No. 645,897. Patented Mar. 20, 1900.

A. D. EMERY.

WEFT REPLENISHING MECHANISM FOR LOOMS.

(Application filed Sept. 23, 1898.)

(No Model.) 8 Sheets—Sheet 1.

Fig. 1

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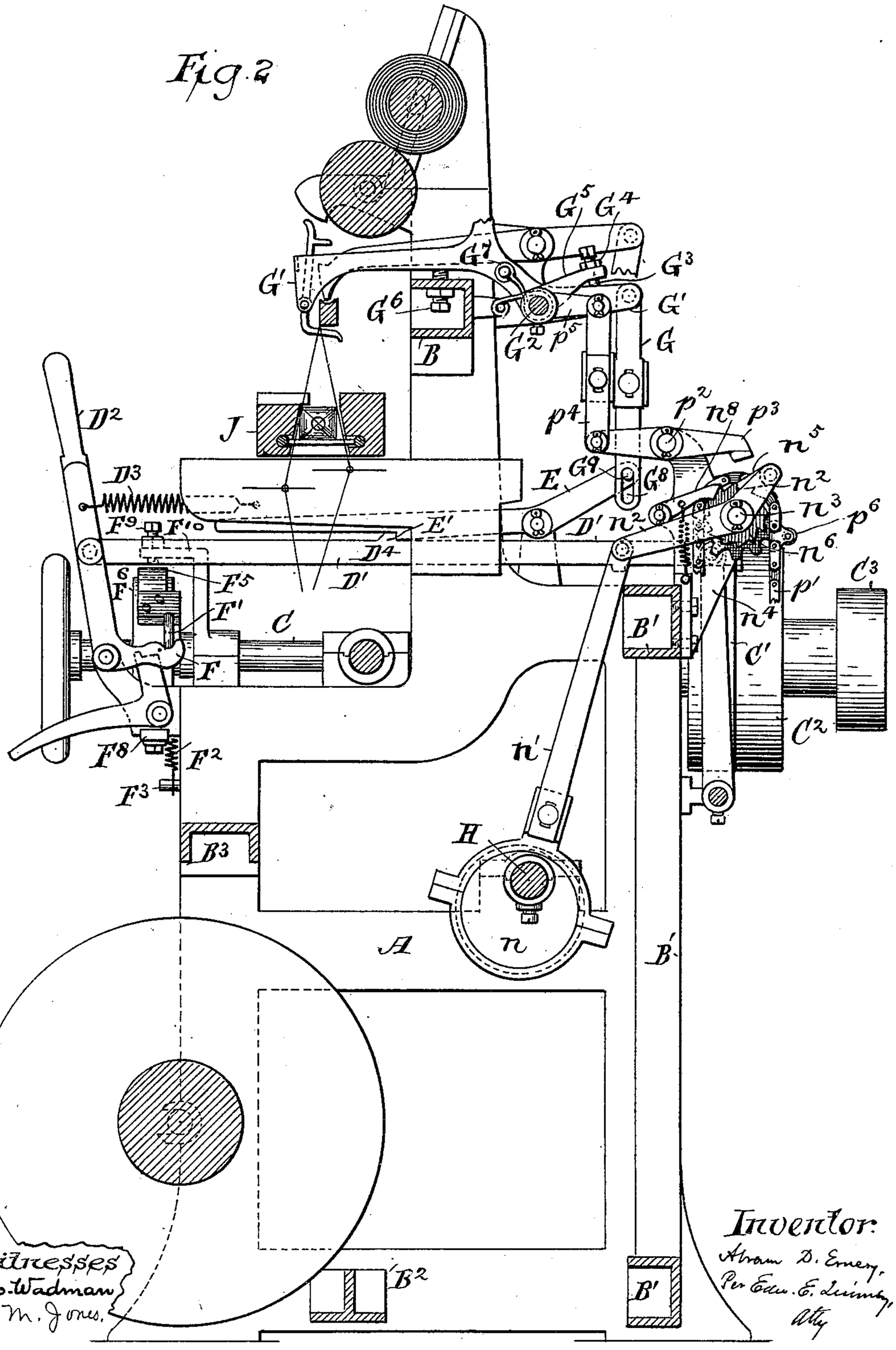
(No Model.) 8 Sheets—Sheet 2.

Fig. 2



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(No Model.) 8 Sheets—Sheet 3

Fig. 3

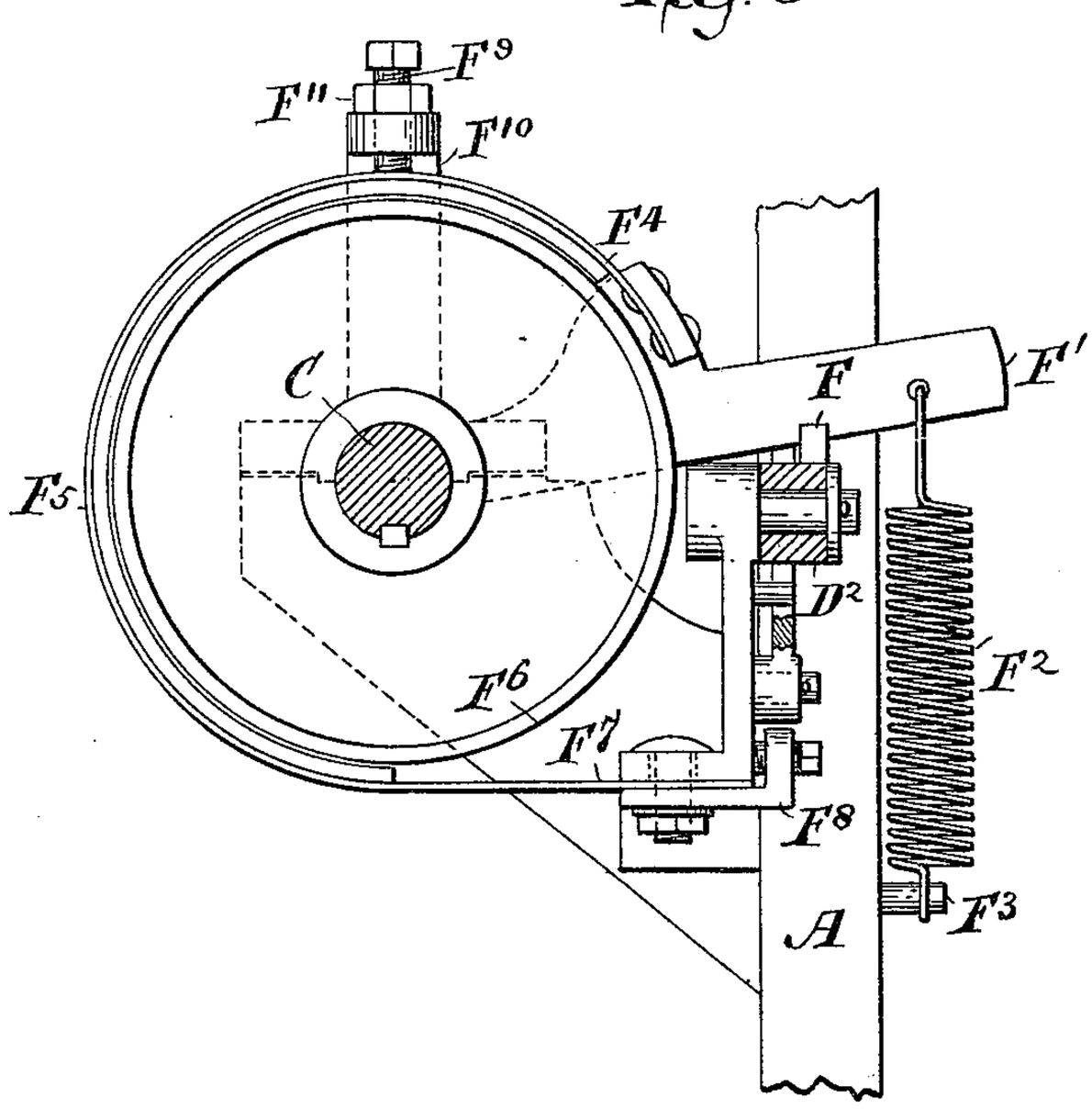
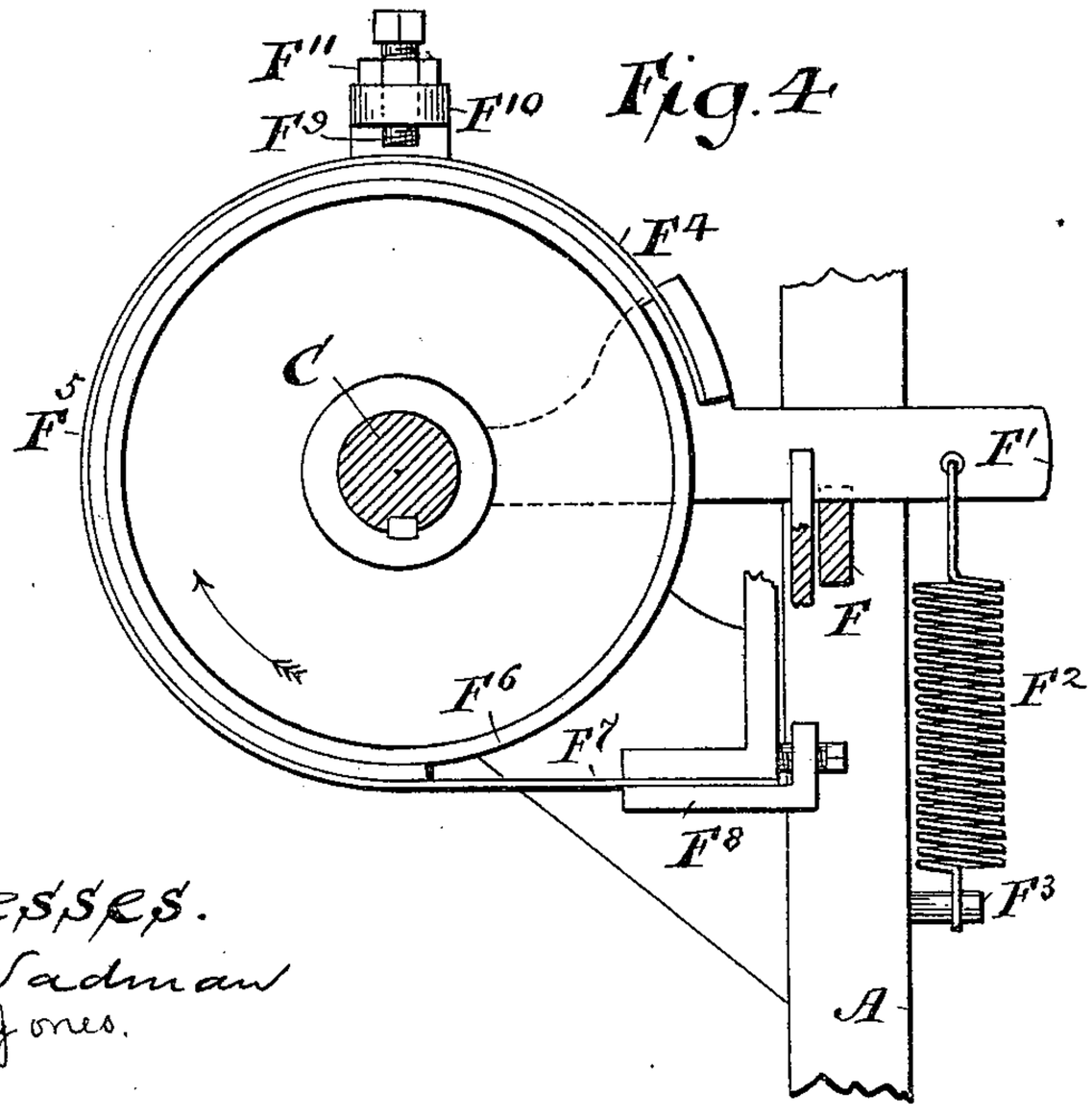


