

(No Model.)

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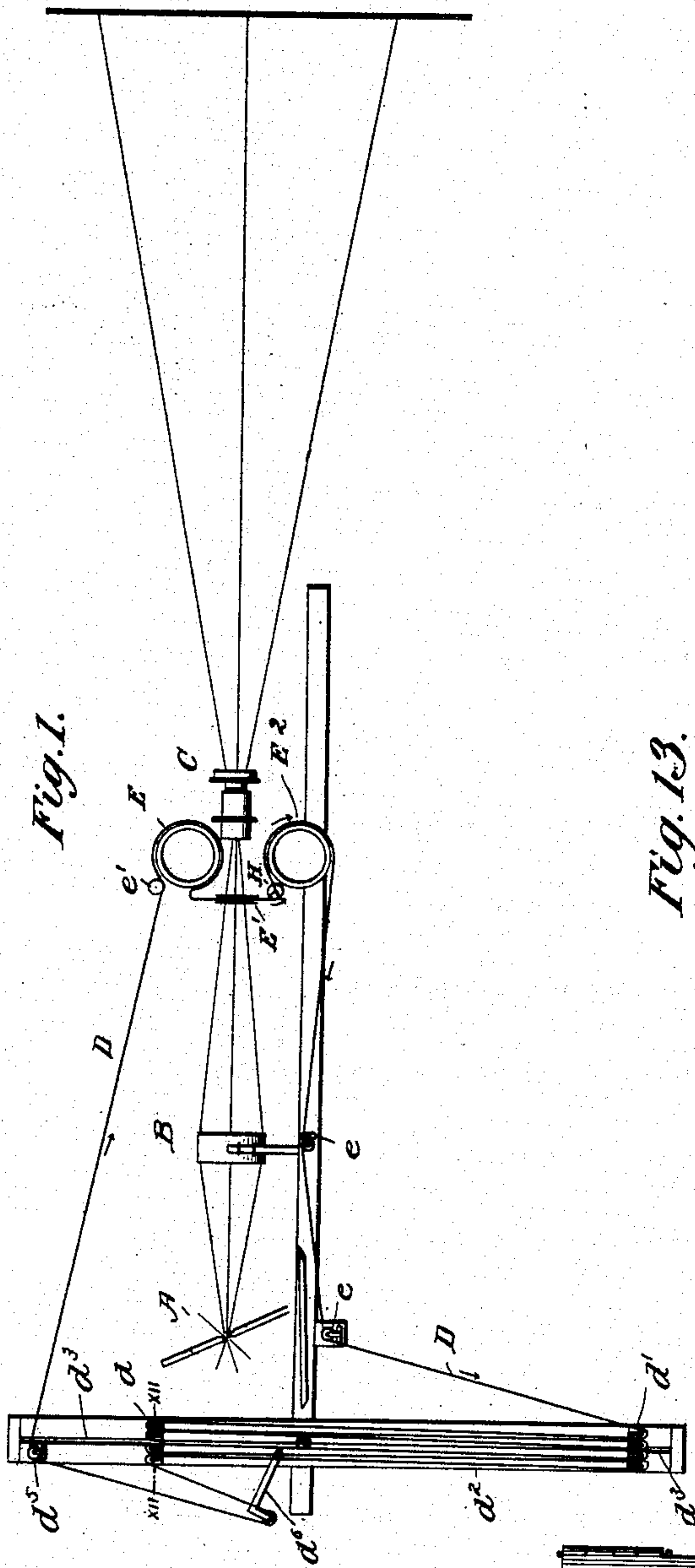


Fig. 1.

Fig. 13.

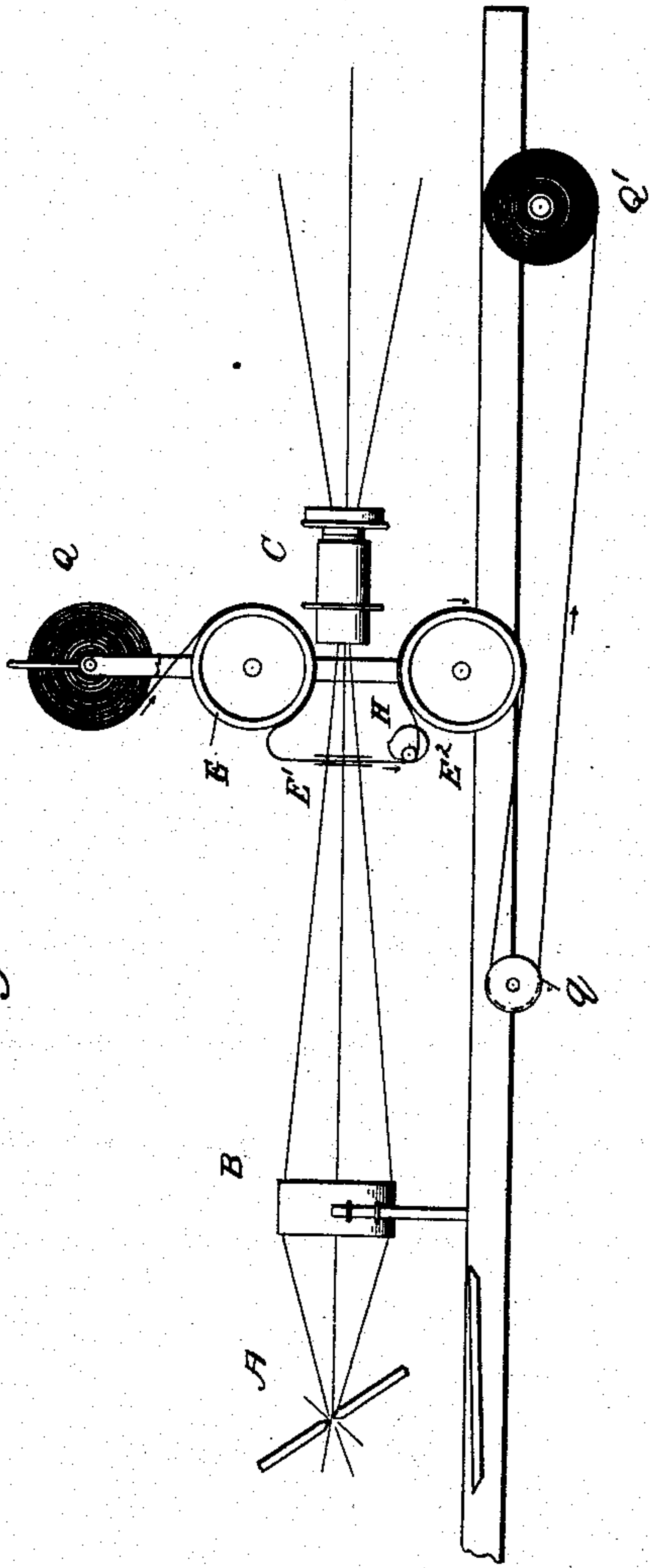
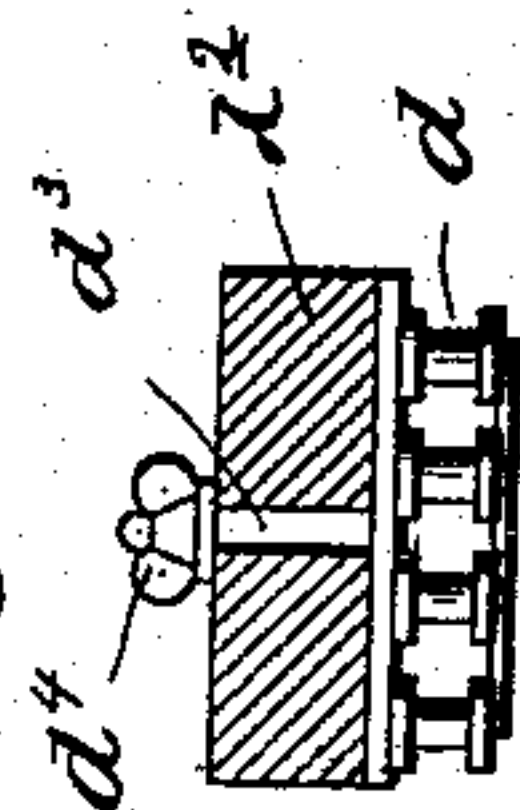
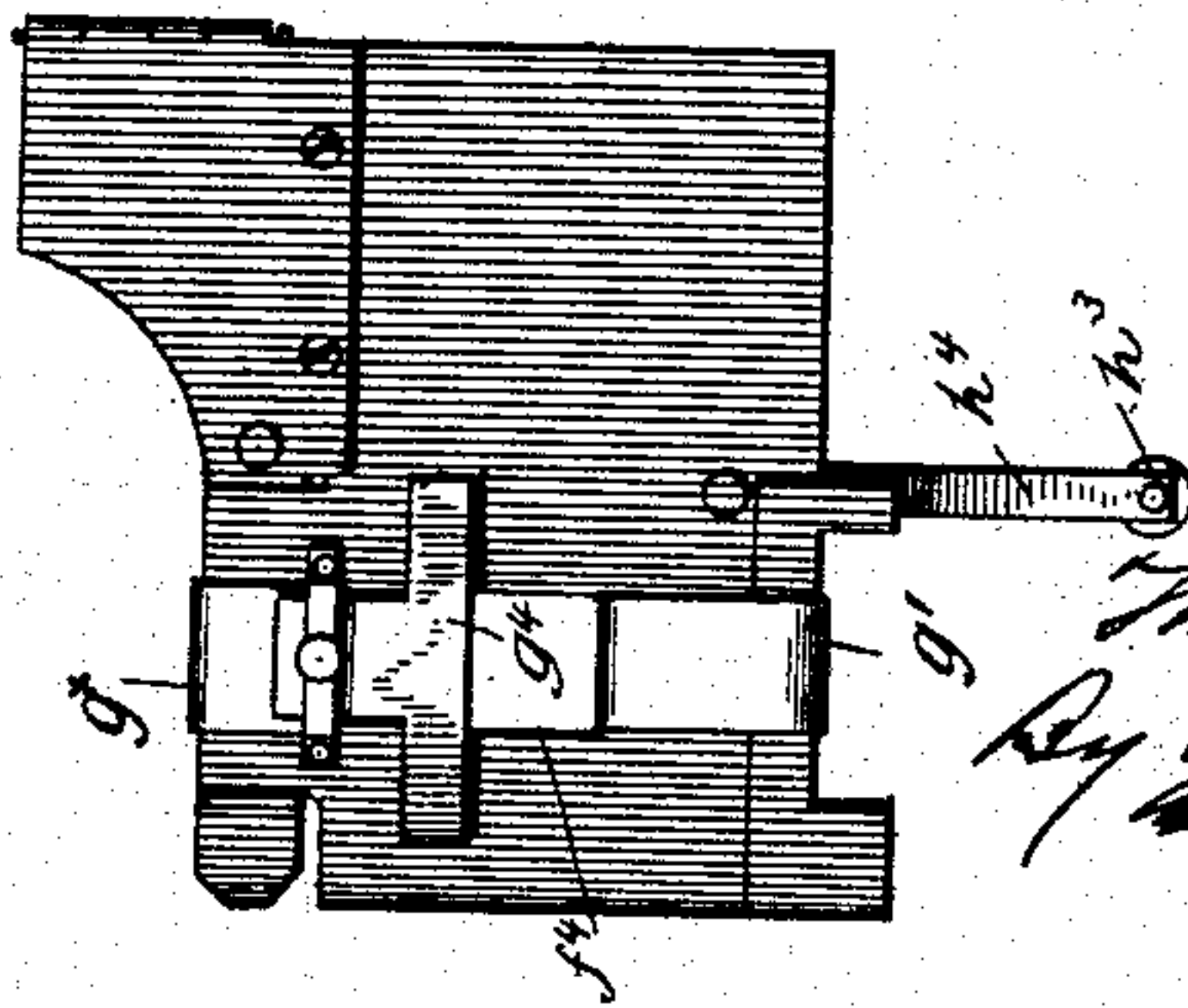


