(No Model.) 4 Sheets—Sheet 1.

J. H. NORTHROP.

LOOM.

No. 590,112. Patented Sept. 14, 1897.

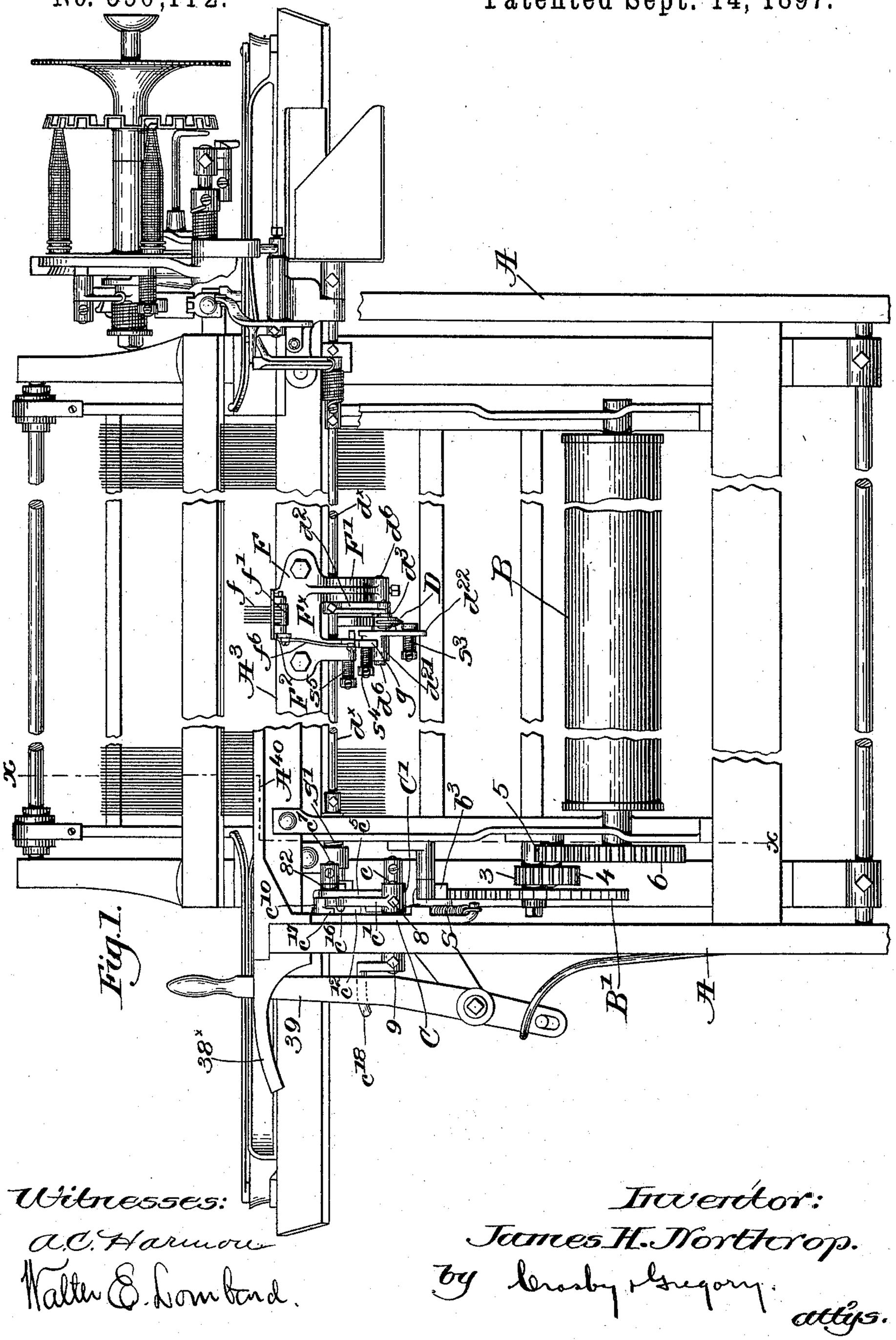

Fig. 1.

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(No Model.) 4 Sheets—Sheet 2.

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Fig. 2.

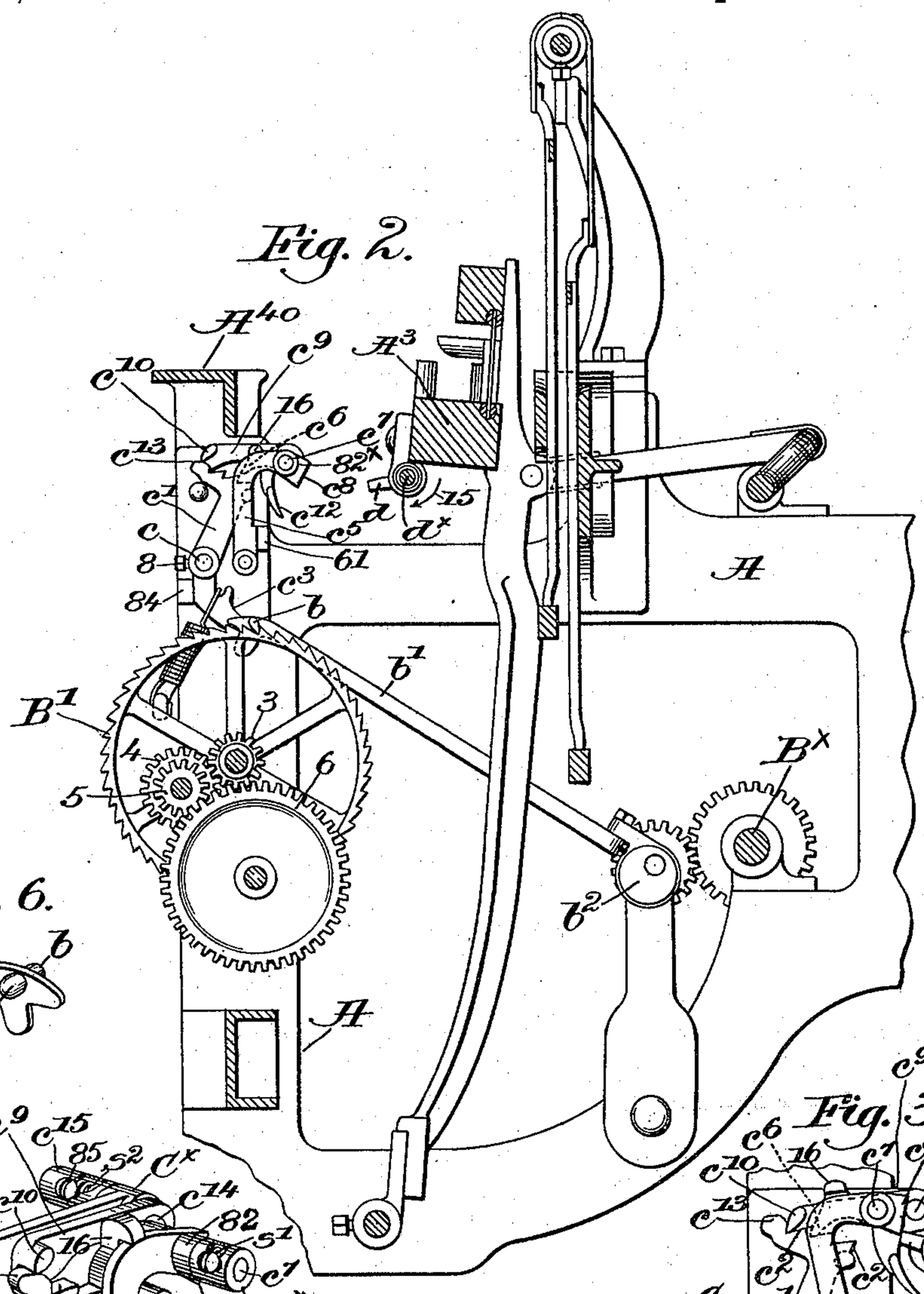

Fig. 6.