Fig. 4



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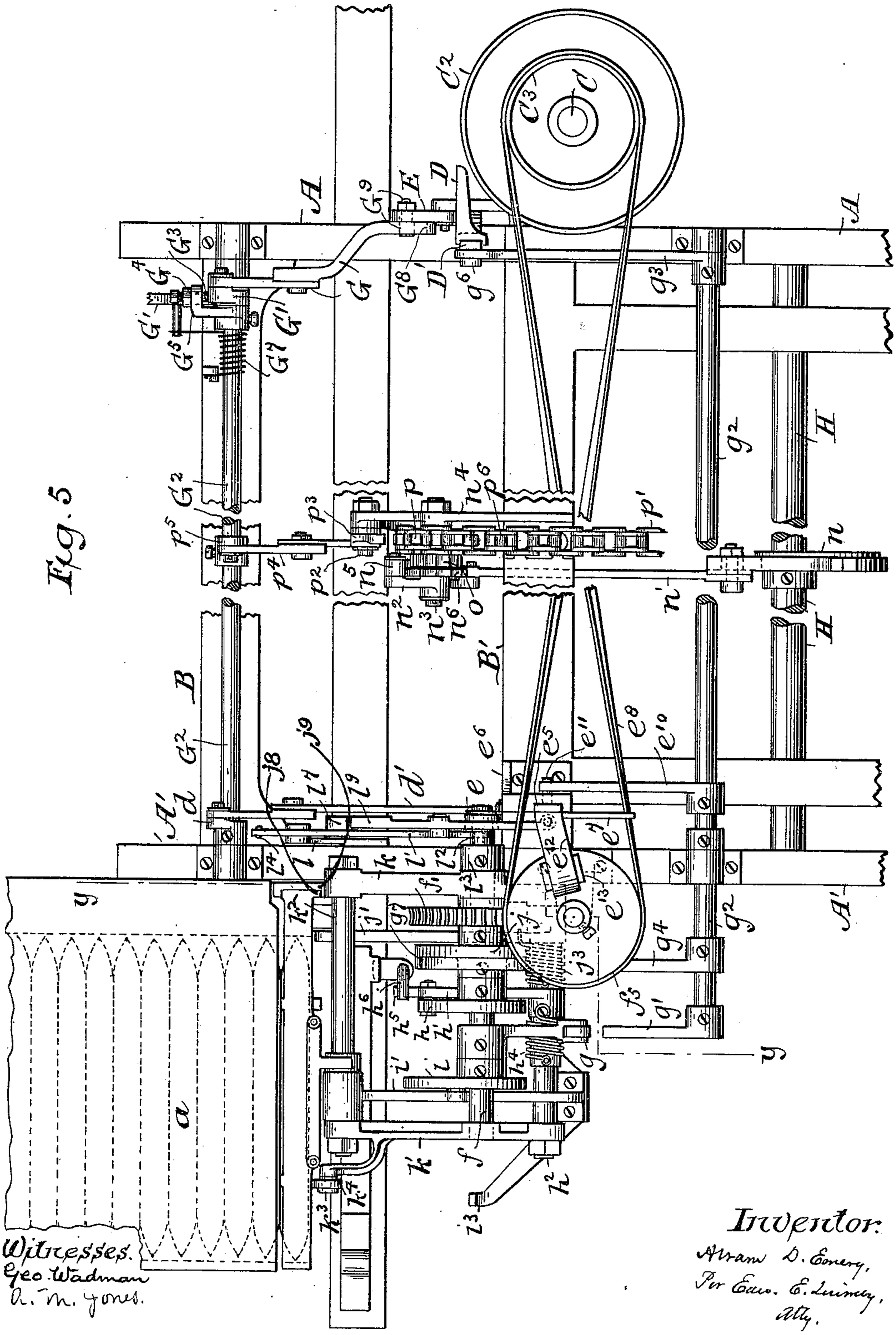
(No Model.) 8 Sheets—Sheet 4.

Fig. 5



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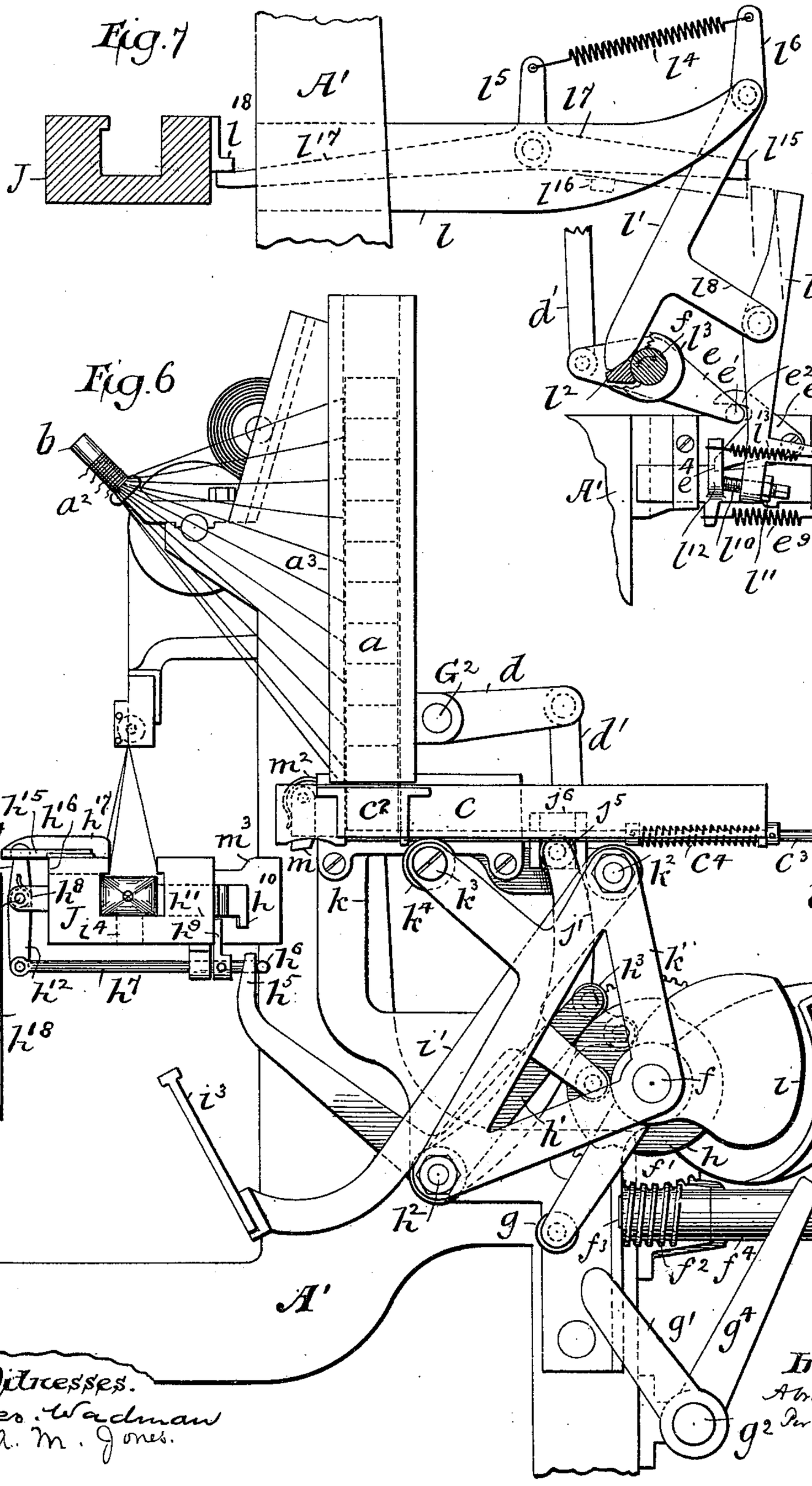
(No Model.) 8 Sheets—Sheet 5.