Fig. 12.



Witnesses  
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Charles E. Rindon

Fig. 6.



Inventor  
Thomas Armat  
By R. B. Burtwell  
his Attorneys.

**No. 673,992.**

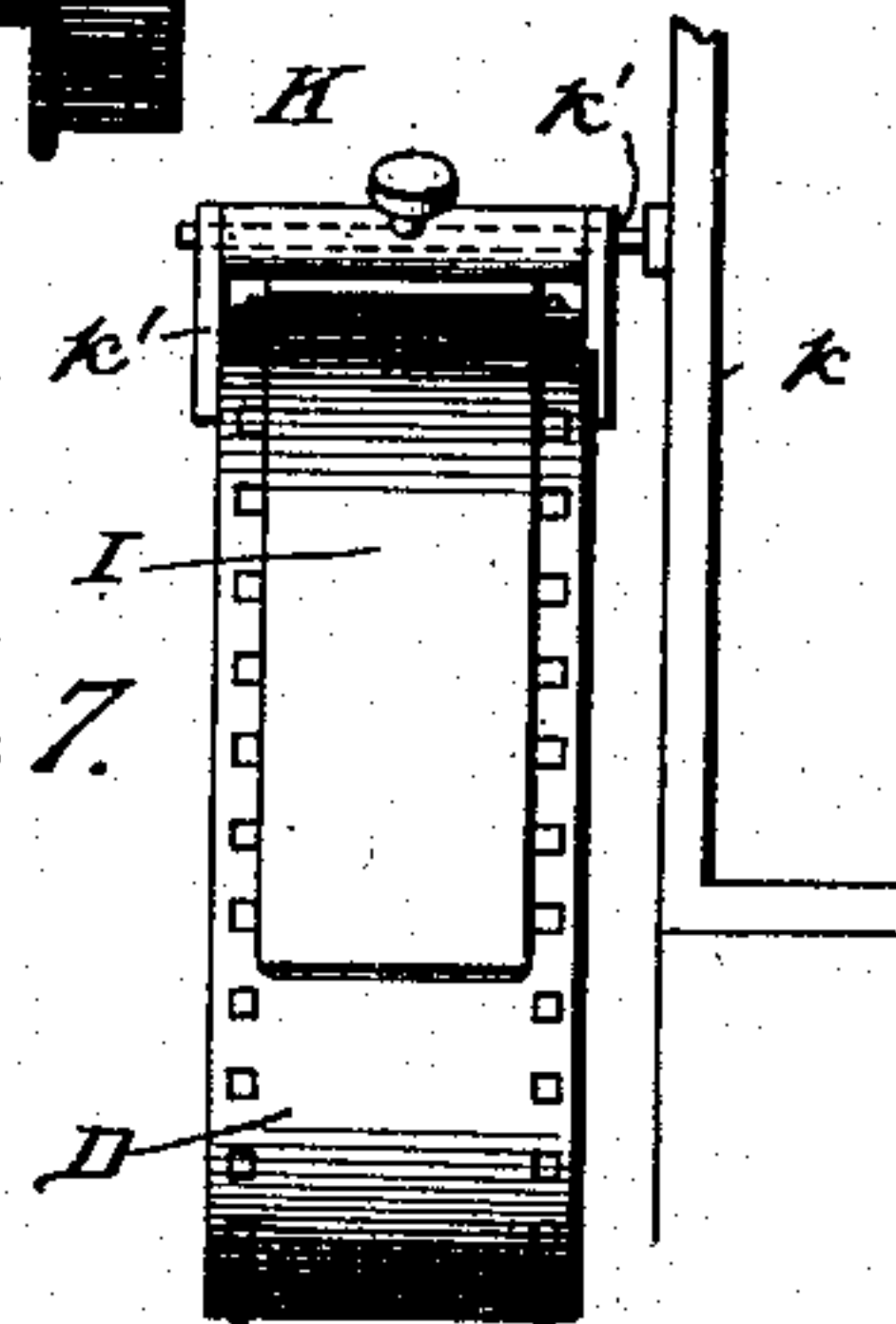