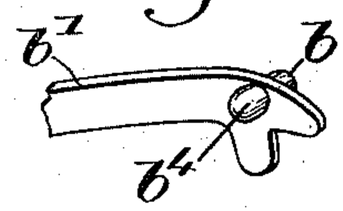

Fig. 4.

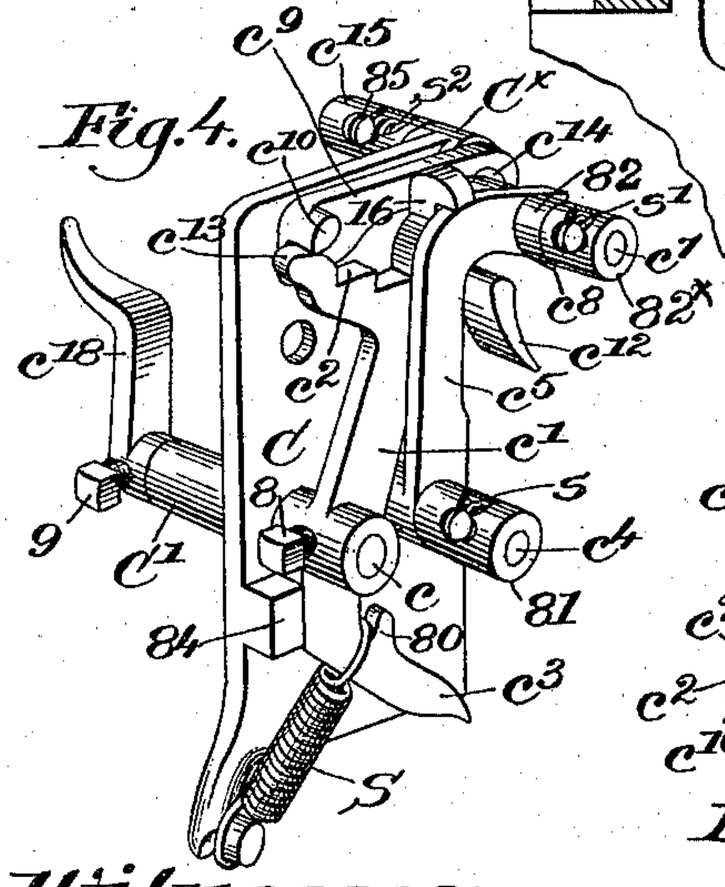

Fig. 5.

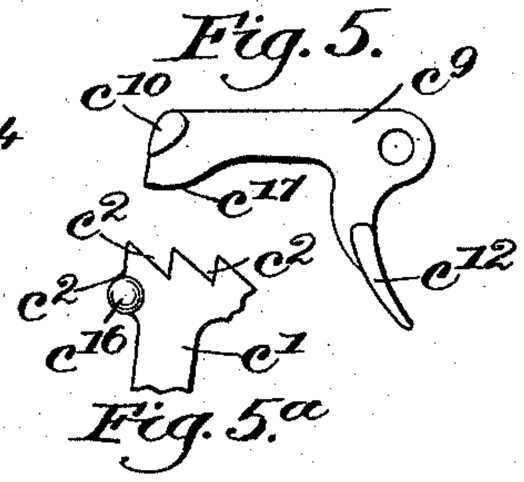

Fig. 5a.

Fig. 3.

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(No Model.) 4 Sheets—Sheet 3.

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No. 590,112. Patented Sept. 14, 1897.

Fig. 7.