Fig. 7



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(No Model.) 8 Sheets—Sheet 6.

Fig. 8

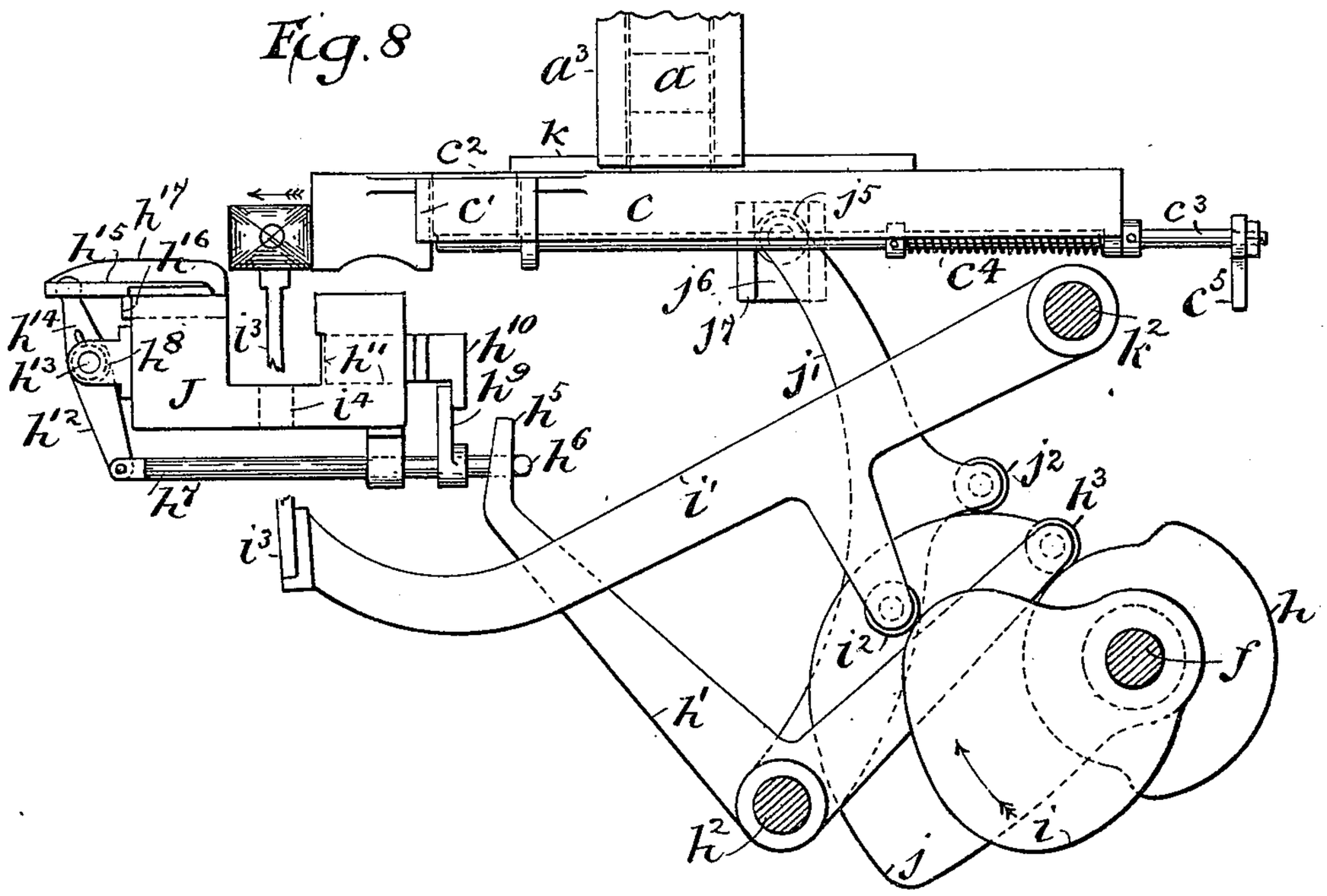
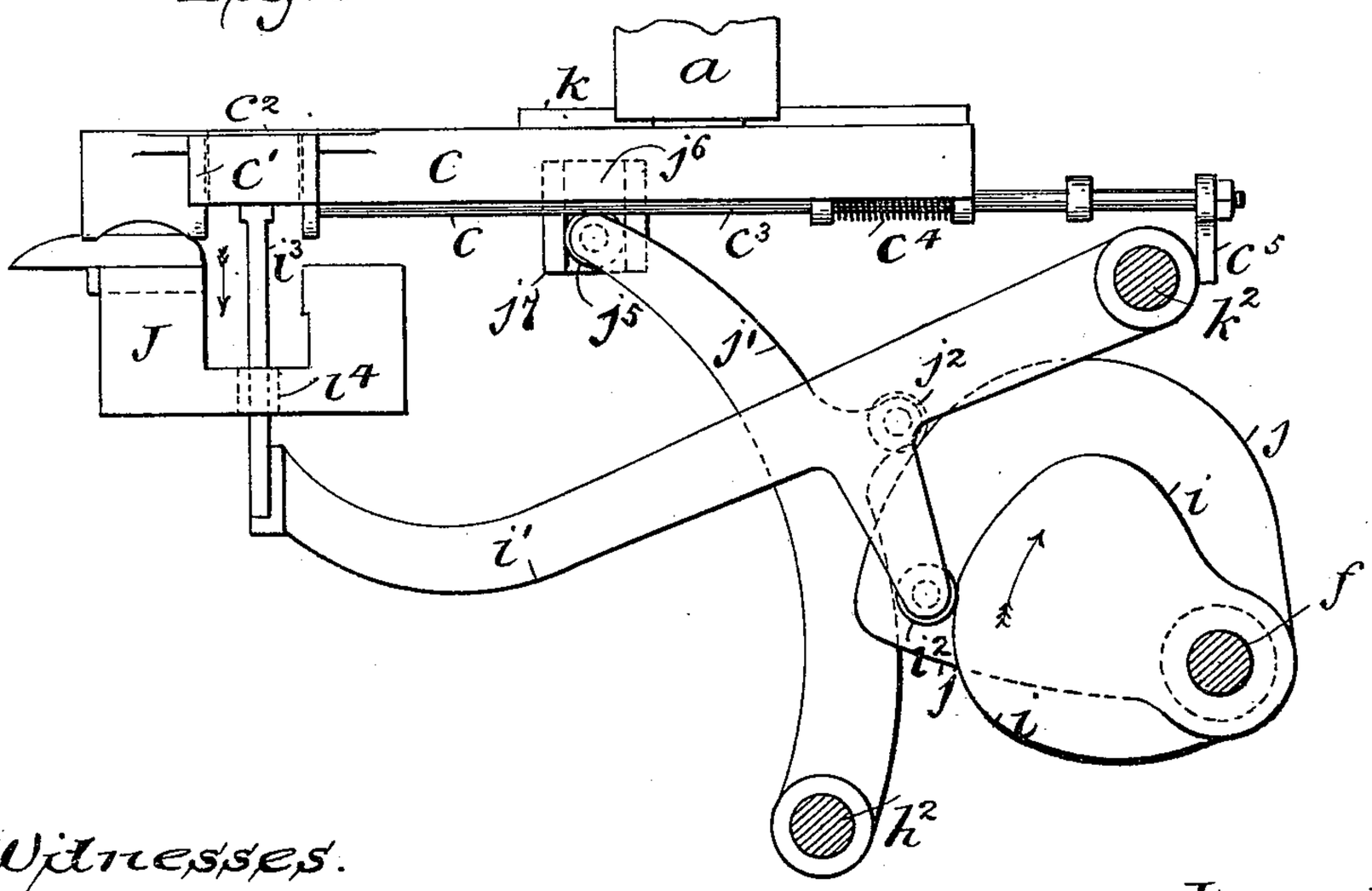


Fig. 9



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(No Model.) (Application filed Sept. 23, 1898.)

