatus will be guarded against. As explained above, in order to produce the proper effect the pictures upon the film must be reproduced in rapid succession. This calls for a very rapid revolution of axle 34, and this we produce by the following means:

97 is the main operating-shaft of the apparatus. The same is revolubly mounted within two bearings 98 at the ends of frame 23, one of said bearings only being shown in Fig. 1. 99 is a disk secured to said shaft and provided with a flange 100 and a knob or handle 101 for revolving it.

102 is an idler or disk free to revolve upon shaft 97.

103 is a tapering or conical plug capable of sliding along the end of shaft 34 and adapted to fit into the space between flange 100 and disk 102, so as to be capable of revolving within such space and to receive its motion through frictional contact with the inner surface of said flange 100, the latter and the periphery of disk 102 being made sloping, so as to conform with the slope of said plug. 104 is a splint at the end of shaft 34, fitting into a proper groove in the interior of said plug to guide the latter along shaft 34 and to compel said two parts to revolve together.

105 is a spiral spring around shaft 34 and interposed between a washer 106, adjoining casing 36, and plug 103, and serving to at all times keep said plug in frictional contact with rim 100 and the periphery of disk 102. Owing to the great difference between the average diameters of the interior surface of said flange 100 and of plug 103, revolution of disk 99 at moderate speed, as may readily be produced by hand, will cause very rapid motion of shaft 34. However, instead of revolving disk 99 by hand any other suitable mode of propelling the same may be employed.

107 107 are three openings in disk 37, so shaped and located that their interior borders *a* lie on a circle which passes through the corners of apertures 40 41 which are nearest to shaft 34, while their exterior borders lie on a circle passing through those corners of apertures 40 41 which are farthest removed from said shaft, while their remaining border-lines *c* and *d*, which are shown to be curved, but which instead might be made straight, are so located as to permit of entirely obscuring apertures 40 41 when those portions of disk 37

which lie between adjoining openings 107 pass over the same, and that said lines *c* and *d* while passing over the central portions of apertures 40 and 41 will assume approximately horizontal positions, thus securing, as nearly as practicable, a uniform lighting up and afterward darkening of apertures 40 and 41 across their entire widths by the passage over the same of borders *c* and *d*, respectively. The number of openings 107 and their positions on disk 37 so correspond with the number and positions of teeth 57 and slots 59 on disk 58 that one of the openings 107 will always be maintained directly opposite apertures 40 41 while the flat portions of the faces of disk 58 slide along the studs 56 nearest thereto, and that during the passage of one of said studs through a slot 59 one of the portions of disk 37, between openings 107, will be passing over apertures 40 41, thereby temporarily obscuring the same.

108 is a lens-box mounted upon frame 26, so as to bring the axes of its lenses 109 and 110 exactly in line with apertures 40 and 41.

111 111 are the carbons of a suitable arc-light, while 112 is a water cell or reservoir of usual construction for protecting the main apparatus containing the film against the heat from arc-lamp 111 111, projected through lenses 109 110. 113 are glass plates forming part of said reservoir through which the electric light is made to pass.

114 is an objective mounted upon frame 25 and containing lenses 115, 116, and 117. 118 is a cap for closing the mouth of said objective, and 119 are the bellows, so attached to frames 22 and 25 that they will be drawn out as frame 25 is being moved away from frame 22.

O is a circular hole in frame 22. The joint axis of objective 114 and hole O coincides with the axis of lens-cell 108.

120 shows in dotted lines a cover, which may be so placed over the parts of the apparatus mounted on frame 22, 23, and 24 as to prevent any light passing to film 33 through apertures 40 and 41.

While negatives of pictures are being produced upon the film it is of particular importance to have said film pass along the surface of its guide-drum with perfect regularity and without the possibility of its slipping along the same, and to secure this result it may be best to substitute during that operation for the drum 50 heretofore described a drum 50′, Fig. 10, carrying along its shell at regular intervals in two rows teeth 121, which are adapted to engage with corresponding perforations 122 in film 33, whereby slipping of the film will be prevented. On the other hand, after the negatives have been taken and when during the projecting of the same upon a screen such absolute regularity in moving the film is not required drum 50, with its rubber bands 55 placed opposite perforations 122, should be employed, as such reproductions from the same film are of frequent occurrence, and the repeated engagement of teeth 121 with perforations 122 would tend to destroy the film. However, either drum 50 or drum 50′ may be employed both during the taking of pictures and the reproducing of the same.

123 is a supporting-plate, upon which plate 21 is pivotally mounted, 124 being the joint pivot of said two plates.

125 is the main support for the apparatus. The same carries in suitable vertical slots 126 a horizontal shaft 127, which serves as a fulcrum around which plate 123 may be rocked.

128 128 are set-screws working in proper slots 129 in vertical flanges on plate 123 for maintaining said plate under a proper angle with support 125. By the use of the instrumentalities last described any direction desired may be given to the main axis of the apparatus.

