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R. CROMPTON & H. WYMAN.

LOOM.

No. 600,490. Patented Mar. 8, 1898.

Fig. 1.

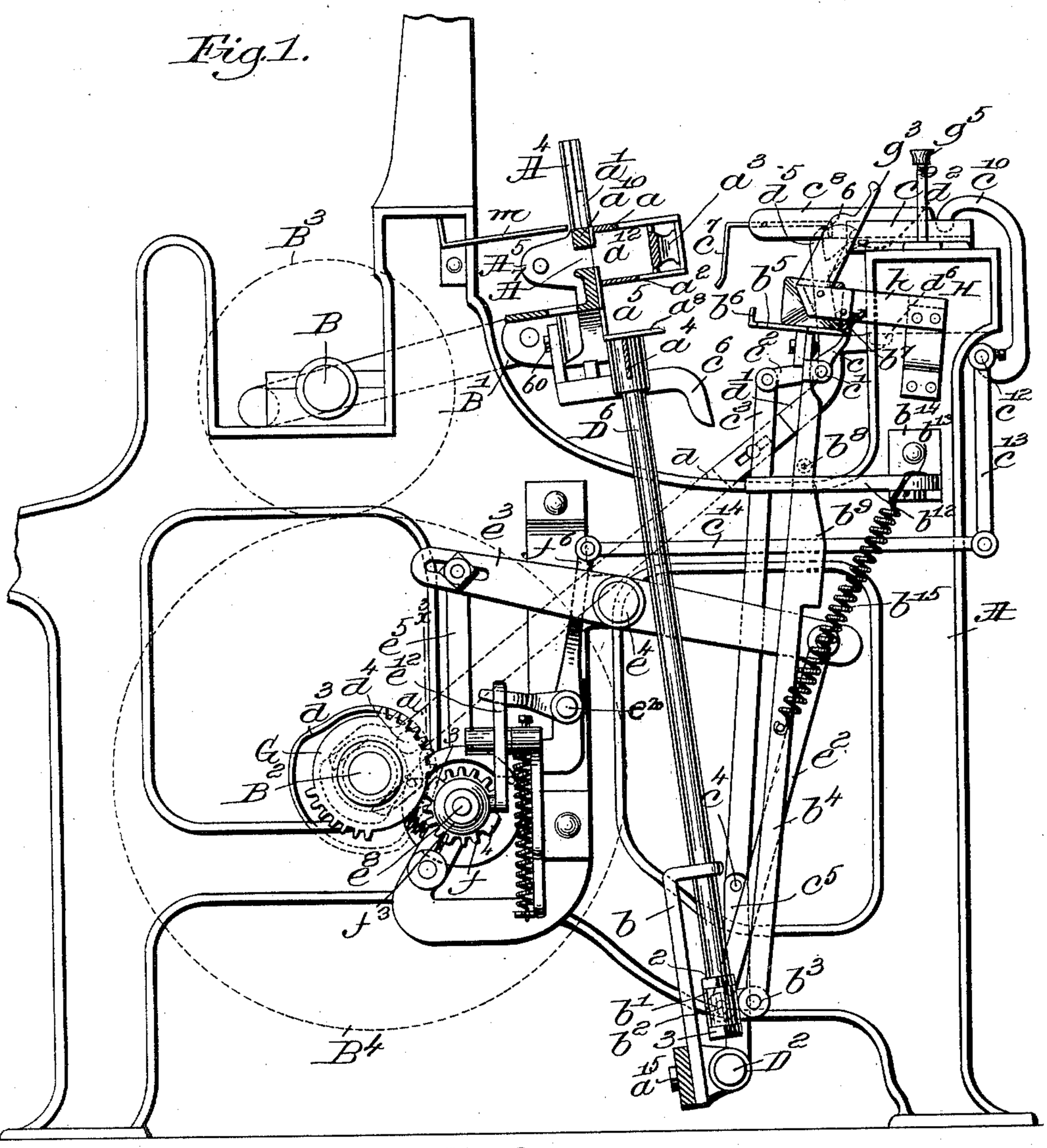
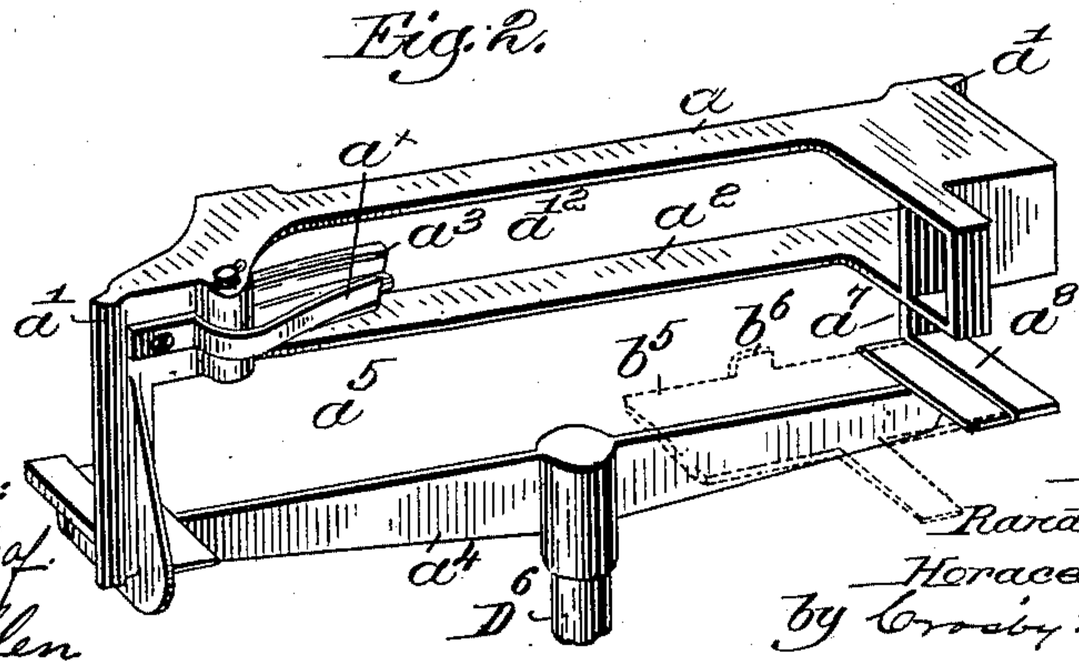