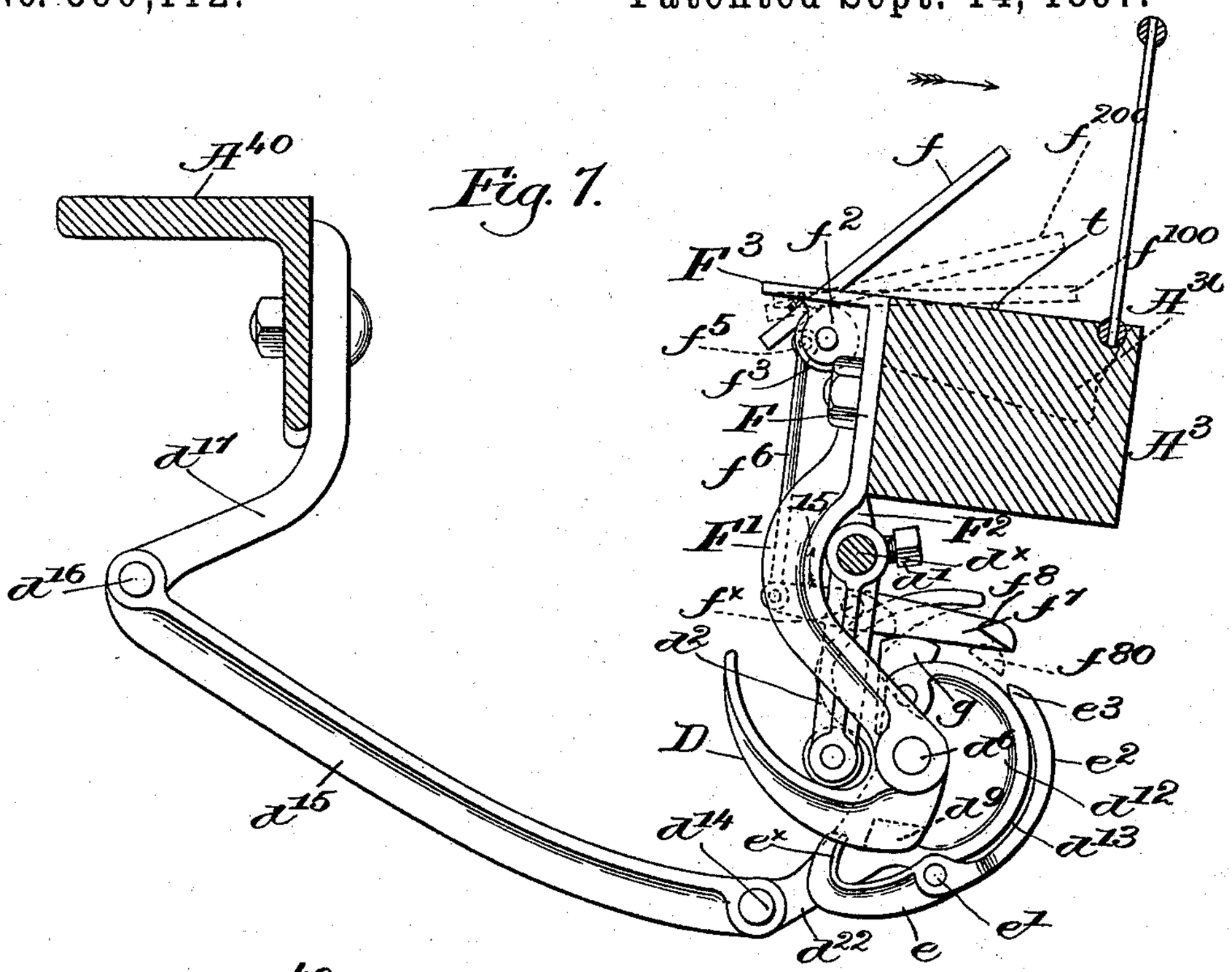
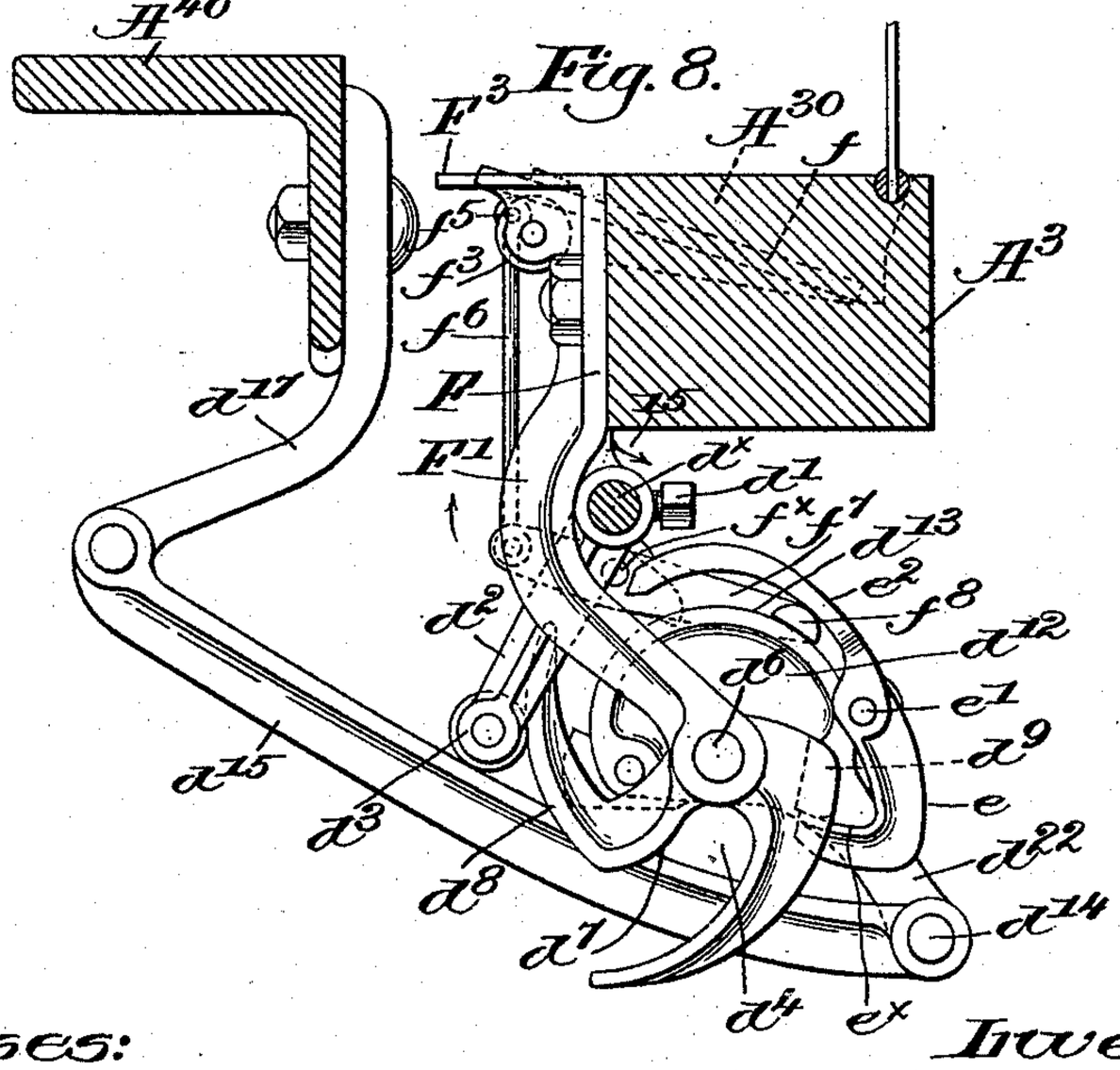


Fig. 8.



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(No Model.) 4 Sheets—Sheet 4.

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LOOM.

No. 590,112. Patented Sept. 14, 1897.

Fig. 14.

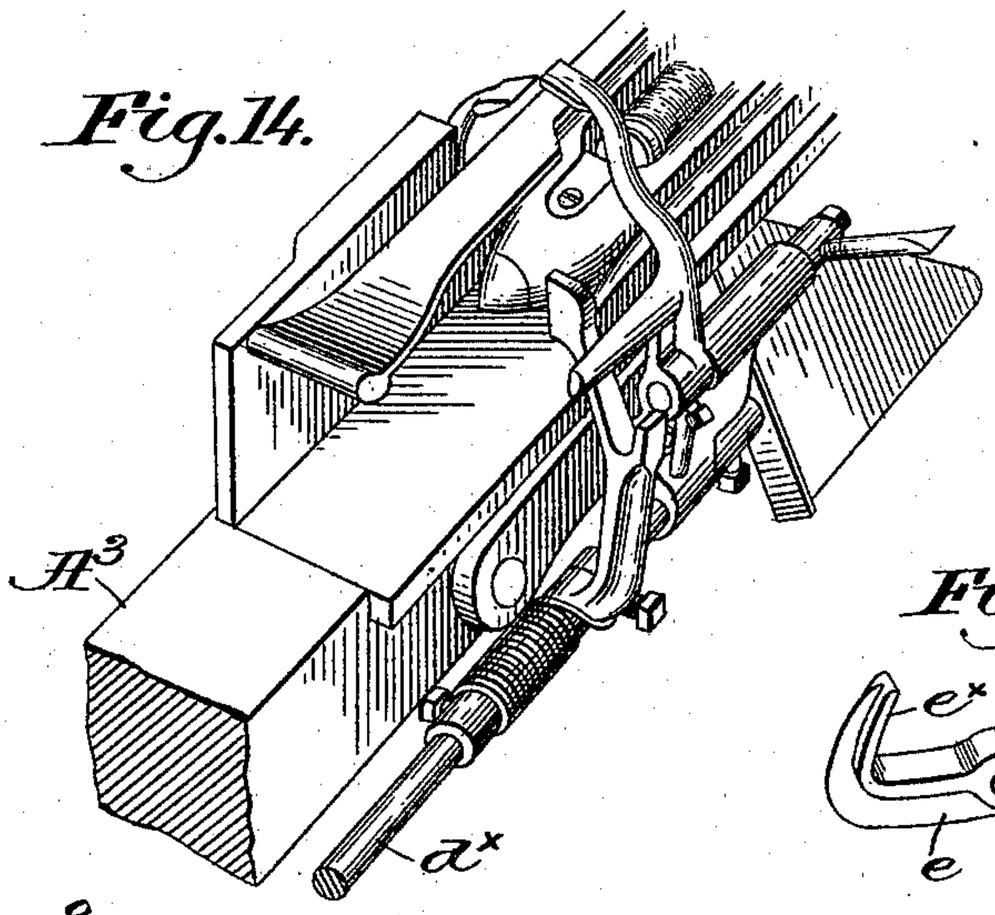


Fig. 12.