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Fig. 10

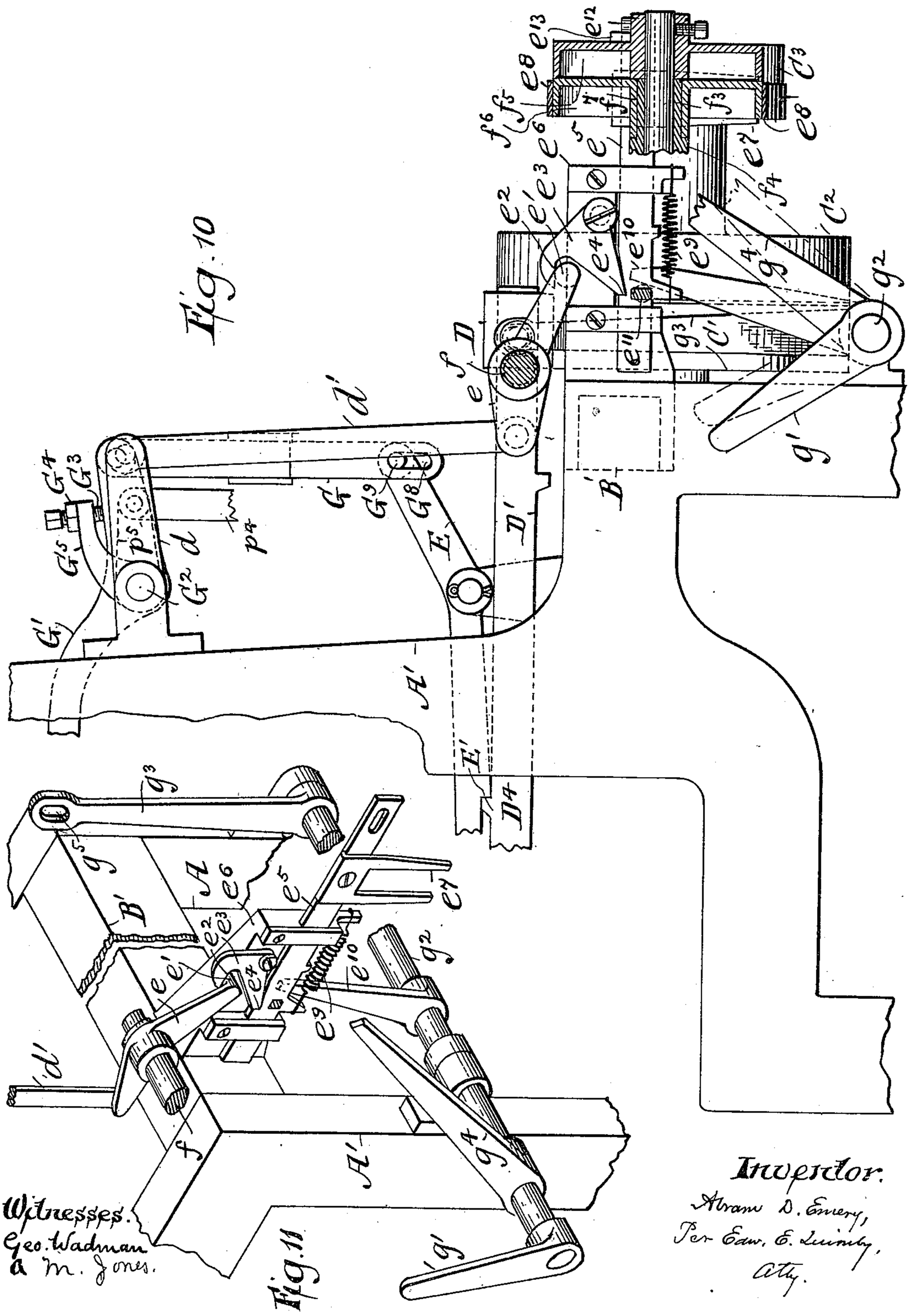

Fig. 11

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WEFT REPLENISHING MECHANISM FOR LOOMS

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(No Model.) 8 Sheets—Sheet 8.

Fig. 13

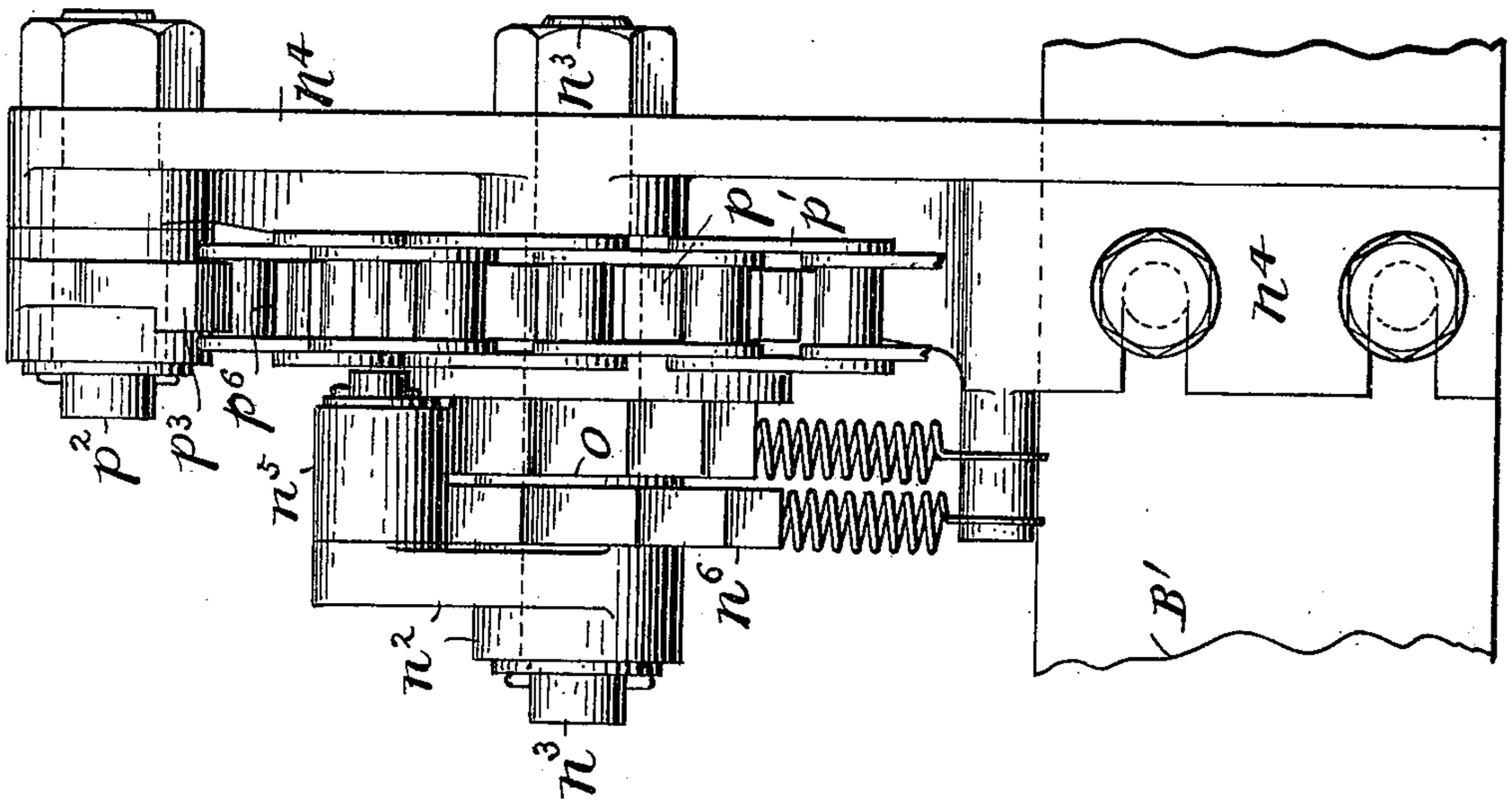
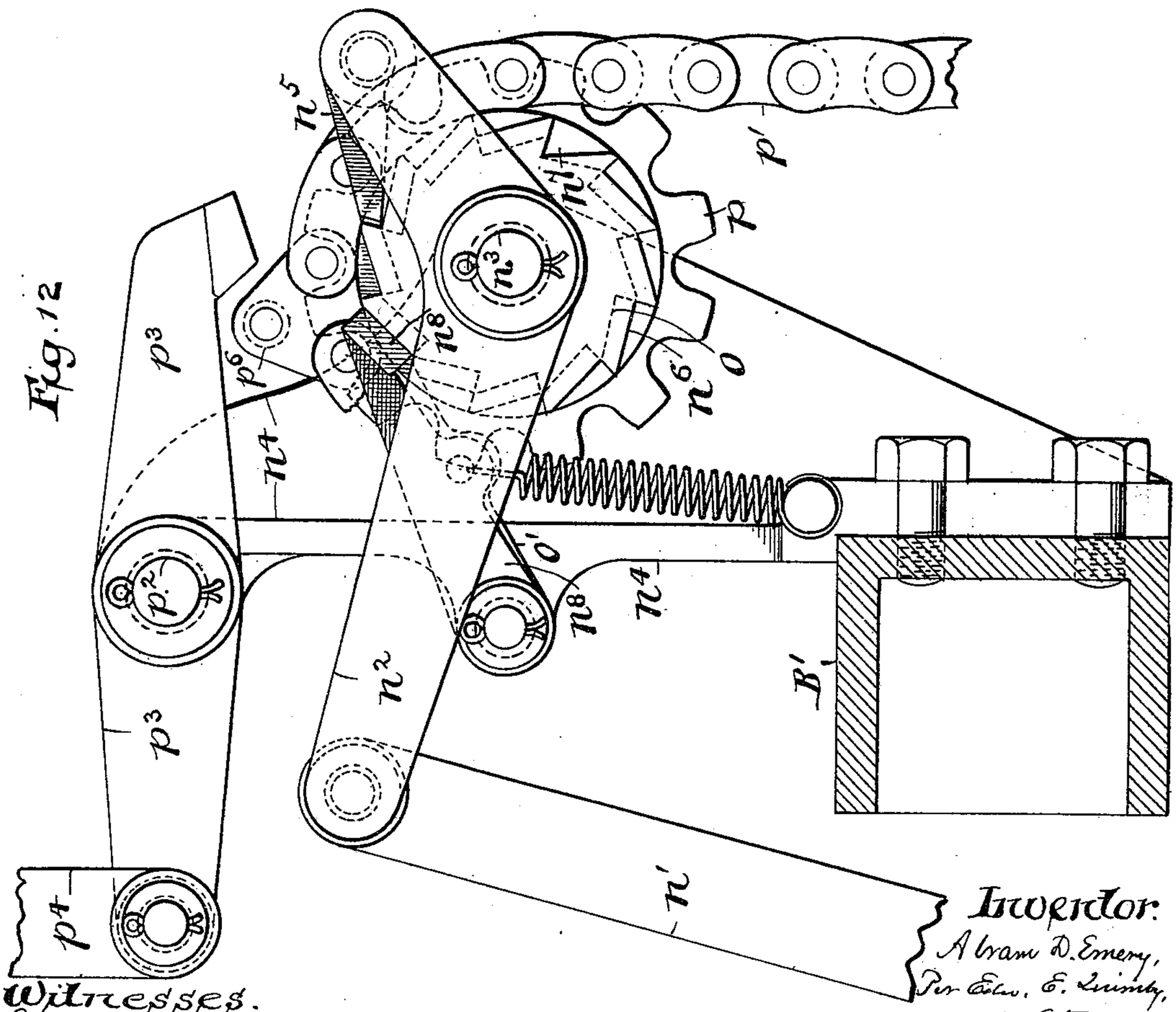


