(No Model.) 3 Sheets—Sheet 1.

O. SMITH.

WARP STOP MOTION FOR LOOMS.

No. 498,193. Patented May 23, 1893.

Fig: 1.

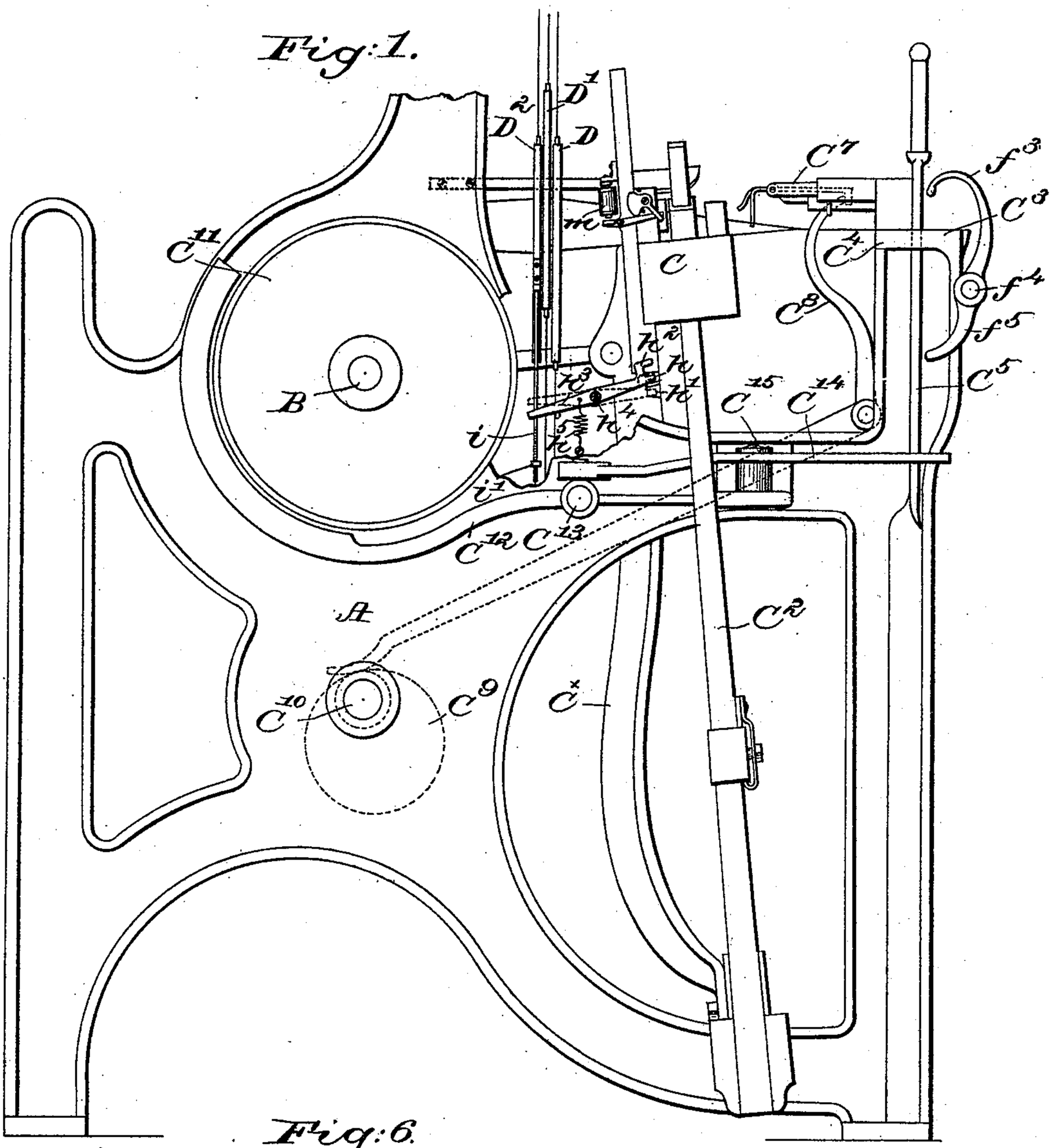


Fig: 6.

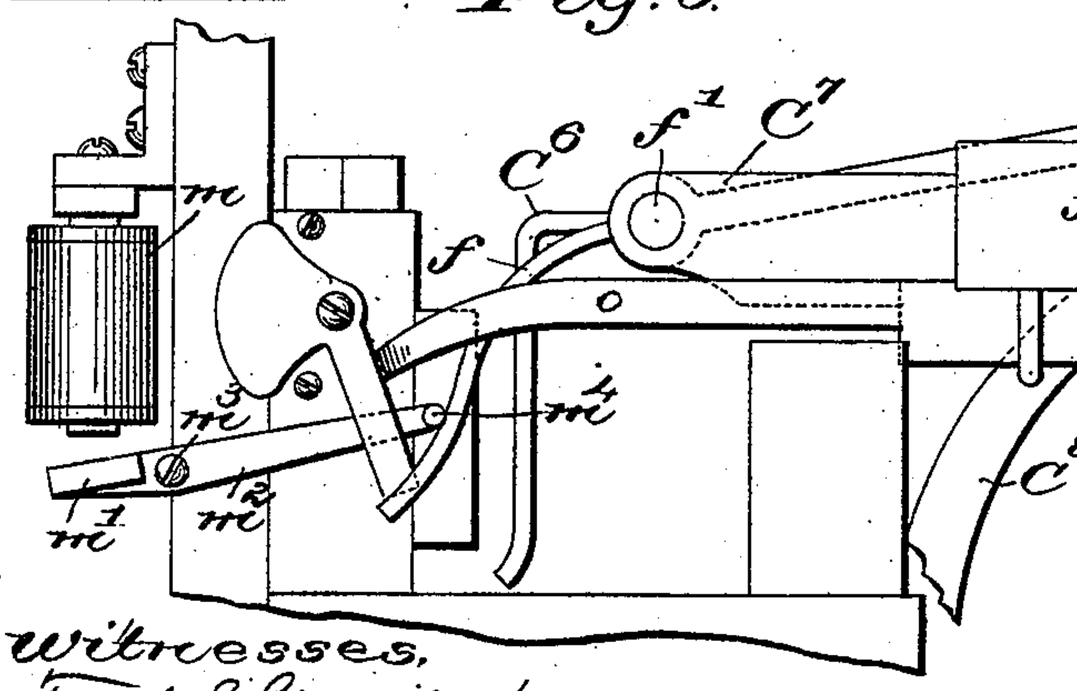
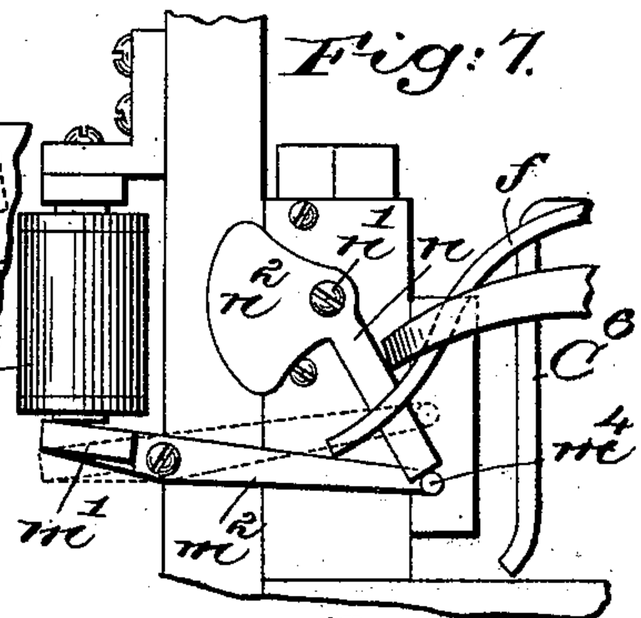


