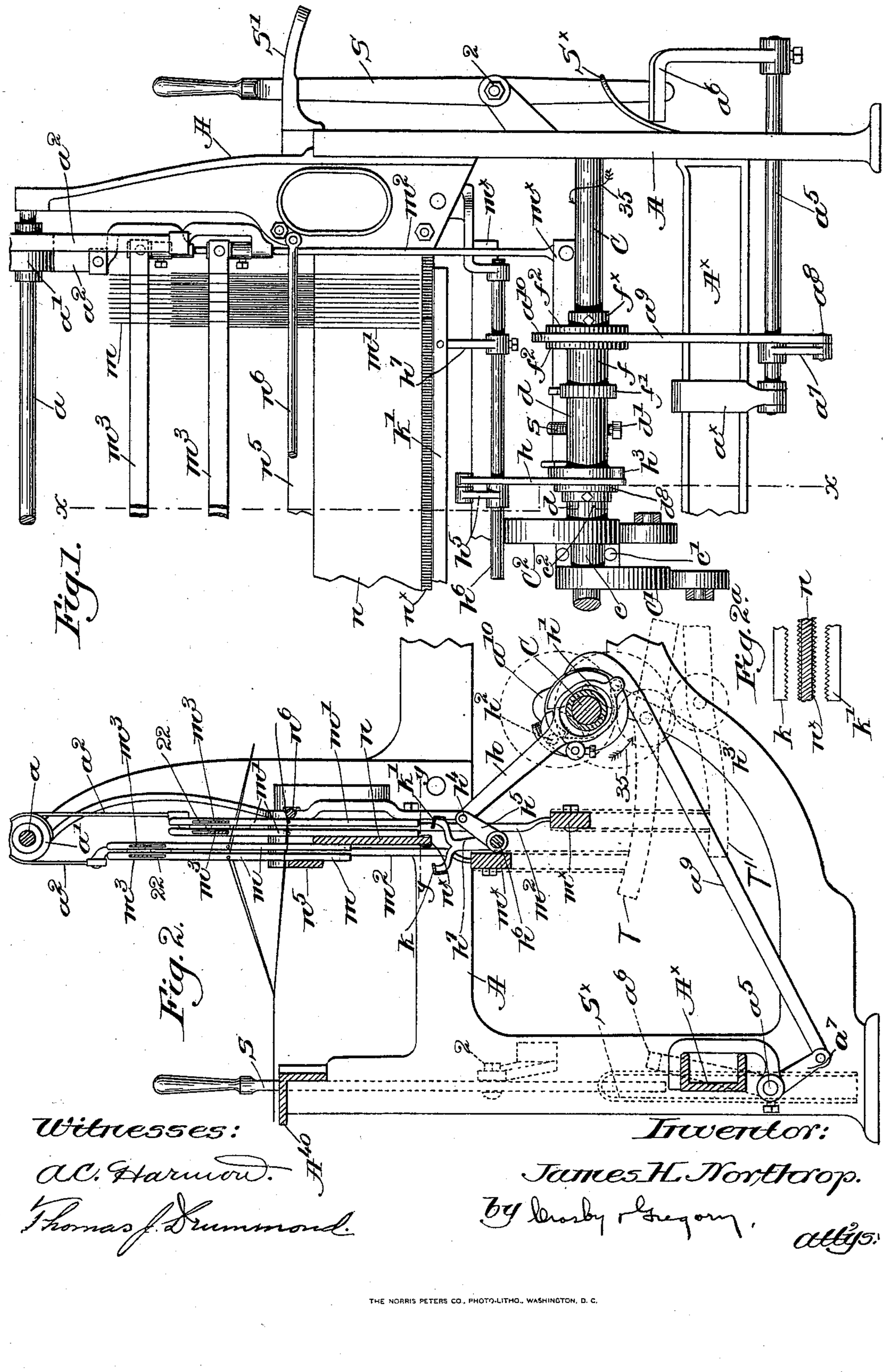
(No Model.)

2 Sheets—Sheet 1.

J. H. NORTHROP.

WARP STOP MOTION FOR LOOMS.

No. 594,355. Patented Nov. 23, 1897.



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(No Model.) 2 Sheets—Sheet 2.

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Fig. 3.