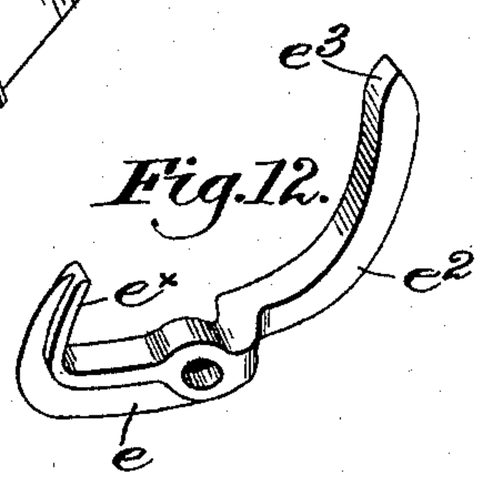


Fig. 11.

Fig. 9.

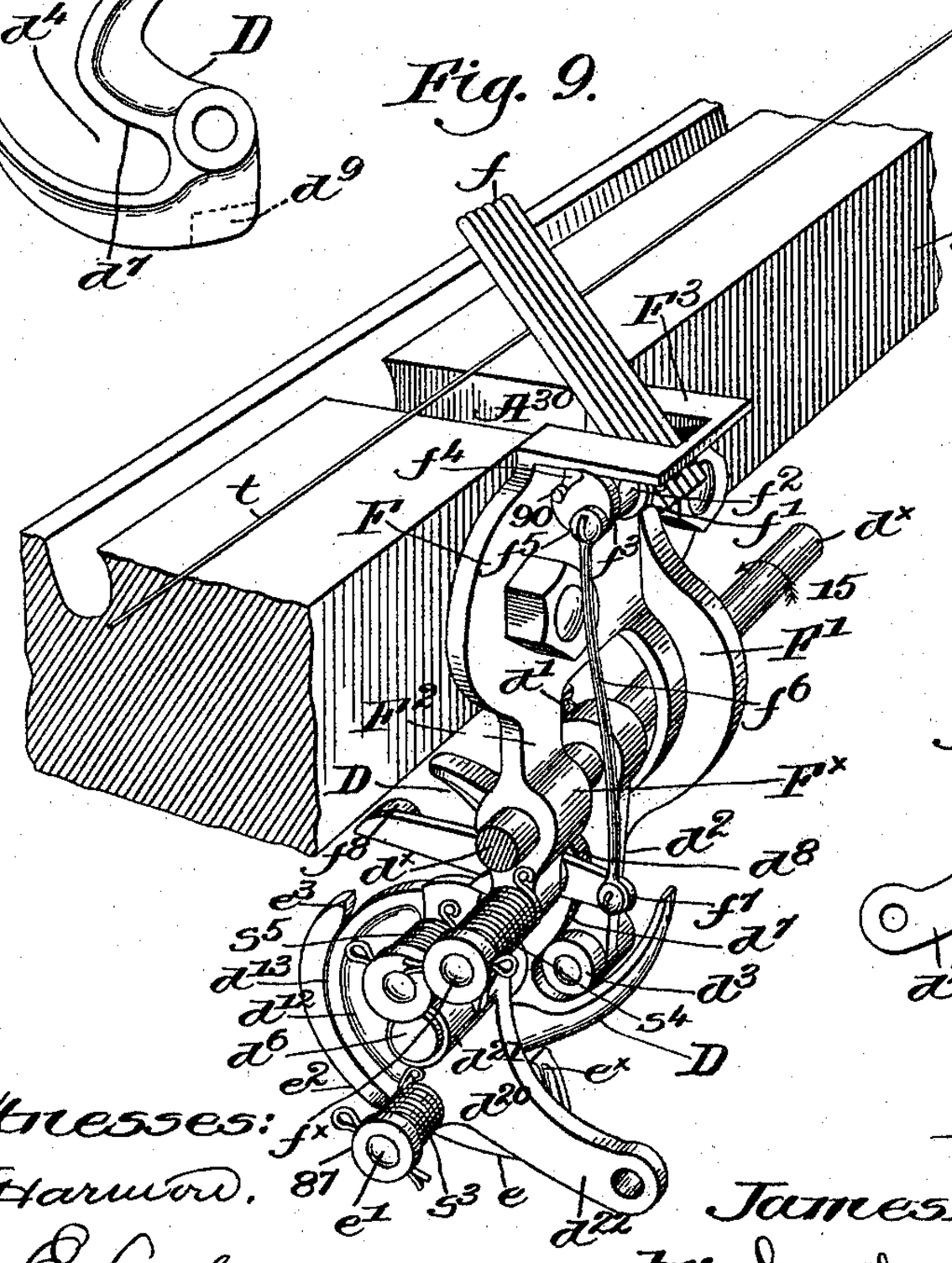


Fig. 13.

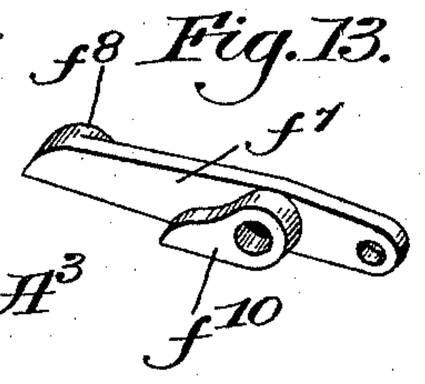
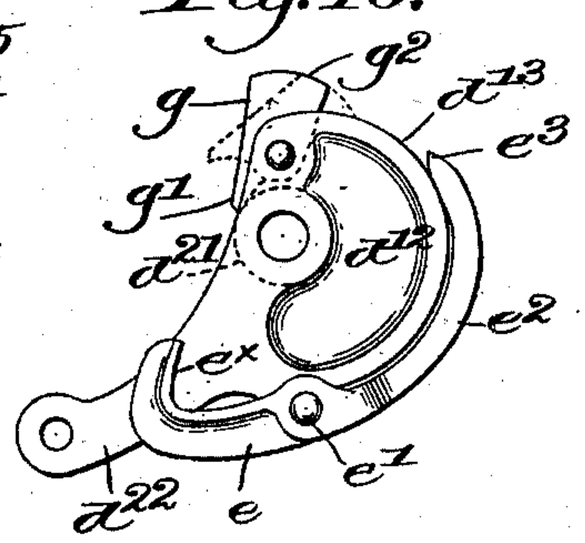


Fig. 10.



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UNITED STATES PATENT OFFICE.

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LOOM.

SPECIFICATION forming part of Letters Patent No. 590,112, dated September 14, 1897.

Application filed December 4, 1896. Serial No. 614,409. (No model.)

To all whom it may concern:

Be it known that I, JAMES H. NORTHROP, of Hopedale, county of Worcester, State of Massachusetts, have invented an Improvement in 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.

Looms for the production of woven fabrics are customarily provided with means for letting back or causing a retrograde movement of the take-up mechanism, upon failure or exhaustion of the filling, for a predetermined number of picks, in order to prevent the formation of thin places in the fabric. It cannot be foretold, however, whether or not the predetermined number of picks the take-up mechanism is let back will correspond to the number of picks rendered necessary by the failure of the filling—that is to say, if the take-up mechanism is arranged to let back for, say, three picks the failure of the filling may only require letting back one pick, so that the take-up mechanism would be let back too much, while, on the other hand, if the predetermined number to be let back be one pick the failure of the filling may require the take-up to be let back two or even more picks. In either case there results a variance between the actual and the proper amount of let-back of the take-up, and the finished fabric shows the effect in imperfections and faults.

This present invention has for one of its objects the production of means operative upon failure of the filling for controlling the take-up mechanism and maintaining it inoperative from the time the filling fails until the filling is again properly laid in the shed.