Fig: 7.



Witnesses,
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Inventor
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(No Model.) 3 Sheets—Sheet 2.

O. SMITH.

WARP STOP MOTION FOR LOOMS.

No. 498,193. Patented May 23, 1893.

Fig: 2.

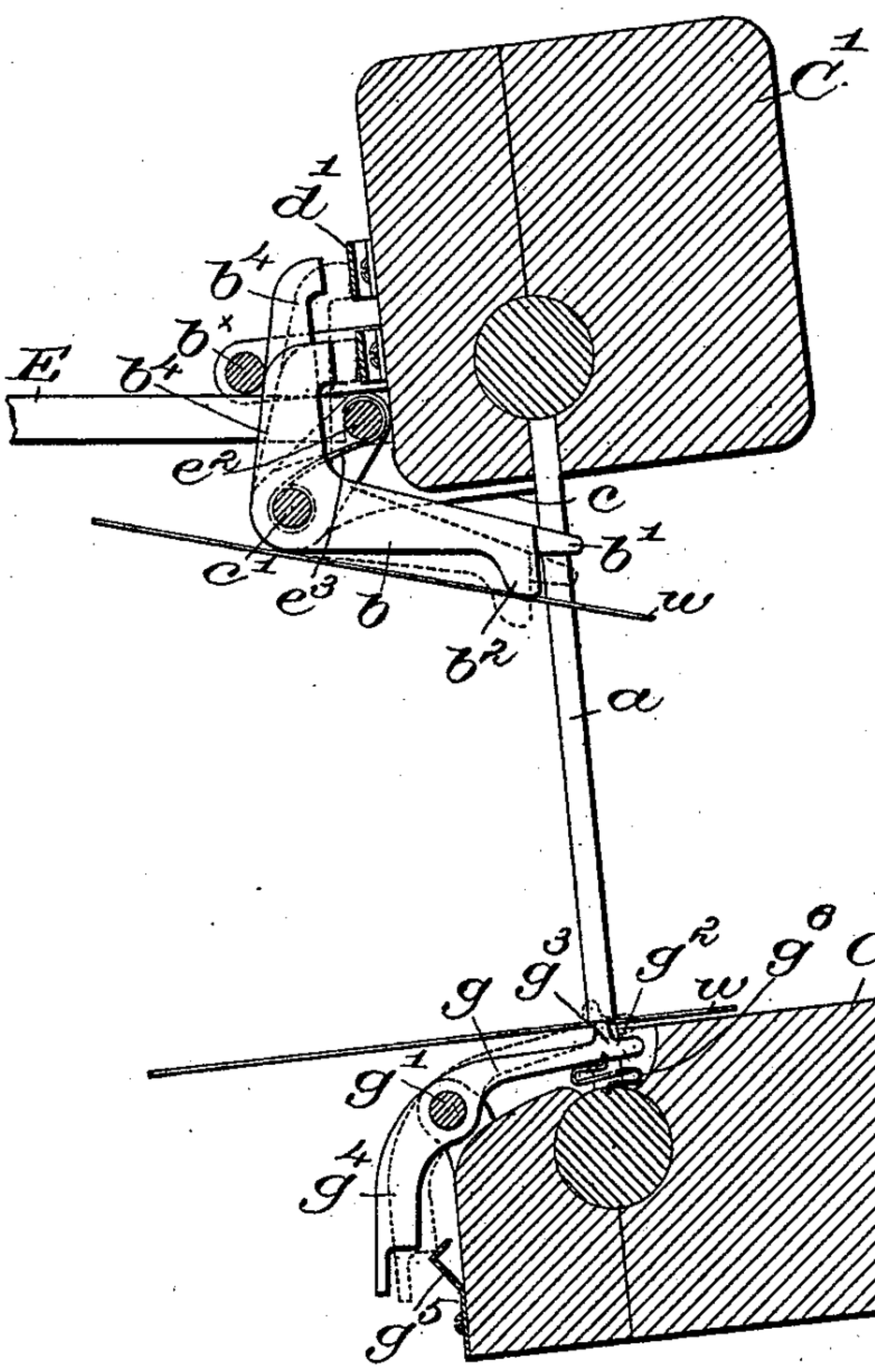

Fig: 3.