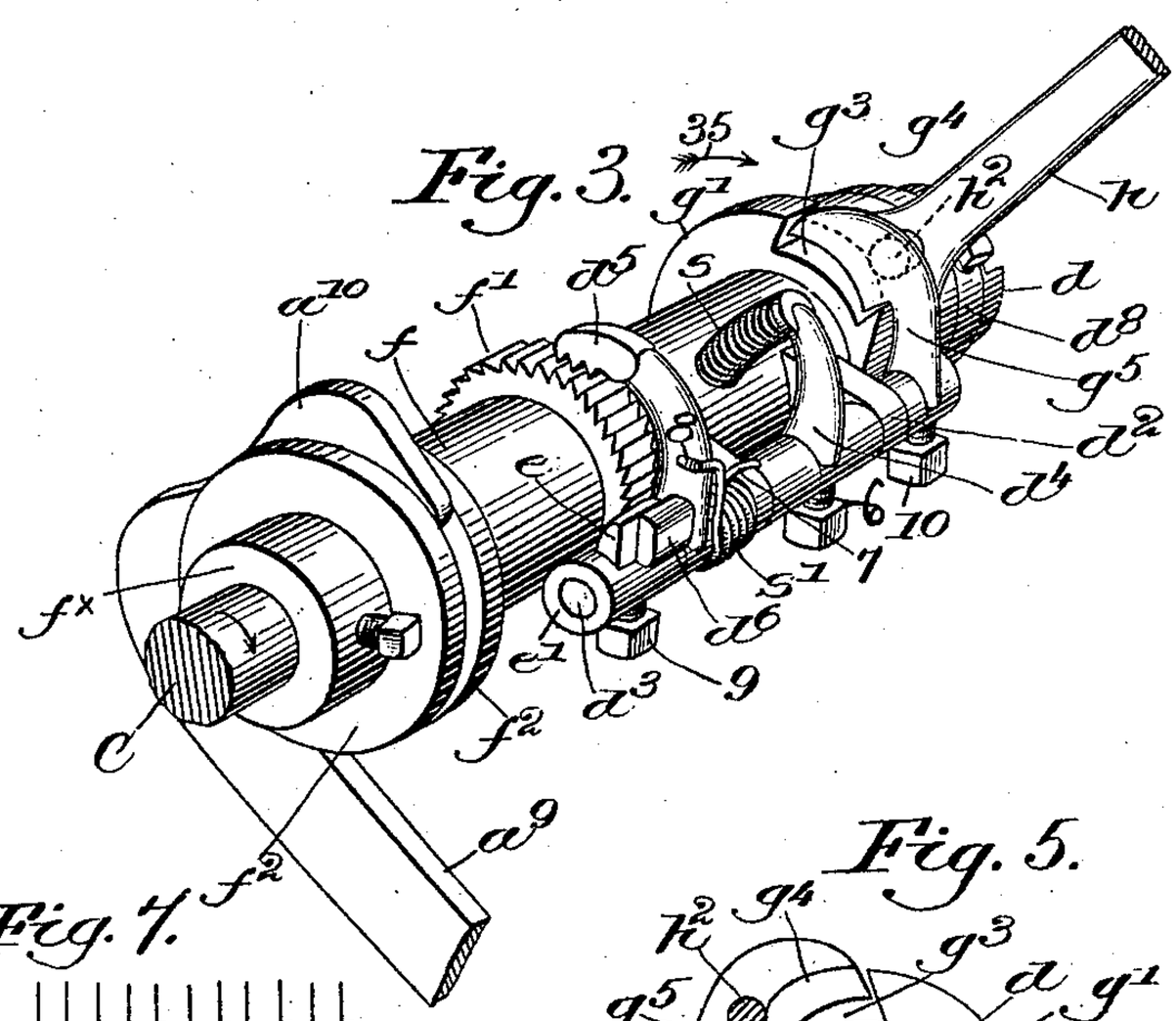


Fig. 7.

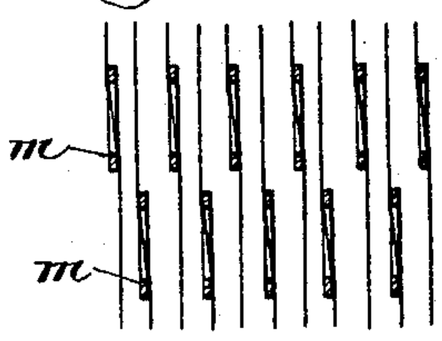


Fig. 5.