If for any reason the filling is not properly supplied at the next pick after its failure or at the second pick, the take-up is still maintained inoperative, and the controlling means therefor is so arranged that the take-up will remain inoperative until the filling has been properly laid or left in the shed to tip the filling fork or detector, whereupon the take-up mechanism is automatically thrown into operation and the loom will continue to run properly.

I have also provided means for automatically stopping the loom if after a predetermined number of picks the filling is not properly laid in the shed, while with a very slight change in the mechanism the loom will continue to run, but the take-up will be restrained from operation until the filling is properly laid in the shed.

These features of my invention are particularly valuable when embodied in recently-invented looms wherein, the filling having failed or been exhausted from the shuttle, a fresh filling-carrier is automatically supplied to the shuttle—as, for instance, in United States Patent No. 529,940, dated November 27, 1894—for it sometimes happens that two or more filling-carriers may be supplied in succession before the filling is properly laid or left in the shed.

When the filling fork or detector is located at or near one end of the shuttle-path and the filling parts after the shuttle passes the detector on its shot across the lay, the shuttle must continue its movement and return at the next pick before the failure is detected, thus leaving a short end of filling in the first pick and none whatever in the second pick. Obviously this is very objectionable, and to overcome it I have located the filling fork or detector at or near the center of the shuttle-path, so that failure of the filling will be detected more quickly, and though such central location of the filling-detector is not broadly of my invention I have combined and arranged the filling-detector and mechanisms controlled thereby in a novel and highly-effective manner, the same forming part of my invention.

Connections are provided between the filling-detector and the controlling means for the take-up mechanism, so that the operation of the latter is governed by or through the filling-detector. When the loom is running properly, the filling-detector is acted upon by the filling at each pick to prevent operation of the take-up-controlling means, and after the detector has felt or detected the filling the detector is moved by suitable means away from the filling to avoid crinkling or stretching the same as the lay beats up.

I have herein shown my invention as applied to a loom provided with filling-supply-

ing mechanism substantially such as shown in United States Patent No. 529,940 referred to, said mechanism being also controlled by the center filling-detector, but the combination therewith is not claimed herein, the same forming the subject-matter of another application, Serial No. 617,597, filed December 31, 1896, by me and another.

Other features of my present invention will be hereinafter described in the specification and particularly pointed out in the claims.

Figure 1, in front elevation and centrally broken out to economize space, represents a loom with my present invention applied thereto, the loom at the right-hand side being shown as provided with automatic filling-supplying mechanism, the greater part of the breast-beam being omitted to show the lay and the center filling-detector thereon. Fig. 2 is a transverse sectional view of the loom, taken on the line $x\,x$, Fig. 1, looking toward the left, the harness-actuating devices being omitted, said view showing more clearly the take-up mechanism and its controlling means in normal position. Fig. 3 is an enlarged detail, in inner side elevation, of a portion of the take-up-controlling means shown in Fig. 2, with the lay forward, however, and the actuating-pawl for the take-up in inoperative position. Fig. 4 is an enlarged perspective view of the take-up-controlling means detached and in the position shown in Fig. 1. Figs. 5 and 5^a are detached details, in side elevation, of parts of the said controlling means, the latter being shown in reversed position, however, relative to the former. Fig. 6 is a partial view in perspective of the take-up-actuating pawl. Fig. 7 is an enlarged view, in side elevation, of the filling-detector and the main connections between it and the take-up-controlling means, the breast-beam and lay being in section, with the lay back and the detector in position to permit the passage of the shuttle thereunder when shot across the lay. Fig. 8 is a similar view, but with the lay forward and the detector in abnormal position caused by failure or absence of the filling, the devices governed by the detector being shown in corresponding position. Fig. 9 is a perspective view of a portion of the lay, the filling-detector, and the devices governed thereby in the position shown in Fig. 7, but viewed from the opposite side to more clearly show the different parts. Figs. 10 and 11 are details in side elevation of some of the parts governed by the filling-detector. Figs. 12 and 13 are perspective views of detached parts partially shown in Figs. 7 and 9; and Fig. 14 is a perspective view of the shuttle-positioning device or feeler and adjacent parts at the right-hand end of the lay, Fig. 1, to show principally the adjacent end of the operating-shaft.

The loom-frame A, breast-beam A^{40}, the lay A^3 and its actuating mechanism, the shipper lever or handle 39 and the notched plate $38^\times$ therefor, and the usual belt-shipping mechanism operated by said shipper-lever, and not herein shown, are and may be substantially as shown in United States Patent No. 529,940, granted to me November 27, 1894.

The take-up roll B, the take-up ratchet-wheel B′, and the train of gears 3, 4, 5, and 6 (see Fig. 2) intermediate the ratchet-wheel and take-up roll B are all of usual construction, the ratchet-wheel being actuated by a pawl b on a pawl-carrier b', operated by an eccentric b^2, driven from the lower loom-shaft $B^\times$, in the usual manner, a detent b^3 (see Fig. 1) preventing retrograde movement of the take-up.

I have provided controlling means for the take-up, to act upon and disengage the actuating-pawl from the ratchet-wheel and thereby stop or throw the take-up out of operation, said normally inoperative controlling means being rendered operative upon failure of the filling.

Referring to Figs. 1, 2, 3, and 4, a stand C is preferably mounted on the inner side of the loom-frame, and a rock-shaft c is supported in a hollow boss C′ thereon, said rock-shaft having adjustably secured thereto by a set-screw 8 the hub of an upturned rocker-arm c', bent outward at its upper end and provided with a series of notches c^2 in its upper edge. The arm is extended downward below the rock-shaft to form a toe c^3, which projects beneath a lateral lug b^4 on the side of the pawl-carrier b' opposite the pawl b, (see Fig. 6,) a suitable spring S, attached at one end to the stand C and at its other end engaging a notch 80 in the toe c^3, normally depressing the latter out of engagement with the pawl-carrier, and also maintaining the notched upper end of the arm c' in normal position, Figs. 2 and 4, the front of the toe at such time resting against a stop 84 on the stand C.

An actuator, shown as a substantially Γ-shaped arm c^5, is pivotally mounted at its lower end on a stud c^4 on the stand C, said arm being acted upon by a spring s, Fig. 4, to normally press its upper end toward the lay, the fixed end of the spring being held by a collar 81, adjustably secured to the stud c^4. A boss 82 on the inner side of the arm c^5 provides a bearing for a rock-shaft c^7, to which is secured a pawl c^6 at the outer side of the arm, a spring s', secured at one end to the boss 82 and at its other end to a collar $82^\times$, fast on the rock-shaft, tending to depress the pawl c^6 to at times engage one or another of the notches c^2 in the rocker-arm c'. A stop 16 on the pawl c^6 prevents undue movement thereof relative to the actuator c^5, with which it engages, and a stop 61, Figs. 2 and 3, on the stand C limits movement of the actuator toward the lay.

The upper inturned end of the actuator c^5 is slightly beveled at c^8, to be engaged at times by a bunter d, fast on an operating-shaft $d^\times$, mounted to rock in suitable bearings on the lay A^3, so that if the bunter is in operative position it will, as the lay moves forward, en-

gage and swing the actuator c^5 outwardly, and inasmuch as the fulcra of the said actuator and the rocker-arm c' are not concentric the pawl c^6 will engage a notch c^2 of and swing said rocker-arm c' toward the front of the loom, lifting the toe c^3 to engage the pawl-carrier b' of the take-up.