Fig. 12



Witnesses.
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UNITED STATES PATENT OFFICE.

ABRAM D. EMERY, OF TAUNTON, MASSACHUSETTS.

WEFT-REPLENISHING MECHANISM FOR LOOMS.

SPECIFICATION forming part of Letters Patent No. 645,897, dated March 20, 1900.

Application filed September 23, 1898. Serial No. 691,691. (No model.)

To all whom it may concern:

Be it known that I, ABRAM D. EMERY, of Taunton, Massachusetts, have invented certain Improvements in Automatic Weft-Replenishing Mechanism for Looms, of which the following is a specification.

The filling-supplying mechanism forming the subject of this invention consists of a periodic tripper which is combined with and which at predetermined intervals, each corresponding with the time taken to nearly exhaust a bobbin of weft, trips into action mechanism which automatically effects the substitution in the lay of a shuttle containing a full bobbin of weft for the shuttle containing the nearly-exhausted bobbin of weft, and thus prevents mispicks. The frequency with which such mechanism is tripped into action is governed by the size of the bobbin of weft employed. The smaller the normal size of the bobbon the more frequently the periodic tripper will be adjusted to perform its tripping function.

The improvement is herein illustrated as applied to an upright loom resembling that shown and described in Letters Patent of the United States No. 605,603, dated June 14, 1898, and in connection with shuttle-changing mechanism like that shown and described in Letters Patent No. 626,860. The loom is also equipped with a weft stop-motion like that described in Letters Patent of the United States No. 605,601, dated June 14, 1898, which upon a failure of the weft operates to stop the loom without affecting the shuttle-changing mechanism.

The accompanying drawings, representing portions of the loom containing mechanism embodying an illustration of the present invention, are as follows, viz:

Figure 1 is a top view of the loom, partly in section. Fig. 2 is a transverse vertical section of the loom, taken through the plane indicated by the dotted line *x x* on Fig. 1. Figs. 3 and 4 are detail drawings of the brake mechanism, Fig. 3 showing the brake-strap released from the brake-wheel, and Fig. 4 showing the brake-strap engaging the brake-wheel. Fig. 5 is a rear view of a portion of the loom, affording a view in elevation of the shuttle-changing mechanism. Fig. 6 is an elevation of a portion of the end of the loom, affording a face view of the cams for operating the shuttle-changing devices. Fig. 7 is an elevation, partly in section, showing details of the safety-stop for preventing the operation of the shuttle-changing mechanism in case the lay has not come to rest in the proper position. Fig. 8 is a detail showing in elevation the positions of the shuttle-changing cams at an early stage in the shuttle-changing operation. Fig. 9 is a similar elevation illustrating the positions of the parts at a later stage in the shuttle-changing operation. Fig. 10 is a transverse section taken through the vertical plane indicated by the dotted line *y y* on Fig. 5, showing details of the restarting devices. Fig. 11 is a perspective view of mechanism for controlling the supplemental driving-belt which operates the shuttle-changing mechanism. Fig. 12 is a detail showing in elevation, upon an enlarged scale, the periodic tripper and its actuating mechanism. Fig. 13 is a rear elevation of the same.

The shuttle-changing mechanism herein shown does not of itself form any part of the present invention, but is merely an element of the combination now sought to be covered. It will hence be understood that its equivalent would be found in any other forms of shuttle-changing mechanism susceptible of combination with a periodic tripper operating to trip it into action at predetermined intervals.

One of the peculiar features of the shuttle-changing mechanism herein shown is that it acts in connection with automatic mechanism, which temporarily brings the operative parts of the loom to rest with the lay and shuttle in prescribed positions preparatory to the change of shuttles, after which the operative parts of the loom are automatically restarted into action.

It is deemed advisable to briefly describe the stopping and shuttle-changing instrumentalities as preliminary to a description of the mechanism which periodically trips those instrumentalities into action. Thus the drawings show portions of an upright loom-frame composed in part of the standards A A′ and the horizontal members B B′ B^2 B^3. The main driving-shaft C is provided with the driving-pulley C′ and the loose pulley C^2, to

the hub of which is secured the supplemental pulley C^3. The position of the driving-belt is governed by the belt-shifter D, carried at the rear end of the horizontal slide-bar D′, which at its front end is pivoted to the hand-lever D^2. The lever D^2 has attached to it the free end of a contracting spiral spring D^3, the opposite end of which is secured to the loom-frame. When the loom is running normally, the driving-belt, as shown in Fig. 1, is retained in engagement with the driving-pulley C′ by means of the main trip-lever E, pivoted at the rear end to the frame of the loom and having near its forward end a shoulder E′, which engages the shoulder D^4 on the slide-bar D′. When the hand-lever D^2 is swung outward into the position in which it is represented in Fig. 2, the finger F, projecting laterally from its hub, engages and lifts the radius-arm F′, which is loosely hung on the main driving-shaft C and which is constantly subjected to the downward pull of the contracting spiral spring F^2, having its upper extremity connected with the free end of the radius-arm F′ and its opposite extremity secured to the pin F^3, affixed to the frame of the loom. The radius-arm F′ has affixed to it the end F^4 of the brake-strap F^5, which surrounds the greater part of the brake-wheel F^6, and has its opposite end F^7 connected to the adjustable clamp F^8, attached to the frame of the loom.