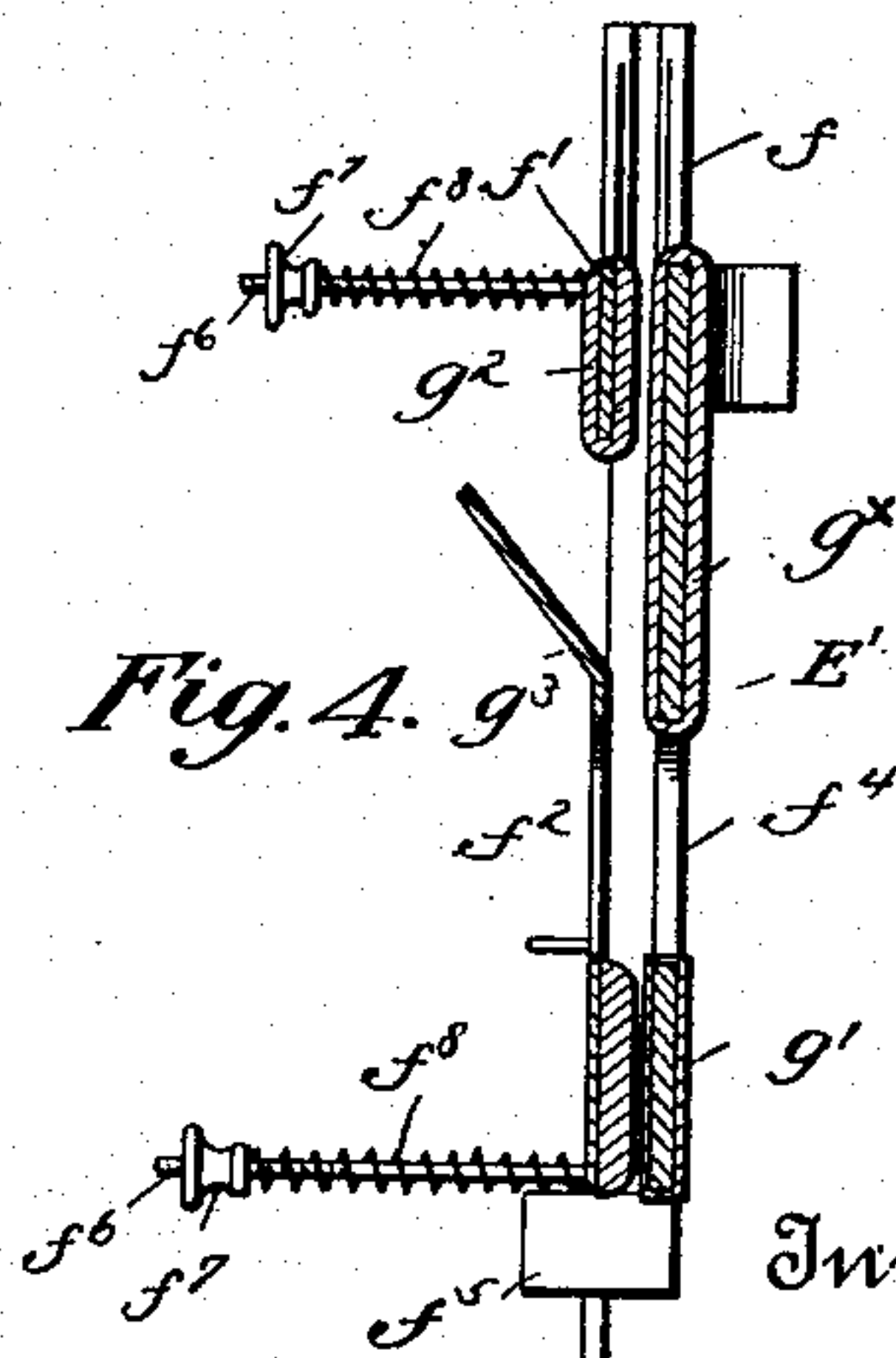
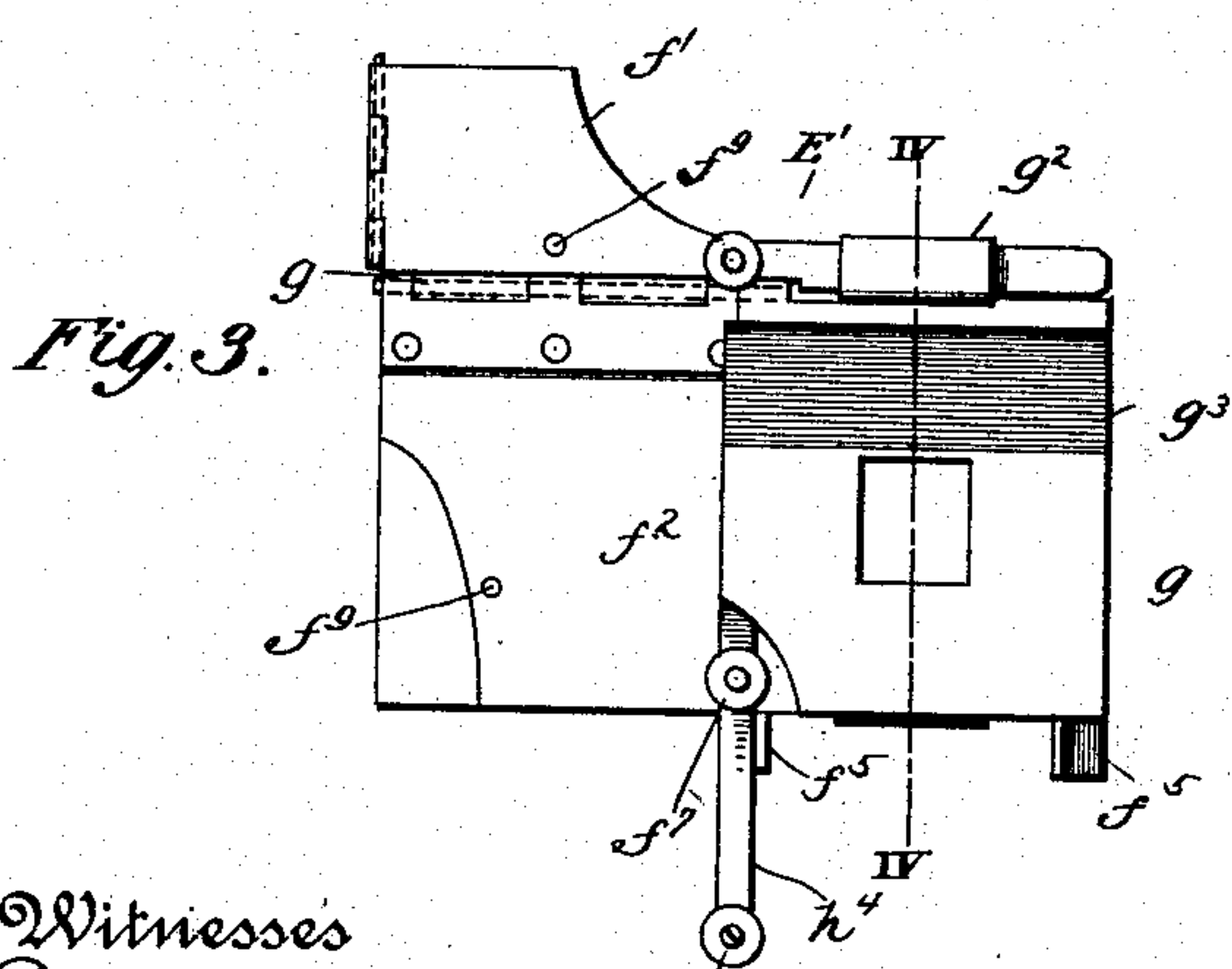
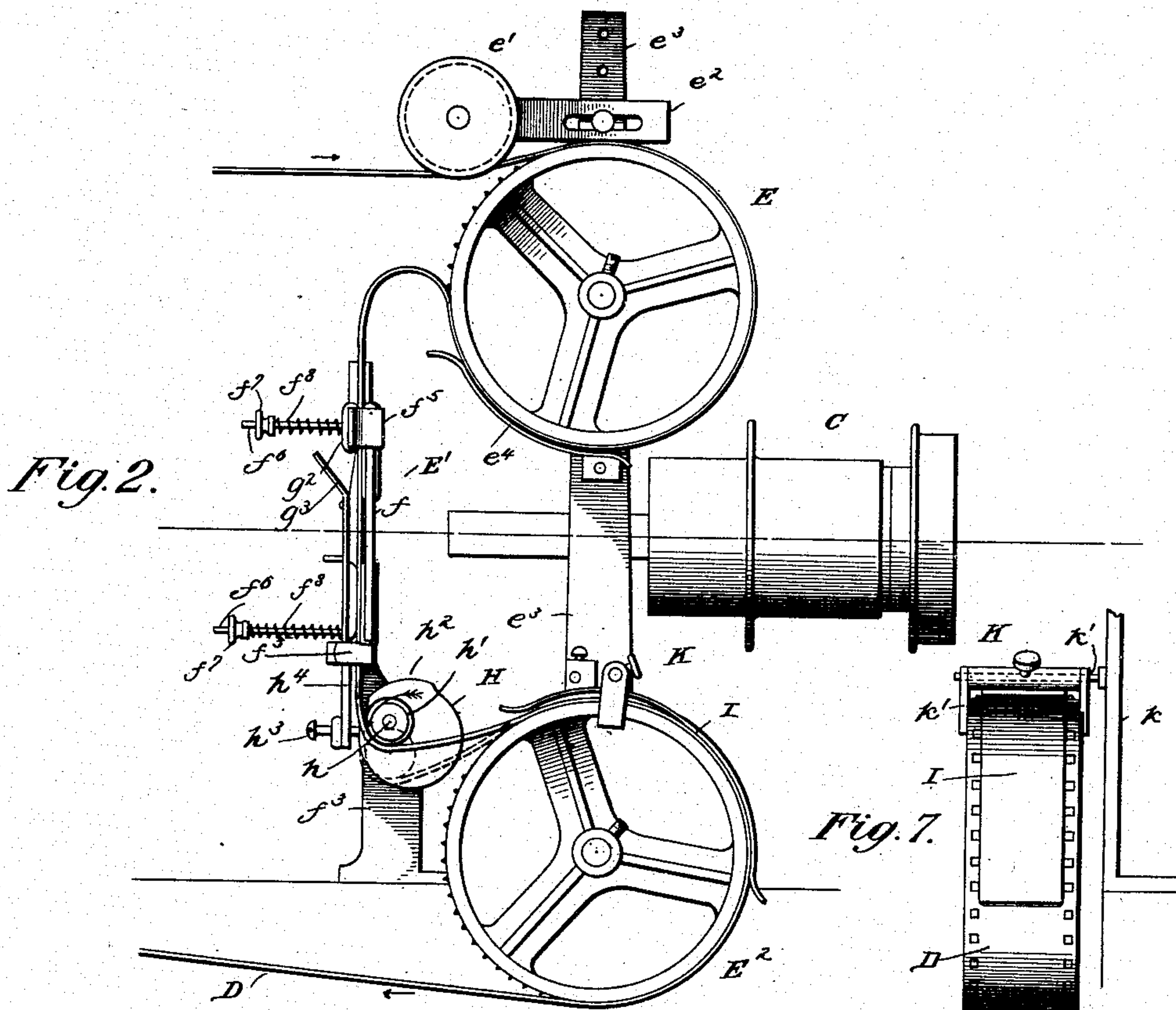
**Patented May 14, 1901.**

**T. ARMAT.**  
**VITASCOPE.**

(Application filed Feb. 19, 1896.)

(No Model.)