I have provided a detent for the rocker-arm to hold it when swung outwardly, as described, and to release it at the proper time, the detent being shown separately in Fig. 5 as an elbow-lever c^9, having at the end of one arm a detent-tooth c^{10} to coöperate with the notches c^2 of the rocker-arm c' and having its other arm widened at c^{12} to form a dog. This dog is in the normal path of the bunter d, so that at each forward beat of the lay the dog will be engaged and the elbow-lever rocked on its pivot c^{14}, lifting the detent-tooth c^{10} from the notches c^2 and thereby releasing the rocker-arm, the spring S returning the latter when released to position, Figs. 2 and 4, against the stop 84. At such time the tooth of the detent rests upon the part c^{13} of the rocker-arm c' at the outer end of the toothed portion, as in said Figs. 2 and 4.

The detent c^9 is fast on a stud c^{14}, rotatable in a box $C^\times$ on the stand C, and is controlled by a spring s^2, (see Fig. 4,) inclosed by and secured at one end to a collar c^{15}, attached by set-screws 85 to the stud, the other end of the spring being fixed, as to the boss $C^\times$, the spring tending to normally depress the detent toward the notched arm c'.

When the filling fails or is absent, the filling-detector, to be hereinafter described, will cause the operating-shaft $d^\times$ to be turned in the direction of arrow 15, Fig. 2, moving the bunter d into position to engage and swing the actuator c^5 when the lay moves forward, the actuator-pawl c^6 engaging and swinging the rocker-arm c' outward a distance depending upon the notch engaged. Normally the second notch from the outer end is engaged, so that the detent-tooth c^{10} will enter the outermost notch (see Fig. 3) and retain the arm in position there shown when the actuator returns to normal position as the lay goes back, the elevation of the toe c^3 disengaging the take-up pawl and ratchet-wheel, throwing the take-up mechanism out of operation. If at the next pick the filling is not properly laid in the shed, the operating-shaft $d^\times$ will cause the bunter d to operate as before, and the actuator-pawl c^6 will engage the third notch of the rocker-arm c', swinging it out far enough for the tooth c^{10} to enter the second notch, the take-up being maintained inoperative. Suppose the filling fails at the next or third pick. The actuator c^5 will be moved as before, its pawl c^6 engaging the last notch, as herein shown, of the series c^2; but it is necessary to prevent the detent-tooth c^{10} from engaging the part of the rocker-arm back of the last notch, as otherwise the rocker-arm c' would be moved too far. To obviate this result, the rocker-arm c' has on its outer side a trip c^{16} to engage the cam c^{17} on the detent c^9 below the tooth c^{10}, holding the latter from engagement with the rocker-arm until the latter moves back far enough to permit the tooth to reënter the notch from which it was lifted by the trip c^{16}.

It will now be obvious from the foregoing that the movement of the actuator by the bunter d may be repeated for an indefinite number of picks, or until the filling is properly laid in the shed, whereupon the filling-detector will permit return of the operating-shaft $d^\times$ and the bunter d to normal position. The bunter d at the forward beat of the lay will then engage the dog c^{12} and lift the detent-tooth c^{10} to release the rocker-arm c', which, through the toe c^3, controls the take-up pawl, and the latter will be returned to engagement with its ratchet-wheel, thus throwing into operation the take-up mechanism, which, it will be remembered, was rendered inoperative at the first movement of the rocker-arm, due to the initial failure of the filling. As soon as the releasing-dog c^{12} is struck by the bunter to free the rocker-arm c' the several parts of the take-up-controlling means described will return to normal inoperative position, and will so remain as long as the filling is properly laid in the shed.

As described, the loom will continue to run indefinitely while the filling fails or is absent from the shed, but it is desirable in many cases to stop the loom absolutely after a predetermined number of picks have been made with the filling improperly laid in the shed, and to this end I rigidly secure, preferably by a set-screw 9, to the outer end of the rock-shaft c a knock-off arm c^{18}, Figs. 1 and 4, extended along one side of the shipper-lever 39.

The arm c^{18} is set at such an angle with the rocker-arm c' that when the last or rearmost notch c^2 thereof is engaged by the actuator-pawl c^6 and the arm swung outward the knock-off c^{18} will engage and release the shipper-lever from the notch in the usual holding-plate $38^\times$, to thereby ship the belt and stop the loom.

By removing the knock-off the take-up and its controlling means will operate as first described.

It will be obvious that the take-up will be rendered inoperative as soon as the filling-detector detects the absence or failure of the filling, and it will remain inoperative for each and every pick in which the filling is not properly laid, so that no let-back devices are required for the take-up and no thin places will appear in the cloth, caused by operation of the take-up when no filling was being laid in the shed. As soon as the filling is properly laid the take-up will begin to operate, pick for pick, so that the operation of the take-up corresponds accurately to the presence or absence of the filling.

A bracket F, Figs. 1, 7, 8, and 9, having depending laterally-separated arms F′ and F^2, is preferably bolted to the front of the lay A^3,

at substantially the center of the shuttle-raceway, for a center filling-detector, the arm F′ being the longer and bent to extend under the lay, the arm F^2 having a bearing $F^\times$ for the operating-shaft $d^\times$. An arm d^2 is adjustably secured to the said shaft by a set-screw d', and it has thereon a roller or other stud d^3 to coöperate with a controlling-cam D, (shown separately at Fig. 11,) mounted to rock freely on a shaft d^6, held securely in the bracket-arms. The cam D is substantially S-shaped, having a reëntrant portion d^4 to receive the roll d^3, the curved face d^7 acting upon the said roll, when the cam is rotated in the direction of arrow 25, Fig. 11, to quickly swing the arm d^2 and rock the operating-shaft $d^\times$ in the direction of arrow 15, Figs. 2, 7, 8, and 9, said movement being continued more slowly by the cam-face d^8, which is eccentric to the axis of the cam. Such rotation of the shaft $d^\times$ moves the bunter d into operative position against the action of a suitable coiled spring S′, Fig. 1, fixed at one end and at its other end secured to the shaft, the force of the spring acting through the shaft and its arm d^2 upon the cam D to normally retain it in position shown in Figs. 7 and 9.

The cam D has on one side and below its center of rotation a lug or projection d^9, to be at times engaged by the upturned end $e^\times$ of a pawl or escapement e, fast on a fulcrum-stud e', pivotally mounted in a boss d^{20}, laterally extended from a pawl-carrier d^{12}. (Shown detached in Fig. 10.)

The pawl-carrier has on its outer side a hub d^{21} to receive the shaft d^6, upon which the carrier rocks, the latter having an eccentric cam-periphery d^{13} and an extension or foot d^{22}, to which is jointed at d^{14} one end of a link d^{15}, the other end of the link being pivoted at d^{16} to a stand d^{17}, secured to and extended below the breast-beam A^{40}.

The pawl e is offset beyond its fulcrum to form a curved cam-arm e^2, preferably beveled at its extremity, as at e^3, the arm being normally held against the cam-periphery d^{13} of the pawl-carrier, as in Figs. 7, 9, and 10, by a spring s^3, Fig. 9, fast to the carrier at one end and at the other end secured to a collar 87 on the stud e'. When the lay beats up into position Fig. 8, the pawl-carrier d^{12} is by the link d^{15} rocked into the position shown in said figure, carrying with it the pawl e, and if the latter is not rocked on its fulcrum e' its toe $e^\times$ will fail to engage the lug d^9 on the cam D, the latter then failing to rock the operating-shaft $d^\times$, and unless the filling fails the pawl will not be rocked on its carrier.