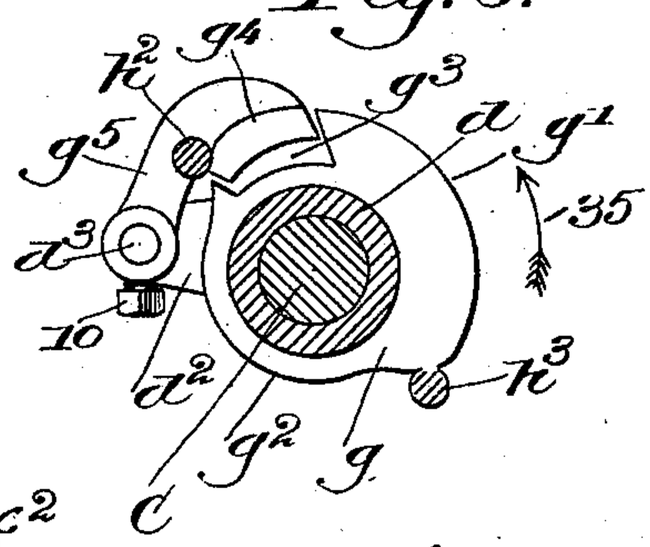


Fig. 6.

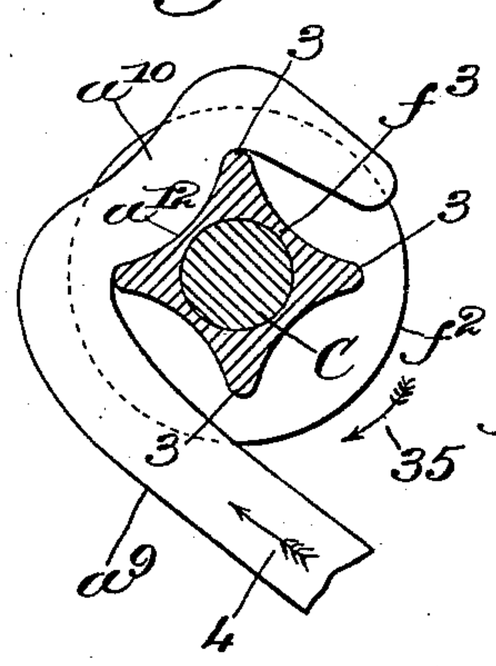
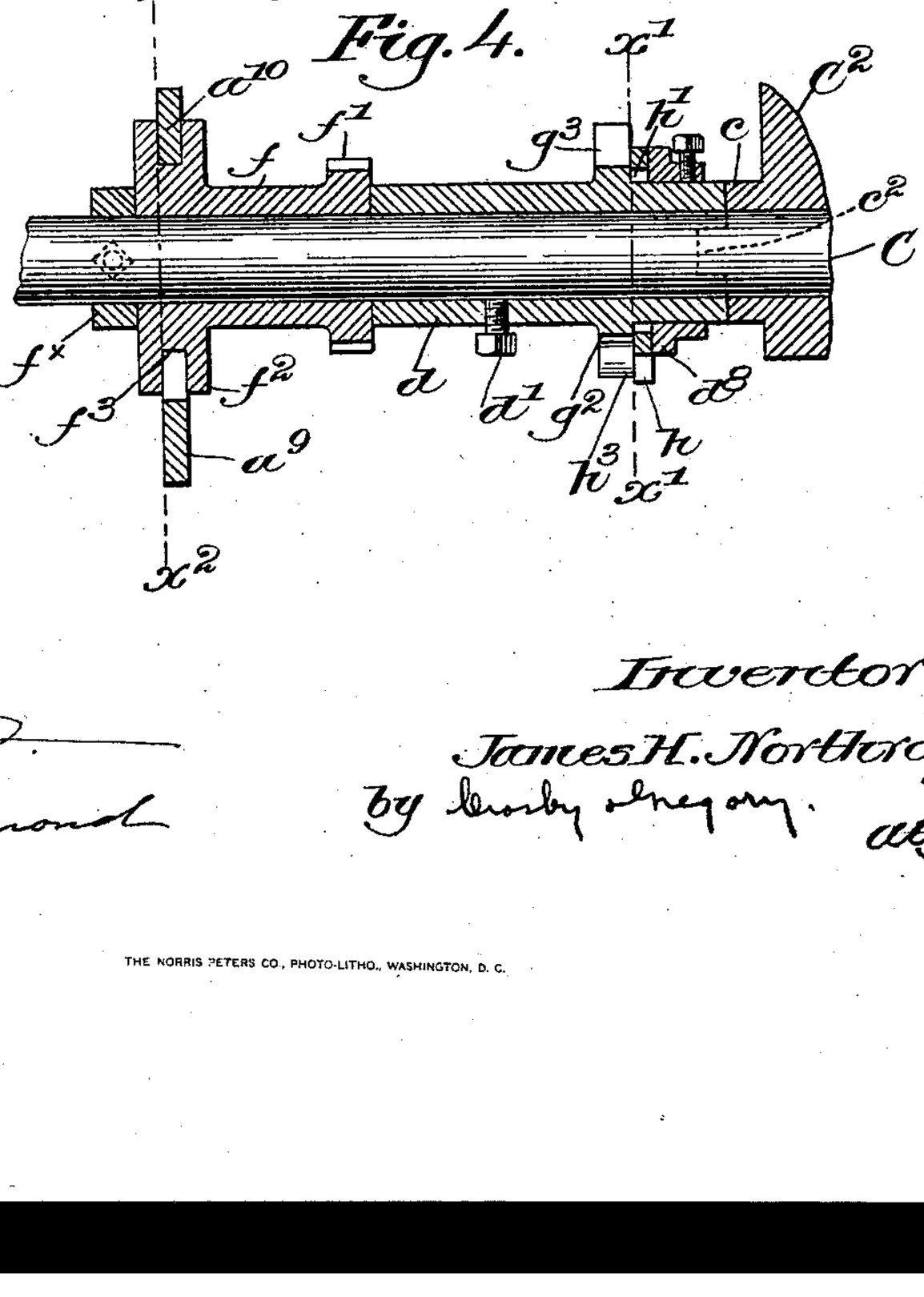