**3 Sheets—Sheet 2.**



Witnesses  
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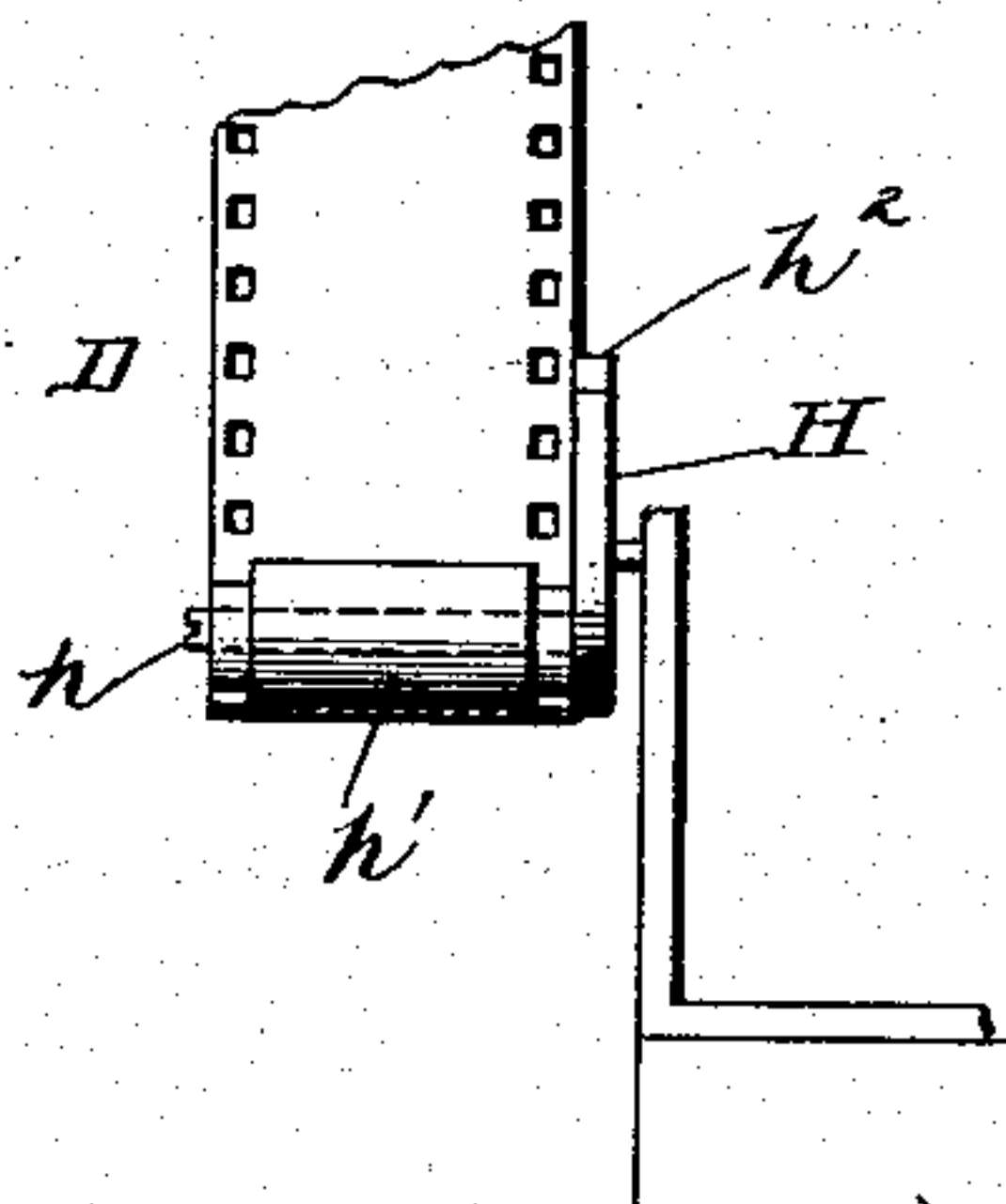
**T. ARMAT.**  
**VITASCOPE.**

(Application filed Feb. 19, 1896.)

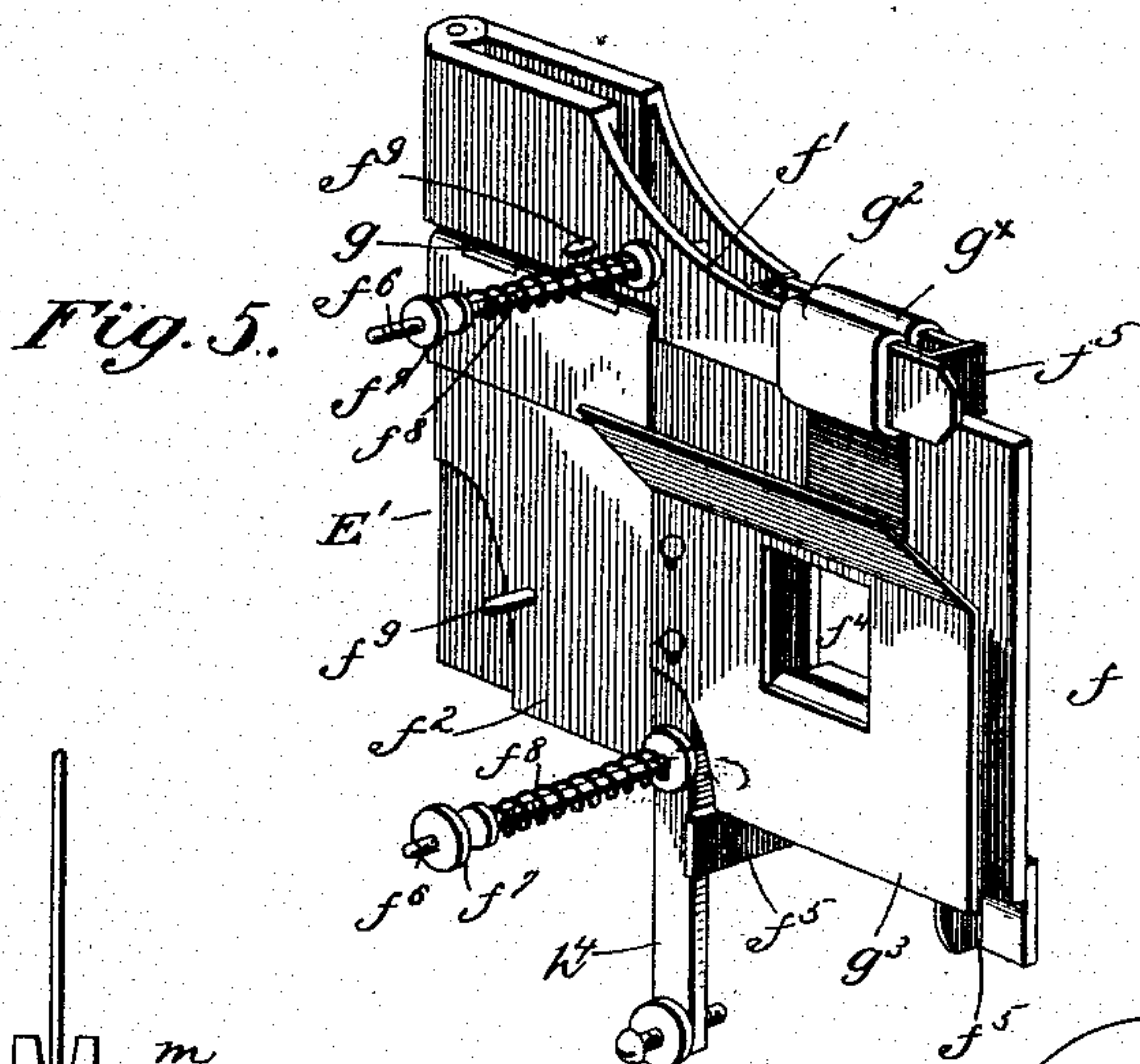
(No Model.)