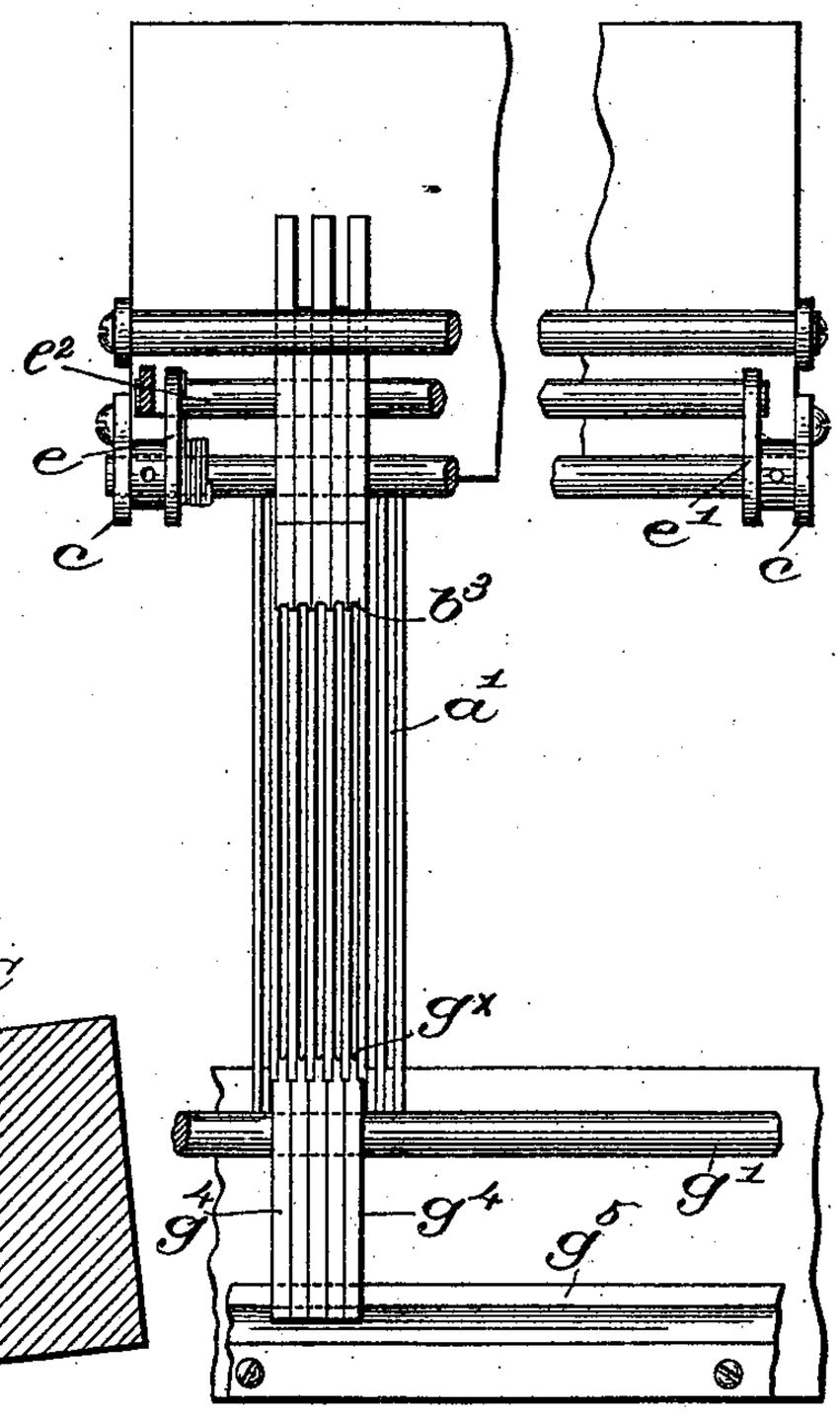

Fig: 4.

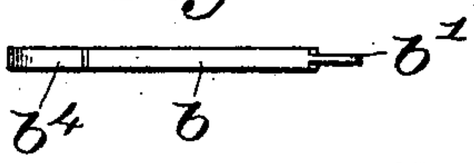

Fig: 5.

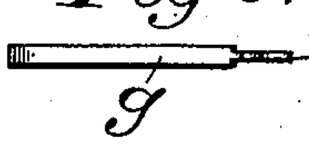

Fig: 8.

Fig: 15.

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(No Model.) 3 Sheets—Sheet 3.

O. SMITH.

WARP STOP MOTION FOR LOOMS.

No. 498,193. Patented May 23, 1893.

Fig: 9.

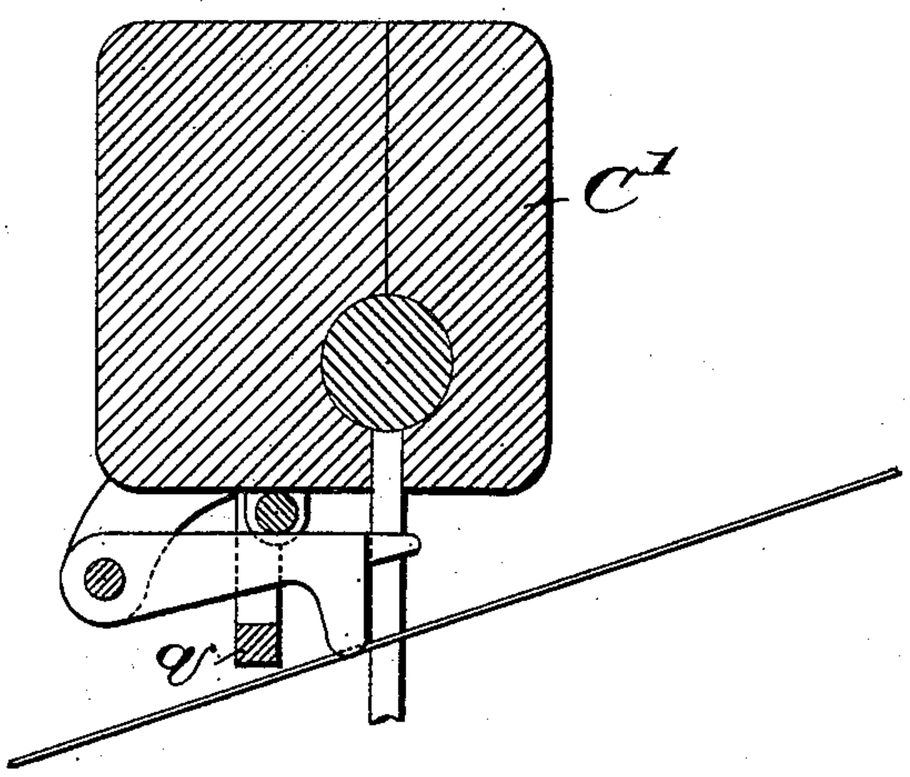


Fig: 10.