The bracket F has at its top a projecting open shelf F^3, opposite a transverse pocket or recess A^{30} in the raceway of the lay, and over the top of which pocket the filling l, Fig. 9, passes when properly laid, said pocket receiving the filling-detector, to be described, when the filling fails.

The filling-detector is herein shown as a series of thin and preferably flat metal tines f, extended up through the open shelf F^3, their lower ends being secured to a holder f', (see Fig. 1,) journaled in depending bearings f^2 on the shelf and having fast thereon a wrist-plate f^3, notched at f^4 and provided with a wrist-pin f^5. A link f^6 is pivoted on the wrist-pin at one end, and at its other end said link is pivoted to a controlling-lever f^7, fast on a short shaft $f^\times$, mounted to rock in a bearing in the bracket-arm F^2 and controlled by an attached spring s^4, the other end of which is fixed to the arm, as best shown in Fig. 9, said spring acting upon the lever f^7 to normally lift the link f^6 and depress the detector f. The rear end of the lever f^7 has at one side a beveled lug or toe f^8, which is adapted to either ride over the exterior of the arm e^2 or to enter between said arm and the cam-surface d^{13}, in the latter case the toe f^8 acting to turn the pawl e on its carrier and bring the end $e^\times$ into engagement with the projection d^9 of the cam D. A stop-pin 90 enters the notch of the wrist-plate f^3 and limits the undue rocking movement of the detector in either direction.

Upon the outer side of the pawl-carrier d^{12}, as herein shown, is pivotally mounted a dog g, (best shown in Figs. 9 and 10,) controlled by a spring s^5 and normally held thereby with its tail g' against the hub d^{21} of the carrier, as in full lines, Fig. 10, the curved upper end g^2 being eccentric to the axis of rotation d^6 of the carrier. This dog is in the path of a projection f^{10} on the outer side and back of the fulcrum of the lever f^7, and if the loom has been running properly the dog g will act upon and hold the lever in the position shown in Fig. 7 when the lay is moving back and almost at the end of its stroke, the detector being raised to permit the passage of the shuttle. When the lay is all the way back, the dog will pass beyond the lug f^{10}, releasing the "controlling-lever" f^7, as it may be termed, to leave the detector f free to be depressed by its controlling-spring s^4 to feel for the filling t, and if the latter is present the detector will be held in dotted-line position f^{100}, Fig. 7, as the lay moves forward, with the toe f^8 of the selecting-lever in dotted-line position f^{80}, Fig. 7, it being remembered, however, that the dog g is behind the lug f^{10}. As the lay moves forward the pawl-carrier d^{12} is rocked, as described, and the controlling-spring s^5 of the dog g permits the latter to turn, as in dotted lines, Fig. 10, and wipe under the lug f^{10} on the controlling-lever, and when past said lug the toe f^8 of the controlling-lever will ride over the outer side of the curved arm e^2, so that the pawl e will not be moved relatively to its carrier, and consequently the cam D will not be rocked, the operating-shaft $d^\times$ remaining in normal position and failing to cause any operation of the take-up-controlling means. The arm e^2 is so curved from its tip that it acts to slightly elevate the rear end of the lever f^7 and through the connections also elevates the detector f into rela-

tive dotted-line position f^{200}, Fig. 7, away from the filling *t* to avoid crinkling or stretching it by engagement of the detector as the lay beats up. The detector is thus positively moved toward and to detect the filling if present, and if it is present the detector is subsequently moved positively away from the filling as the lay beats up, relieving the said filling from any strain due to the detector. Now if the filling fails the detector will move from full-line position, Fig. 7, when the controlling-lever f^7 is released by the dog *g*, and as there will be no obstacle to prevent the detector will enter the depression A^{30} in the lay, such position of the detector being shown in Fig. 8, and the toe f^8 of the controlling-lever will be correspondingly depressed to pass beneath the beveled end of the arm e^2 and between it and the cam-periphery d^{13} of the pawl-carrier. As the carrier d^{12} is turned on its fulcrum in the forward movement of the lay the toe f^8 acts to rock the pawl *e* and move its end $e^\times$ into position to engage the lug d^9 of and turn the cam D, the latter thereafter being positively rocked in unison with the pawl-carrier d^{12} into the position shown in Fig. 8, the lay being fully forward.

The rocking of the cam D causes the face d^7 to act first upon the roll d^3 and swing the arm d^2 rapidly, giving thereby a rapid initial movement to the operating-shaft $d^\times$, the better to overcome the inertia of the parts, and thereafter the cam-face d^8, acting upon the roll d^3, completes the rotative movement of the operating-shaft, but more slowly, such movement of said shaft bringing the bunter *d* into operative position to engage and move the actuator c^5 of the take-up-controlling means described. When the lay moves back, the several parts carried by the bracket F return to their respective normal positions, the dog *g* passing under the lug f^{10} and rocking the controlling-lever f^7 to move the detector *f* into position shown in Fig. 9, the spring S′ of the operating-shaft $d^\times$ returning the latter and, through the arm d^2 and its roll, the cam D to normal position.

It sometimes happens that the filling will not be properly laid for several picks, and at each of such picks the detector will act, as described, to cause the rocking of the shaft $d^\times$ and the operation of the take-up-controlling means.

When the lay is moving back from the position shown in Fig. 8 after detection of a failure or absence of the filling, the controlling-lever f^7 is released from between the arm e^2 and the pawl-carrier in time to permit the dog *g* to rock said lever and lift the toe f^8 into position to be moved at the next pick into position to be acted upon by either the arm e^2 or the cam d^{13}, accordingly as the filling is properly present in the shed or is absent therefrom, respectively.

It will be seen that the distance between the path of the filling and the fulcrum of the detector is considerably greater than the distance between said fulcrum and the wrist-pin f^5, so that the greater leverage exerted on the detector by the filling is sufficient to overcome the resistance of the detector-actuating spring s^4, the latter being only strong enough to depress the detector into the recess A^{30} when unobstructed by the filling.

Should the filling break at any point between the shuttle-boxes, the relaxation of tension upon it would permit the detector to enter the recess and stop the take-up on that pick of the loom.

In a loom provided with automatic filling-supplying mechanism, as in said patent referred to, a fresh filling-carrier is inserted in the shuttle when the latter enters the shuttle-box adjacent such mechanism, and on the next shot of the shuttle if the filling is properly laid the detector herein described will detect the same and the take-up will be automatically thrown into operation.

The advantages of a center detector will be obvious, and in this my present invention, while I cannot prevent the formation of a pick with the filling only part way across the cloth, I can prevent the formation of any subsequent pick without any filling whatever therein, so that thin places are prevented and the product of the loom greatly improved.

My invention is not restricted to the precise construction, operation, and arrangement of parts herein shown, as it is obvious that the same may be modified or altered in various particulars without departing from the spirit and scope of my invention.

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

1. In a loom, the lay, a filling-detector centrally mounted thereon, means controlled by movement of the lay to cause said detector to detect the presence or failure of the filling; a bunter on the lay, and connections between it and the detector, to move said bunter into operative position upon failure of the filling, combined with take-up mechanism, controlling means therefor actuated by the bunter when in operative position, and an independent device actuated by the bunter when in normal position, to render said controlling means inoperative, substantially as described.

2. In a loom, the lay, a filling-detector thereon, and a bunter controlled by said detector, combined with take-up mechanism, including a ratchet-wheel and actuating-pawl, and controlling means therefor including a notched rocker-arm having a toe to engage the actuating-pawl, a swinging actuator eccentric to said rock-arm and provided with a pawl to engage the notches of the rocker-arms successively, and springs to return the rocker-arm and actuator to normal position, the actuator being swung in opposition to its spring by the bunter when in abnormal position due to failure of the filling, whereby the take-up is rendered inoperative during failure of the filling, substantially as described.