**3 Sheets—Sheet 3.**

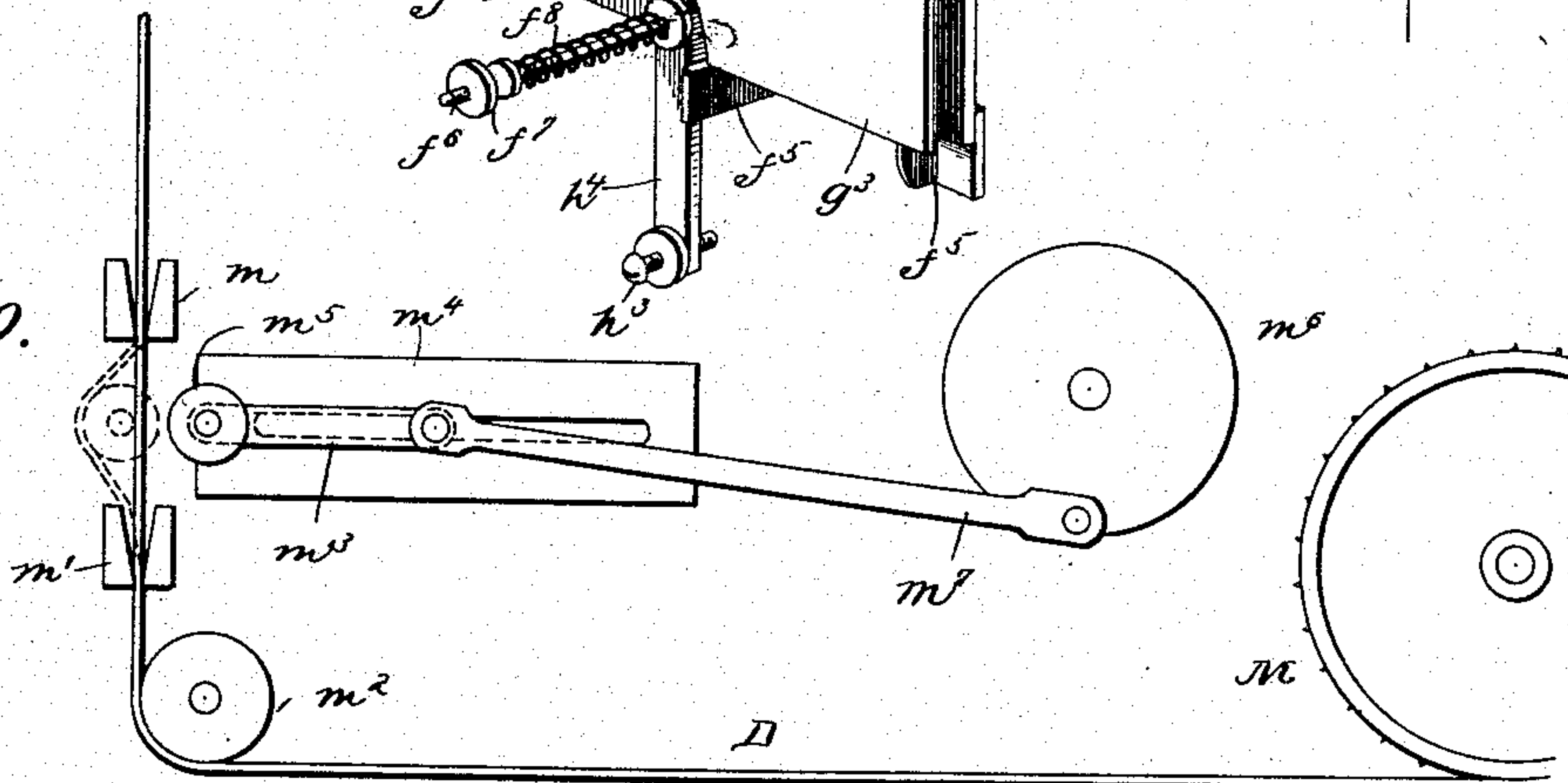
*Fig. 8.*



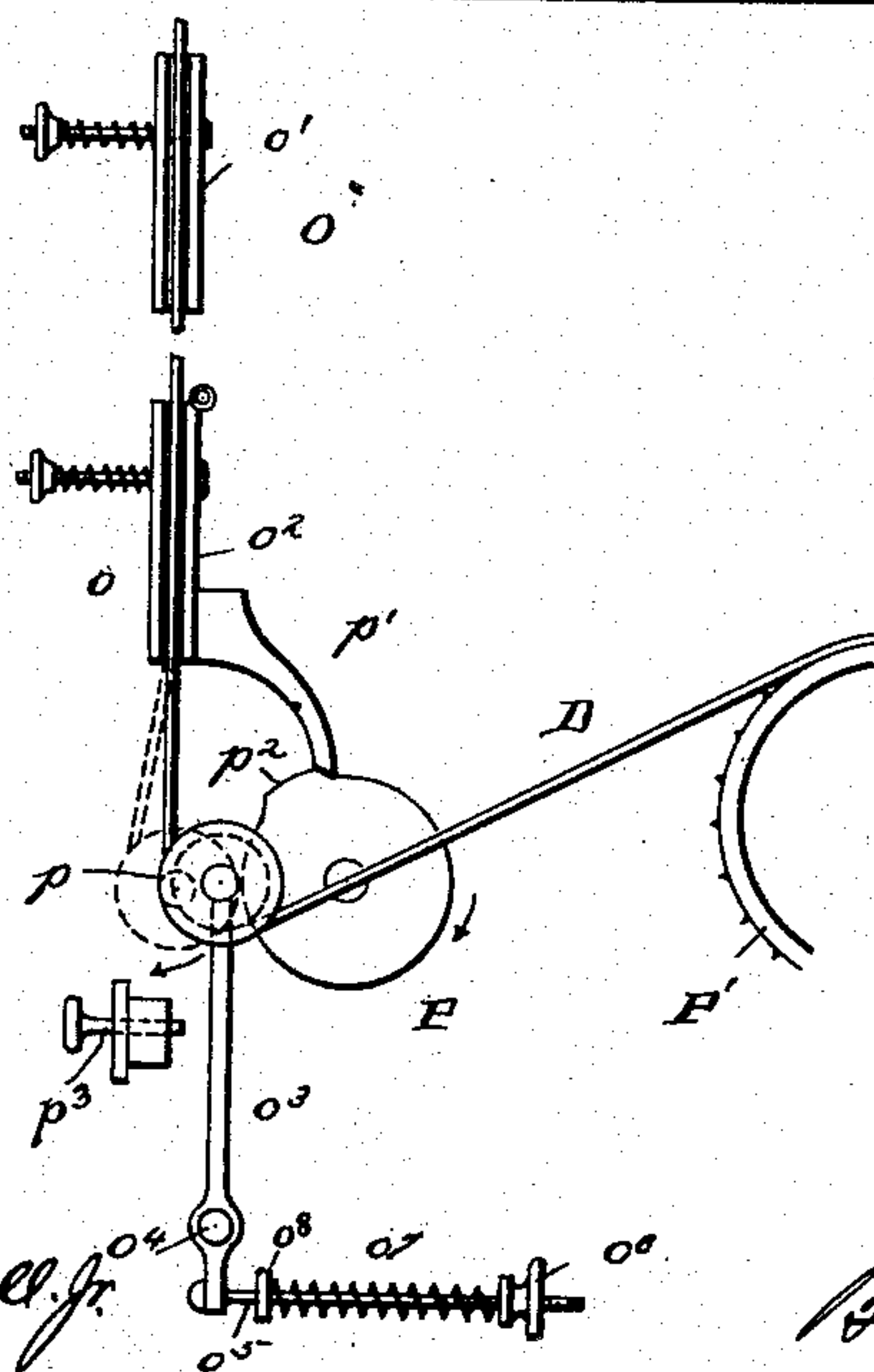
*Fig. 5.*



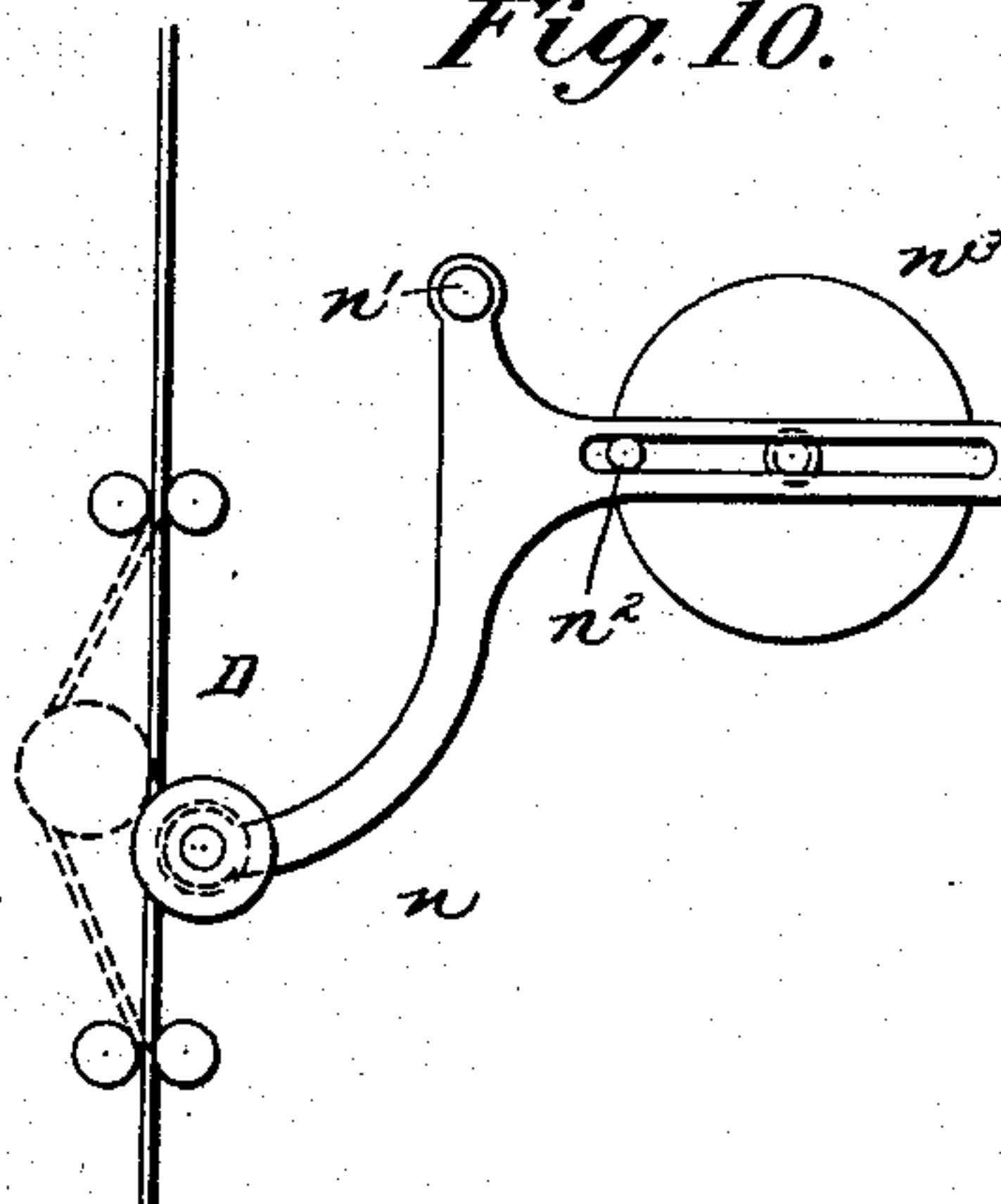
*Fig. 9.*



*Fig. 11.*



*Fig. 10.*



Witnesses  
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# UNITED STATES PATENT OFFICE.

THOMAS ARMAT, OF WASHINGTON, DISTRICT OF COLUMBIA.

## VITASCOPE.

SPECIFICATION forming part of Letters Patent No. 673,992, dated May 14, 1901.

Application filed February 19, 1896. Serial No. 579,901. (No model.)

*To all whom it may concern:*

Be it known that I, THOMAS ARMAT, a citizen of the United States, residing at Washington, in the District of Columbia, have invented certain new and useful Improvements in Vitascope; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same.

This invention relates to apparatus for exhibiting pictures, but more particularly to that class of picture-exhibiting apparatus in which the impression is given to the eye of objects in motion.

The primary object of the invention is to provide improved and efficient means whereby a series of photographic or other pictures showing successively the different positions or attitudes assumed by a person or object in motion may be displayed in such manner as to reproduce to the eye the appearance of the moving object through all the phases of such movement with a life-like and unblurred effect.

Another object is to provide means by which a continuous or endless strip or film forming the picture-carrying surface may be operated so as to successively place the objects thereon in position for reproduction without liability to injury from unnecessary strain and wear thereon and without the knocking and jarring of the mechanism which is incident to the means heretofore proposed.

Other objects are to provide means for preventing the film from flexing or puckering at the point of exposure (in order to assure a proper reproduction of the objects thereon) and for intermittently releasing the film, so as to permit it to move a sufficient distance to expose a picture at each successive movement, and also to provide continuously-operated mechanism for moving the film, and means for intermittently moving it so as to successively place the pictures in the field of illumination for reproduction.

These several objects may be accomplished by the use of the mechanism hereinafter described and without using a shutter or equivalent device, such as is commonly used in apparatuses of a similar character, whereby the light for illuminating the picture to be pro-

jected or reproduced is utilized continuously and to the best advantage and the casting of shadows or cloud effects produced by the passage of the shutter across the light is avoided.

The invention will first be hereinafter more particularly described and then pointed out in the claims at the end of the description.

