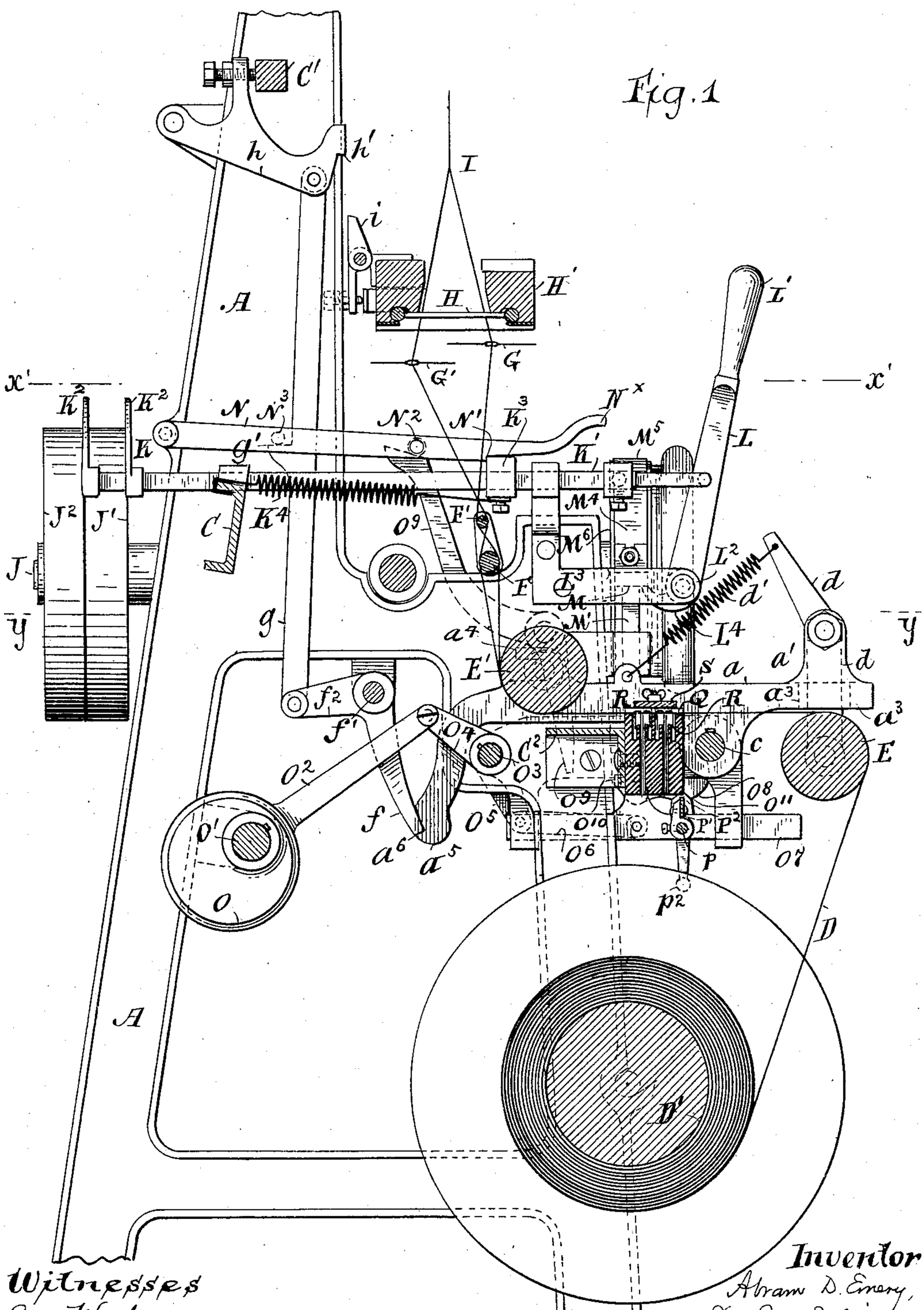
(No Model.) 3 Sheets—Sheet 1.

A. D. EMERY.

WARP STOP MOTION FOR LOOMS.

No. 605,600. Patented June 14, 1898.

Fig. 1



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3 Sheets—Sheet 2.

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WARP STOP MOTION FOR LOOMS.

No. 605,600. Patented June 14, 1898.