Preferably I employ a brake-strap clearer for insuring the complete clearance of the brake-strap from the brake-wheel whenever the brake-releasing mechanism is actuated. A suitable device for this purpose herein shown by way of illustration consists of the screw-bolt F^9, inserted through a vertical aperture in the arm F^{10}, connected with a stationary part of the loom. A jam-nut F^{11} serves to hold the screw-bolt F^9 in position. When the radius-arm F′ is oscillated to release the brake, the portion of the brake-strap adjacent to its free end—that is, the end attached to the arm F′—after moving clear from the brake-wheel encounters the stop presented for it by the lower end of the screw-bolt F^9, from which it results that the brake-strap, which is a flexible metallic band, is made to spring into a position in which it is approximately concentric with the periphery of the brake-wheel and is wholly cleared therefrom.

The device of a stop arranged near the free end of the brake-strap to deflect the brake-strap when released into a position approximately concentric with the brake-wheel is important, not only because it prevents the heating which would be caused if any portion of the brake-strap were permitted to be in contact with the brake-wheel while the loom is running, but also because it facilitates the nearly-simultaneous application to the brake-wheel of the entire operative portion of the brake-strap.

The relative positions of the members of the brake mechanism when the loom is in normal operation are indicated in Fig. 3. The stopping of the loom involves the lifting, either manually or otherwise, of the forward end of the trip-lever E. This disengages the shoulder E′ from the shoulder D^4, and thus releases the belt-shifter slide-bar D′ to the action of the contracting spring D^3. The spring D^3 then pulls the slide-bar D′ backward and shifts the belt to the loose pulley C^2 and at the same time swings backward the hand-lever D^2, swinging downward the finger F, and thereby releasing the radius-arm F′ to the influence of the spring F^2. The brake-strap is thereby tightened around the brake-wheel in part by the contractile force of the spring F^2 and in part by the frictional influence upon the brake-strap of the periphery of the brake-wheel, which rotates, as indicated by the curved arrow on Fig. 4, in such direction as to make that frictional influence tend to pull the brake-strap away from its fixed end F^7, and thus cause it to tighten itself upon the brake-wheel. The effectiveness of the brake-strap thus organized is such that by varying the position of the adjustable clamp F^8 the operative stress of the spring F^2 can be so regulated with relation to the speed at which the loom is running as to always effect the stopping of the loom at the expiration of a predetermined period after the belt-shifter and brake-strap have been released by the tripping of the main trip-lever E, and the loom can thus always be brought to rest with its parts in a prescribed position.

The periodic tripping of the main trip-lever E is effected by a downward motion communicated to its rear end through the link G, pivoted to the rear arm of lever G′, which is comprised in the weft stop-motion and is loosely mounted on the rock-shaft G^2, such motion being caused by the downward push of a screw-bolt G^3, secured by a jam-nut G^4 in the free end of the crank-arm G^5, affixed to the rock-shaft G^2. An adjustable screw-bolt G^6, extending upward from the girder B, acts as a stop to limit the range of downward swing of the forward end of the lever G′. A suitably-arranged torsion-spring G^7, surrounding shaft G^2 and having one end thereof engaged with a fixed stop G^{71} and the other with a pin G^{72} on lever G′, tends to hold the rock-shaft G^2, the crank-arm G^5, and the link G in their normal positions. The said link G is provided with a slot G^8, the upper end of which bears upon the pin G^9, projecting laterally from the rear end of the main trip-lever E. The main trip-lever E is therefore tripped whenever the rock-shaft G^2 is caused to be rocked against the influence of the spring G^7 by the periodic tripper, presently to be described.

The mechanism for automatically supplying the filling embraces the vertical shuttle-magazine *a*, adapted to contain a plurality of shuttles. Each shuttle is intended to contain a full bobbin or cop *a*′ of weft, the free end a^2 of which is led from the pot-eye through

the open side a^3 of the shuttle-magazine and is given several turns around the pin b, projecting from the loom-frame. Beneath the magazine is a transferrer c, which is adapted to be reciprocated in a horizontal plane. On its front side the transferrer c is provided with the inwardly-turned arms $c'c'$, forming the end boundaries of a shuttle-receiver c^2, which when the transferrer occupies its normal position is immediately beneath the shuttle-magazine, so that the lowermost shuttle in the magazine will drop into it. At the appropriate time the transferrer c is moved forward to deliver to the lay the shuttle contained in the shuttle-receiver c^2. Endwise-sliding rods c^3 c^3 are supported on the under side of the transferrer and under the influence of the springs c^4 c^4 are made to project across the bottom of the receiver c^2, and thus serve to sustain the shuttle therein until at a prescribed stage in the forward excursion of the transferrer c the arm c^5, affixed to and projecting downwardly from a cross-bar secured to their rear ends, is brought into collision with a stop, which operates to detain the rods c^3 c^3 and permits the shuttle to be delivered from the receiver c^2 to the lay. As the transferrer moves backward the rods c^3 c^3 are released to the influence of the springs c^4 c^4, and thus made to resume their positions across the bottom of the receiver c^2 in time to act as supports for the next shuttle dropped into the receiver c^2.

When the periodic tripper is acting to trip the main-belt shifter and brake, motion is transmitted from the radius-arm d, affixed to the rock-shaft G^2, through the link d' to the rock-lever e, which is loosely mounted on a supplemental cam-shaft f and provided with a laterally-extending pin e' to engage a shoulder e^2 of a gravity-pawl e^3 and raise the latter clear of the shoulder e^4, formed on the slide-bar e^5. The slide-bar e^5 is mounted in a bracket e^6, affixed to the loom-frame, and is provided with a belt-shifter e^7 to govern the position of a supplemental driving-belt e^8, which operates the shuttle-changing mechanism. A contracting spiral spring e^9 has one end secured to the bracket e^6 and its opposite end to the slide-bar e^5. When the pawl e^3 is raised, the spring e^9 pulls the slide-bar e^5 into position to set the shuttle-changing mechanism into operation. A radius-arm e^{10}, swayed by the shuttle-changing mechanism during the final portion of its operation, as hereinafter described, catches a pin e^{11}, projecting from the slide-bar e^5, and thereby moves the slide-bar e^5 back into position to be reëngaged by the pawl e^3. The slide-bar e^5 has adjustably affixed to its rear end a curved strip of resilient material e^{12}, carrying at its free end a suitable brake-block e^{13} for preventing the motion of the shuttle-changing mechanism after the supplemental driving-belt has been shifted. A worm-wheel f', affixed to the cam-shaft f, is engaged by a worm f^2, secured to the supplemental driving-shaft f^3, mounted in a tubular bracket f^4, affixed to the loom-frame. Upon the supplemental driving-shaft f^3 is a fixed pulley f^5 and alongside of it a loose pulley f^6, the latter being loosely mounted upon the turned-down portion f^7 of the tubular bracket f^4. The supplemental driving-belt e^8 normally engages the fixed pulley f^5 and extends to and around the pulley C^3, secured to or formed integrally with the main loose pulley C^2, from which motion is derived to operate the shuttle-changing mechanism and automatically restart the loom whenever the main belt is shifted to the main loose pulley by the operation of the periodic tripper.

It will be seen that whenever the main belt is shifted otherwise than by the operation of the periodic tripper the shuttle-changing mechanism remains unaffected.

During the normal operation of the loom, while the cam-shaft f is being prevented from rotation by the engagement of the pawl e^3 with the shoulder e^4, the supplemental driving-belt is held on the loose pulley f^6. The supplemental cam-shaft f makes one complete revolution, during which the cams mounted upon it perform their various functions in effecting the discharge of the shuttle from the box in which it has come to rest and the introduction of another shuttle in its place. During a prescribed part of the concluding portion of the rotation of the supplemental cam-shaft f the restarter g, which is a radius-arm affixed to the said shaft f, by engaging the radius-arm g', affixed to the horizontal rock-shaft g^2, imparts a rocking motion to the said rock-shaft g^2 and corresponding swaying motions to the radius-arms e^{10}, g^3, and g^4, which are also affixed to the rock-shaft g^2. The function performed by the radius-arm e^{10} when thus swayed is the moving back of the slide-bar e^5, as hereinbefore mentioned. The radius-arm g^3 is provided with a slot g^5, which when the radius-arm g^3 is thus swayed by its engagement with a pin g^6, affixed to and projecting from the main-belt shifter D, pushes the slide-bar D′ forward, and by thus shifting the main belt and loosening the brake-strap from the brake-wheel restarts the operative parts of the loom. The radius-arm g^4 when thus swayed serves as a dog which by engaging a shoulder g^7 on the cam j positively prevents the rotation of the shuttle-changing mechanism during the normal operation of the weaving instrumentalities. Such rotation will ordinarily be prevented by the brake e^{13}; but the radius-arm g^4 may, if desired, be employed for abundant caution.