Referring to the accompanying drawings, forming a part of this specification, Figure 1 is a diagrammatic view, in side elevation, of one form of picture-exhibiting apparatus embodying my invention. Fig. 2 is an enlarged side elevation of a preferred form of mechanism for operating the picture-carrying surface or film, so as to place the objects thereon successively in position for reproduction. Fig. 3 is a front elevation of the tension and guiding device for the film. Fig. 4 is an enlarged vertical sectional view taken on the line IV IV of Fig. 3. Fig. 5 is a perspective view of the tension and guiding device. Fig. 6 is an elevation of the tension and guiding device looking from the rear, illustrating an adjustable plate which may be employed for enlarging or decreasing the size of the opening therein according to the size of the object to be reproduced. Fig. 7 is a detail view of one of the feed-drums, having a pressure and a guiding device for the film while passing around said drum. Fig. 8 is a detail view of a preferred form of device for intermittently operating the film. Figs. 9 and 10 are side elevations of modified forms of mechanism for intermittently operating the film. Fig. 11 is a side view of another form of mechanism for intermittently operating the film, showing how pressure may be applied to and released therefrom. Fig. 12 is a sectional plan on the line XII XII of Fig. 1, illustrating how the banks or series of rollers may be adjusted upon their support; and Fig. 13 is a diagrammatic view of a modified form of apparatus in which a continuous instead of an endless strip or film is employed.

In devices or apparatuses such as have heretofore been devised for exhibiting life-like pictures or producing the appearance of objects in motion it has been considered most feasible to keep the series of similar pictures (whether on a disk, tape, or other surface) constantly moving at a regulated speed corresponding with the speed at which the pic-



5 tures were taken and by means of a shutter  
 or light-obstructing surface to alternately  
 cover and expose the pictures successively  
 in a manner quite similar to the method of  
 10 exposing the sensitive film or substance in  
 taking the photographs, so as to bring the  
 opening through the shutter centrally over a  
 picture at intervals practically equal to the  
 15 intervals between exposure in taking the pic-  
 tures, so that each picture may be seen only  
 when it is in such a position that it will be  
 exactly superposed upon the image not yet  
 (owing to the persistence of vision) faded  
 20 from the eye. The openings in such shutters,  
 which are ordinarily in the form of revolving  
 disks having openings near their circumfer-  
 ences, usually cover but a fractional part of  
 the circumference of the disk, so that a view  
 25 of the picture is afforded through an inter-  
 val of time much less than the period of in-  
 terruption, and as the illuminated pictures  
 and the cloud effect or darkness of interrup-  
 tion caused by the passage of the shutter  
 30 across the light are blended or mixed together  
 in the eye of the observer the darkness con-  
 tinues to impress upon the retina so much  
 longer than the light that the value of the  
 illumination is very greatly diminished and  
 the picture appears to be poorly lighted or  
 35 blurred. In the case of my invention the  
 conditions are quite different, and the results  
 produced are therefore more satisfactory than  
 and superior to anything of the kind hereto-  
 fore obtained, for the reason that the picture  
 40 is held a much longer time than is required  
 to remove it and substitute another in its  
 stead, thus prolonging the period of view or  
 illumination very greatly as compared with  
 the period of interruption or change, and there  
 45 is no obstruction of the light by the interpo-  
 sition of a shutter or opaque substance across  
 its path, so that the impression of the picture  
 on the eye is so much longer and more perma-  
 nent than the distortion or shadow effect inci-  
 50 dent to its movement and the interval of  
 change or interruption is so infinitesimal that  
 the image of the picture is readily retained  
 until displacement and substitution takes  
 effect, and owing to the inability of the eye  
 55 to receive an impression from every phase of  
 motion the interruption or change is wholly  
 imperceptible, and the result is a most vivid  
 appearance of an object in motion, otherwise  
 unchanging, clearly exhibiting all the phases  
 of such motion with life-like effect.

My invention depends for its successful op-  
 eration both upon the inability of the eye to  
 receive an impression of movement exceeding  
 a certain rapidity and upon that faculty of  
 60 the eye which enables it to retain an impres-  
 sion after the source of light has vanished—  
 the persistence of vision—which enables me  
 to change the pictures, one for another, im-  
 perceptibly. This I accomplish by moving  
 65 the film or other picture-carrying surface in-  
 termittently in such manner that the interval  
 of exposure and illumination of the picture

shall exceed the interval of time required to  
 effect a change sufficiently to enable the eye  
 to form a perfect impression or image at each  
 exposure and to retain it through the interval  
 of motion or change and until another picture  
 has been superimposed, as it were, upon the  
 one displaced, thus rendering the act or effect  
 of displacement and substitution of pictures  
 75 wholly imperceptible and giving the impres-  
 sion to the eye of objects in motion. Various  
 contrivances and forms of mechanisms may  
 be employed for effecting the intermittent  
 movement, the requirement being that the  
 80 film or other surface shall be moved quickly  
 between successive pauses far enough to ex-  
 pose the next succeeding picture in the series.

In the arrangement illustrated in Fig. 1 is  
 shown an illuminator A and a condensing-  
 85 lens B, the latter arranged adjacent to the  
 illuminator and adapted to concentrate the  
 rays of light upon a picture located in the  
 focus of an objective lens C, all of which parts  
 may be of the usual or of any preferred con-  
 90 struction and arranged in any suitable man-  
 ner. The strip or film D may be composed of  
 any suitable transparent or translucent flexi-  
 ble substance adapted to provide a surface  
 for carrying pictures produced or impressed  
 95 thereon by photographic or other means, the  
 several pictures in the series representing  
 successively different positions of a moving  
 object, so that the rapid exhibition of the en-  
 100 tire series of pictures in the order in which  
 they were made or taken may result in the re-  
 production of the appearance of the moving  
 object in every phase of its motion. An up-  
 per and a lower bank or series of rollers  $d$   $d'$ ,  
 105 respectively, may be arranged upon a suit-  
 able support  $d^2$ , and the film may be made to  
 pass around or partially around each roller  
 in the series, passing alternately from an up-  
 per to a lower roller, or vice versa, so as to  
 take up the surplus material and provide com-  
 110 pact means by which a very long continuous  
 or endless strip may be employed. These  
 banks or series of rollers are preferably ad-  
 justably supported upon the standard  $d^3$  in  
 order to permit films of various lengths to be  
 115 used, and for this purpose the frames of the  
 rollers  $d$   $d'$  may be provided with projecting  
 screw-threaded bolts which may pass through  
 slots  $d^3$  in said support or standard and be se-  
 120 cured thereto by a thumb-nut  $d^4$  on the pro-  
 jecting threaded end of the bolt or otherwise,  
 as shown in Fig. 12. From the last roller of  
 the upper series or bank the film may pass  
 around or over a roller or stud  $d^5$ , preferably  
 125 first passing under a take-up roller arranged  
 between said roller  $d^5$  and the upper series or  
 bank of rollers  $d$ , said take-up roller being  
 arranged on an arm  $d^6$ , which has its inner  
 end pivoted to the support, so that its outer  
 end may move freely in order to provide a  
 130 yielding surface over which the film may  
 pass and to provide means for taking up the  
 slack in said film, though as an additional  
 means for taking up the slack the arm  $d^6$  may



be weighted or otherwise caused to exert a pressure upon the surface of the film. The film after leaving the roller  $d^5$  is caused to pass around a drum or spool E, then through a tension and guiding device E', and then around a drum or spool E<sup>2</sup>, as hereinafter more fully explained, and then over one or more rollers  $e$  to the lower series or bank of rollers  $d'$  in the direction shown by the arrows.

The drums or spools E and E<sup>2</sup> are preferably provided with peripheral teeth or projections adapted to engage perforations in the film, so as to properly guide and hold it against slipping. These spools may have their shafts journaled in any suitable support or standard and may be geared together by a sprocket-chain or otherwise, so as to rotate in unison, being so timed that each spool will rotate the same number of times in the same space of time. The film is preferably gently pressed in its passage over the drum E by a roller  $e'$  resting thereon, said roller being journaled in a bracket  $e^2$ , which is adjustably mounted upon a standard  $e^3$ , rising above the drum E. Below the drum E may also be placed a curved spring or yielding strip of metal  $e^4$ , which may be secured to the standard  $e^3$ , so as to bear underneath the film and press it gently against the periphery of the drum. Owing to its rigidity or stiffness the film D will be caused to move or be carried upwardly or outwardly a short distance away from the drum E and its point of contact with the spring  $e^4$ , so as to provide constant slack in the film at this point, and then with a return-bend it may pass in a substantially straight line through the tension and guiding device E' and thence to the drum E<sup>2</sup>.

