No. 789,291. PATENTED MAY 9, 1905.

J. NORTHROP.

FILLING REPLENISHING LOOM.

APPLICATION FILED JAN. 4, 1905.

2 SHEETS—SHEET 1.

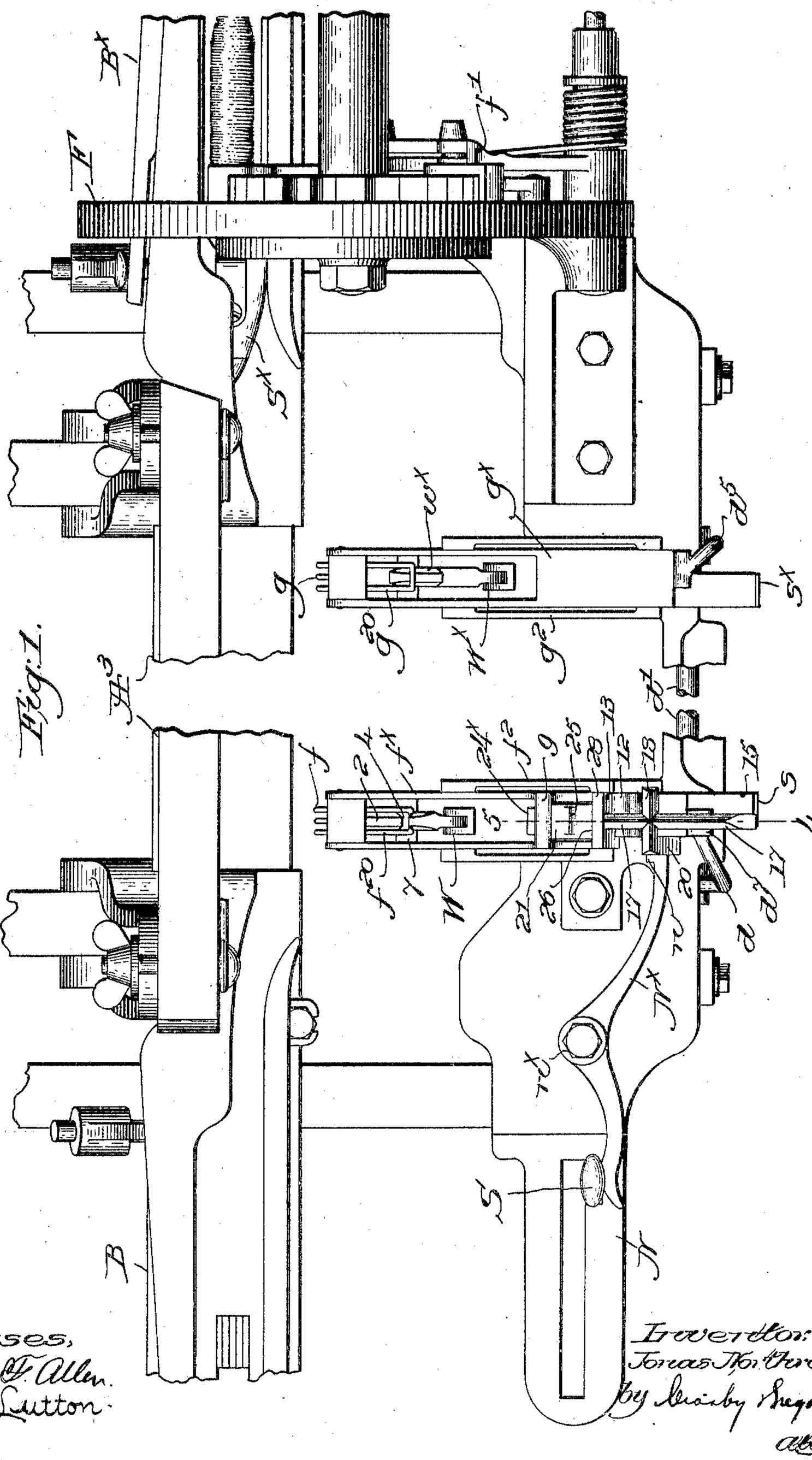


Fig. 1.

Witnesses,
Edward F. Allen.
L. Wm. Lutton.

Inventor:
Thomas Northrop,
by Duffy Gregory
Attys

PHOTO LITHOGRAPHED BY SACKETT & WILHELMS LITHO. & PTG. CO. NEW YORK.

No. 789,291 PATENTED MAY 9, 1905.

J. NORTHROP.

FILLING REPLENISHING LOOM.

APPLICATION FILED JAN. 4, 1905.

2 SHEETS—SHEET 2.

Fig: 2.