The parts are so timed that the shoulder E′ of the trip-lever E drops behind the shoulder D^4 on the slide-bar D′, and the pawl e^3 drops behind the shoulder e^4 on the slide-bar e^5 just before the restarter g clears the radius-arms g', thereby keeping the operating parts of the loom in action until the main-belt shifter and brake are again tripped. In the meantime the brake-block e^{13}, having been

carried by the slide-bar e^5 into contact with the face of the fixed pulley f^5, arrests the rotation of the cam-shaft f, which remains stationary until again set in motion in consequence of the action of the periodic tripper, as described. It is essential that the restarter g shall continue its swaying movement to some extent after having effected the restarting of the loom in order that the radius-arm g' may be free to be swayed into the position in which it is indicated in dotted lines in Fig. 10. The supplemental driving-belt e^8 will have been shifted by this time onto the loose pulley f^6; but the momentum of the moving parts suffices to furnish the small amount of force needed to prolong the rotation of the shaft f until the free end of the restarter g has been carried around beyond the path of motion of the free end of the radius-arm g', so that the radius-arm g' will not encounter the restarter when again swayed by the rock-shaft g^2 the next time the shuttle-changing mechanism is started into operation.

At appropriate stages in the single revolution of the cam-shaft f the shuttle-changing cams thereon perform their several functions in due order, as follows: First, the clearer-cam h operates to bring about the clearance of the path through which the spent shuttle is ejected from and a shuttle with a full bobbin of weft is subsequently introduced into the shuttle-box at the end of the lay in front of the shuttle-magazine. This is effected by the appropriate rocking of the bell-crank lever h', loosely mounted on the fixed bar h^2. The cam-follower h^3 at the rear end of the bell-crank lever h' is made to constantly bear upon the cam h by the suitably-strong torsion-spring h^4, having one of its extremities fixed to the bell-crank lever h' and the other to the bar h^2. When the cam-follower h^3 drops upon the depressed part of the cam h, the finger h^5 at the forward end of the bell-crank lever h' swings backward. When the lay is down, the finger h^5 occupies a position which enables it in its backward swing to engage the laterally-projecting shoulder or bend h^6 at the rear end of the horizontal reciprocable shaft h^7, loosely mounted upon the under side of the lay and subject to the influence of the retracting spring h^8. A finger h^9, affixed to and projecting upwardly from the shaft h^7, is adapted to engage an arm h^{10}, affixed to the binder or spring-check h^{11}, which is one of the appurtenances of the shuttle stop-motion with which the loom is equipped. The lower part of the rear wall of the shuttle-box is recessed to contain the binder, so that the shuttle when being lowered into the box will not encounter any part of the heel of the binder. At its forward end the shaft h^7 is pivotally connected with the crank-arm h^{12}, projecting downwardly from a rock-shaft h^{13}, in connection with which the said retracting spring h^8 is arranged. The rock-shaft h^{13} is mounted in bearings upon the front side of the lay and is provided with two upwardly-extending arms h^{14} h^{14}, suitably engaging slots in the arms h^{15} h^{15}, affixed to the movable cap h^{16}, which when the parts are in normal position projects partially over the shuttle-box. When the finger h^5 swings backward, the binder h^{11} is removed from the rear wall of the shuttle-box, while the cap h^{16} is moved forward, so that it no longer overhangs the shuttle-box. The path being thus cleared, the next step is to eject the spent-shuttle. This function is performed by the ejector-cam i, which at the proper time rocks upward the ejector-arm i', carrying the cam-follower i^2, which is made to constantly bear against the cam i by the influence of gravity upon the ejector-arm i'. At its forward end the arm i' is bifurcated to form the two lifters i^3 i^3, which when the arm i' rises enter through the usual slot i^4 in the bottom of the box in which the spent shuttle is contained and elevate the spent shuttle into position to be pushed off sidewise over guide-strips h^{17} into a box h^{18} by the forward end of the transferrer c, during the latter part of the forward movement thereof.

Preferably the cam i is so shaped as to retain the lifters i^3 i^3 at the level represented in Fig. 9, so that the shuttle contained in the receiver c^2 will be lodged upon the tops of the lifters i^3 i^3 and be thereafter gradually lowered into the shuttle-box as the arm i' under the influence of gravity is permitted to fall by the cam i. The timely forward movement of the transferrer c, enabling it to knock off the spent shuttle from the lifters i^3 i^3, is effected by the feed-cam j, which acts upon the cam-follower j^2, carried by the arm j', loosely mounted upon the stationary bar h^2 and having affixed to it one end of a suitably-strong torsion-spring j^3, the opposite end j^4 of which is affixed to the bar h^2. At its upper end the arm j' carries the roller j^5, which engages a vertical groove j^6 in a bracket j^7, affixed to the under side of the transferrer c.

The inner side of the transferrer is provided with a downwardly-projecting flange j^8, adapted to slide in the horizontal guide j^9, formed in the inner upright member k of the supplemental frame in which the shuttle-changing mechanism is mounted. The said frame consists of the inner upright member k, which is secured to the standard A' of the main frame, as shown in Fig. 6, and which is united to the outer upright member k' by the horizontal bar h^2 and by the horizontal bar k^2. The bar k^2 affords the axis for the ejector-arm i'. The upright member k' carries the horizontal stud k^3, affording the axis for the roller k^4, supporting the outer side of the transferrer c.

The cam j is provided with a concentric portion for the purpose of detaining the transferrer c in its forward position for a sufficient length of time to permit the new shuttle to be lowered from the receiver c^2 to the shuttle-box.

Care has thus been taken to describe cer-

tain features of the loom which do not of themselves constitute part of the present invention, because the shuttle-changing operation is performed while the operative parts of the loom are at rest in prescribed positions, and it hence follows that the instrumentalities for stopping the operative parts of the loom must so far as possible operate to bring about such stoppage with the lay down and with the shuttle in the box at the end of the lay in front of the shuttle-magazine. If, however, from any cause the lay should not come to rest in the proper position, there is provided a safety device for preventing the shuttle-changing mechanism from acting. For this purpose there is pivoted to a bracket l, secured to the loom-frame, a lever l', whose lower end is engaged and rocked by a wiper-cam l^2, projecting from the face of a collar l^3, affixed to the supplemental cam-shaft f. A contracting spiral spring l^4, having one end secured to the extension l^6 of the lever l' and its other end secured to the extremity of the shank l^5 of the inverted-T lever l^7, tends to rock the lower end of the lever l' against the supplemental cam-shaft f. An arm l^8, projecting laterally from the lever l', is pivotally connected to a lever l^9, whose lower end is provided with an adjustable stop comprising a screw-bolt l^{10}, secured in a threaded aperture by a jam-nut l^{11}. This stop engages an arm l^{12}, extending from the slide-bar e^5, and is held normally in contact therewith by means of a contracting spiral spring l^{13}, one end of which is secured to an arm l^{14} of the lever l^9 and its opposite end to a finger projecting upward from the arm l^{12}. The lower end of the lever l^9 will therefore partake of the to-and-fro motions of the slide-bar e^5, and its upper end will be rocked between two positions, one of which is shown by full lines and the other by dotted lines in Fig. 7. The inverted-T lever l^7 is pivoted between its ends to the bracket l, and one of its arms l^{15}, under the influence of the spring l^4, may rest upon a stop l^{16}, in which case the extremity of the arm l^{15} intersects the path of motion of the upper end of the lever l^9, as shown by the dotted lines in Fig. 7. The end of the opposite arm l^{17} of the lever l^7 is adapted to be engaged by a toe l^{18}, secured to the lay, so that when the lay is within about three-sixteenths of an inch of its lowermost position the end of the arm l^{15} will have been rocked upward out of the way of the lever l^9. Should the lay not be in its proper position when the loom stops and the slide-bar e^5 is tripped, the relative positions of the adjacent ends of the arm l^{15} and the lever l^9 will be as indicated by the dotted lines in Fig. 7. Under these circumstances, as soon as the shuttle-changing mechanism begins to move, the wiper-cam l^2 will rock the lever l', by the pull of which the upper end of the lever l^9 will be carried against the end of the arm l^{15}, which then becomes the fulcrum of the lever l^9, so that by the continued pull of the lever l' the lower end of the lever l^9 is made to move the slide-bar e^5 back, and thereby shift the supplemental driving-belt e^8 and prevent further movement of the shuttle-changing mechanism. If the lay be in proper position, the arm l^{15} will be swung out of the way, so that the upper end of the lever l^9 will be left free to swing instead of the lower end, with the result that the shuttle-changing mechanism will not be interfered with.

For abundant caution in case the described safety device should fail to act properly there is provided a protector consisting of a hinged blade m, mounted between lugs m', formed on the front edge of the transferrer c and free to turn in one direction against a spring m^2. If the lay is not in proper position, the front edge of the blade m will be carried into collision with a stop m^3, affixed to the lay. Such collision prevents further forward movement of the transferrer c and compels the supplemental driving-belt e^8 to slip until it runs off the pulley which drives it.