Fig. 2.



Witnesses:
Fred. S. Grundy.
Edward F. Allen

Inventors:
Randolph Crompton.
Horace Wyman.
By Crosby & Gregory Attys.

(No Model.) 4 Sheets—Sheet 2.

R. CROMPTON & H. WYMAN.

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Fig. 3.

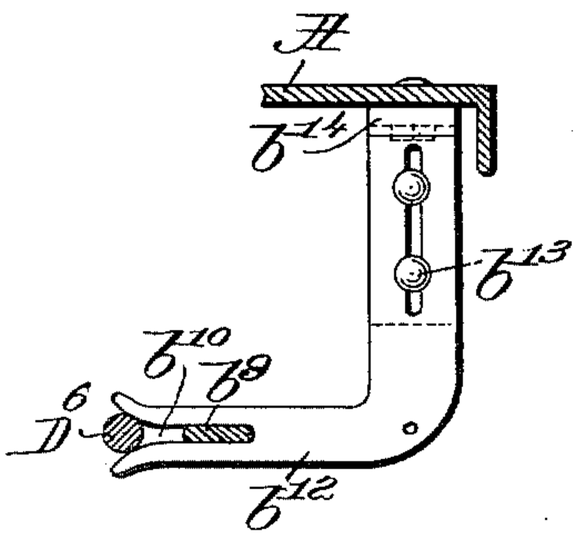


Fig. 4.

Fig. 5.