Fig. 2

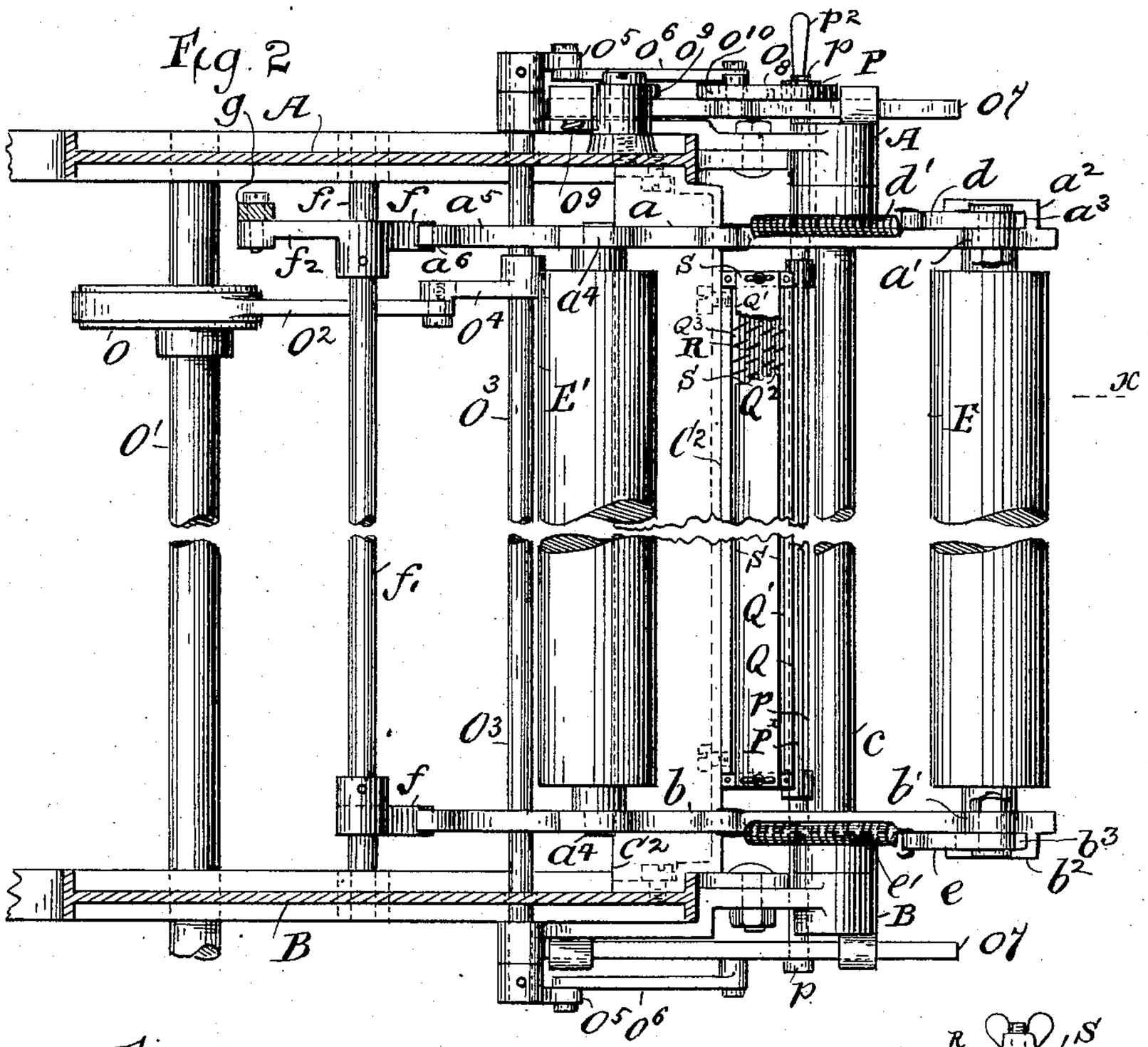


Fig. 3

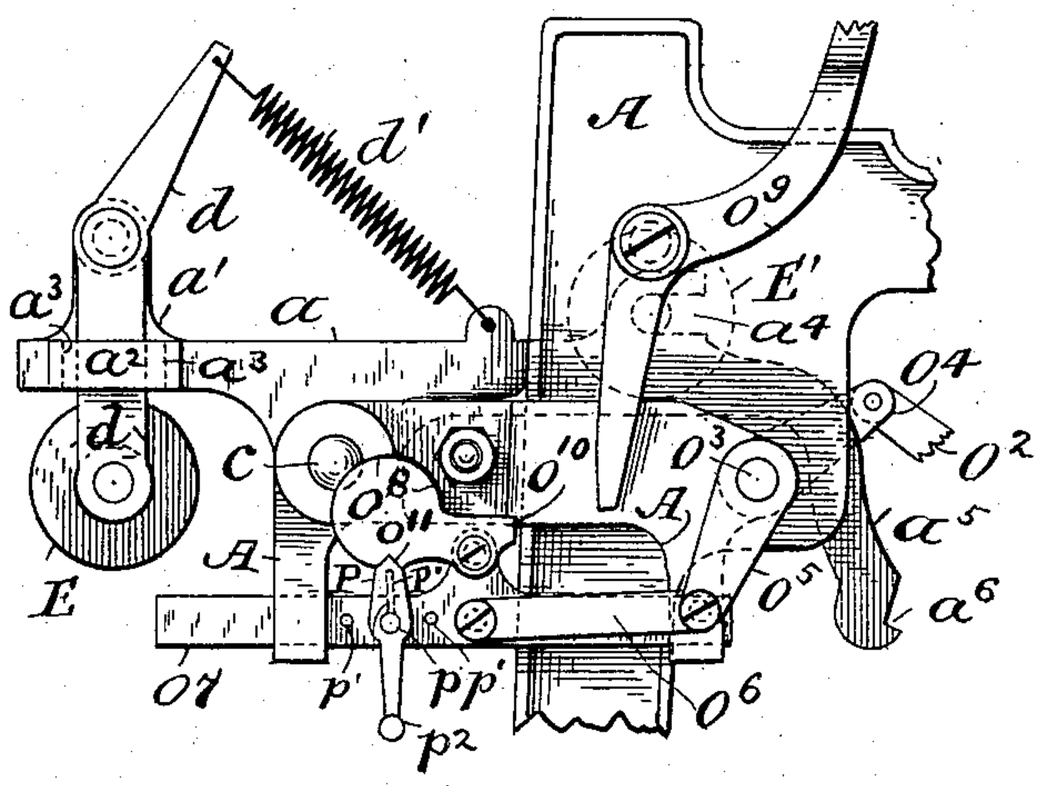


Fig. 5

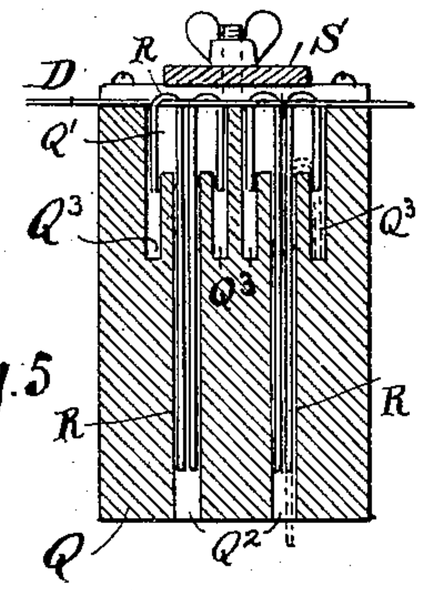
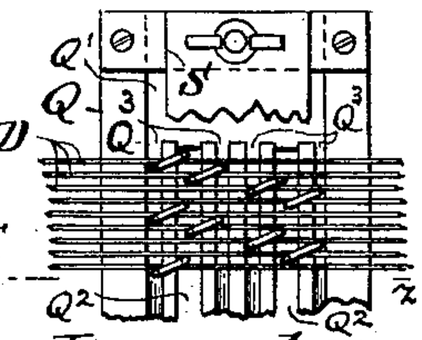


Fig. 4



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WARP STOP MOTION FOR LOOMS.

No. 605,600. Patented June 14, 1898.