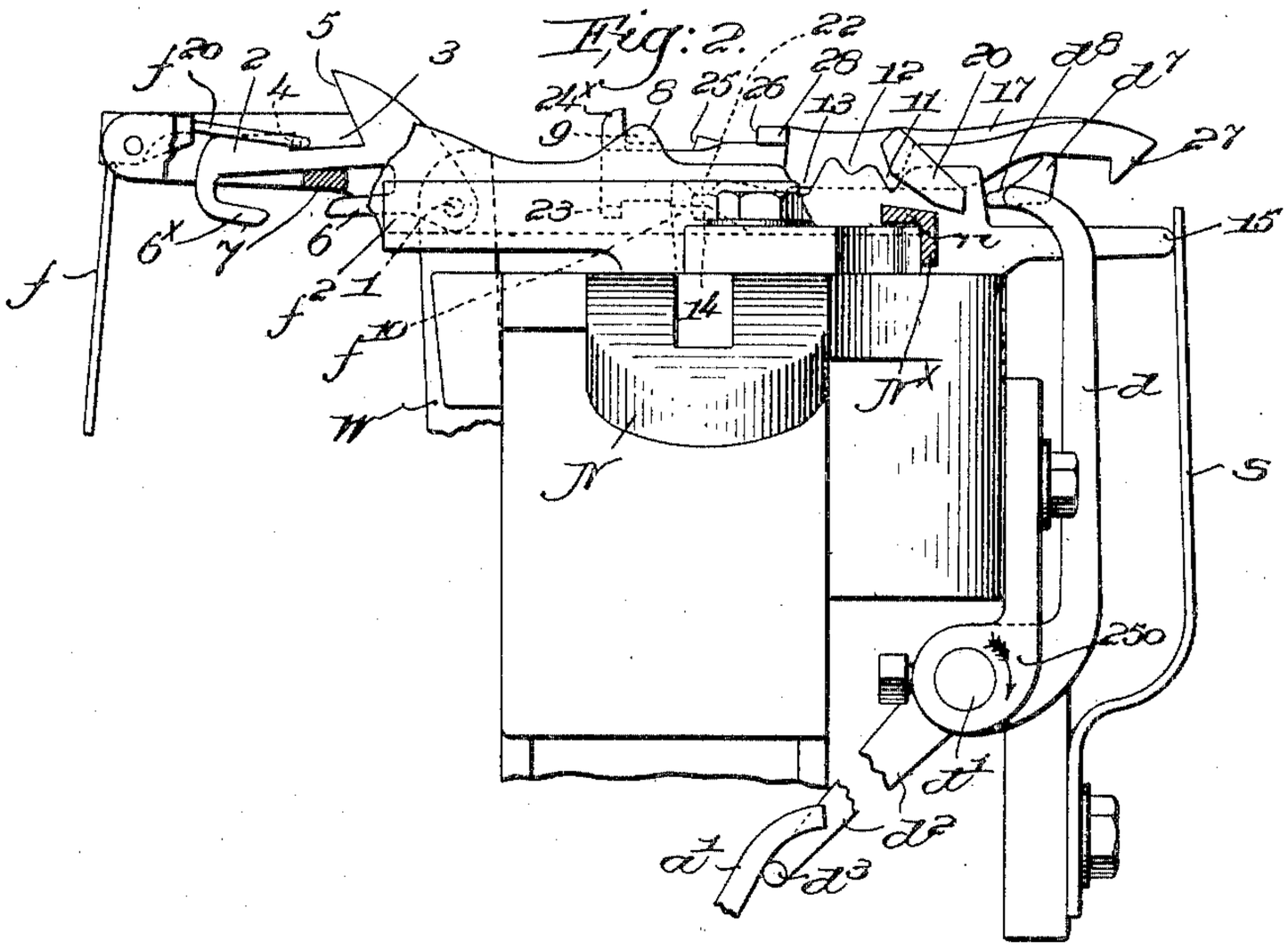


Fig: 3.

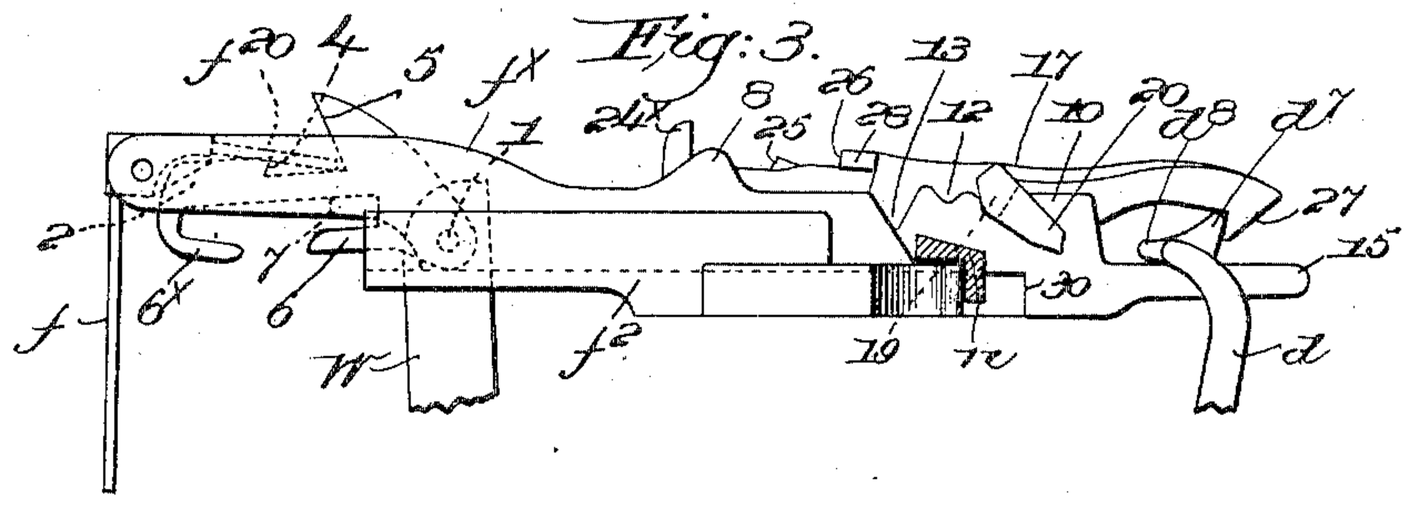


Fig: 4.

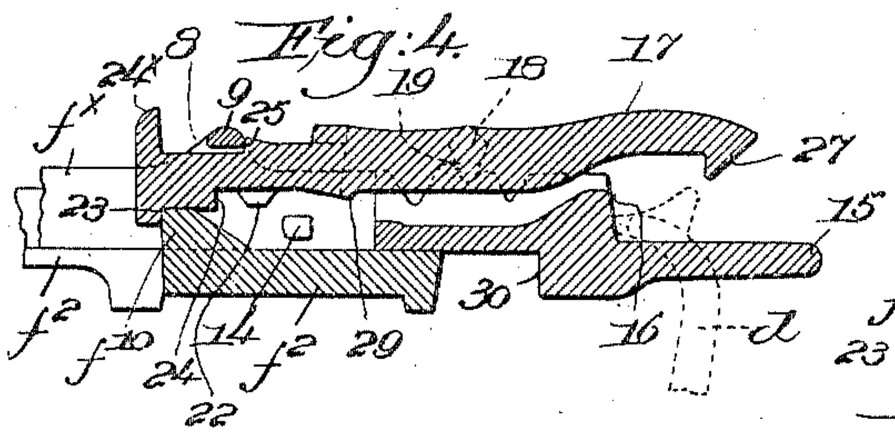


Fig: 5.

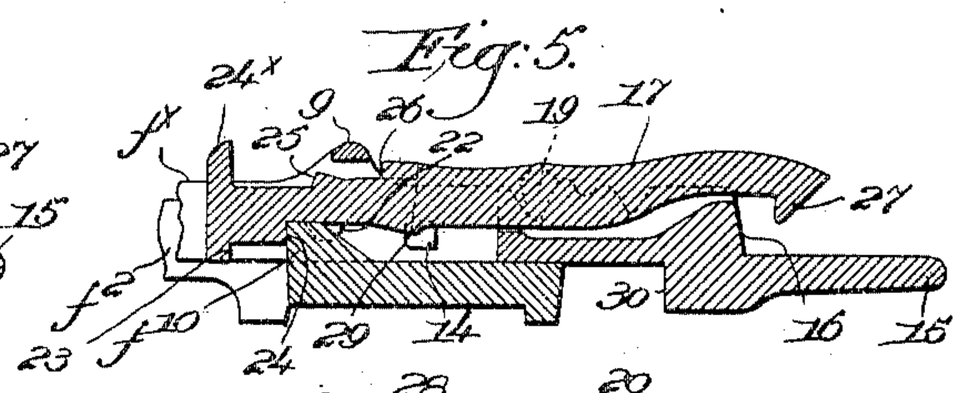


Fig: 6.

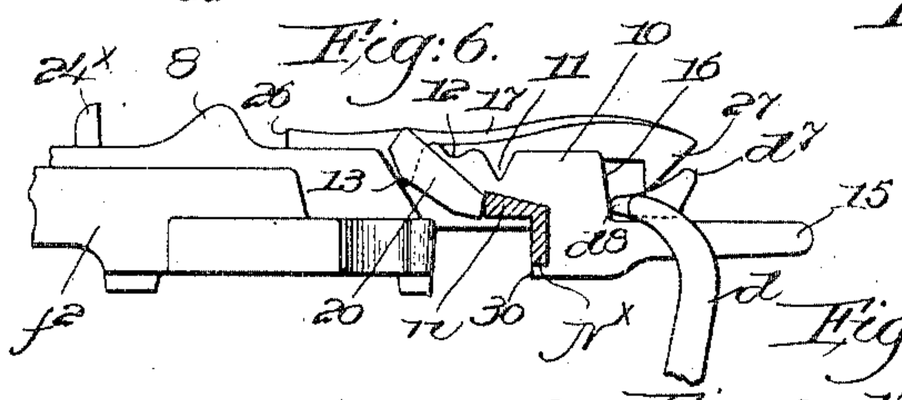


Fig: 7.