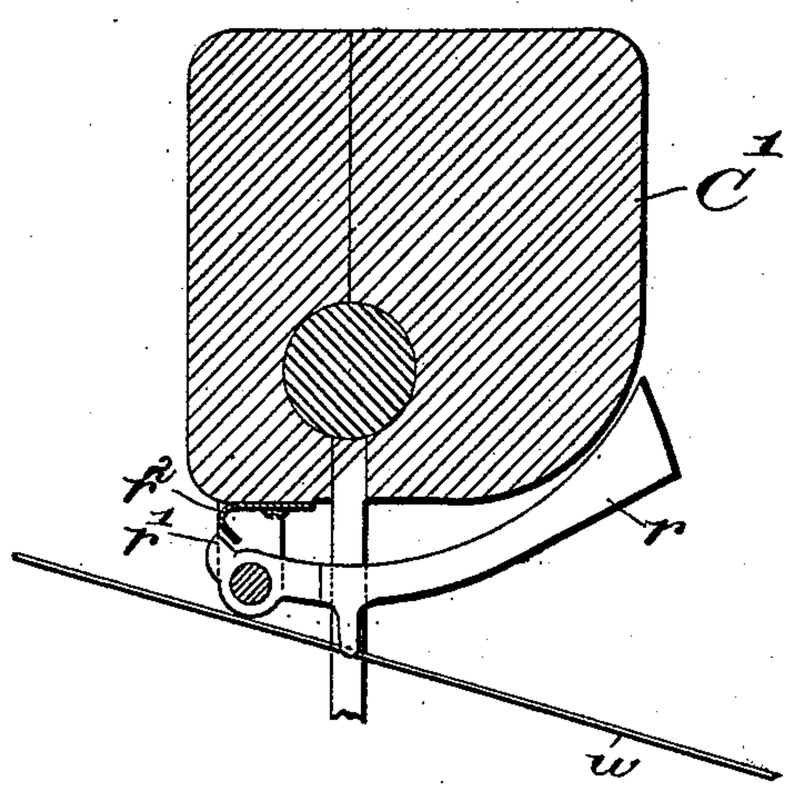


Fig: 12.

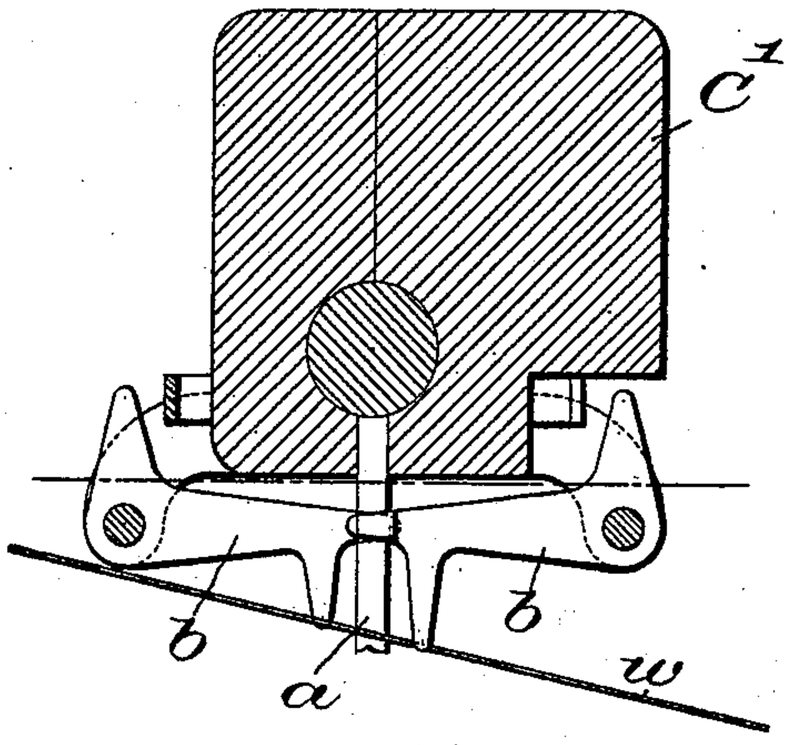


Fig: 11.

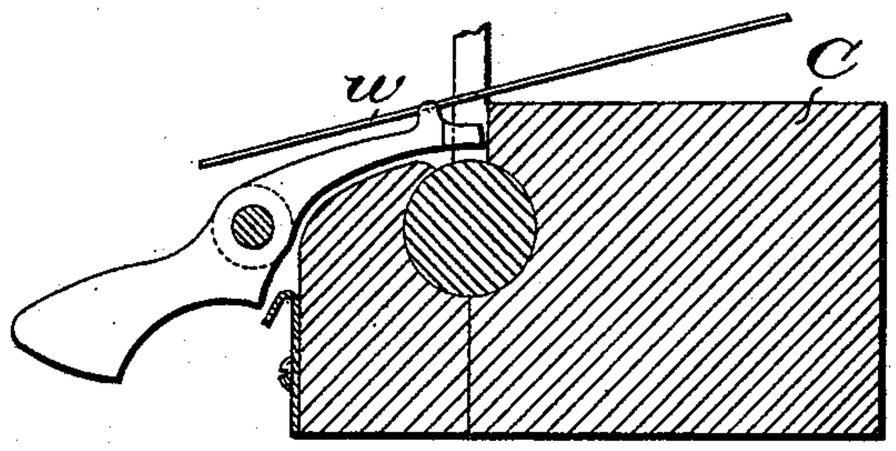


Fig: 13.