Fig. 6

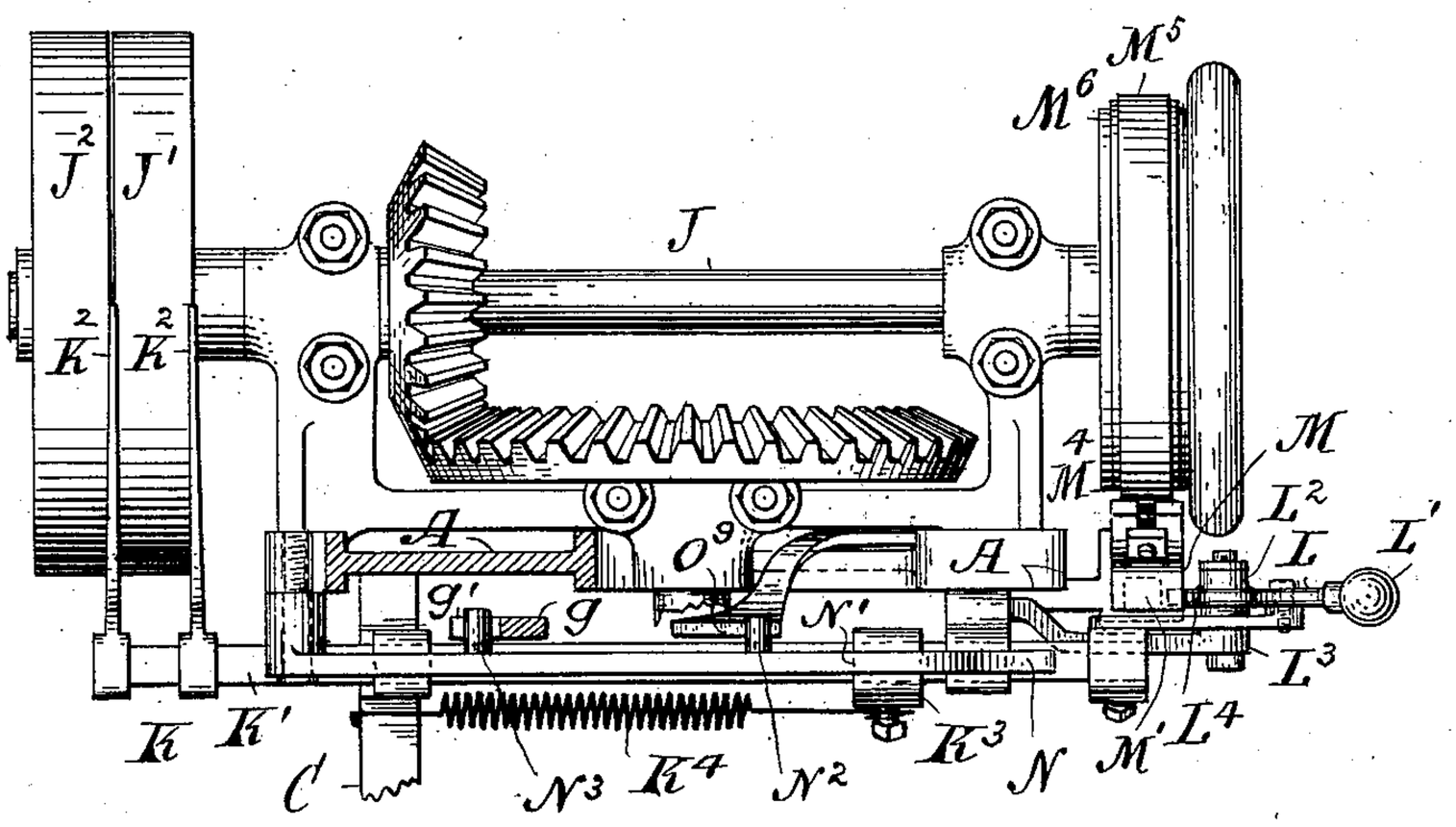
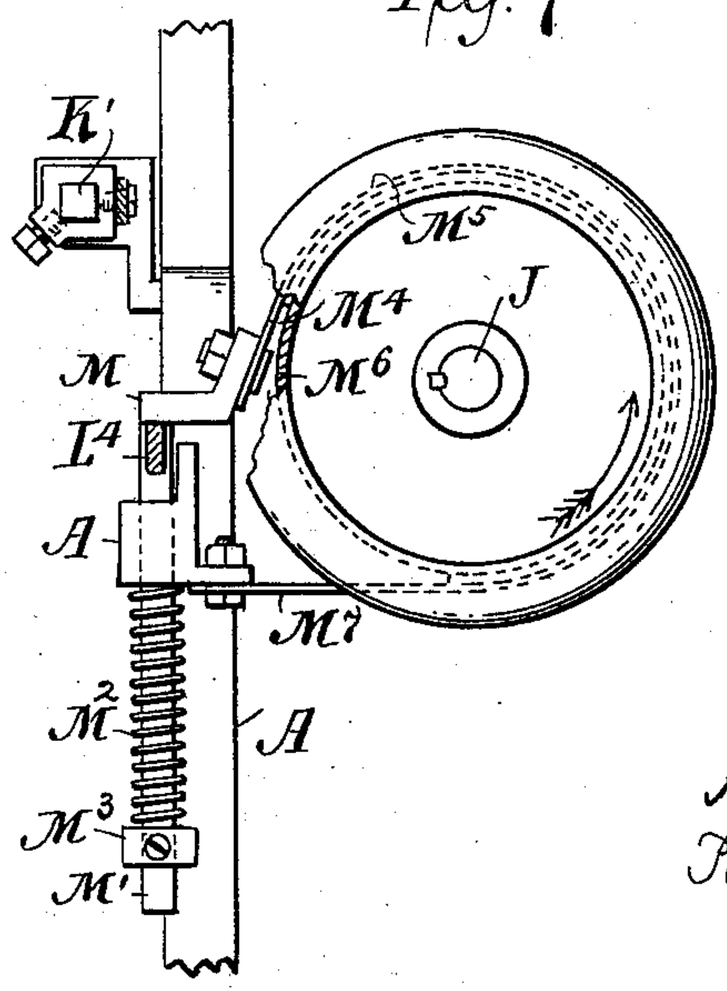


Fig. 7



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UNITED STATES PATENT OFFICE.

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WARP STOP-MOTION FOR LOOMS.

SPECIFICATION forming part of Letters Patent No. 605,600, dated June 14, 1898.

Application filed December 4, 1896. Serial No. 614,421. (No model.)

To all whom it may concern:

Be it known that I, ABRAM D. EMERY, of Taunton, Massachusetts, have invented certain Improvements in Warp Stop-Motions and Warp-Guiding Mechanism for Upright Looms, of which the following is a specification.

The object of the herein-described improvement is to automatically bring the operative parts of a loom to rest with the shed closed whenever a warp-thread breaks. This object is accomplished by the combination of the herein-described warp stop-motion with the spring-actuated progressively-acting stopping instrumentality which in my pending application, Serial No. 643,320, is shown, described, and claimed in combination with a plurality of stop-motions. The said stopping instrumentality, which is thrown into action by the tripping of a master trip-lever, is adapted to bring the operative parts of the loom to rest by its progressive action during a prescribed part of one revolution of the lay-driving shaft.

In the present combination the warp stop-motion is so timed as to perform the function of tripping said master trip-lever at such predetermined stage in the revolution of the lay-driving shaft as will result in stopping the loom with the shed closed whenever a warp-thread breaks.