As a means for tensioning and frictionally holding the film so as to permit the series of pictures thereon to be brought successively into the illuminated field and retained for exposure therein for a predetermined time I preferably employ a tension device E', having a stationary member  $f$  and the pivoted or hinged members  $f'$  and  $f^2$ , between which the film passes, as shown in Figs. 2 to 6, inclusive. The stationary member  $f$  may be supported in any suitable manner, as upon the standard  $f^3$ , and is provided with an opening  $f^4$ , through which the successive pictures may be exposed, and with the upper and lower guides  $f^5$ , against which the edges of the film may abut, so as to be properly aligned while passing between the yielding and stationary members. Pins or stems  $f^6$  may project from the stationary member  $f$  and pass through apertures in the yielding or movable members  $f'$  and  $f^2$ , each stem being provided with a nut  $f^7$  at its outer end, between which and its corresponding yielding member is placed a coiled or other suitable spring  $f^8$ , so that said movable members may be held with a yielding force in proper relation to the stationary member to clasp the film between the same, said yielding or movable

members being each also preferably provided with an aperture through which pins  $f^9$ , projecting from the stationary member, may pass in order to serve as a guide therefor when moved on their pivots. The member  $f^2$  may be pivoted or hinged, as at  $g$ , below the member  $f'$  and is preferably angular in form and forced with greater pressure against the film than the member  $f'$  in order to prevent flexing or puckering at the point of exposure and to yieldingly hold the film and to exert a pressure sufficient to prevent the displacement thereof while the objects thereon are in position for reproduction. By employing two tension devices or a tension device having two members adapted to exert different pressures for yieldingly holding the film or picture-carrying surface one of said members will act promptly in case the other should not, and thus insure the stoppage of the film the instant it has been advanced the desired distance and the holding of the same stationary during the desired interval of exposure. In the form shown the pivot of the member  $f'$  is arranged above and at right angles to the pivot of the member  $f^2$ . To cushion and provide a smooth brushing-surface for the film between the members or any two or more of the same of the tension device, a strip of leather or other suitable material  $g'$  and a strip of softer material  $g^x$ , as felt or plush, may be cemented or otherwise secured on the stationary member  $f$ , between the guides  $f^5$  and on opposite sides of the opening  $f^4$ , while on either or both of the movable or yielding members (preferably the member  $f'$ ) may be secured felt, plush, or other suitable material, as at  $g^2$ , adapted to contact with the film and exert a yielding pressure thereon, so as to keep the film free from dust and to prevent it from slipping. Upon the movable member  $f^2$  and secured thereto or formed integrally therewith is a plate or shield  $g^3$ , having an aperture therethrough corresponding with the aperture  $f^4$  of the stationary member, said shield being separated from the stationary member  $f$  by a suitable space in order to protect the film and tension and guiding device from the heat of the illuminator and to provide a space for the circulation of air, so as to keep the film cool, this result being facilitated by the fanning action of said plate or shield under the action of the cam operating intermittently to release the tension on the film.

As the pictures on different films do not always occupy the same position with reference to the perforations in the film, one or more adjustable plates, as  $g^4$ , Fig. 6, may be provided for varying the size of the opening  $f^4$  of the stationary member according to the position of the pictures or objects to be exposed relative to such perforations.

For the purpose of intermittently moving or feeding the film or picture-carrying surface in such manner as to cause the series of pictures thereon to be brought into and permit-



ted to remain in the illuminated field for an interval of time exceeding the time required to effect the displacement of any one picture and the substitution of another therefor and to automatically release the pressure exerted upon the film by the yielding member of the tension device I may employ a rotating disk, cam, or other rotating element H, Figs. 1, 2, and 8, having thereon, preferably, an eccentric stud or pin  $h$ , which may have a friction-roller  $h'$  journaled thereon and adapted to impinge against the film and advance the same a predetermined distance at each revolution of said disk or cam. The disk may be journaled in a suitable standard or frame-piece, as  $f^3$ , in such position that the stud or roller thereon may press downwardly upon the film at a point between the tension device  $E'$  and drum  $E^2$ , so as to cause the film to be moved or drawn downward the required distance at each revolution of said disk or cam. A cam-surface  $h^2$  on the disk or cam H is adapted to engage the end of a screw  $h^3$ , arranged in a pendent arm  $h^4$ , which is secured to or formed integrally with the member  $f^2$  of the tension device, in order to release the pressure on the film by said member prior to and while the film is being drawn downward by the roller  $h'$ . This roller is preferably provided with a suitable covering and may have reduced ends, as shown in Fig. 8, so that it may engage the surface of the film between the perforations in order to prevent enlarging or otherwise distorting the perforations. This arrangement permits the film to be constantly moved by the drums  $E$   $E^2$ , while a portion thereof is intermittently fed forward and positively held during the interval of exposure, so as to present the successive pictures in the field of illumination, while maintaining sufficient tension thereon to prevent the film from slipping or moving more than the required distance.

In connection with one or both of the feed-drums  $E$  and  $E^2$ , I may employ a pressure device, such as shown at I in Figs. 2 and 7. This pressure device may consist of a spring having a portion thereof adapted to press the film yieldingly against the smooth face or periphery of the drum, between the rows of teeth thereon, so as to hold the film in place. A guide K may also be provided for either or both of the feed-drums, said guide being preferably supported upon a suitable standard  $k$  and provided with depending arms or fingers  $k'$ , adapted to embrace the edges of the film, so as to aline the same and prevent the projections on the drum from enlarging or otherwise injuring the perforations in the film.

The feed-drums  $E$  and  $E^2$  should be geared together, so as to run at a regulated speed and should revolve in unison with each other, each making a complete revolution in the same instant of time, and the disk or cam H should be so actuated and timed with respect to the rate of movement of the drums that

the film may be advanced the same distance for every revolution. Though no mechanism is shown for this purpose it is obvious that gearing, belts, chains, or any other suitable means may be employed and may be actuated by an electric or other suitable motor.

The operation of the invention will be readily understood from the foregoing description when taken in connection with the accompanying drawings, the parts being in the position shown in Figs. 1 and 2. If the feed-drums are rotated at a proper speed, the film D will be moved in the direction indicated by the arrows; but the pressure exerted by the tension device  $E'$  will hold the film stationary with the exposed picture in the field of illumination for a predetermined time and until the disk H has rotated far enough to cause its roller  $h'$  to contact with the film for advancing the latter, so as to displace the exposed picture and bring another picture into the field of illumination, there being sufficient slack in the film at the bend thereof above said tension device to permit a rapid movement of a given length sufficient to displace any one of the pictures in the series and permit another to be brought into position for exposure or reproduction. When the object has been held in the field of illumination the proper interval of time, the cam-surface  $h^2$  of the cam or disk H will engage the set-screw  $h^3$  and throw the member  $f^2$  of the tension device outwardly on its pivot, so as to relieve the pressure exerted thereby upon the film, the member  $f'$  being adapted to exert a constant but yielding pressure on the film to prevent the latter from slipping or being fed farther than is required to present the successive pictures in proper position. When the pressure exerted on the film by the member  $f^2$  is relieved, the roller  $h'$  on the disk H will simultaneously engage the film and move it downward a sufficient distance to displace one object or picture and place the next succeeding object in proper position for exposure. When the tension device and film are released by the cam  $h^2$  and roller  $h'$ , respectively, on the disk H, the roller will revolve the remaining portion of a complete revolution before again moving the film, while the released tension device instantly regains its hold upon and holds that part of the film which is in the field of illumination stationary until the roller again contacts with the film. During this interval of time the slack in the film between the tension device and the drum  $E^2$  will be gradually taken up by the last-mentioned drum, but not at such a speed as to exert a tension sufficient to move the film during the interval of exposure of the picture, and in the same instant of time, while the picture is being exhibited, the slack in the film between the tension device and the drum  $E$ , which has been taken up by advancing the film, will be compensated by an additional amount of slack paid out by the drum  $E$ , thus providing sufficient slack ahead



of the tension device to permit the next succeeding picture to be brought quickly into the field of illumination and allowing sufficient slack in that portion of the film which has passed the tension device to be taken up by the succeeding drum during the inaction of the film-advancing device. This operation will be repeated in regular sequence, the film being caused to move over the surface of the drums E and E<sup>2</sup> continuously, while that portion thereof which lies between the two drums is intermittently moved forward just far enough to expose a picture at each move, the film-advancing mechanism being also continuously driven, but adapted to only intermittently advance the film, the interval of illumination of the picture being made to exceed the interval of movement or change preferably very greatly or in the ratio of about one to ten. In this manner the pictures on the picture-carrying surface or film may be successively displaced and substituted one for another with great rapidity, so that in exhibiting a series of similar pictures representing the same moving object in different phases of its motion the impression may be given to the eye of persons or objects in motion and with a vivid or life-like appearance. I thus provide means for operating the film so that it may be moved the proper distance for exposing successive pictures without liability to injury thereto, and whereby the knocking and jolting of the machinery incident to the necessarily rapid movement of the parts may be effectually prevented.

It is obvious that various devices may be employed for intermittently moving the film so as to successively place the pictures in the field of illumination. In Fig. 9 the film passes between two suitable tension devices *m m'*, then around a roller *m<sup>2</sup>*, and thence to the drum M, though other means for guiding said film may be used, if desired. Between the guides *m m'* may be arranged an arm or cross-head *m<sup>3</sup>*, adapted to slide in a suitable support *m<sup>4</sup>*, one end of said cross-head being provided with a roller or other engaging portion *m<sup>5</sup>*, and the other end thereof connected to suitable driving mechanism, as a crank and pitman *m<sup>6</sup> m<sup>7</sup>*, respectively, so that when the cross-head is forced forward the roller will engage the film between the guides and force it outward, thereby causing the slack portion of the film above the guide or tension device *m* to move downward the desired distance to displace one picture and place another in its stead, the slack below the tension device *m'* in the film being taken up by the drum M or in any other preferred manner. The roller for actuating the film, instead of having a sliding reciprocating movement, as in Fig. 9, may be arranged on the end of an oscillating arm or lever *n*, Fig. 10, pivoted, as at *n'*, to a suitable support, so as to swing in the arc of a circle. In this case the lever *n* may have a slotted portion in which a pin or stud *n<sup>2</sup>*,

projecting from a rotary disk or crank *n<sup>3</sup>*, may work, so as to tilt said lever on its pivot and force the film outward, as shown in dotted lines.