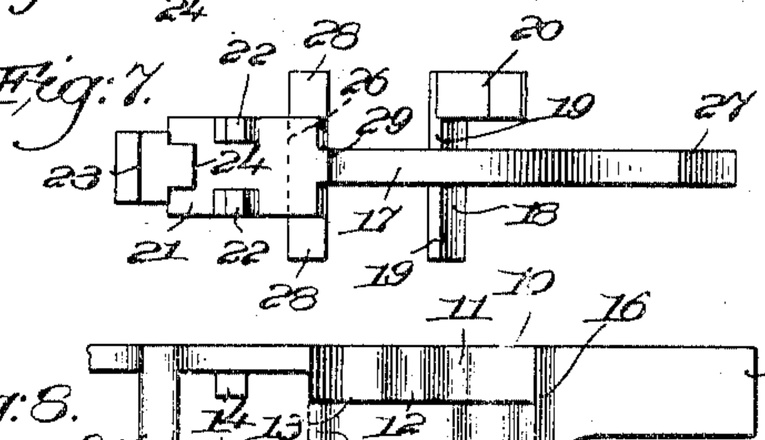
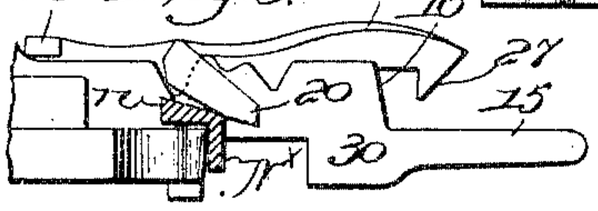


Fig: 8.

Fig: 9.



Witnesses,
Edward F. Allen.
L. Wm. Luttoro

Inventor:
Jonas Northrop,
by Crosby Gregory.
Atty's.

No. 789,291. Patented May 9, 1905.

UNITED STATES PATENT OFFICE.

JONAS NORTHROP, OF HOPEDALE, MASSACHUSETTS, ASSIGNOR TO DRAPER COMPANY, OF HOPEDALE, MASSACHUSETTS, A CORPORATION OF MAINE.

FILLING-REPLENISHING LOOM.

SPECIFICATION forming part of Letters Patent No. 789,291, dated May 9, 1905.

Application filed January 4, 1905. Serial No. 239,580.

To all whom it may concern:

Be it known that I, JONAS NORTHROP, a citizen of the United States, and a resident of Hopedale, county of Worcester, State of Massachusetts, have invented an Improvement in Filling-Replenishing Looms, of which the following description, in connection with the accompanying drawings, is a specification, like characters on the drawings representing like parts.

In United States Patent No. 727,014, dated May 5, 1903, an automatic filling-replenishing loom is shown and described provided with two detecting devices, so that the detecting action takes place on each pick. The operation of the replenishing mechanism is directly controlled by one of such devices, and the other detecting device operates in an indirect manner to cause filling replenishment by or through the first-mentioned detecting device whether or not the latter detects and responds to failure of filling. Thus upon filling failure, no matter whether detected by either or both of the detecting devices, the operation of the filling-replenishing mechanism is effected and is not interrupted or interfered with even should a long end of filling trail from the shuttle. Both detectors control the take-up mechanism, so that upon detection of filling failure by either detector take-up is arrested. In the patent referred to a number of different parts are employed to effect the desired result, some being pivotally connected with others by suitable fulcrum-pins or studs, and in later patents the structure has been simplified—as, for instance, in United States Patent No. 754,024, dated March 8, 1904.

My present invention relates to the double detector automatic filling-replenishing type of loom shown in these patents; and one of the objects of my invention is the further simplification of parts and the construction and arrangement thereof in such manner that the manufacture is reduced in cost and the assembling accomplished with great ease.

Still another object of my invention is the production of novel and very simple-acting means to cause absolutely and without fail the operation of the replenishing mechanism by or through the direct-acting detector upon detection of filling failure by the other detector.

These and other novel features of my invention will be fully described in detail in the subjoined specification and particularly pointed out in the following claims.

Figure 1 is a top or plan view, centrally broken out, of a portion of an automatic filling-replenishing loom embodying my present invention, the filling-detecting devices and parts coöperating therewith or controlled thereby being shown in normal position. Fig. 2 is an enlarged left-hand side elevation of the main filling-detector and adjacent parts in normal position, the fork-slide being partly broken out. Fig. 3 is a similar view of the same parts, but taken just after the first change in the relative position thereof has been made, due to detection of filling failure by the other detector, conveniently termed the "auxiliary" filling-detector. Fig. 4 is a longitudinal sectional view on the line 4 5, Fig. 1, showing the relative position of the parts when the main detector-slide has been moved outward by or through its own actuator to cause the first operation of the filling-replenishing mechanism. Fig. 5 is a like view, but taken after a second successive and similarly-actuated outward movement of the main slide to cause a second operation of the replenishing mechanism and set the latch; and Fig. 6 is a side elevation of the parts after a third outward movement of the main slide by its own actuator in order to illustrate more clearly the operation of the latch and the device coöperating therewith to effect release of the shipper when the main slide is thus moved outward the third time in succession. Fig. 7 is an under side view of the controller for the shipper-releasing latch. Fig. 8 is a top plan view of the outer end of the main detector-slide, and Fig. 9 is a side elevation of the parts in the relative position shown in Fig. 5.

As will be fully explained hereinafter, the apparatus herein illustrated is constructed and arranged to effect a second replenishment of

filling should the shuttle misthread—*i. e.*, fail to thread properly upon the first replenishing operation—and if a misthread occurs upon the second replenishment the loom is stopped automatically and a third change of filling is effected concurrently with the operation of the loom-stopping instrumentality.

The loom herein shown is provided with two filling-detecting devices, so that detecting takes place on each pick in order to insure operation of the filling-replenishing mechanism even if an end of filling by trailing from the shuttle should tend to act upon one of the detectors, as if the filling were in proper condition, and I have also shown herein means adapted to arrest the operation of a take-up instrumentality in such manner that no thin places will be made in the cloth. The operation of the filling-replenishing mechanism, which may be conveniently of the Northrop type, as shown in United States Patent No. 529,940, is effected upon filling failure whether the same is detected by either or both of the detecting devices, thereby obviating any delay in replenishment.