The devices composing the warp stop-motion embrace a group of pins equaling in number the number of the warp-threads and respectively so supported by the warp-threads, so long as the warp is intact, as to occupy positions wherein they are out of the path of motion of a feeler-blade having its ends pivotally mounted in a frame which has a transverse reciprocating motion while the loom is running and which carries a dog having one of its ends weighted and provided with a V-shaped notch for engaging and normally holding the feeler-blade in an upright position. If, however, a single warp-thread breaks, its pin drops into the path of the upper edge of the feeler-blade. The resulting collision with the dropped pin rocks the feeler-blade upon its longitudinal axis in one direction or the other, as the case may be, and thus removes the support from the weighted end of the said dog. By the consequent fall of its weighted end the opposite end of the dog is so elevated that during the latter part of the rearward excursion of the frame upon which the dog is carried it engages and pushes laterally the lower end of a bell-crank lever, the upper end of which is thereby made to push upward, and thus trip said master trip-lever.

The stopping of the loom with the shed closed is desirable, because the parts are then in the positions into which they would otherwise be required to be moved to facilitate the tying up of the broken warp-threads. The progressively-acting stopping instrumentality herein shown embraces a brake-strap surrounding about three-quarters of the brake-wheel, and so arranged with relation to the direction of rotation of the brake-wheel when the loom is running as to be self-tightening, because the frictional influence of the periphery of the brake-wheel upon the brake-strap in contact with it tends to pull the brake-strap away from its fixed end, and thereby coöperates with a brake-spring in tightening the hug of the brake-strap upon the brake-wheel.

The warp-guiding mechanism forming another part of the invention embraces, essentially, two whip-rollers mounted at the opposite extremities of transverse rockers secured to a rock-shaft having its bearings in a part of the frame of the loom, whereby the said whip-rollers, in addition to having motions of rotation upon their own axes, have a rocking motion upon the common axis afforded to them by the said rock-shaft. The warp is led upwardly from the warp-roll across the front side and over the top of the front whip-roller, thence in an approximately horizontal plane rearwardly under the bottom and upwardly across the rear side of the rearward whip-roller, the section of the warp between the two whip-rollers being that upon which the warp stop-pins are suspended. The whip-rollers are maintained in position to hold the said section of warp in a substantially horizontal plane and to administer the desired degree of tension to the warp by the engagement of the rearward extremities of said transverse rockers with notched radius-arms affixed to a rock-

shaft which is normally stationary, but which, if the shuttle fails to box properly, is so rocked as to disengage said notched arms from said rockers, and thereby free the warp from tension.

A horizontal guide-bar affixed to the frame of the loom at a suitable distance beneath the section of warp between the whip-rollers has two parallel vertical slots extending through it, and is provided upon its upper surface with four grooves parallel with said slots. The slots and grooves are for guiding the warp stop-pins. At their upper ends the stop-pins are provided with return-bends, giving each of them the form of a staple with parallel legs of unequal length. The longer legs extend into the vertical slots in the guide-bar and the shorter legs into the said grooves respectively. Each pin is suspended by its bight on one of the warp-threads at such a distance above the top of the guide-bar that the pin may have some vertical play without dropping far enough to carry its lower end in the path of motion of the feeler-blade, while, if a warp-thread breaks, its pin drops until its fall is arrested by the bearing of the lower end of its return-bend upon the bottom of its groove, in which case the lower end of the longer leg of the staple or pin projects below the bottom of the guide-bar, and hence into the path of motion of the feeler-blade.

For abundant caution to prevent any possible dislodgment of the pins in an upward direction a horizontal guard-board is arranged a short distance above the section of warp upon which the pins are hung and is detachably secured to piers erected upon the ends of the guide-bar. The arrangement of the slots and grooves permits each pin to occupy a position in which it does not interfere with the warp-threads on either side of the warp-thread upon which it is suspended or with the pins suspended upon the adjoining warp-threads. This mode of suspending the pins upon the warp is more convenient than that heretofore practiced of suspending the pins by means of eyes through which the warp-threads are led, because the return-bend pins can be removed from or replaced in position without the necessity of threading the warp-threads through eyes, and hence without disturbing the warp. The arrangement of the slots and grooves which constitute the guides for the pins is especially advantageous, because it permits the use of comparatively stout pins grouped closely together and yet not interfering with one another, because their bights extend diagonally across the warp-threads.

The accompanying drawings, representing the warp stop mechanism and so much of an upright loom as serves to illustrate the embodiment of the invention therein, are as follows, viz:

Figure 1 is a transverse vertical section of a part of the loom, taken through the plane indicated by the dotted line $x\,x$ on Fig. 2. Fig. 2 is a horizontal section taken through the plane indicated by the dotted line $y\,y$ on Fig. 1. Fig. 3 is an elevation of the part of the warp stop mechanism from the point of view opposite that from which the loom mechanism is represented in Fig. 1. Fig. 4 is a top view of a portion of the stop-pin guide-bar, showing a few of the warp-threads and the upper ends of a few of the stop-pins. Fig. 5 is a transverse section of the stop-pin guide-bar, taken through the vertical plane indicated by the dotted line $z\,z$ on Fig. 4. Fig. 6 is a horizontal section taken through the plane indicated by the dotted line $x'\,x'$ on Fig. 1, affording a top view of the driving-gear and the brake-wheel; and Fig. 7 is a detail affording a face view of the brake-wheel.