Fig. 4.



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UNITED STATES PATENT OFFICE.

JAMES H. NORTHROP, OF HOPEDALE, MASSACHUSETTS, ASSIGNOR TO THE DRAPER COMPANY, OF SAME PLACE AND PORTLAND, MAINE.

WARP STOP-MOTION FOR LOOMS.

SPECIFICATION forming part of Letters Patent No. 594,355, dated November 23, 1897.

Application filed March 15, 1897. Serial No. 627,545. (No model.)

To all whom it may concern:

Be it known that I, JAMES H. NORTHROP, of Hopedale, in the county of Worcester and State of Massachusetts, 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.

This invention relates to that class of looms wherein breakage or undue slackness of the warp-threads is made effective through stop-motion-actuating detectors to stop the loom, and in my present invention said detectors also serve as heddles. When the warps are unbroken or under proper tension, the detectors are maintained inoperative; but should a warp-thread break or unduly slacken its detector will move into abnormal position to act upon devices intermediate it and the stopping mechanism for the loom to stop the latter.

In my present invention I have provided each harness or heddle frame with two banks of detector-heddles, the latter being shown as flat metallic bars or strips having each a warp-eye, the warp-thread entering the eye at one side of the heddle and passing therefrom at the other, the plane of the heddle being substantially parallel to the warp-thread.

By dividing the heddles in each frame into a plurality of banks I am enabled to weave cloth of close slay, while leaving ample room for the threads and detector-heddles, without that closeness or proximity which the same number of heddles in a single bank would necessitate.

As a matter of fact on many goods the single banks or sets of heddles cannot be used without severely chafing the warp-threads, as there is not room enough for so many threads and their heddles in one line.

Another important feature of my invention relates to the vibrator or feeler which coöperates with a dropped detector, the vibrator being governed in its actuating position by the set of the harness-cam.

Other warp stop-motion devices have been so constructed that the set of the vibrator is independent of the harness-cam, the result being that a change in the set of the harness-cam is liable to cause the vibrator to operate improperly.

Weavers find it necessary in order to produce certain effects in the face of the cloth to beat up the filling with the sheds more or less closed, and it thus becomes necessary to so construct the warp stop-motion that it will be governed in its action to a certain extent by the harness-cam in order that a change in the set of the cam will effect a corresponding change in the time of operation of the vibrator. I have herein attained this object by so connecting the vibrator-actuator to the harness-cam that the vibrator will always operate properly when the heddles are properly lowered, the proper lowering of the heddles depending on the harness-cam.