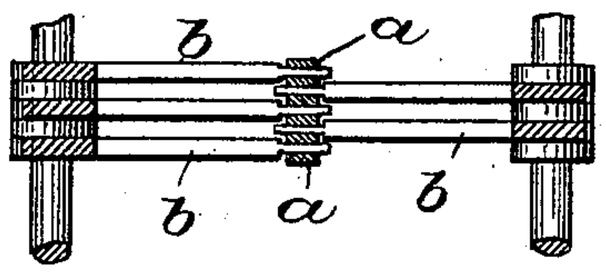
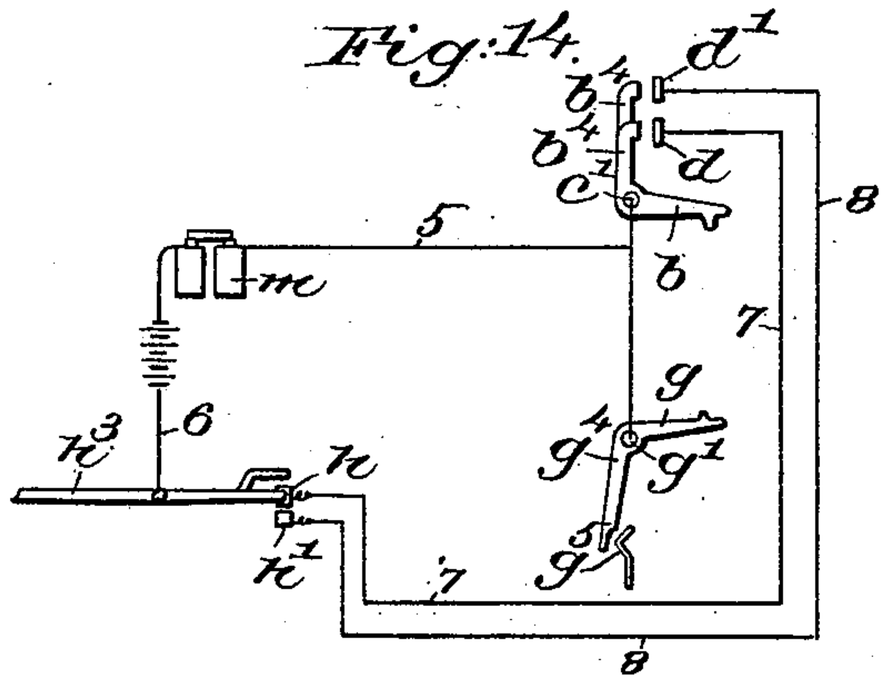


Fig: 14.



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Edward F. Allen.

Inventor.
Oberlin Smith.
by Crosby & Gregory Attys.

UNITED STATES PATENT OFFICE.

OBERLIN SMITH, OF BRIDGETON, NEW JERSEY, ASSIGNOR, BY MESNE ASSIGNMENTS, OF ONE-HALF TO THE NORTHROP LOOM COMPANY, OF HOPEDALE, MASSACHUSETTS.

WARP STOP-MOTION FOR LOOMS.

SPECIFICATION forming part of Letters Patent No. 498,193, dated May 23, 1893.

Application filed March 8, 1892. Renewed May 1, 1893. Serial No. 472,612. (No model.)

To all whom it may concern:

Be it known that I, OBERLIN SMITH, of Bridgeton, county of Cumberland, State of New Jersey, have invented an Improvement in Warp Stop-Motions for Looms, of which the following description, in connection with the accompanying drawings, is a specification, like letters and figures on the drawings representing like parts.

In an application, Serial No. 421,388, filed by me February 3, 1892, I have shown and described a warp stop motion for looms wherein a series of sliding warp detectors are arranged in such manner that they may be acted upon and moved from their normal into their abnormal positions by the warp threads, provided such warp threads are unbroken; but should a warp thread be broken, the particular detector which should have been moved by it had it remained unbroken, will fail to be moved into its abnormal position as described, and will act through suitable mechanism to effect the stopping of the loom.

This invention has for its object to provide a warp-stop motion for looms wherein the warp detectors are pivoted to move in the arc of a circle rather than made to slide as in the application referred to.

In accordance with this invention, the detectors are pivoted at the front of, or behind the usual reed, the ends of the detectors entering the spaces between the reed-dents through which the warp threads are passed so that whenever the warp threads are raised or lowered in the formation of a shed for the passage of the shuttle, the detectors in the reed-spaces through which said threads pass will be moved thereby into their abnormal positions. Failure of a warp thread to properly move its detector from its normal into its abnormal position, will permit or cause the closure of an electric circuit which, acting through suitable electrically-controlled mechanism, will effect the stopping of the loom.

Another feature of this invention is a sustaining device to normally sustain the warp detectors in their abnormal positions to thus relieve the warp threads from the weight of the detectors, the said sustaining device, however, releasing the detectors at the proper time in those reed-spaces through which the warp threads pass which are to be moved for the formation of the shed, thus permitting such detectors to move toward the warp threads until arrested in their movement by said warp threads; but if one of the warp threads should be broken, it will fail to arrest the movement of its warp detector when the same is released by the sustaining device, thus permitting the said detector to move into its normal position which through suitable mechanism will effect the stopping of the loom.

One part of this invention therefore consists in a loom containing the following instrumentalities, viz:—a lay; a series of reed-dents carried thereby; pivoted warp detectors having their free ends adapted to be turned on their pivots from their normal into their abnormal positions by the warp threads passed through said spaces, and an electrically actuated stopping mechanism for the loom controlled by said detectors, substantially as will be described. Also, in a warp stop motion for looms, a series of warp detectors adapted to be acted upon and moved from their normal into their abnormal positions by the warp threads, combined with a sustaining device to normally sustain said detectors in their abnormal positions out of contact with the warp threads and to release said detectors at the proper time to permit them to move toward said warp threads, substantially as will be described.

Other features of this invention will be hereinafter described and pointed out in the claims.

Figure 1, is a left-hand end elevation of a sufficient portion of a loom to enable this invention to be understood; Fig. 2, an enlarged sectional detail showing the lay, lay-cap, reed, and detectors, the detectors being held in their abnormal positions by the warp threads which latter are represented as moved to form a shed; Fig. 3, a partial rear or left-hand elevation of Fig. 2; Figs. 4 and 5, top views of the detectors arranged respectively at the top and bottom of the reed; Figs. 6 and 7, details

illustrating the action of the stopping mechism; Fig. 8, a sectional detail of the lay-cap, a portion of the reed, and some of the detectors, the figure showing the latter as held in their abnormal positions by the sustaining device; Figs. 9 to 13 inclusive, modifications to be hereinafter described; Fig. 14, a diagrammatical view showing the arrangement of circuits, and Fig. 15, a modified construction to be referred to.

Referring to the drawings, A represents a portion of the end frame of a loom; B the lay or crank shaft; C the lay; $C^{\times}$ the lay sword; C^2 the picker stick; C^3 the breast beam; C^4 a holding plate having a slot for the shipper C^5 to move in, and a notch to hold the said shipper in position: C^6 a weft fork; C^7 a weft fork slide bar; C^8 a weft hammer; C^9 a cam on the shaft C^{10} to actuate the said weft hammer; C^{11} a driving pulley on the shaft B; C^{12} a belt controller mounted to slide on the rod C^{13} and actuated by the lever C^{14} pivoted at C^{15} and having its outer end in engagement with the shipper C^5; and D, D', D^2 heddle frames, all of which are and may be of well known or desired construction and arrangement; and which may be made in usual manner, as will be hereinafter described.