Fig. 11 illustrates a modified form of tension and guiding device and means for intermittently operating the film. The stationary member *o* of the tension device O in this instance may be in two parts, as shown, (or in one piece, if preferred,) and has an upper yielding member *o'*, which exerts a constant yielding pressure upon the film, and a lower pivoted or hinged and yielding member *o<sup>2</sup>*, adapted to exert a greater pressure upon the film than the member *o'* in substantially the same manner as in the tension device E'. A lever *o<sup>3</sup>* may be pivoted, as at *o<sup>4</sup>*, to a suitable support and has on one end thereof a rod or stem *o<sup>5</sup>*, provided with an adjusting-nut *o<sup>6</sup>*, and a spring *o<sup>7</sup>*, interposed between said nut and a suitable stop or fixture *o<sup>8</sup>*, through which the rod *o<sup>5</sup>* slides, so that the rod will be normally forced inward, and on the opposite end of said lever may be journaled a roller *p*, adapted to engage the film and tending to normally force the same outward, as shown in dotted lines. The yielding member *o<sup>2</sup>* of the tension device is provided with a depending arm or finger *p'*, adapted to be engaged by the cam-surface *p<sup>2</sup>* of the disk or cam P at a predetermined time, so that when said member is thrown outward sufficiently to relieve the pressure on the film the spring *o<sup>7</sup>* will force the end of the lever *o<sup>3</sup>*, with the roller *p* thereon, in the direction indicated by the arrow, until the lever reaches the adjustable stop *p<sup>3</sup>*, at which time the picture in the field of illumination will be displaced and another substituted therefor. At P' is a drum for taking up the slack in the film and holding the lever *o<sup>3</sup>* against the tension of the spring *o<sup>7</sup>* until the pressure on the film by the member *o<sup>2</sup>* of the tension device is relieved by the cam P.

In Fig. 13 the film is shown as a continuous strip or band instead of an endless strip, as shown in Fig. 1. In this case the film may be unwound from a reel or spool Q' and after passing around the feed-drums E and E<sup>2</sup>, as heretofore explained, may be caused to pass around a roller *q* and then to the reel or spool Q', the latter being operated in any suitable manner, as by frictional engagement devices, to take up the slack in the film as it is unwound from the drum E without causing unnecessary tension upon said film. The reel Q' may, however, be placed in such position that the film may be wound directly thereon from the drum E<sup>2</sup>.

It will be understood, of course, that the film may be fed to the tension device and taken up after leaving the same by other means than by the use of the feed-drums, that certain parts of the apparatus may be dispensed with or others substituted therefor, and that some parts of the operating mechanism and other parts of the apparatus may



be employed in other connections or for other purposes than exhibiting pictures without departing from the spirit of my invention.

5 From the foregoing description it will be seen that the pictures are brought successively into an illuminated field and that each picture is illuminated without interruption from the instant it enters such field until displaced by the next picture in the series and that the several pictures in the series are successively substituted one for another with such rapidity that although the exposed portion of the film or picture-carrying surface is continuously illuminated the eye receives an impression of the picture which so greatly predominates any possible impression that might be made by the practically instantaneous motion of said film or surface in substituting picture for picture that the predominating impression which the eye receives, owing to its inability to receive two impressions at one and the same time and to the persistence of vision, has the effect of rendering the movement of the film utterly imperceptible, while the successive impressions of different pictures are each retained until another picture in the series is superimposed, as it were, upon the previous impression or picture, thus rendering it possible to produce most vivid and life-like effects without any interruption whatever in the illumination, whether the film is moving or stationary and without interposing a shutter, and thereby causing a shadow or shade effect which reduces the vividness of the impression; but I do not desire to be confined to the use of the invention without a shutter, inasmuch as such a device might be used under some circumstances—as, for instance, when constructed so as to interrupt the illumination only at that instant of time when the film is moving and without rendering the interruption perceptible to the eye; but for all practical purposes a shutter of any kind is useless and objectionable and is preferably dispensed with.

Having thus fully described my invention, what I claim as new, and desire to secure by Letters Patent of the United States, is—

50 1. In a picture-exhibiting apparatus for giving the impression to the eye of objects in motion, the combination with a picture-carrying strip or film, a tension device adapted to keep the film taut and prevent flexing or puckering at the point of exposure, means for intermittently moving the film through the tension device at short intervals exceeding the interval required in effecting the movement, so that the period during which each picture is stationary and visible shall exceed the period occupied in substituting one picture for another, and mechanism for feeding the film so as to provide slack therein between the same and said tension device, whereby the film may be moved with great rapidity without unnecessary strain and wear upon the film, substantially as described.

2. In a picture-exhibiting apparatus for giving the impression to the eye of objects in motion, the combination with a picture-carrying strip or film, a tension device adapted to keep the film taut and prevent flexing or puckering at the point of exposure, means for intermittently moving the film through the tension device at short intervals exceeding the interval required in effecting the movement, so that the interval of pause and illumination shall exceed the interval of motion, and mechanism for feeding the film so as to provide slack therein between the same and said tension device, whereby the film may be intermittently moved with great rapidity without unnecessary strain and wear upon the film, substantially as described.

3. In a picture-exhibiting apparatus for giving the impression to the eye of objects in motion, the combination with an illuminator and a projecting lens, of a picture-carrying strip or film having a portion thereof arranged in the focus of the objective of the projecting lens, a tension device adapted to keep the exposed portion of the film taut and prevent flexing or puckering at the point of exposure, means for intermittently moving the film at short intervals exceeding the interval required in effecting the movement, so that the interval of pause and illumination shall exceed the interval of motion; mechanism for taking up the film as it is intermittently moved, and mechanism for feeding the film so as to provide slack therein between the same and said tension device, whereby that portion of the film between the feeding and take-up mechanisms may be intermittently moved with great rapidity without unnecessary strain and wear upon the film, substantially as described.

4. The combination, in an apparatus for exhibiting pictures so as to give the impression to the eye of objects in motion, of a picture-carrying film or strip, a pair of feed-drums adapted to be continuously rotated so as to give a continuous movement to the film, a tension device interposed between the feed-drums adapted to hold and keep the film taut so as to provide slack on one side thereof, together with means for intermittently moving the film between the drums at short intervals exceeding the interval required in effecting the movement, so that the interval of pause and illumination shall exceed the interval of motion, substantially as described.

5. In a picture-exhibiting apparatus, the combination with a picture-carrying film and means for giving movement to the same, of a tension device provided with a yielding member adapted to hold and prevent movement of the film for a predetermined interval of time, together with mechanism for intermittently moving the film and simultaneously engaging a portion of the yielding member so as to release the pressure exerted thereby upon the film, whereby the pictures may be successively placed in position for ex-



posure with great rapidity without unnecessary strain and wear upon the film, substantially as described.

6. In a picture-exhibiting apparatus, the combination with a picture-carrying surface or film and means for intermittently moving the same so as to successively expose the pictures thereon, a tension device for yieldingly holding the film, having two parts or members adapted to exert different pressures, so as to insure prompt action of one or the other of said parts the instant the film has moved the desired distance, substantially as described.

7. In a picture-exhibiting apparatus, the combination with an illuminator and a projecting lens, of a picture-carrying strip or film having a portion thereof arranged in the focus of the objective of the projecting lens, a tension device having two members adapted to exert different pressures so as to keep said portion of the film taut and prevent flexing or puckering at the point of exposure, means for intermittently moving said portion so as to impart a step-by-step movement thereto and successively place the pictures in position for exposure, mechanism for taking up the film as it is intermittently moved, and mechanism for feeding the film so as to provide slack therein between the same and said tension device, whereby that portion of the film between the feeding and take-up mechanisms may be intermittently moved with great rapidity without unnecessary strain and wear upon the film, substantially as described.

8. In a picture-exhibiting apparatus, the combination with a picture-carrying film, of a tension device therefor having two members adapted to exert different pressures so as to keep the film taut and prevent flexing or puckering at the point of exposure, mechanism for taking up the film after leaving the tension device, means located intermediate said tension device and the take-up mechanism for intermittently moving the film, together with means for feeding the film so as to provide slack between the same and said tension device, whereby the pictures may be successively placed in position for exposure with great rapidity without unnecessary strain and wear upon the film, substantially as described.

9. The combination with a film or strip and means for imparting movement thereto, of a tension device provided with a yielding member adapted to hold and keep the film taut and prevent flexing or puckering at the point of exposure, a rotatable element adapted to contact with a portion of the yielding member so as to relieve the pressure exerted thereby upon the film, together with means for intermittently moving the film through the tension device, substantially as described.

10. The combination with a film or strip, of a pair of feed-drums adapted to be continuously rotated so as to give a continuous movement to the film, a tension device interposed

between the feed-drums and provided with a yielding member adapted to hold and keep the film taut, so as to provide slack on one side thereof, a rotary disk or cam adapted to contact with a portion of the yielding member so as to release the pressure thereof on said film, and having thereon a projecting portion adapted to engage the film and intermittently move the same when the pressure of said yielding member is released, substantially as described.

11. In combination with the film and means for imparting movement thereto, the tension device comprising three members between which the film is adapted to pass, one member being stationary and the others adapted to press the film against said stationary member with different pressures so that when the pressure of one of the yielding members is released the other may exert a pressure sufficient to prevent slipping of the film without preventing its proper movement, whereby the film may be successively moved a uniform distance, substantially as described.

12. The combination with a film or strip, of a tension device comprising a stationary member, two spring-pressed yielding members adapted to press the film against said stationary member with different pressures, guides for alining the film, and means whereby one of the yielding members may be actuated so as to release the pressure exerted thereby upon the film, substantially as described.

13. The combination with a film or strip, of a tension device comprising a stationary member, two yielding members hinged thereto adapted to press the film against said stationary member with different pressures, guides for alining the film, means whereby one of the yielding members may be actuated so as to release the pressure thereof upon the film, and a plate or shield carried by one of the yielding members and separated therefrom sufficiently to provide space for the circulation of air, whereby the film may be protected from the heat of the illuminator and the parts kept cool by the fanning action of said plate, substantially as described.

14. The combination with a film or strip and means for imparting movement thereto, of a support, banks or series of rollers separated from each other and adjustably held upon said support so that the film may pass alternately from a roller of one series to the next succeeding roller of the other series, together with an arm pivotally held to the support and provided with a roller adapted to engage the film and exert a tension thereon, substantially as described.

In testimony whereof I affix my signature in presence of two witnesses.

THOMAS ARMAT.

Witnesses:

J. A. E. CRISWELL,  
CHARLES E. RIORDON.