Referring to Fig. 1, the lay A^3, having shuttle-boxes B $B^\times$, the automatically self-threading shuttle $S^\times$, the filling-replenishing mechanism at the side of the loom adjacent the shuttle-box $B^\times$ and including the transferrer F′ and filling-feeder F (only a portion of the inner end thereof being shown) to contain a supply of filling-carriers, as is common in the Northrop type of loom referred to, the controlling rock-shaft d', which governs the operation of the replenishing mechanism, the shipper S, its notched holding-plate N, and a releasing device for the shipper, shown as a kock-off lever $N^\times$, fulcrumed at $n^\times$, may be and are all of well-known construction and operate in a manner familiar to those skilled in the art, the inner end of the knock-off lever having an enlargement or shelf n, for a purpose to be described, with an inclined upper face. The two filling-detectors are located at the replenishing and shipping sides of the loom, respectively, the main detector being located at the shipping side. The other detector, which for convenience is termed the "auxiliary" filling-detector, includes a filling-fork g and its slide $g^\times$, longitudinally movable in a guide g^2, the fork having a tail g^{20}, to be engaged by the hook $w^\times$ of an actuator, shown as a weft-hammer $W^\times$, when the fork is not tilted to thereby move said slide outward, all in usual manner. When the slide is so moved, it engages and swings out the upper end of an arm d^5, fast on the rock-shaft d', and turns the latter, the throw imparted to the actuator $W^\times$ by the usual cam (not shown) in the present embodiment of my invention being sufficient to turn the rock-shaft only enough to arrest take-up. Referring to Fig. 2, such rocking of the shaft in the direction of the arrow 250 operates, through a depending arm d^2, fast on the shaft, to arrest take-up, the arm d^2 for this purpose having a lateral lug d^3 to engage the take-up-pawl carrier a', and thereby disengage the pawl from the usual ratchet. Any suitable take-up mechanism may be employed—such, for instance, as shown in United States Patent No. 643,284. A spring $s^\times$ acting against the auxiliary slide serves to return it to normal position. (See Fig. 1.)

The main filling-detector includes a filling-fork f of usual construction provided with a tail f^{20} and pivotally mounted in a slide $f^\times$. The slide is moved outward by operative movement of an actuator or weft-hammer W, provided with a hook of novel construction, to be hereinafter referred to, and when the slide is so moved its outer end engages an arm d, (see Figs. 1 and 2,) fast on the rock-shaft d', rocking the latter far enough to effect filling replenishment, the operating-cam of the actuator W imparting a sufficiently long stroke to the actuator for the purpose.

From the foregoing it will be understood that while the rocking of the shaft d' by or through either slide operates to arrest take-up the said rock-shaft will be turned far enough to effect filling-replenishing only when actuated by or through outward movement of the main slide $f^\times$. The actuators vibrate in alternation, and the auxiliary detector detects filling failure when the shuttle is in the box $B^\times$, while the main detector f detects filling failure when the shuttle is in the opposite box B, provided there is no interference (as by a trailing filling end) with the proper operation of such main detector. A spring s serves to return the main slide to its normal, inward, or retracted position. If the filling fails on the shot of the shuttle to the box B, the trailing filling end might be long enough to engage and tilt the fork f on the beat-up of the lay, while on the next pick the fork g would detect failure, and the auxiliary slide $g^\times$ would then be moved outward to rock the controlling-shaft d' and swing the arm d outward. This movement of the arm d is made effective to impart what may be termed an "initial" movement of the main slide to thereby withdraw its detector from the filling-path, rendering it irresponsive to the presence of filling, and through means to be described a complete outward movement of the main slide by or through its own actuator is made certain on the next pick to thereby effect the operation of the replenishing mechanism. If the initial detection of filling failure is made by the main detector f, the subsequent detecting action of the detector g will be ineffective so far as concerns the replenishing mechanism.

Referring particularly to Figs. 2 and 3, the actuator W has fulcrumed upon it at 1 a hook 2, having a notch 3 formed in its upper edge, the rear end of the notch presenting a single shoulder 4 to coöperate with the tail f^{20} of the

fork *f* when the latter is not tilted, and I have herein shown the hook as provided with an overhanging guard 5 at the front end of and rearwardly inclined above the notch for a safety device, as will be described. The hook-body is provided beneath the rearwardly-projecting guard with a finger 6, and a hook-support, shown as a transverse bar 7 on the main slide $f^{\times}$, is adapted to vertically and slidably support the free end of the hook as the actuator W vibrates. The finger 6 extends beneath the support at times, and the rear end of the hook-body is bent under and forward to form a prong $6^{\times}$, which also is adapted to at times coöperate with the support 7. When the parts are in the position shown in Fig. 2, the fork *f* can be tilted by the filling in front of the usual grid as the lay beats up, and the tail can rise out of the notch 3 without striking the guard 5. At the rear end of the stroke of the actuator W (see Fig. 2) the projection or finger 6 extends beneath the hook-support 7, so that the hook cannot jump or be accidentally thrown upward so as to get above the fork-tail f^{20}, as sometimes occurs with the ordinary hook, and when the actuator is at the front end of its stroke the prong or projection $6^{\times}$ coöperates in a similar manner with the support 7 with a like result. Thus I have provided portions of the hook which coöperate alternately with a relatively fixed part—viz., the hook-support 7—to prevent the hook from getting over the fork-tail at the opposite ends of the stroke of the actuator. When the main slide is moved forward a limited distance upon detecting action of the auxiliary detector, as will be described, the bodily movement of the detector or fork *f* will cause its tail to slide forward to the base of the guard 5, as in Fig. 3; but at this instant the hook-support 7 engages the hook-body just above the finger 6, and any further movement of the slide tending to tilt the actuator W forward will be taken up by the support 7 rather than by the fork-tail, relieving the same from undue strain. Such initial movement of the slide manifestly carries the main fork *f* bodily with it, the object being to retract the said fork far enough away from the grid and the filling-path to render the fork irresponsive even should filling be present on the beat-up—as, for instance, a trailing filling end. As the fork is designed to be thus rendered inoperative, it will not be tilted, and as the actuator W moves forward the hook-shoulder 4 engages the fork-tail f^{20}, and a change in the operation of the loom will be effected, such as the operation of the replenishing mechanism. Referring to Fig. 3, the guard 5 is shown overhanging the fork-tail to prevent any tilting of the main fork if through some improper adjustment of the mechanism the described retraction of the fork should fail to remove it from engagement by trailing filling, for it will be obvious that the impact of such filling on the fork could not lift the tail and throw back the guard while the finger 6 is under the hook-support 7. The guard thus serves as a safety device and acts in conjunction with the retraction of the main fork to prevent any filling-induced movement thereof when the auxiliary fork *g* has detected filling failure. In turning the loom over by hand the shuttle might stop in front of the main fork when the guard is in its operative position, as in Fig. 3, and in such case the pressure of the shuttle on the fork *f* would tilt it, causing its tail f^{20} to slide up along the guard 5, and this would act through the hook to rock forward the actuator W, thereby preventing breakage of the parts. While, therefore, the guard at times serves as an auxiliary or safety device to prevent filling-induced movement of the main fork, it will permit tilting movement of the latter should it be engaged by the shuttle. The outward movement of the main fork-slide $f^{\times}$ to effect the retraction of the main fork and the described coöperation of the parts, as shown in Fig. 3, is hereinafter termed an "initial" movement of the said slide. The coöperation of the guard with the fork-tail is when effected maintained until the forward stroke of the actuator W causes the shoulder 4 to take hold of the fork-tail f^{20} and move the main slide outward to its full extent to effect filling-replenishing. The upturned sides of the main slide are elevated at 8 and connected thereat by a stop-bar 9, (see Figs. 1, 4, 5, and 8,) and said sides are extended at the forward end of the slide, as at 10, such extensions being provided each with a series of notches or depressions 11, 12, and 13, located opposite each other, the innermost notches 13 being the deepest and the intermediate notches 12 being quite shallow for a purpose to be described. Opposite lugs or projections 14 are formed between the sides of the slide, as clearly shown in Fig. 8. The prolongation 15 of the main slide beyond the outer ends of the extensions 10 coöperates with the spring *s*, as clearly shown in Figs. 1 and 2, while the transverse shoulder 16 adjacent the extensions cooperates with the upper end of the arm *d* when the slide is moved outward. The guide or stand f^{2}, on which the main slide is mounted and in which it is longitudinally slidable, is provided at its inner end with an upturned abutment f^{10} for a purpose to be described, the abutment being clearly shown in Figs. 4 and 5 and in dotted lines in Fig. 2.