Referring to Figs. 2 and 3, the lay C and lay cap C' are formed to receive and hold in usual manner the series of reed-dents *a*, separated to leave reed spaces *a'* through which the warp-threads *w* are passed, said warp-threads being passed through the heddles in the frames D, D', D^2, and moved thereby in usual manner. The lay cap C', at its rear side, is provided with brackets *c* which support the rod *c'* on which are pivoted the upper warp detectors *b*, with their free ends located in line with the reed spaces *a'* between the reed-dents *a*, the ends of the said detectors, which, in the present instance enter the reed spaces, being made thinner as at *b'*, to properly fill the said spaces, while the remaining or thicker portions of the said detectors contact with each other, as represented in Fig. 3, each of said detectors being provided with a supporting lug b^2 preferably grooved as at b^3 on its under side to receive a warp thread.

In the present embodiment of this invention, the detectors *b* are provided with arms b^4 having their outer ends suitably formed to make electric contact or engagement with the fixed contact strips *d*, *d'*, secured to the lay-cap, the arms b^4 of some of the detectors being of suitable length to co-operate with the contact-strip *d*, while the arms b^4 of other of the detectors are made longer to co-operate with the fixed contact strip *d'*, as best represented in Fig. 2. The rod *c'*, outside the warp-detectors, has loosely journaled upon it two arms *e*, *e'*, joined across the lay by a rod e^2 which extends in front of the arms b^4 of the warp-detectors, as best represented in Fig. 2, said rod being acted upon by a spring e^3 which tends to move the rod in such manner as to lift or move all the detectors *b* into their elevated or abnormal full line positions Fig. 2, against the stop rod $b^{\times}$. This rod e^2 constitutes a sustaining device for the warp detectors and sustains the said detectors in their elevated abnormal positions, as shown, to relieve the warp-threads from the weight or pressure of the detectors at all times except, in the present instance, when the lay reaches its rearmost position just prior to which the said rod e^2 will strike the fixed abutment E which will move the rod to the right Fig. 2, and permit all of the detectors to drop until they are arrested by the warp threads *w*, they being so arrested before their arms b^4 have made electrical engagement with either of the fixed contact strips *d*, *d'*. Should however, one of the warp threads be broken, the detector in the reed-space in which said warp thread lies will not be arrested but will be permitted to drop into its dotted line position, Fig. 2, until its arm b^4 engages one or the other of the contact-strips *d*, *d'*, to thus close an electric circuit between said detector and contact strip.

The lay C is provided at or near its ends with suitable brackets or supports for the rod *g'* on which are pivoted a series of lower-warp detectors *g* having their ends g^2 thinned to pass into or through the reed-spaces *a'* between the reed-dents *a*, said detectors also having suitable bearing lugs g^3 grooved as at $g^{\times}$, see Fig. 3, said lugs constituting the warp supports for the detectors *g*.

The lower warp-detectors are provided with arms g^4 formed to make electrical engagement with a fixed contact-strip g^5 when in their normal positions, springs g^6 acting to normally raise the said detectors to cause their arms g^4 to make electrical contact or engagement with the said fixed contact strip g^5, see Fig. 2, provided said detectors are not held in their lowermost abnormal positions by the unbroken warp-threads forming the lower plane of the shed, and the lower series *g* are arranged in circuit with an electro-magnet *m* shown mounted on the lay and having its armature *m'* carried by one end of an armature-carrier m^2, pivoted at m^3 and having its end m^4 turned at right angles to form a hook which when the armature is in its retracted position with the armature-carrier in the position Fig. 6, is adapted to co-operate with a warp-fork *f*, pivoted at *f'* in the weft-slide bar C^7, and having its opposite end provided with a down-turned hook f^2 which when the said warp fork is in its normal position lies in the path of movement of the weft hammer C^8, so that when the said weft hammer is moved forward, it will engage said hook f^2 and move the said slide bar to the right and through an arm f^3 on a rock-shaft f^4 to rotate the latter and cause its arm f^5 to strike the shipper C^5 and move the latter to the left to disengage it from the notch in the holding plate C^4 and permit the said shipper to be moved to effect the stopping of the loom.

The normal position of the armature carrier m^2 is as represented in Fig. 6, its hook m^4, being in its elevated position, so that at each forward movement of the lay when beating in the weft, the hook m^4 on the said carrier will strike the warp-fork f and turn the same on its pivot to lift its hook f^2 out of the path of movement of the weft-hammer C^8 to prevent the latter moving the slide-bar C^7 to stop the loom. If, however, the circuit of the electro-magnet m is closed, its armature m' will be attracted and the armature-carrier will be moved into its full line position Fig. 7, where it will be locked by a suitable locking device n, pivoted at n', and having a counterweight n^2 so that the hook m^4 on the said carrier, at the next forward movement of the lay, will pass beneath the end of the warp-fork f and will fail to turn the latter on its pivot, permitting its hook f^2 to remain in its normal position directly in the path of movement of the weft-hammer C^8 which upon its subsequent forward movement will catch the said hook and move the slide-bar C^7 to the right to act through the rock-shaft f^4, as described and effect the stopping of the loom.

The locking device n retains the armature-carrier in its position Fig. 7, during the forward movement of the lay, or until the hook m^4 has passed beyond the end of the warp-fork f, when the said locking device will be moved into its position Fig. 6, by striking an abutment o and thus release the armature carrier and permit the same to resume its normal position when the magnet is demagnetized.