Figure 1 is a rear elevation of a sufficient portion of a loom to be understood with my present invention embodied therein. Fig. 2 is a vertical sectional view thereof, taken on the irregular line $x\ x$, Fig. 1, looking toward the right. Fig. 2^a is a detail taken below the line $y\ y$, Fig. 2, and enlarged, of the vibrators and coöperating back-stop for the detectors. Fig. 3 is an enlarged perspective view of the vibrator-actuator and the connections between said actuator and the releasing device for the stopping mechanism of the loom. Fig. 4 is a longitudinal sectional view of the parts shown in Fig. 3, the cam-shaft being shown in elevation. Fig. 5 is a transverse sectional view on the line $x'\ x'$, Fig. 4, looking to the left. Fig. 6 is a similar view on line $x^2 x^2$, Fig. 4, but looking toward the right; and Fig. 7 is an enlarged horizontal section taken through the two banks of detector-heddles, above the warp-eyes, to more clearly show the relative position of the heddles and the manner of threading.

The lay is omitted from the drawings in order to simplify the construction and to more clearly show the relation of the parts comprising and coöperating with my invention.

The loom-frame A, of suitable shape to support the operating parts, the breast-beam A^{40}, harness-cam shaft C, the overhead connection between the harness or heddle frames and comprising the shaft a, sheaves a', and flexible straps a^2, and the cam-actuated treadles

T T′, connected with the lower ends of the harness-frames, may be and are all of usual and well-known construction in looms.

The shipper-lever S, pivoted at 2 and held in a notch in the usual holding-plate S′ against the action of the actuating-spring $S^{\times}$, is also of well-known and ordinary construction, operating a belt-shifter mechanism. (Not shown.)

A rock-shaft a^5 is supported in a bearing in the loom side and in a bearing on a bracket $a^{\times}$, secured to the cross-girt $A^{\times}$ of the loom-frame, said shaft having fast thereon a knock-off arm a^6 to engage and release the shipper-lever from its holding-notch at the proper time, the end of the arm being extended laterally to remain in engagement with the lever, as best shown in Fig. 1.

The harness-cams C′ C^2 are mounted on a sleeve or hub *c*, suitably secured to the cam-shaft C by bolts *c′*, Fig. 1, one end of the hub being shown as provided with lugs c^2 to enter notches in a sleeve *d*, fixed in adjusted position on the cam-shaft by a set-screw *d′*. A locking connection is thus effected between the harness-cams and the sleeve *d*, so that any change in the set of the cams on the shaft C will effect a corresponding change in the angular position of the sleeve, the set-screw *d′* being loosened for the purpose. A second sleeve *f*, loose on the cam-shaft between the inner end of the sleeve *d* and a collar $f^{\times}$, is provided with a ratchet-wheel *f′* at one end and at the other end, adjacent the collar, with annular flanges f^2, (see Figs. 3, 4, and 6,) between which is a cam-surface f^3, having four points 3, Fig. 6, and intermediate low portions.

The rock-shaft a^5 has fast thereon an arm a^7, to which is jointed at a^8 a link a^9, upwardly extended and bent or hooked at its upper end at a^{10} to enter between the flanges f^2 and convexed at a^{12} to enter the low portion of the cam f^3 between two points 3. Now when the cam is rotated the points act upon the link a^9 to move it in the direction of the arrow 4, Fig. 6, a one-eighth turn of the cam from the position therein shown moving the link longitudinally to rock the shaft a^5 sufficiently to relieve the shipper-lever S from its holding-notch.