I have mounted upon the main slide a latch-carrier having an attached latch, the carrier and latch being also made as a casting and requiring no machining, said carrier being movable with and also longitudinally upon the slide, so that their relative position may be changed, as will be described. An under side plan view of the latch-carrier is shown separately in Fig. 7, the same comprising an elongated body 17,

provided with a cross-bar 18, extended laterally from opposite sides of the body and beveled on its under side, as at 19, to constitute a detent, and on one end of the cross-bar a latch 20 is formed. The shape of the latch in side elevation is clearly shown in Figs. 2, 3, 6, and 9, and referring to these figures and Fig. 1 it will be seen that the latch depends outside one of the side extensions 10 of the main slide, the latch being arranged to coöperate at times with the enlargement or shelf *n* of the knock-off lever N× to rock such lever and release the shipper from its holding-notch. The inner end of the carrier-body 17 is enlarged, as at 21, such enlargement having two depending lugs 22, located opposite each other, and transverse shoulders 23 24 are formed on the under side of the enlargement beyond the lugs. An upturned lug 24× is formed on the latch-carrier at its inner end, said lug being elevated above the plane of the stop-bar 9 on the fork-slide, and forward of this lug 24× I have provided two transverse shoulders 25 and 26. Said shoulders are stepped with relation to each other, the latter being the higher, and the shoulders 23 and 24 are also stepped, the shoulder 23 being lower than its fellow. The body 17 of the carrier is made narrow, so that it can enter readily between the extensions 10, and at its outer end the body is downturned or hooked at 27. Lateral and oppositely-extended lugs 28 are formed on the latch-carrier at the forward end of the enlargement 21, the rear faces of the said lateral lugs forming a continuation of the shoulder 26. A depending bevel-face lump 29 is formed on the under side of the body 17, substantially where it joins the enlargement 21, as best shown in Fig. 7. The detent 19 coöperates with the several notches 11, 12, and 13, such notches acting as detent-stops in the operation of the device. The latch-carrier is inserted between the upturned sides of the main slide *f*× and the stop-bar 9, and the latter extends across the enlarged portion 21 of the carrier between the upturned lug 24× and the stop-shoulder 26, the body portion 17 of the carrier being inserted between the extensions 10, while the detent 19 coöperates with one or the other of the series of detent-stops 11, 12, and 13, and the inner end of the carrier is supported by the engagement of the projections 22 with the tops of the inturned lugs 14 on the slide. The normal position of the latch-carrier is shown in Figs. 1 and 2, and it will be observed that at such time the shoulder 23 is some little distance back of the abutment f^{10}. The upper end of the arm *d* is provided with an upturned head d^7 and a cam-face d^8, the hooked end of the latch-carrier normally projecting above the head d^7, as shown in Fig. 2. If filling failure is detected first by the main detector or fork *f*, the hook 2 will engage the tail of the fork and the outward movement of the actuator W will move the main slide outward from the position shown in Figs. 1 and 2, the latch-carrier moving in unison with the slide until the shoulder 23 engages the abutment f^{10}, whereupon the movement of the carrier is stopped before the slide completes its movement. This stoppage of the latch-carrier causes the detent 19 thereof to ride up out of the notches 11 into the intermediate notches 12, as shown in Fig. 4, the hooked end 72 being elevated above the head of the arm *d*, the projection 22 dropping off the tops of the lugs 14. The abutment f^{10} then vertically supports the inner end of the carrier. The arm *d* is moved outward by the slide movement, rocking the shaft *d'* in the direction of the arrow 250, Fig. 2, to effect filling-replenishing in well-known manner when the shuttle is in the shuttle-box B×.

By reference to Figs. 2 and 3 it will be seen that the latch 20 is above and forward of the rear edge of the shelf *n* on the knock-off lever, and as will hereinafter appear the latch is gradually moved into position behind the shelf to coöperate therewith upon a predetermined number of successive outward movements of the slide. As the actuator W swings back the spring *s* moves the slide inward and the coöperation of the detent with the stops 12 causes the latch-carrier to move inward with the slide and until the shoulder 30 of the latter meets the outer end of the stand or guide f^2. During such inward movement of the latch-carrier with the slide the hooked end 27 passes over the upturned end d^7 of the arm *d*, and as the slide completes its inward movement the portion of the carrier between the shoulders 23 and 24 is carried past the abutment f^{10}, so that the inner end of the carrier drops when the abutment reaches the shoulder 24. This relative position of the carrier and abutment is shown in Fig. 5. When, therefore, the main slide is moved outward a second time, as will be the case if the shuttle fails to thread after the first replenishment of filling, the slide will move outward to the position shown in Fig. 5, and as the latch-carrier is held from movement the detent 19 will be drawn out of the notches 12 and will drop into the deep notches 13. At such time the latch 20 depends in front of the shelf *n*, as shown in Fig. 9, and as the main slide moves inward from the position shown in Figs. 5 and 9 the latch will ride over the inclined upper face of the shelf and drop off its rear edge behind the same as the slide completes its inward movement. The second outward movement of the slide acts upon the arm *d*, as before described, to rock the shaft *d'* and effect a second replenishment of filling, and as the actuator W moves back the spring *s* returns the slide to normal position from the position shown in Fig. 5. If there is a second misthread or failure of the fresh filling to properly thread in the shuttle, the slide will again be moved outward a third time in

succession, and on such third outward movement the latch 20 engages the rear edge of the shelf *n* and moves it forward, thereby rocking the knock-off lever N× and releasing the shipper. The final position of the shelf, latch, and adjacent parts is shown in Fig. 6, and such outward movement of the slide not only causes release of the shipper, but effects a third operation of the replenishing mechanism concurrently with the shipper-release, and by reference to said Fig. 6 it will be seen that the hooked end 27 of the latch-carrier rests upon the cam-face d^8 of the head of the arm *d*. When the weaver has discovered and corrected the cause of the misthreading and throws on the shipper to start the loom, the first outward stroke of the actuator W engages the inner end of the latch-carrier and pushes the same forward, the lump 29 riding over the top of the abutment f^{10} and assisting the projections 22 to slide up onto the lugs 14 as the latch-carrier resumes its normal position with relation to the slide, as shown in Figs. 1 and 2, and as the latch-carrier is thus moved forward the detent 19 travels up out of the notches 13 across the notches 12 and drops down into the outermost notches 11, the lug 24× limiting the outward movement of the latch-carrier by engagement with the stop-bar 9. It should be stated that on the first outward movement of the main slide when the latch-carrier is stopped by engagement of the fixed abutment with the shoulder 23 the shoulder 25 on the upper side of the carrier engages the stop-bar 9 and prevents any undue or improper movement of the carrier which might be caused by the momentum of the parts.