Referring to Fig. 14 the arrangement of the circuits is as follows: The pivotal rods c', g' on the lay-cap and lay respectively are connected by a wire 5 with the electro-magnet m, said magnet being connected by a wire 6 with the switch-lever h^3, pivoted at h^4 on the frame A, and normally retained in its elevated position as shown by a spring h^5, said lever upon the backward movement of the lay being engaged by a contact h on the lay which contact is connected in circuit by a wire 7 with the fixed contact strips d and g^5 of the lay-cap and lay. When the switch lever h^3 is moved into its dotted line position, Fig. 1, it will upon the backward movement of the lay engage the contact h', which latter is connected in circuit by wire 8 with the contact strip d' on the lay-cap, an arm h^2 on the said lever, when the latter is in its dotted line position, being in proper position to engage the contact h on the lay so that when the lay is moved to its rearmost position, the circuit will always be closed between the contact h and switch-lever h^3; said circuit being closed however, between the contact h' and the switch-lever h^3, only when the said switch-lever has been moved into its dotted line position. The movement of this switch-lever is effected in the present instance by means of a nut i', threaded upon a rod i attached to and movable with the heddle-frame D^2, the warp-detectors which are arranged in the reed spaces through which the warp-threads controlled by the said heddle frame D^2 are passed having their arms b^4 made longer to co-operate with the contact-plate d', so that whenever the said heddle-frame D^2 is raised to bring the warp-threads controlled by it into the upper plane of the shed for the introduction of such threads into the face of the fabric, such movement of the heddle-frame will also move the switch-lever h^3 into position to close the circuit upon the next backward movement of the lay through the contact h'. The contact-strip d' on the lay cap is thus thrown into circuit with the magnet m, so that if the warp-detectors b which should be acted upon and moved into their abnormal positions by the warp-threads controlled by the said heddle-frame D^2 when the latter is to be raised into the upper plane of the shed, are not arrested in their descent when released by the bar e^2 then their arms b^4 will engage the contact-strip d' and close the circuit at that point, and upon the next backward movement of the lay, when the circuit is closed between the switch-lever h^3 and contact h', a complete circuit will be formed which will energize the magnet m and cause the same to attract its armature and stop the loom, as described.

The operation of the device is as follows:—Referring to Figs. 1 and 2, the heddle-frames D, and D′ in the present instance are supposed to be moved regularly at each pick of the loom to move the warp threads controlled thereby alternately into the upper and the lower planes of the shed. As the lay in its backward movement approaches its rearmost position, the abutment E will move the sustaining rod e^2 away from the arms b^4 of the series of warp-detectors, thereby permitting the said detectors to drop, but the detectors having the short arms b^4 and which lie in the reed spaces through which the warp threads controlled by the said heddle frames are passed, will be arrested in their movement by the said warp-threads, if the latter have been properly moved into the upper plane of the shed, and their arms b^4 will thus be prevented from coming into engagement with the fixed contact-strip d, so that notwithstanding the circuit will be closed by the contact h moving beneath the switch-lever h^3, no current will be permitted to pass through the magnet m because the circuit will still be broken between the several warp detectors and the contact strip d. Should however, one of the warp threads controlled by the heddle frames D, D′, be broken, it will fail to be moved into either the upper or the lower plane of the shed, and upon the next backward movement of the lay when the abutment E moves the sustaining device e^2 to release the detectors, the particular detector which lies in the reed space through which the broken warp thread is passed will have no supporting warp thread and will therefore drop into its normal or dotted line position, Fig. 2, its arm b^4 making

electrical engagement with the contact strip *d*. The circuit is thus closed at this point so that when by the same backward movement of the lay the circuit is closed by the contact *h* passing beneath the switch-lever h^3, a complete circuit will thus be formed through the magnet *m* to attract its armature and move the hook m^4 into its full line position Fig. 7, where it will be locked by the locking-device *n*, and upon the next succeeding forward movement of the lay to beat in the weft-thread, said hook will pass below the end of the warp-fork *f* and will fail to turn the latter on its pivot and the weft-hammer C^8 upon its next succeeding forward movement will engage the hook f^2 on the warp-fork and stop the loom, as described. As the lay leaves its rearmost position the circuit is broken by reason of the contact *h* moving away from the switch-lever h^3, but notwithstanding the circuit is thus broken, the armature of the electro-magnet *m* is still held in its attracted position by the locking device *n*, which latter retains the hook m^4 in its lowermost position where it will fail to strike the warp-fork *f* until after said hook has passed the fork, when the abutment *o* will move the locking-device to release the armature and permit it to resume its normal or retracted position in readiness to effect the stopping of the loom upon the next pick after the broken warp thread has been mended should another thread be broken. During the time in which the warp threads controlled by the heddle frames D, D′, are moved alternately into the upper planes of the shed while the warp threads controlled by the heddle frame D^2 remain in the lower shed, and are not moved the detectors in the reed-spaces through which the warp-threads controlled by the said frame D^2 are passed, will, when released drop into their lowermost positions and their arms b^4 will make electrical engagement with the contact-strip *d′*; but such engagement will not close the circuit through the magnet *m* and effect the stopping of the loom for the reason that the said contact strip *d′* is arranged in circuit with the contact *h′* which does not co-operate with the switch-lever h^3 when the latter is in its elevated or normal position, the said warp detectors being thus cut out of circuit at all times except when the heddle frame D^2 is raised. When however, the said heddle frame D^2 is raised to move its warp threads into the upper plane of the shed for the introduction of said threads into the face of the fabric, the nut *i′* on the rod *i* will engage the switch-lever h^3 and move the same into its dotted line position, so that upon the next backward movement of the lay the circuit will be closed between the contact *h′* and the said lever. The threads controlled by the heddle frame D^2 being then moved into the upper plane of the shed, will arrest their respective detectors *b* having the long arms b^4 when the latter are released, as previously described, in precisely the same manner as the detectors having the short arms are arrested by the warp-threads controlled by the heddle-frames D, D′, so that notwithstanding the circuit is closed at the contact *h′*, the detectors are all prevented from moving to their normal positions and their arms b^4 will not contact with the strip *d′*, and the circuit remains broken. Should however one of the warp-threads controlled by the heddle-frame D^2 be broken, its detector having a long arm b^4 will, when released, fail to be arrested in its movement and will close the circuit at that point through the contact strip *d′*, and the circuit being at the same time closed between the switch lever h^3 and contact *h′* a complete circuit will be established, the magnet *m* energized, and the loom stopped in the same manner as when one of the warp threads controlled by the frames D, D′ was broken as previously described. These detectors controlled by the warp threads which are not moved at each shed of the loom are cut out of circuit at all times except when their respective warp-threads are moved, said detectors at such times being automatically cut into circuit by means of the switch-lever h^3, so that if one of the threads should be broken and thus fail to be moved, its detector will effect the stopping of the loom. The lower warp detectors *g* operate precisely as described to stop the loom, for if they are not acted upon and depressed into their full line positions Fig. 2, by the warp-threads moved to form the lower plane of the shed, the springs g^6 will raise the said detectors into their dotted line position Fig. 2, so that their arms g^4 will engage the contact strip g^5 which is in circuit with the contact strip *d* and thus stop the loom upon the first backward movement of the lay.