Referring now to Fig. 3, the sleeve *d* has upon its exterior lugs d^2, which provide bearings for a rock-shaft d^3, to which is secured, between the lugs, the hub of a finger d^4, a set-screw 6, holding the hub securely on the rock-shaft. A spring *s*, secured at one end to the sleeve *d*, bears against the finger and normally tends to throw the latter out or away from the sleeve, and to thereby maintain a toothed pawl d^5 out of engagement with the ratchet-wheel *f′*. This pawl is loosely mounted on the rock-shaft d^3 opposite the ratchet-wheel and is pressed toward the latter by a spring *s′*, coiled around the rock-shaft, as herein shown, one end, 7, of said spring bearing against one of the lugs d^2 and its other end, 8, bearing against the pawl-carrier. The latter has an ear d^6 thereon to coöperate with an ear *e* on a collar *e′*, held fast on the rock-shaft by a set-screw 9, and also preventing endwise movement of the pawl, so that the spring *s*, acting through the rock-shaft, collar *e*, and ear *e′*, normally presses the pawl outwardly against the action of the weaker spring *s′*. When the latter is free to act, it operates to throw the teeth of the pawl d^5 into engagement with the ratchet-wheel *f′*, so that the latter and the sleeve *f* will partake of any rotative movement of the main sleeve *d*.

At its end near the harness-cams C′ C^2, as herein shown, the sleeve *d* has secured to or forming part of it a cam-disk *g*, (shown in side elevation in Fig. 5,) the cam having a high portion *g′*, a low portion g^2, and a notch g^3 at one end of the high portion, the notch being entered by a segment g^4 on the side of an arm g^5, rigidly secured to the rock-shaft d^3 by a suitable set-screw 10. The contour of the segment g^4 is such that it normally forms a continuation of the periphery of the cam-disk *g*, the springs *s* and *s′* maintaining the segment in the relative position shown in Fig. 5.

A collar d^8, suitably secured to the sleeve *d* adjacent the cam-disk *g*, forms an annular recess between them, in which recess plays the end of a longitudinally-movable link *h*, slotted longitudinally at *h′* to embrace the sleeve *d* and provided with studs or pins h^2 h^3 to engage opposite portions of the cam-periphery of disk *g*.

The link *h* is pivotally connected at h^4 to a rocker-arm h^5, fast on a rock-shaft h^6, mounted in suitable bearings in the loom-frame, and, as herein shown, having rigid yoke-arms h^7, to the ends of which are attached two like and parallel vibrators or feelers *k k′* below the paths of and to coöperate with the warp stop-motion-actuating detectors *m m′*, herein shown serving as heddles, the vibrators being shown as angle-irons, preferably having their edges coöperating with the detectors notched as in Fig. 2^a.

Obviously the rotation of the cam-shaft C will, through the cam-disk *g*, acting upon the rolls or studs h^2 h^3, reciprocate the link *h* and thereby rock the shaft h^6, so that the vibrators or feelers *k k′* will move back and forth unless such movement is prevented.

Referring to Figs. 1 and 2, the harness or heddle frames are shown as each comprising a bottom bar $m^{\times}$, rigid side bars m^2, and two top bars m^3 m^3 in parallelism, the detector-heddles of each frame being divided into two banks and supported in the top bars, which pass through the longitudinal slots 22 near the upper ends of the detectors. A flat plate or bar *n*, interposed between the lower ends of the detector-heddles of the two frames, prevents intermingling thereof and also serves as a stop for a dropped heddle when engaged by a vibrator.

It will be understood that the heddles have a limited vertical movement independent of

the heddle-frames, owing to the slots 22 being longer than the depth of the supporting-bars m^3, so that upon breakage or undue slackening of a warp-thread its detector-heddle will drop into position between the separator n and one of the vibrators k or k', as the case may be. Preferably the separator is provided with a foot $n^\times$, notched to receive the edge of the dropped heddle and prevent it from twisting when engaged by the vibrator.

Referring to Fig. 7, it will be seen that the heddles in one bank of the frame are staggered relatively to the heddles in the other bank, so that there is ample room for the heddles and their warp-threads without chafing the yarns entering the warp-eyes at one side of the heddle and passing out along the other flat side.

Only one vibrator is required for the plurality of banks or series of detector-heddles carried by the frame, as the lower ends of the heddles are free to move, and the path of movement of the vibrator is sufficient to cooperate with a dropped heddle of either bank, though I may use more vibrators without departing from my invention.

Now so long as the vibrator meets no obstruction the rock-shaft h^6 will be free to be rocked by the link h, as described; but when a vibrator engages a dropped detector the rocking of the shaft h^6 is prevented, and hence the longitudinal movement of the link h. When the movable segment g^4 of the cam-disk g engages one of the studs h^2 or h^3, the link being held from movement, such segment will be pressed toward the center of the disk, thus rocking the shaft d^3. When the said shaft d^3 is rocked, the pawl d^5 is thrown into engagement with the ratchet-wheel f', so that the sleeves d and f will rotate in unison until the cam f^3 is turned sufficiently to move the knockoff-arm a^6 through the link a^9, releasing the shipper-lever and stopping the loom.