From the foregoing description it will be seen that the abutment coöperates with the carrier on the outward movement of the slide to stop the carrier and cause a change in the position of the detent with the detent stops or notches and that on the succeeding inward movement of the slide the stops and detent serve to move the carrier with the slide, whereby a step-by-step movement of the latch-carrier is effected upon and with relation to the slide to finally operatively position the latch in the path of and to coöperate with the shipper-releasing device upon final outward movement of the slide.

If initial detection of filling failure is made by the auxiliary detector *g*, then the consequent outward movement of the auxiliary slide $g^×$ rocks the shaft *d'*, arresting take-up and at the same time swinging the arm *d* forward far enough to effect engagement of its head d^7 with the hook 27 of the latch-carrier, and as the lug 24× is then in engagement with the stop-bar 9 the forward movement of the latch-carrier will be sufficient to impart the initial movement to the main slide, hereinbefore referred to, from the position shown in Fig. 2 to that shown in Fig. 3. Thereby the main fork *f* is retracted, as has been hereinbefore described, and rendered irresponsive to the presence of filling, and consequently the operation of the replenishing mechanism will be effected when the complete outward movement of the main slide $f^×$ is accomplished by its actuator W. The fork-tail f^{20} moves forward under the overhanging guard 5 on the initial movement, the finger 6 of the hook coöperating with the support 7, all as shown in Fig. 3, and the guard will, by coöperation with the fork-tail f^{20}, prevent filling-induced movement of fork *f*, as hereinbefore described. The positive coöperation of the hook and the main filling-detector will be maintained until the main actuator W moves forward and the shoulder 4 catches the fork-tail, so that the main slide will be moved outward its full distance to act through the arm *d* and controlling-shaft *d'* and effect filling-replenishing. If, therefore, after detection of filling failure by the auxiliary detector a trailing filling end should be present in front of the main detector, the latter cannot be tilted thereby under any circumstances, and consequently the main slide must and will be moved outward by its actuator W to effect filling replenishment, the latter being always effected by or through the main filling-detector.

It will be observed that the hook 2 is provided with but a single shoulder at 4 and that the operation of the replenishing mechanism is always effected by coöperation of the tail of the main fork with such shoulder, a much simpler construction than heretofore employed, and a better construction, because with two shoulders and a separate train or set of connections coöperating with each the angular movement of the rock-shaft or controlling-rod *d'* is very apt to vary, resulting in uncertainty in the operation of the replenishing mechanism and possibly its failure to operate when it should.

Of course the complete step-by-step movement of the latch-carrier will not be effected if only one change of filling is called for, as will be the case when the shuttle properly threads, for the latch-carrier will be reset in its normal position by the first subsequent forward stroke of the actuator W.

When the latch-carrier is held from movement by the engagement of the abutment f^{10} with the shoulder 24, the lateral lugs 28 act as stops, coöperating with the raised portions 8 of the sides of the main slide to prevent any improper positioning of the carrier on such slide.

It will be manifest from an inspection of the drawings that there are no pivot-pins or studs or other similar connecting devices between the latch-carrier and slide, so that the castings constituting such parts can be immediately assembled and the device is ready for operation.

To assemble the parts, the lug 24× is passed

underneath the stop-bar 9 of the slide and the carrier is moved forward until the detent portion thereof coöperates with the innermost notches 13, after which the slide can be inserted in the guide. When the latch-carrier is reset, the hooked end 27 thereof rides up over the cam-face d^8 and drops in front of the part d^7 of the arm d.

My invention is not restricted to the precise construction and arrangement herein shown and described, as the same may be modified or rearranged in various particulars by those skilled in the art without departing from the spirit and scope of the invention.

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

1. In a loom, in combination, two filling-detectors normally adapted to detect filling failure on alternate picks, mechanism to change the action of the loom, one of the detectors directly controlling the operation of such mechanism, and means whereby detection of filling failure by the other detector renders the first-named detector irresponsive to the presence of filling and thereby insures the operation of the said directly-controlled mechanism.

2. In a loom, in combination, two filling-detectors normally adapted to detect filling failure on alternate picks, filling-replenishing mechanism, one of said detectors directly controlling the operation thereof, and means whereby detection of filling failure by the other detector renders the first-named detector irresponsive to the presence of filling and thereby insures the operation of the replenishing mechanism.

3. In a loom, in combination, two filling-detectors normally adapted to detect filling failure on alternate picks, filling-replenishing mechanism, one of said detectors directly controlling the operation thereof, and means automatically operative by or through detection of filling failure by the other detector to move the first-named detector out of detecting position prior to the time for detection and insure the operation of the replenishing mechanism.

4. In a loom, in combination, two filling-detectors normally adapted to detect filling failure on alternate picks, filling-replenishing mechanism, one of said detectors directly controlling the operation thereof, and means automatically operative by or through detection of filling failure by the other detector to retract bodily the first-named detector from the path of the filling prior to the time for detection and thereby prevent positively detecting action thereof, to insure the operation of the replenishing mechanism through such retracted detector.

5. In a loom, in combination, two filling-detectors normally adapted to detect filling failure on alternate picks, their slides, filling-replenishing mechanism, one of said detectors through complete outward movement of its slide controlling the operation of said mechanism, and means to effect an initial outward movement of such slide upon detection of filling failure by the other detector, such initial movement of the slide retracting its detector far enough from the filling-path to insure the subsequent complete outward movement of its slide and consequent operation of the replenishing mechanism.

6. In a loom, main and auxiliary filling-detectors, filling-replenishing mechanism directly controlled as to its operation by the main detector upon detection of filling failure, and means operative by or through detecting action of the auxiliary detector to effect bodily movement of and render the main detector irresponsive to the presence of filling, to insure the operation of the replenishing mechanism through the main detector.

7. In a loom, in combination, two filling-detectors normally adapted to detect filling failure on alternate picks, means whereby detection of filling failure by one detector moves the other detector out of detecting position, to cause the operation of the replenishing mechanism, and a safety device to coöperate with such latter detector when moved as described, to positively prevent any accidental detecting movement thereof.

8. In a loom, main and auxiliary tilting filling-forks, filling-replenishing mechanism directly controlled as to its operation by the main fork upon detection of filling failure thereby, means operative by or through detecting action of the auxiliary fork to effect bodily movement of the main fork away from detecting position, to thereby cause the operation of the replenishing mechanism, and means to coöperate with and prevent filling-induced tilting of the main fork when out of detecting position.