The drawings represent portions of an upright loom the frame of which is composed of two standards A and B, united by suitable horizontal members, three of which, C, C′, and C^2, are indicated in cross-section in Fig. 1, a top view of C^2 being shown in Fig. 2. Parts of the inner and outer sides of the standard A are shown in Figs. 1 and 3, respectively.

The warp D is led from the warp-roll D′ upwardly around the front side and over the top of the whip-roller E, thence rearwardly under the bottom and around the rear side of the whip-roller E′, thence upwardly across the lease-rods F F′, through the harnesses G G′ and the reed H of the vertically-reciprocating lay H′, to the weaving-line I.

The loom is driven by the transverse shaft J, provided with the fixed pulley J′ and the loose pulley J^2. The position of the driving-belt is governed by the prongs K^2 of the belt-shifter K, which is connected to the rear end of a horizontally-sliding bar K′, the front end of which is pivoted to the starting-lever L. A contracting spiral spring K^4 is secured at one end to the collar K^3, mounted on the sliding bar K′, and at its opposite end to the frame of the loom. The starting-lever L has at its upper end the handle L′ and at its lower end the hub L^2, which is pivotally supported upon the bracket L^3, affixed to the loom-frame.

When the starting-lever L is swung outward toward the position in which it is represented in Fig. 1, a toe L^4, projecting laterally from its hub, engages a collar M, affixed to the upper end of a slide-rod M′, and by pulling upward the slide-rod M′ compresses an expanding spiral spring M^2, which abuts at its upper end against the perforated bracket, through which rod M′ slides and delivers its thrust against a collar M^3, adjustably secured to the lower part of the slide-rod M′.

The collar M on the upper end of the slide-rod M′ has fastened to it the loose end M^4 of the brake-strap M^5, which partially surmounts the brake-wheel M^6, affixed to the driving-shaft J, and has its opposite end M^7 secured to the frame of the loom. So long as the collar M remains thus elevated the brake-strap M^5 is held clear of the brake-wheel M^6. The

parts are held in running position, as represented in Fig. 1, by means of the master trip-lever N, pivoted at its rear end to the frame of the loom and provided with a shoulder N′, adapted to catch against the collar K^3, affixed to the brake-shifter slide-bar K′. When thus caught, the master trip-lever N acts as a strut which holds the belt-shifter in its forward position. The master trip-lever N is provided at its forward end with a handle $N^\times$, by means of which it may be manually swung upward out of engagement with the collar K^3, thereby releasing the belt-shifter to the influence of its spring K^4, which by its contraction shifts the driving-belt from the fixed pulley J′ to the loose pulley J^2. Concurrently the brake-shifter pulls the hand-lever L backward, and thus releases the brake-strap M^5 to the influence of its spring M^2. The brake-strap is consequently tightened around the brake-wheel in part by the pull of the spring M^2 and in part by the frictional influence upon the brake-strap of the periphery of the brake-wheel, which when the loom is running rotates in such direction as to make that frictional influence, when the brake-strap is in contact with the brake-wheel, tend to pull the brake-strap away from its fixed end M^7.

The self-tightening brake-strap, in connection with its adjustable actuating-spring, is utilized with peculiar effectiveness in the described organization, in which the brake is thrown into action concurrently with the shifting of the belt by means of the master trip-lever, which is adapted to be actuated to stop the loom either manually or automatically by either one of a multiplicity of devices set into operation, respectively, by the different casualties to which looms when running are more or less liable.

Motion to raise the master trip-lever and stop the loom if a warp-thread breaks is transmitted from the eccentric O, affixed to the constantly-rotating cam-shaft O′, by a train of connections consisting of the eccentric strap-arm O^2, the rock-shaft O^3, having its bearings in the loom-frame and having an upwardly-extending crank-arm O^4, to which the strap-arm O^2 is pivoted, and having two downwardly-extending crank-arms O^5, connected by the links O^6 to the transversely-vibratable frame O^7, the weighted dog O^8, pivotally mounted upon the frame O^7, and the bell-crank lever O^9, pivoted to the loom-frame and so arranged that its lower extremity intersects the path of bodily-reciprocating movement of the unweighted end O^{10} of the dog O^8 whenever the weighted end thereof is permitted to fall from the position which it normally occupies while the loom is running. Normally the weighted end of the dog O^8 is retained in its more elevated position by the bearing of the notch O^{11} in its under side upon the upper end of the radius-arm P, affixed to the end of the rock-shaft p, to which the lower edge of the horizontal feeler-blade P′ is secured. The rock-shaft p is pivoted at its ends upon the frame O^7, so that while the radius-arm P is engaged by the notch O^{11} the feeler-blade P′ remains upright. Stops p' p' limit the range of swaying movement of the radius-arm P. A crank-arm p^2 is affixed to the rock-shaft p for convenience in manually restoring the feeler-blade to its upright position, and thereby elevating the weighted end of the dog O^8. As will be seen, the under edge of the weighted end of the dog O^8 is so curved as to facilitate the action of the upper end of the radius-arm P in thus elevating the weighted end of the dog O^8.