Referring to Fig. 5, it is to be noted that the segment g^4 can enter the recess g^3 of the cam-disk g, and that the travel of the cam and sleeve d for an angular distance less than that between the ends of the recess g^3 is sufficient to turn the cam f^3 to cause release of the shipper-lever and consequent stoppage of the loom, but at the same time the frame carrying the dropped detector has been raised sufficiently to withdraw the detector from between the separator n and vibrator, releasing the latter. As soon as the vibrator is released the spring s returns the segment g^4 to normal position, so that the stud on the link h will not come in contact with the end of the recess g^3, as the cam-disk g rotates, and the pawl and ratchet will also be disengaged. The front bar n^5 prevents displacement of the detector-heddles of the front frame, and also forms a warp-rest, and the rod n^6 behind the back frame serves for a second warp-rest.

From the foregoing description it will be obvious that any change in the set of the harness-cams will cause a corresponding change in the set of the vibrator-actuating mechanism, whereby the vibrator will continue to operate properly. It is also obvious that a single series of detectors could be employed in each frame instead of a plurality of series or banks, if desired, and in many instances such construction might be most convenient.

The direction of rotation of the cam-shaft C and parts carried thereby is indicated by the arrow 35, Figs. 1, 2, 3, 5, and 6.

It will be noted that when the movable cam-segment g^4 is returned to normal position, as described, the pawl d^5 is disengaged from the ratchet-wheel f', leaving the controlling-cam f^3 for the knockoff-arm a^6 free, and when the shipper-lever is returned to starting position the pull on the link a^9 will act to partially rotate the said cam into normal position. (Shown in Fig. 6.)

Having fully described my invention, what I claim, and desire to secure by Letters Patent, is—

1. In a loom, a series of warp-stop-motion-actuating detectors movable into operative position by breakage or undue slackening of the warp-threads, a vibrator to engage and be held by a dropped detector, mechanism to vertically reciprocate said detectors, means to normally rock the vibrator, a rotatable shaft and controlling connections mounted adjustably on said shaft between said means and the mechanism for reciprocating the detectors, whereby adjustment of the detector-reciprocating mechanism governs the timing of the means for rocking the vibrator, substantially as described.

2. In a loom, a series of warp-stop-motion-actuating detectors movable into operative position by breakage or undue slackness of the warp-threads, a vibrator to engage and be stopped by a dropped detector, means to normally rock the vibrator, a harness-cam, and connections between it and said means, whereby the timing of the normal operation of the vibrator is controlled by the set of said cam on its shaft, substantially as described.

3. In a loom, a series of warp-stop-motion-actuating detectors serving as heddles; means, including harness-cams, to reciprocate said detectors vertically, a vibrator to engage and be stopped by a dropped detector due to breakage or undue slackening of its warp-thread; mechanism to normally rock the vibrator, and connections between said mechanism and the harness-cams, whereby the set of the latter on their shaft controls the timing of the normal operation of the vibrator, substantially as described.

4. In a loom, a series of warp-stop-motion-actuating detectors serving as heddles; means, including adjustable harness-cams, to reciprocate said detectors vertically, a vibrator to engage and be stopped by a dropped detector due to breakage or undue slackening of its warp-thread, mechanism to normally rock the

vibrator, connections between said mechanism and the harness-cams, whereby adjustment of the latter on their shaft will govern the timing of the former, stopping mechanism for the loom, and means to operate the stopping mechanism when a dropped detector is engaged by the vibrator, substantially as described.

5. In a loom, shed-forming mechanism, including detector-heddles, and adjustable cams to effect their vertical reciprocation, combined with stopping mechanism for the loom, including a vibrator to coöperate with a dropped heddle, and connections between said vibrator and said cams, whereby the set of the latter on their shaft governs the timing of the normal operation of the vibrator, substantially as described.