9. In a loom, main and auxiliary tilting filling-forks, filling-replenishing mechanism directly controlled as to its operation by the main fork upon detection of filling failure thereby, and means rendered operative by or through detection of filling failure by the auxiliary fork to prevent filling-induced tilting of the main fork, thereby insuring the operation of the replenishing mechanism, while permitting tilting of such main fork if engaged by the shuttle.

10. In a loom, main and auxiliary tilting filling-forks, filling-replenishing mechanism directly controlled as to its operation by the main fork upon detection of filling failure thereby, separately-acting means rendered operative upon detection of the filling failure by the auxiliary fork to prevent movement of the main fork in response to the presence of filling while permitting tilting of the said fork if engaged by the shuttle.

11. In a loom, main and auxiliary filling-

forks, their slides, filling-replenishing mechanism directly controlled as to its operation by the main fork, an actuator for the main slide, a hook mounted on said actuator and having a single shoulder, to coöperate with the main fork-tail upon detection of filling failure by either fork, and means operative upon detection of filling failure by the auxiliary fork to prevent filling-induced movement of the main fork and thereby effect the operation of the replenishing mechanism.

12. In a loom, two filling-detectors, filling-replenishing mechanism directly controlled as to its operation by one detector, an actuator for the latter, means operative by or through detecting action of the other detector to render inert the first-named detector and thereby cause filling-replenishing, and a hook mounted on said actuator and having a guard, operation of the aforesaid means to render said detector inert effecting coöperation thereof with the guard and maintaining such coöperation for a predetermined period after detection of filling failure.

13. In a loom, main and auxiliary filling-detectors, their slides, filling-replenishing mechanism directly controlled as to its operation by the main detector, an actuator for the slide of the latter, a hook on the actuator to coöperate with the main detector and move its slide, an overhanging guard on said hook, and means operative by or through detecting action of the auxiliary detector to cause filling-replenishing through the main detector, said means operating initially to move the main detector into inoperative position with relation to the filling-path and thereafter causing the guard to insure positive coöperation of the hook and the main detector and subsequent operative movement of its slide thereby.

14. In a loom, main and auxiliary filling-detectors, their slides, filling-replenishing mechanism directly controlled as to its operation by the main detector, an actuator for the slide of the latter, a hook on the latter to coöperate with the main detector and thereby move its slide, an overhanging guard on said hook, a hook-support on the main slide, a finger on the hook to at times coöperate with the support, and means operative by or through detecting action of the auxiliary detector to impart a limited initial outward movement to the main slide, and thereby retract the main detector from detecting position, to cause the operation of the replenishing mechanism, such retraction causing the guard to overhang the outer end of the detector, while the finger cooperates with the hook-support and acts, through the guard, to prevent any filling-induced movement of the main detector.

15. In a loom, main and auxiliary filling-detectors, their slides, filling-replenishing mechanism directly controlled as to its operation by the main detector, an actuator for the main detector-slide, a hook mounted on the actuator to coöperate with the main detector and thereby move its slide, and means operative upon detection of filling failure by the auxiliary detector to change the relative position of the hook and the main detector and maintain such change of position until operative movement of the actuator is begun, preventing detecting movement of the main detector and thus insuring outward movement of the main slide and consequent actuation of the filling-replenishing mechanism.

16. In a loom, main and auxiliary filling-detectors, their slides, filling-replenishing mechanism directly controlled as to its operation by the main detector, an actuator for the main detector-slide, a hook mounted on the actuator to coöperate with the main detector and thereby move its slide, a hook-support on the main slide, means operative by or through detecting action of the auxiliary detector to cause filling replenishing through the main detector, said means including a member mounted on and having a limited longitudinal movement upon the main slide and adapted to impart an initial movement to the latter when the auxiliary detector detects filling failure, such initial movement of the slide retracting the main detector from detecting position, and a guard on the hook to at such time coöperate with said detector and prevent any filling-induced movement thereof while insuring coöperation of the hook and said detector until the actuator begins its operative movement.

17. In a loom, main and auxiliary filling-detectors, their slides, an actuator for and to operatively move each slide upon detection of filling failure, filling-replenishing mechanism the operation whereof is directly controlled and effected by operative movement of the main slide, a hook on the main-slide actuator, having a guard and a finger, a hook-support on the main slide movable into engagement with the finger, and connections between the main and auxiliary slides to impart a short initial movement to the main slide by operative movement of the auxiliary slide upon detection of filling failure by the auxiliary detector, such initial movement causing the hook-support to move forward above the finger, and effecting relative movement of the guard and the main detector to cause their cooperation and prevent any filling-induced detecting movement of the said detector, thus insuring the operative outward movement of the main slide when its actuator operates, the hook-support and finger serving to maintain coöperation of the guard and the main detector.

18. In a loom, a main filling-fork having a tail, its slide, an actuator therefor, a shouldered hook thereon having an overhanging guard in front of and rising above the hook-shoulder, the guard normally permitting the filling-fork to tilt, a hook-support on the main

slide, filling-replenishing mechanism controlled by or through the slide, an auxiliary filling-fork, its slide and actuator therefor, and means intermediate the main and auxiliary slides to impart an initial movement to the former when the latter is moved by its actuator upon detecting action of the auxiliary filling-fork, the initial movement of the main slide causing the tail of its fork to pass under the guard, whereby the said fork is held from filling-induced tilting movement and retained in position to coöperate with the hook-shoulder upon operative movement of the main actuator.

19. In a loom, a main filling-fork having a tail, its slide, an actuator therefor, a hook mounted on the actuator and having a shoulder to coöperate with the tail and thereby move the main slide, an overhanging guard on the hook in front of the shoulder and normally out of the path of the tail when the fork is tilted, filling-replenishing mechanism operated upon movement of the main slide by its actuator, an auxiliary filling-fork, means operative by or through detecting action thereof to impart an initial movement to the main slide and thereby cause the tail of the main filling-fork to extend beneath said guard, and means to prevent filling-induced tilting of the main filling-fork, subsequent operation of the main actuator causing the hook to move forward and bring its shoulder into engagement with the fork-tail, thereby moving the main slide outward its full stroke and effecting filling replenishment, actuation of the filling-replenishing mechanism being always effected by coöperation of the main fork-tail and the shoulder of the hook.

20. In a loom, main and auxiliary filling-forks, their slides, filling-replenishing mechanism directly controlled as to its operation by the main fork, an actuator for the main slide, a hook mounted on said actuator and having a single shoulder, to coöperate with the tail of the main fork upon detection of filling failure thereby, and means operative by or through detecting action of the auxiliary fork to prevent detecting action of the main fork on the next pick and effect coöperation of the tail thereof with the shoulder of said hook on the operative movement of the main actuator on such pick, to thereby cause outward movement of the main slide and consequent filling replenishment.

21. In a loom, main and auxiliary filling-forks, their slides, filling-replenishing mechanism directly controlled as to its operation by the main fork, an actuator for the main slide, a hook mounted on said actuator and having a single shoulder, to coöperate with the tail of the main fork upon detection of filling failure thereby, and means operative by or through detecting action of the auxiliary fork to retract the main fork from the filling-path on the next pick while retaining its tail in position to be engaged by the hook-shoulder on the operative stroke of the main actuator on such pick.