Having thus described the tripping mechanism for temporarily tripping the operative parts of the loom out of action, tripping the shuttle-changing mechanism into action, and, finally, restarting the operative parts of the loom, it remains to describe the mechanism for effecting such tripping operations at predetermined intervals, whereby at a prescribed stage in the exhaustion of each weft-bobbin the shuttle containing such bobbin will be ejected from the lay and another shuttle containing a full bobbin of weft be substituted therefor, the operative parts of the loom being in the meantime held at rest, from which it results that there can be no flaw in the fabric, such as would be caused by a repetition of picks in the absence of a weft-thread.

The main cam-shaft H of the loom is provided with the eccentric n, by which endwise reciprocating motion is imparted to the link n', pivotally connected at its upper end to the rocker n^2, which is loosely mounted upon the stud n^3, affixed to a bracket n^4, secured to the girder B'. The rocker carries at its rear end the gravity-pawl n^5, adapted to bear upon the periphery of the ratchet-wheel n^6, also loosely mounted upon the stud n^3. Adjoining the ratchet-wheel n^6 is another ratchet-wheel o of slightly-smaller diameter. Both ratchet-wheels have the same number of teeth; but one tooth n^7 of the ratchet-wheel n^6 is of greater depth than the others. Spring-brakes n^8 and o' respectively serve to prevent the ratchet-wheels n^6 and o from turning too freely. Affixed to or formed integrally with the ratchet-wheel o is a sprocket-wheel p, turning loosely on the stud n^3 and carrying an endless sprocket-chain p'. Once during each revolution of the ratchet-wheel n^6 the pawl n^5 encounters and drops into the deep notch n^7, and thereby engages one of the teeth of the ratchet-wheel o and imparts thereto a range of motion sufficient to move the endless sprocket-chain p' a distance equal to the length of a link.

Loosely mounted on a stud p^2, affixed to the bracket n^4, is a controller consisting of the rock-lever p^3, having one end pivotally connected to a link p^4, whose upper end is pivotally connected to a crank-arm p^5, affixed to the rock-shaft G^2. The other end of the lever p^3 is arranged to normally occupy a position in the path of motion of a periodic tripper p^6, affixed to the links of the chain. At prescribed intervals the controller or lever p^3 is rocked by the tripper p^6, thereby causing the screw-bolt G^3 to press down on the rear arm of the lever G'. This trips the main trip-lever E and stops the operative parts of the loom and concurrently disengages the pawl e^3 from the shoulder e^4, and thereby releases the shuttle-changing and loom-restarting apparatus to the influence of its driving mechanism.

The endless sprocket-chain p' may be composed of any desired number of links. The less the number of links the more frequently the periodic tripper p^6 will be brought into engagement with the lever p^3, and will thereby effect the establishment of continuity in the previously discontinuous train of connections between the rock-shaft G^2 and the main cam-shaft H, from which motion is derived to trip the main trip-lever E and disengage the pawl e^3 from the shoulder e^4.

The ratchet-wheels n^6 and o are represented as each having twelve teeth. At each impulse of the driving-pawl n^5 the lay makes two beats. Hence the ratchet-wheel n^6 makes one complete revolution, the ratchet-wheel o moves one tooth, and the endless sprocket-chain p' moves one link during each twenty-four picks. It follows that if the endless sprocket-chain has, for example, fifty links the periodic tripper will bring about the change of shuttles at every twelve hundred picks. If there should be used weft-bobbins each containing, when full, sufficient weft for, say, two thousand two hundred picks, the endless sprocket-chain would be made to contain ninety links, and the periodic tripper would then act at every two thousand one hundred and sixty picks.

Two features are to be especially noted—to wit, that the endless sprocket-chain is composed of the link carrying the periodic tripper p^6, together with any desired number of the ordinary manually attachable and detachable links, and that the sprocket-wheel o may be manually rotated independently of the sprocket-wheel n^6 and of the driving-pawl n^5. These features render the periodic tripper susceptible of the most ready adjustment with reference to the timing of its operations.

What is claimed as the invention is—

1. In a loom, in combination, weft-changing instrumentalities, instrumentalities for occasioning a dwell in the regular working of the loom, tripping of the weft-changing instrumentalities into action to effect a change of the working weft-supply during such dwell, and restarting the loom under normal working conditions after such change has been effected, and a periodic tripper for tripping the said instrumentalities into action.

2. In a loom, in combination, the lay, weft-changing mechanism comprising essentially a holder for a reserve supply independent of the lay and means to feed therefrom to the lay, loom-driving mechanism having a shipper device to control the action thereof, a periodic tripper, and means under the control of the said periodic tripper for causing the said shipper device to be actuated to occasion a dwell in the regular working of the loom, the weft-changing mechanism to perform its operations, and the operative parts of the loom to be restarted under normal working conditions after the change of weft has been effected.

3. In a loom, in combination, weft-changing instrumentalities, a shaft by which said instrumentalities are actuated, a periodic tripper, means for rotating the said shaft under the control of the said tripper, and driving means for the loom having a shipper device to control the action thereof, the said shipper device being itself controlled from the said shaft.

4. In a loom, instrumentalities for temporarily bringing the operative parts of the loom to rest, instrumentalities adapted to act while the operative parts of the loom are thus at rest for automatically discharging the shuttle from the lay and introducing into the lay another shuttle, and then restarting the operative parts of the loom, in combination with a periodic tripper for effecting the tripping of said instrumentalities into action at intervals, each corresponding to the time occupied by the loom in making a prescribed number of picks.

5. In a loom, a shipper device, a trip device operating in connection therewith for temporarily bringing the operative parts of the loom to rest, instrumentalities adapted to act while the operative parts of the loom are thus at rest for automatically changing the working weft-supply and then restarting the operative parts of the loom, in combination with a periodic tripper for actuating the said trip device and effecting the tripping of said instrumentalities into action at intervals, each corresponding to the time occupied by the loom in making a prescribed number of picks, and weft-indicator devices operative upon failure of the weft to trip the said trip device and stop the operative parts of the loom without affecting said weft-changing and loom-restarting instrumentalities.

6. In a loom, in combination, weft-changing instrumentalities, a periodic tripper for effecting the tripping of said instrumentalities into action at intervals, each corresponding to the time occupied by the loom in making a prescribed number of picks, a shipper, a trip device therefor, and weft-indicator devices operative upon the failure of the weft to trip said trip device and stop the operative

parts of the loom without affecting the weft-changing instrumentalities.

7. In a loom, instrumentalities for automatically discharging the shuttle from the lay and introducing into the lay another shuttle; a tripper for tripping said instrumentalities into action; a shaft making one revolution to each two beats of the lay; operative connections between said shaft and said tripper; a controller for normally preserving the discontinuity of said connections, and a periodic tripper for periodically tripping said controller from its controlling position and thereby permitting the establishment of continuity in said connections at intervals, each corresponding to the time occupied by the loom in making a prescribed number of picks.

8. In a loom, instrumentalities for temporarily bringing the operative parts of the loom to rest with the lay and shuttle in prescribed positions; instrumentalities adapted to act while the operative parts of the loom are thus at rest for automatically discharging the shuttle from the lay and introducing into the lay another shuttle, and then restarting the operative parts of the loom, in combination with a periodic tripper for effecting the tripping of said instrumentalities into action at intervals, each corresponding to the time occupied by the loom in making a prescribed number of picks.

9. In a loom, instrumentalities consisting of a belt-shifter, a brake and main trip-lever for temporarily bringing the operative parts of the loom to rest with the lay and shuttle in prescribed positions; instrumentalities adapted to act while the operative parts of the loom are thus at rest for automatically discharging the shuttle from the lay and introducing into the lay another shuttle and then restarting the operative parts of the loom, in combination with a periodic tripper for effecting the tripping of said instrumentalities into action at intervals, each corresponding to the time occupied by the loom in making a prescribed number of picks, and a fork-carrying lever independently connected to said main trip-lever and operative upon the failure of the weft to trip said main trip-lever and stop the operative parts of the loom without affecting said shuttle-changing and loom-restarting instrumentalities.

10. In a loom, a main driving-shaft for driving the operative parts of the loom; means including a spring-actuated belt-shifter for stopping the rotation of said main driving-shaft; shuttle-changing mechanism adapted to act when said main driving-shaft is at rest; a normally-stationary supplemental driving-shaft provided with a fast and a loose pulley; a supplemental cam-shaft geared to said supplemental driving-shaft and operative during a single revolution for driving said shuttle-changing mechanism; connections from said supplemental cam-shaft to said belt-shifter for restarting said main driving-shaft during the concluding portion of the operative revolution of said supplemental cam-shaft; a pawl for normally preventing the rotation of said supplemental cam-shaft while said main driving-shaft is in motion; a supplemental driving-belt adapted to bear upon said fast and loose pulleys and to run on said loose pulley when said supplemental cam-shaft is prevented from rotation by said pawl, and a periodic tripper for causing the release of said belt-shifter to the action of its spring and thus causing the stopping of the rotation of said main driving-shaft and for concurrently causing said pawl to be tripped and thereby allowing said supplemental driving-shaft to make one revolution at the conclusion of each interval corresponding to the time occupied by the loom in making a prescribed number of picks.

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