6. In a warp stop-motion for looms, a cam-shaft, harness-cams adjustable thereon, a vibrator, actuating mechanism therefor, connections between said mechanism and the cams, whereby adjustment of the latter on their shaft will govern and adjust the timing of said mechanism, a shipper-lever, releasing mechanism therefor, and means to operate it upon stoppage of the vibrator in its normal movement, substantially as described.

7. In a loom, warp-stop-motion-actuating detectors, a vibrator to engage a dropped detector, mechanism to normally rock said vibrator, including a cam having a movable segment, and a link reciprocated by the cam, combined with a shipper-lever, a releasing device therefor, and means operative upon movement of the cam-segment into abnormal position to actuate the releasing device, substantially as described.

8. In a loom, a rock-shaft having a vibrator mounted thereon, a link to rock said shaft and provided with a roll or stud, a coöperating actuating-cam having a spring-controlled segment, and a normally inoperative pawl, combined with a shipper-lever, and releasing means therefor, including a controlling-cam and a ratchet-wheel, stoppage of the vibrator, acting to move the cam-segment and bring the pawl into engagement with the ratchet-wheel, to thereby rotate the controlling-cam in unison with the actuating-cam, substantially as described.

9. In a loom, a rotatable shaft, a fast and a loose sleeve thereon, the latter having a ratchet-wheel, a shipper-lever, and means to release it upon rotation of the loose sleeve, combined with a cam on the fast sleeve, having a recessed periphery, a spring-controlled segment movable in the recess, a pawl for the ratchet-wheel, controlled by said segment and pivotally mounted on the fast sleeve, and means operative upon failure of a warp-thread to move said segment, and effect the stoppage of the loom, substantially as described.

10. In a loom, the harness-cam shaft, harness-cams adjustable thereon, a connected cam having a recessed periphery, a movable segment therein, means operative upon failure of a warp-thread to move said segment, a shipper-lever, and releasing devices operated by movement of the cam-segment into abnormal position, substantially as described.

11. In a loom, the harness-cam shaft, harness-cams adjustable thereon, a connected cam having a recessed periphery, a movable segment therein, and means operative upon failure of a warp-thread to move the segment, said means including a series of detector-heddles moved into operative position upon breakage or undue slackening of the warp-threads, a coöperating vibrator, and connections between it and the recessed cam, combined with a shipper-lever, and releasing means therefor operated by movement of the cam-segment into abnormal position due to stoppage of the vibrator by a dropped heddle, substantially as described.

12. In a loom, a heddle-frame provided with a plurality of adjacent cross-bars in parallelism, and a series of flat metallic heddles supported upon each of said bars and adapted to be moved vertically independently thereof, the heddles of one series being staggered relatively to the heddles of an adjacent series, combined with a common vibrator movable in the direction of the length of the warp-threads, to engage and be stopped by a dropped detector of a series, means to reciprocate said heddle-frames vertically, and mechanism controlled thereby as to its normal operation, to rock the vibrator when the warp-threads are intact, substantially as described.

13. In a loom, a harness-frame having a plurality of adjacent cross-bars, series of heddles having each a warp-eye and an elongated slot near its end, each bar supporting a series of heddles, and a vibrator having its axis of motion at right angles to the length of the warp, to coöperate with a dropped heddle and be stopped thereby, combined with means to reciprocate said harness-frame vertically, vibrator-actuating mechanism, stopping mechanism for the loom controlled thereby, and connections between said actuating mechanism and the means to reciprocate the harness-frame, whereby a change in the timing of the latter will effect a corresponding change in the timing of the former, substantially as described.

14. In a loom, a series of vertically-movable warp-stop-motion-actuating detectors, and a vibrator movable in the direction of the length of the warp-threads and adapted to engage a dropped detector, combined with means to move said vibrator back and forth in the direction of the length of the warp, said means including an actuating-cam, and a connected cam to control the vertical reciprocation of the detectors, variation in the set of the latter cam acting to adjust the timing of the vibrator, substantially as described.

15. In a loom, shed-forming mechanism, including detector-heddles and cam-actuated means to reciprocate them, a vibrator mov-

able in the direction of the length of the warp-threads, to coöperate with a dropped detector, stopping mechanism for the loom, operative upon engagement of the vibrator with a detector, and connections between the said cam-actuated means and the vibrator, to control the normal vibration of the latter, substantially as described.

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

JAMES H. NORTHROP.

Witnesses:
HERBERT S. MANLEY,
GEO. OTIS DRAPER.