22. In a loom, a pivotally-mounted filling-fork having a loop-like tail, a vibrating actuator, a hook fulcrumed thereon to coöperate with the tail upon failure of the filling, and means, including alternately-acting members on the hook, to prevent lifting of the hook over the fork-tail at each end of the stroke of the actuator.

23. In a loom, a pivotally-mounted filling-fork having a loop-like tail, a vibrating actuator, a hook fulcrumed thereon to coöperate with the tail upon failure of the filling, and separate, alternately-acting devices to prevent lifting of the hook over the fork-tail at each end of the stroke of the actuator.

24. In a loom, a slide having a hook-support, a filling-fork pivoted on the slide and having a tail, a vibrating actuator, a hook fulcrumed thereon and slidable on said support, to coöperate with the fork-tail upon filling failure, and projections on the hook to alternately coöperate with the hook-support and prevent lifting of the hook over the fork-tail at the opposite ends of the stroke of the actuator.

25. In a loom, in combination, a main slide having a hook-support, a filling-fork pivoted on the slide and having a tail, a vibrating actuator, a hook fulcrumed thereon and slidable on said support, and having a shoulder to coöperate with the fork-tail upon filling failure, projections on the hook to coöperate alternately with the hook-support and prevent lifting of the hook over the fork-tail at the opposite ends of the stroke of the actuator, filling-replenishing mechanism the operation whereof is effected by said actuator through the main slide, an auxiliary filling-fork, and means operative upon detection of filling failure by such fork to prevent filling-induced movement of the main fork and cause the operative engagement of the hook-shoulder with the main fork-tail, whereby the main slide will be moved by its actuator and filling replenishment effected.

26. In a loom, a filling-detector, its slide provided with a series of detent-stops and adapted to be moved upon detection of filling failure, filling-replenishing mechanism controlled by or through the slide, a shipper, a releasing device therefor, a latch-carrier having a rigidly-attached latch and a detent and movable with and also longitudinally of the slide, and a fixed abutment, the latter coöperating with the carrier on each outward movement of the slide to change its relative position on the slide, the detent coöperating with one after another of the detent-stops on successive inward movements of the slide to thereby effect movement of carrier and slide in unison, and thereby

cause the latch (after a predetermined number of successive slide movements) to engage and move the shipper-releasing device on an additional outward movement of the slide.

27. In a loom, a filling-detector, its slide provided with a series of detent-stops and adapted to be moved upon detection of filling failure, filling-replenishing mechanism controlled by or through the slide, a shipper, a releasing device therefor, a latch-carrier mounted upon and movable longitudinally on the slide and having a plurality of shoulders, a detent and a latch rigidly attached to the carrier, and a fixed abutment, the latter coöperating with the carrier-shoulders on successive outward movements of the slide to hold the carrier stationary temporarily and thereby bring the detent into engagement with one after another of the stops on the slide, thus moving the carrier step by step relatively to the slide to position the latch in the path of the shipper-releasing device after a predetermined number of successive slide movements.

28. In a loom, a filling-detector, its slide provided with a series of detent-stops and adapted to be moved upon detection of filling failure, filling-replenishing mechanism controlled by or through the slide, a shipper, a releasing device therefor, a latch-carrier mounted upon and movable longitudinally on the slide and having a plurality of shoulders on its under side, a detent rigidly attached to and extended from one side of the carrier, a rigidly-attached latch on the opposite side and depending over the side of the slide, and a fixed abutment to coöperate with one after another of the carrier-shoulders on successive outward slide movements to thereby change the relative position of the carrier and slide and bring the detent into engagement with the detent-stops successively, thus advancing the carrier and latch step by step upon the slide to operatively position the latch and effect its coöperation with the shipper-releasing device upon a predetermined number of successive slide movements.

29. In a loom, a filling-detector, its slide adapted to be moved upon detection of filling failure, having upturned sides each of which is provided with a series of opposite notches, filling-replenishing mechanism, controlled by or through the slide, a shipper, a knock-off lever therefor, a latch-carrier longitudinally movable between the sides of the slide and having a rigidly-attached cross-bar constituting a detent to coöperate with the notches in the slide, a downturned, rigid latch on one end of the bar outside the slide, two transverse shoulders on the under side of the carrier near its inner end, and an upturned, fixed abutment to coöperate with the shoulders on successive outward movements of the slide and cause the detent to successively engage one after another of the notches, to gradually move the carrier inward upon the slide and position the latch back of the knock-off lever, the innermost notch of each series being deep enough to permit the carrier to drop and thereby set the latch in the path of the knock-off lever to operate the latter on the final successive outward movement of the slide.

30. In a loom, a filling-detector, its slide adapted to be moved upon detection of filling failure, having upturned sides each of which is provided with a series of opposite notches, filling-replenishing mechanism controlled by or through the slide, a shipper, a knock-off lever therefor, a latch-carrier longitudinally movable between the sides of the slide and having a rigidly-attached detent to rest upon the sides of the slide and coöperate with the notches, a latch on one end of the detent outside the slide, a stop-bar on the latter extended across the carrier, two shoulders on the upper and under sides of the carrier, and a fixed abutment to coöperate successively with the under shoulders on two successive outward movements of the slide, to thereby cause the detent to engage one after another of the notches, the innermost notch of each series being the deepest, to finally position the latch behind and in the path of the knock-off lever.

31. In a loom, a filling-detector, its slide provided with a series of detent-stops and adapted to be moved upon detection of filling failure, filling-replenishing mechanism controlled by or through the slide, a shipper, a releasing device therefor, a latch-carrier having a rigidly-attached latch and a detent and movable with and longitudinally of the slide, the latter having upturned sides and a transverse stop-bar connecting them above the carrier, an upturned lug at the inner end of the carrier back of the stop-bar, transverse shoulders on the under side of the carrier, and a fixed abutment, the latter coöperating with the shoulders on outward movements of the slide and the detent coöperating with the detent-stops on the inward movements of said slide, to move the carrier and thereby position the latch to engage the shipper-releasing device, the stop-bar preventing lifting and limiting outward movement of the carrier relatively to the slide.

32. In a loom, a filling-detector, its slide adapted to be moved upon detection of filling failure and provided with a series of notches, filling-replenishing mechanism controlled by or through the slide, a shipper, a knock-off lever therefor, a latch-carrier mounted on and having a limited longitudinal movement relatively to the slide, a latch and a detent rigidly mounted on the carrier, the detent coöperating with the notches in the slide, the carrier having a plurality of shoulders on its under side, a fixed abutment to coöperate with one after another of the shoulders and permit the detent to coöperate with one after an-

other of the notches, the innermost notch being deeper than the others, and means to prevent disengagement of the carrier and slide, the final one of a predetermined number of successive movements of the slide causing the latch to actuate the knock-off lever and release the shipper.

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

JONAS NORTHROP.

Witnesses :

GEORGE OTIS DRAPER,

ERNEST W. WOOD.