When the apparatus is to be used for taking pictures, cap 118 must be removed, while cover 120 is kept in position, and then the upper left-hand portion of the apparatus, Fig. 1, embodying objective 114, will perform the function of a photographer's camera, and in order to produce the negatives in proper succession disk 99 will have to be revolved, thus causing quick, partial, and intermittent revolutions of shaft 34. This will produce the desired step-by-step movement of film 33, causing a negative to be taken at each intermission in the movement and the film to be yieldingly held against and conducted along its guide-drum 50 or 50′, while the mechanism for regulating the speed of receiving-reel 73 will be actuated, all as described above. On the other hand, when pictures are to be projected upon a screen placed at right angles to the main axis of the apparatus and to the left of objective 114, Fig. 1, cover 120 will have to be removed and arc-lamp 111 111 lighted, after which by the rays of the latter the negatives or pictures upon film 33 will be projected through objective 114 upon such screen, operation of the apparatus in other respects being the same as described. Instead of having the axes of the objective and the lens-cell coincide, reflected light from an artificial source of light or sunlight might be projected upon film 33 and through the objective, so as to reproduce the pictures upon a screen. It will readily be seen that many of the mechanical features and details embodied in our apparatus might be changed without departing from the spirit of our invention.

We claim as new and desire to secure by Letters Patent—

1. The combination with a suitable frame, of an objective, a guide-drum adapted to engage with a film and to draw the same past the axis of the objective, means for imparting intermittent revolving motion to said drum, and a spring-actuated shoe adapted to enforce contact between the film and said drum.

2. The combination with a suitable frame, of a guide-drum provided with a contact-sur-

face with which different portions of the film successively engage, means for imparting intermittent motion to said drum, rollers adapted to be moved toward the drum and a band passing over said rollers for the purpose of enforcing contact between film and drum.

3. The combination with a suitable frame, of a guide-drum adapted to engage with a film, means for imparting intermittent motion to said drum, a shoe, and an auxiliary shoe hinged to aforesaid shoe, both adapted to be forced toward the drum under yielding pressure, for the purpose of enforcing contact between film and drum.

4. The combination with a suitable frame, of a guide-drum adapted to engage with a film, means for imparting intermittent motion to said drum, a shoe adapted to be forced toward the drum under yielding pressure, an auxiliary shoe and a spring attached to aforesaid shoe and adapted to force the auxiliary shoe toward said drum.

5. The combination with a suitable frame, of a guide-drum provided with a contact-surface with which different portions of the film successively engage, means for forcing the film toward said contact-surface, and an elastic band upon the periphery of said drum adapted to receive said film.

6. The combination with a suitable frame, of a guide-drum adapted to engage with a film provided with perforations along its edges, means for forcing the film toward the drum, and a pair of elastic bands upon the periphery of the drum adapted to cover the perforations in such film.

7. The combination with a suitable frame, of a supply-reel and a receiving-reel, a guide-drum adapted to engage with a film, means for imparting uniform intermittent motion thereto, a shoe adapted to force the film against said drum and independent automatic means for reducing the speed of the receiving-reel as the diameter of the body of film wound upon it increases.

8. The combination with a frame, of a guide-plate and a tension-plate, both provided with corresponding apertures, guides along which the tension-plate is adapted to travel in positions parallel with the guide-plate, means for conducting a film between said plates and a spring for enforcing contact between the film and the adjoining surfaces of said plates.

9. The combination with a frame, of a guide-plate and a tension-plate, both provided with corresponding apertures, means for conducting a film between said plates, studs passing through said plates, proper rests for said studs when in their operative positions and springs for maintaining the studs in such positions, the stud-holes in the plates being extended laterally whereby the studs may be removed laterally for the purpose of detaching the tension-plate.

10. The combination with a suitable frame, of the main driving-shaft, a flanged disk secured thereto, an idler upon said shaft, a second shaft, a shoe at its end, and means for holding said shoe in frictional contact with the interior surface of the flange and with the circumference of said idler.

11. The combination with a suitable frame, of the main driving-shaft, a flanged disk secured thereto, an idler upon said shaft, a second shaft, a shoe adapted to slide along its end, and a spring adapted to hold said shoe in frictional contact with the interior surface of the flange and with the circumference of said idler.

12. The combination with a receiving-reel, of means for feeding a film to said reel, a swinging lever, a contact-roller on said lever adapted to engage with the film on said reel, a friction-disk on said reel, a shaft actuated by the feeding mechanism, a friction-roller adapted to travel along said shaft and to engage with said friction-disk, and means for imparting motion of said lever to said friction-roller.

13. The combination with a receiving-reel of a friction-disk thereon, a revolving drum, means for conducting a film along said drum to said reel, a swinging lever, a contact-roller on said lever adapted to engage with the film on said reel, a shaft, a friction-roller on said shaft in contact with said drum, a second friction-roller adapted to travel along said shaft and in contact with said friction-disk and to be moved outward from the axis of the reel as the body of film on said reel increases in diameter.

14. The combination with a suitable frame, of a reel, means for feeding a film to said reel, a friction-disk on the reel, a friction-roller held in contact with said disk, means for imparting motion to said roller from the operating mechanism of the apparatus, and means for moving the friction-roller toward the periphery of the friction-disk as the diameter of the body of film on the reel is increased.

15. The combination with a suitable frame, of means for guiding a film through the frame, an objective, a rectangular opening being provided in the frame in the rear of the film and a disk adjusted to revolve between the film and the objective and provided with apertures capable of passing over said opening, the inner and outer border-lines of said apertures being parts of circles passing substantially through the inner and the outer corners of said opening, and the connecting border-lines being located so as to occupy approximately horizontal positions when passing over the central section of said opening, all substantially as set forth.

In testimony that we claim the foregoing as our invention we have signed our names, in presence of two witnesses, this 7th day of December, 1896.

ERNEST UNGER.
PHILIP F. KRUG.

Witnesses:
CHAS. L. HORACK,
GEORGE W. DEASE.