During the transverse reciprocating movements of the frame O^7 the upper edge of the feeler-blade traverses a horizontal path a short distance below the horizontal guide-bar Q, secured to the loom-frame and having upon its upper side the longitudinal grooves Q′. Two parallel vertical slots Q^2 Q^2 extend entirely through the lower part of the guide-bar Q, and four parallel grooves Q^3 are formed in the upper side of the guide-bar Q.

The slots Q^2 and the grooves Q^3 are the guides for the warp stop-pins R, each of which has a return-bend at the top, by means of which it is hooked over and suspended upon one of the threads of the part of the warp extending across from the whip-roller E to the whip-roller E′. Each warp-thread extends through the bight of one of the pins R, and where necessary across the tops of the bights of the adjoining pins. The grooves Q^3 afford room for the return-bends of the pins and are sufficiently deep to permit any pin whose warp-thread breaks to drop to such distance as will carry its lower end into the horizontal path traversed by the upper edge P^2 of the feeler-blade when the feeler-blade is in its upright position. The collision of the feeler-blade with a dropped pin sways over the radius-arm P, and by thus removing its support permits the weighted end of the dog O^8 to fall, whereby the unweighted end O^{10} of the said dog is swung upward, so that in the latter part of the backward excursion of the frame O^7 the dog strikes against and pushes backward the lower arm of the bell-crank lever O^9. The upper arm of the bell-crank lever O^9 is thus swung upwardly against the under side of the master trip-lever N or against a shoulder or pin, such as the pin N^2, connected to or forming a part of the master trip-lever N.

The resulting upward thrust of the upper arm of the bell-crank lever O^9 raises the master trip-lever N and clears its shoulder N′ from the collar K^3, and thus releases the belt-shifter and brake-strap to the influence of their respective springs, by which they are instantly thrown into action and made to stop the loom within a period of time which is prearranged by appropriately adjusting the tension of the brake-strap spring M^2. The required adjustment is effected by suitably changing the position upon the slide-rod M′ of the adjustable collar M^3. The loom

is thus brought to rest with its parts in definitely predetermined positions.

It will be seen that, broadly considered, the described warp stop-motion consists of means whereby if any one of the warp-threads break continuity is established in a previously-discontinuous train of connections between a constantly-moving part of the loom and a master trip-lever for tripping into action a belt-shifter and a progressively-acting stopping instrumentality.

The warp-guiding devices forming part of the invention are included in the present case, because they are arranged with reference to facilitating the operation of the warp stop-motion, the section of warp between the whip-roller E and the whip-roller E′ being that upon which the stop-pins are suspended. The two whip-rollers E and E′ derive their support from two rockers *a* and *b*, each of which is splined or otherwise fastened to the horizontal rock-shaft *c*, having its bearings in brackets affixed to the loom-frame. The trunnion at one end of the whip-roller E is provided with a bearing in the lower arm of the bell-crank lever *d*, transversely pivoted to the standard *a′*, projecting upwardly from the front end of the rocker *a*. The upper end of the bell-crank lever *d* is connected by the contracting spiral spring *d′* to the top of the rocker *a*. The rocker *a* has near its forward end the lateral extension a^2, which is provided with a vertical slot to admit the lower arm of the bell-crank lever *d*. The end walls of the said slot, which are indicated by the dotted lines a^3, (shown in Figs. 1 and 3,) serve as stops which limit the possible range of swinging movement of the lower arm of the bell-crank lever *d*. Similarly the rocker *b* is provided near its front end with a standard *b′*, in which is pivoted the bell-crank lever *e*, the lower arm of which affords the bearing for the trunnion at the end of the whip-roller E opposite that seated in the lower end of the bell-crank lever *d*. A contracting spiral spring *e′* connects the upper end of the bell-crank lever *e* with the top of the rocker *b*. The rocker *b* is provided near its forward end with the lateral extension b^2, which is provided with the vertical slot b^3 to admit the lower arm of the bell-crank lever *e*.

The whip-roller E′ has its trunnions seated in notched bearings formed near the rear end of the rockers *a* and *b*, one of these bearings a^4 being shown in dotted lines in Fig. 1. The whip-roller E′ is held in its bearings by the strain upon it of the warp, which extends under it and upward across its rear side.

By means of the described contracting springs *d′* and *e′* pressure in an outward direction is constantly exerted upon the whip-roller E, and the warp is thus constantly maintained under elastic tension.