3. In a loom, the lay, a filling-detector thereon, means to positively move it to detect the filling, a controlling device for said means, operated by movement of the lay, and a bunter moved by or through said detector into operative position upon failure of the filling, combined with take-up mechanism, and controlling means therefor including a notched rocker-arm, and an actuator provided with a pawl to engage the notches thereof successively, said actuator being moved at each beat of the lay by engagement with the bunter when in operative position, substantially as described.

4. In a loom, the lay, a filling-detector mounted thereon, a bunter, and connections between it and the detector, combined with take-up mechanism, controlling means therefor, operated by the bunter when in operative position, to stop the take-up, and an independent device controlled by said bunter when in normal position to render the controlling means inoperative, substantially as described.

5. In a loom, the lay, a filling-detector mounted thereon and operative by movement of the lay to detect the filling, combined with take-up mechanism, normally-inoperative controlling means therefor to stop the take-up, a bunter controlled by the detector, to actuate said means upon failure of the filling, and a detent to maintain said means operative, the bunter when in normal position due to subsequent presence of the filling coöperating with the detent and releasing said controlling means substantially as described.

6. In a loom, the lay, a filling-detector thereon, and a bunter controlled as to its position by said detector, combined with take-up mechanism, means actuated by the bunter when in abnormal position due to failure of the filling, to stop the take-up, and independent means actuated by said bunter upon its return to normal position to release the take-up, substantially as described.

7. In a loom, the lay, a bunter thereon, means operative upon failure of the filling to move the bunter into abnormal position; take-up mechanism, including an actuating-pawl, a notched rocker-arm to render it inoperative, an actuator for said arm, adapted to be engaged and moved at each pick by the bunter when in abnormal position, a detent to engage successive notches of said arm at successive picks, and a releasing-dog on the detent, engaged by the bunter when returned to normal position, to thereby throw the take-up pawl into operation, substantially as described.

8. In a loom, the lay, a bunter thereon, means to control its position upon failure of the filling; take-up mechanism, and normally-inoperative controlling means therefor, said means including a device to throw the take-up out of operation when acted upon by the bunter, and a detent to maintain the take-up inoperative, said controlling means being rendered inoperative by the bunter when returned to normal position, releasing the detent, substantially as described.

9. In a loom, the lay, and a normally-inoperative bunter thereon and means to move it into operative position upon failure of the filling, combined with take-up mechanism, a device to render it inoperative, said device being actuated by the bunter in abnormal position, and a detent to maintain the said device operative, the bunter when in normal position acting to render the detent inoperative, substantially as described.

10. In a loom, the lay, a filling-detector mounted thereon, means to positively move it to detect the filling, a bunter, controlling means therefor, a pawl and its carrier, rocked at each beat of the lay, and a device controlled by the position of the detector, to move the pawl relatively to its carrier and thereby operate the bunter-controlling means when the filling fails, substantially as described.

11. In a loom, the lay, a rock-shaft mounted thereon and provided with a bunter, a normally-inoperative bunter-cam, connections between it and the rock-shaft, a pawl-carrier mounted on and rocked by movement of the lay, a pawl on said carrier, a filling-detector, and connections between it and the pawl to cause the latter to engage and operate the bunter-cam upon the failure of the filling, whereby the bunter is moved into operative position, substantially as described.

12. In a loom, the lay, a filling-detector pivotally mounted thereon, a carrier on and rocked by movement of the lay, a cam-arm pivoted on said carrier and normally resting against its periphery, a device controlled by the position of the detector and having a toe to be engaged by either the cam-arm or by the periphery of the carrier, engagement thereof with the cam-arm acting to lift the detector from the filling after detection thereof, substantially as described.

13. In a loom, the lay, a filling-detector and a bunter mounted thereon, a normally-inoperative bunter-cam, a pawl-carrier rocked by movement of the lay, a cam-actuating pawl pivoted on the carrier, and connections between the detector and pawl, to move the latter to engage and actuate the bunter-cam upon failure of the filling, substantially as described.

14. In a loom, the lay, a filling-detector and a bunter mounted thereon, a normally-inoperative bunter-cam, a pawl-carrier rocked by movement of the lay, a cam-actuating pawl pivoted thereon, having a cam extension normally adjacent the periphery of the pawl-carrier, a lever adapted to normally travel upon said extension, to lift the detector from the filling, and connections between said lever and the detector, whereby upon failure of the filling the said lever will move the pawl to engage and operate the bunter-cam, substantially as described.

15. In a loom, the lay, a spring-controlled

filling-detector and a bunter mounted thereon, a bunter-cam, a pawl-carrier rocked by movement of the lay, a cam-actuating pawl pivoted thereon, a lifting-dog for the detector also mounted on said carrier, and connections between the detector and pawl, to move the latter into engagement with and to actuate the bunter-cam upon failure of the filling, the lifting-dog acting upon said connections on the backward stroke of the lay to lift the detector for the passage of the shuttle, substantially as described.

16. In a loom, a filling-detector, means to positively move it across the path of the filling, to detect presence or absence thereof, and independent means to give the detector an auxiliary movement away from the detected filling, to avoid stretching or crinkling the latter, substantially as described.

17. In a loom, the lay, a filling-detector mounted thereon, an actuating-spring to positively move said detector toward and to detect the filling, connections, including a lever, between the detector and its spring, and means controlled by movement of the lay to rock said lever and thereby quickly raise the detector from the detected filling, substantially as described.

18. In a loom, the lay, a rock-shaft thereon having a bunter and a rocker-arm, a normally loose bunter-cam in engagement with said arm, a filling-detector and means operative upon failure of the filling to rock the bunter-cam and move the bunter into operative position, substantially as described.

19. In a loom, the lay, take-up mechanism, a controlling-bunter and its rock-shaft, mounted on the lay, a filling-detector, a spring to move it toward and to detect the filling, a bunter-cam, actuating means therefor moved by the lay and operative upon failure of the filling, and a device operated by said means to quickly move the detector in opposition to its spring away from the filling after detection thereof, substantially as described.

20. In a loom, the lay, a filling-detector mounted thereon, a spring to move the detector across the path of the filling, means to raise the detector on the backward beat of the lay to permit the passage of the shuttle, and independent means to give a secondary lifting movement to the detector away from and after detection of the filling, substantially as described.

21. In a loom, a filling-detector, means to positively move it across the path of the filling, to detect presence or absence thereof, a stop to limit the throw of said detector, and means operated by the movement of the lay to give the detector an auxiliary movement away from the detected filling, to avoid stretching or crinkling the latter, substantially as described.

22. In a loom, the lay, a filling-detector and a bunter mounted thereon, and means actuated by movement of the lay and operative upon failure of the filling, to move the bunter into abnormal position, combined with stopping mechanism for the loom, and controlling means therefor, actuated by the bunter when in abnormal position, to stop the loom after failure of the filling for a predetermined number of picks, substantially as described.

23. In a loom, the lay, a filling-detector and a bunter mounted thereon, means actuated by movement of the lay and operative upon failure of the filling, to move the bunter into abnormal position, and stopping mechanism for the loom, combined with a knock-off arm for said mechanism, and step-by-step operating means for said arm, actuated by the bunter when in abnormal position, to stop the loom after failure of the filling for a predetermined number of picks, 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.