I have not shown in this present construction any device to normally sustain the lower detectors *g* in their abnormal positions like the rod e^2 for the upper detectors; still it is obvious that the said lower detectors may be provided with a device similar to the rod e^2 and operated in a similar manner, which would maintain the lower detectors *g* normally in their abnormal positions to relieve the wrap-threads in the lower plane of the shed from any wear, and to release said detectors at the proper time to permit them to be moved to determine whether or not there is a broken warp thread.

The loom herein described may be considered as a type of quite simple form of fancy loom, the warp-threads controlled by the heddle frames D, D′, being moved alternately at each pick into the upper or lower plane of the shed, while the warp-threads controlled by the frame D^2 are moved only occasionally for the introduction of said threads into the face of the fabric; but it will be obvious that the invention herein embodied is equally applicable to any other fancy looms for the detectors may be provided with arms b^4 even longer than those herein shown and of varying lengths to co-operate with any number of

contact strips on the lay or lay-cap, which contact strips will be thrown into circuit with the electro-magnet m at the proper time by a switch which may be similar to the switch lever h^3 actuated by the harness motion of the loom; therefore this invention is not limited to the particular motion or adaptation herein shown and described; neither is the invention limited to the particular construction of parts herein shown and described.

Fig. 9 represents a pivoted detector wherein the circuit is closed by the dropping of the detector upon a contact rod q, the arms b^4 being dispensed with in this construction.

Fig. 10, represents another modified construction wherein the detector is pivoted at one side of the reed dents and extends through to the opposite side thereof, the extended rod r serving to keep the detector in its lowermost or normal position with its ear r' in electrical engagement with the contact strip r^2.

Fig. 11, is a view showing another modified construction of lower detector, detail description being unnecessary.

In Figs. 12 and 13, the detectors are represented as pivoted alternately at opposite sides of the reed dents such construction enabling the detectors to be made larger than where all the detectors are pivoted upon the same side of the reed dents.

Fig. 15 represents the supporting lugs for the detectors as thickened, and moving in curved slots in the reed dents at either side.

By pivoting the warp detectors at a distance from the reed dents and permitting the free ends of the detectors to play or move vertically between the reed dents in the reed spaces, the free ends of the detectors are guided by the reed dents and are prevented from lateral movement or displacement to any extent. The warp thread supports are also located in proximity to the reed dents and therefore to the ends of the detectors guided by the reed dents, so that it is practically impossible for the warp threads to become dislodged from the detectors or the warp supports, because the free ends of the detectors near the warp supports are guided by the reed dents and the threads also are guided by the reed dents, and as neither can move laterally to any extent, displacement is rendered practically impossible, and continuous and perfect operation of the stop motion assured.

I claim—

1. A loom containing the following instrumentalities, viz:—a reed, a series of warp detectors pivoted at one side thereof with their free ends extended between the dents of the reeds and provided with warp supports close to said reed, said detectors being adapted to be moved from their normal into their abnormal positions by the warp threads passed between the reed dents provided the threads are unbroken, and a stopping mechanism for the loom adapted to be actuated by a detector when in its normal position, substantially as described.

2. A loom containing the following instrumentalities, namely, a lay; a series of reed dents; a series of pivoted warp detectors adapted to be acted upon and moved from their normal into their abnormal position by the warp threads, if the latter are unbroken; a fixed contact with which a detector is in electrical engagement when in one position; an electro-magnet in circuit with said detector and fixed contact; its armature; and a stopping mechanism for the loom actuated by movement of the said armature by its magnet substantially as described.

3. A loom containing the following instrumentalies, viz:—a shed-forming mechanism; a lay; a series of reed-dents carried thereby; a series of pivoted warp detectors, co-operating fixed contacts with one or the other of which said detectors are adapted to make electrical engagement; an electro-magnet, a stopping mechanism controlled thereby; and devices intermediate the shed-forming mechanism and fixed contacts to place one or the other of said contacts in circuit with said magnet, substantially as described.

4. A loom containing the following instrumentalities, viz:—a shed-forming mechanism; a lay; a series of reed-dents carried thereby, a series of pivoted elbow-shaped warp-detectors, co-operating fixed contacts with one or the other of which said detectors are adapted to make electrical engagement, an electro-magnet, a stopping mechanism controlled thereby, and devices intermediate the shed-forming mechanism, and fixed contacts to place one or the other of said contacts into circuit with said magnet, substantially as described.

5. In a warp-stop motion for looms, the combination with a series of warp-detectors, of a sustaining device for the same, and means to move said sustaining device at predetermined times to permit the said detectors to move toward the warp threads, substantially as described.

6. In a warp-stop motion for looms, a lay, and a series of warp detectors carried thereby, combined with a movable sustaining device for said detectors, and an abutment to effect movement of said sustaining device to permit the said detectors to move toward the warp threads, substantially as described.

7. In a warp-stop motion for looms, the combination of a lay; a series of reed-dents carried thereby; a rod supported at its ends on said lay; and a series of warp-detectors pivoted on said rod and extending between the said reed-dents, substantially as described.

8. In a warp-stop motion for looms, the combination of a lay; a series of reed-dents carried thereby; a rod supported at its ends on said lay; and a series of warp detectors pivoted thereon; and a sustaining rod for the detectors also pivoted on said rod, and means to move the same, substantially as described.

9. In a warp-stop motion for looms, the combination of a lay; a series of reed-dents car-

ried thereby; a rod supported at its ends on said lay; and a series of warp-detectors pivoted thereon; and a sustaining rod for the detectors, also pivoted on said rod; a spring to move the said sustaining rod in one direction; and a fixed abutment to move the rod in the opposite direction, substantially as described.

10. A warp-stop motion for looms, containing a lay; a series of reed-dents carried thereby; and a series of warp-detectors pivoted at one side of said reed-dents and having their ends thinned to extend between said reed-dents, substantially as described.

In testimony whereof I have signed my name to this specification in the presence of two subscribing witnesses.

OBERLIN SMITH.

Witnesses:
JAMES J. REEVES,
ENOS PAULLIN.