The rocker *a* is provided at its rear end with a downward extension a^5, in which is formed a notch a^6, adapted to engage the lower extremity of a radius-arm *f*, extending downwardly from the adjacent part of the horizontal rock-shaft *f′*, pivoted to brackets affixed to the frame of the loom. The rocker *b* is provided at its rear end with a similar downward extension similarly notched to engage the lower extremity of a similar radius-arm extending downwardly from the rock-shaft *f′*. The rock-shaft *f′* is provided with a laterally-extending arm f^2, which is linked by the pitman *g* to the lever *h*, pivoted at its rear end upon a bracket affixed to the frame of the loom, and pesenting at its front end a shoulder *h′*, which intersects the path of upward motion of the upper end of the dagger *i* if the shuttle has failed to box properly, in which case a shoulder *g′* upon the pitman *g* by its bearing upon the under side of the pin N^3, affixed to the master trip-lever N, raises the master trip-lever clear of the collar K^3 and thus stops the loom. When the loom is thus stopped, the warp is released from tension, owing to the disengagement of the radius-arms *f* of the rock-shaft *f′* from the said notches in the downward extensions of the rockers, because by such disengagement the whip-rollers E and E′ are left free to move bodily upon the common axis afforded for them by the rock-shaft *c*, to which the rockers *a* and *b* are secured.

It will be seen that the whip-roller E′ is slightly more distant from the rock-shaft *c* than the whip-roller E, and thus to a slight extent overbalances the whip-roller E.

A horizontal guard-board S is arranged above the section of warp upon which the stop-pins are suspended and is detachably secured to the opposite ends of the guide-bar Q. This guard-board prevents the stop-pins from being dislodged in an upward direction from their proper positions.

There is no danger of the disengagement of the warp-threads from the stop-pins, because when the warp is slacked the stop-pins simply drop down as far as the slack of the warp-threads will permit.

Preparatory to starting the loom the front ends of the rockers *a* and *b* are pushed up until the notches in the rearward extensions reëngage the lower extremities of the radius-arms *f* of the rock-shaft *f′*, which restores the warp to its original condition of tension.

As the position of the section of warp upon which the warp stop-pins are suspended is affected by the operation of the shuttle stop-motion, the shuttle stop-motion is herein described for the purposes of explanation merely, the shuttle stop-motion in itself being described and claimed in pending application, Serial No. 624,384.

What is claimed as the invention is—

1. In an upright loom, the combination, as herein set forth, of a progressively-acting stopping instrumentality adapted to bring the operative parts of the loom to rest by its progressive action during a prescribed part of one revolution of the lay-driving shaft; a master trip-lever for normally holding said

stopping instrumentality out of action; a warp stop-motion adapted to be, by the breaking of a warp-thread, rendered operative for tripping said master trip-lever, and so timed as to perform said tripping function at such predetermined stage in the revolution of the lay-driving shaft as will result in stopping the loom with the shed closed whenever a warp-thread breaks.

2. In an upright loom, a warp stop-motion comprising the following devices; warp-guides for guiding a section of warp through an approximately horizontal plane; a system of pins suspended upon the threads of said section of warp; a horizontally-sliding frame arranged beneath said system of pins; guides for guiding said pins in vertical paths; a horizontal rock-shaft mounted on said frame; a feeler-blade affixed to and projecting upwardly from said rock-shaft; connections between said frame and a constantly-moving part of the loom, whereby said frame is constantly vibrated when the loom is in operation; a weighted dog pivotally mounted upon said frame and having its weighted end adapted to engage a radius-arm affixed to said feeler-blade rock-shaft, whereby by such engagement said feeler-blade is held in an upright position and said dog is held in an inoperative position; a progressively-acting stopping instrumentality and connections therewith projecting into the operative path of motion of said dog, as and for the purposes set forth.

3. In an upright loom, mechanism for automatically stopping the loom with the shed closed whenever a warp-thread breaks, comprising essentially a group of pins suspended upon a section of warp occupying an approximately horizontal plane; a horizontally-sliding constantly-reciprocating frame arranged beneath said system of pins; a dog pivotally mounted upon said frame and partaking of the reciprocating motions thereof; means carried by said frame for normally holding said dog in inoperative position, said means embracing an upright feeler-blade traversing a path adapting it to be carried into collision with any warp stop-pin which by the breaking of the warp-thread on which it was suspended has been permitted to fall below its normal position; a progressively-stopping instrumentality and connections therewith projecting into the operative path of motion of said dog, as and for the purposes set forth.

4. In an upright loom, the combination, as herein set forth, of guides for maintaining a section of warp in an approximately horizontal plane; a series of stop-pins provided at their upper ends with return-bends and suspended upon the threads of said approximately horizontal section of warp; guides for said pins, the same consisting of parallel vertical slots extending through a guide-board arranged beneath said section of warp and adapted to receive the longer legs of the said stop-pins, and parallel vertical grooves in the top of said guide-board for receiving the return-bends or shorter legs of the said stop-pins; a stopping instrumentality for stopping the loom, and connections between said stopping instrumentality and said system of warp stop-pins, whereby if a warp-thread breaks the stop-pin originally suspended thereon by dropping from its normal position throws said loom-stopping instrumentality into action.

5. In a warp stop mechanism, substantially such as described, the group of return-bend pins, R, severally supported by the threads of the warp, in combination with the guide-bar, Q, provided with the vertical slots, Q^2, and the parallel grooves, Q^3, whereby the bights of said pins are made to extend diagonally across the warp-threads upon which they are respectively supported.

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