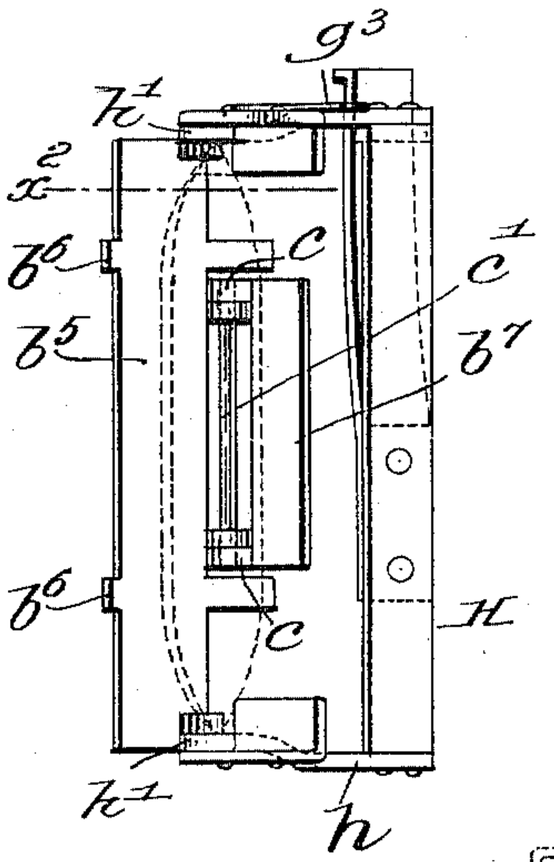


Fig. 5a.

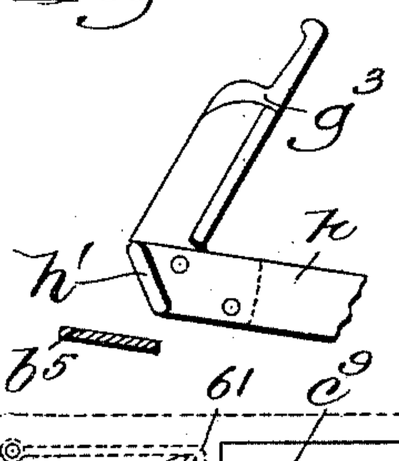
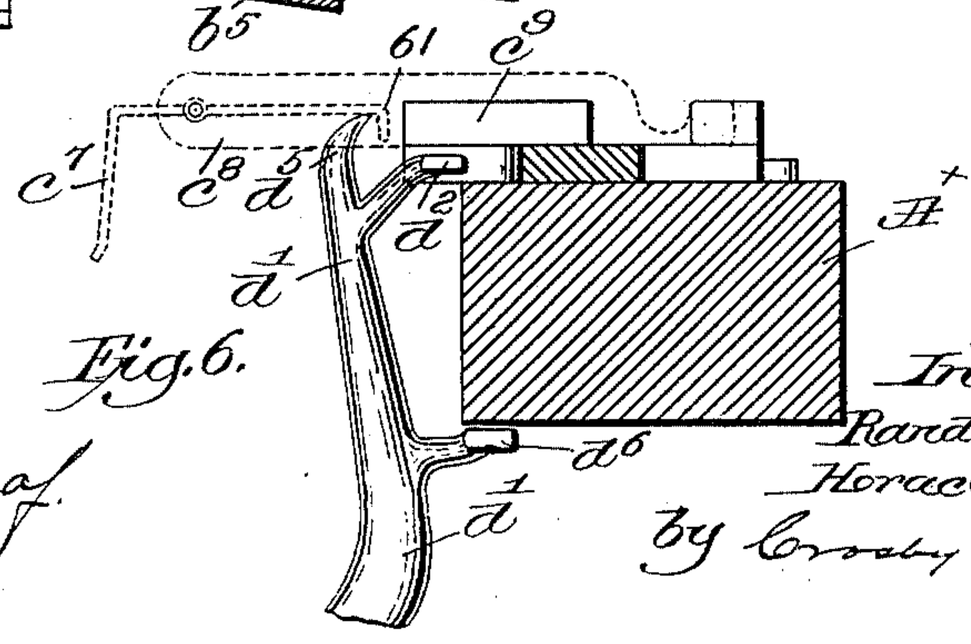


Fig. 6.



Witnesses:
Fred S. Grundlof.
Edward F. Allen.

Inventors:
Randolph Crompton.
Horace Wyman.
By Crosby & Gregory
Attys.

(No Model.) 4 Sheets—Sheet 3.

R. CROMPTON & H. WYMAN.

LOOM.

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Fig. 7.

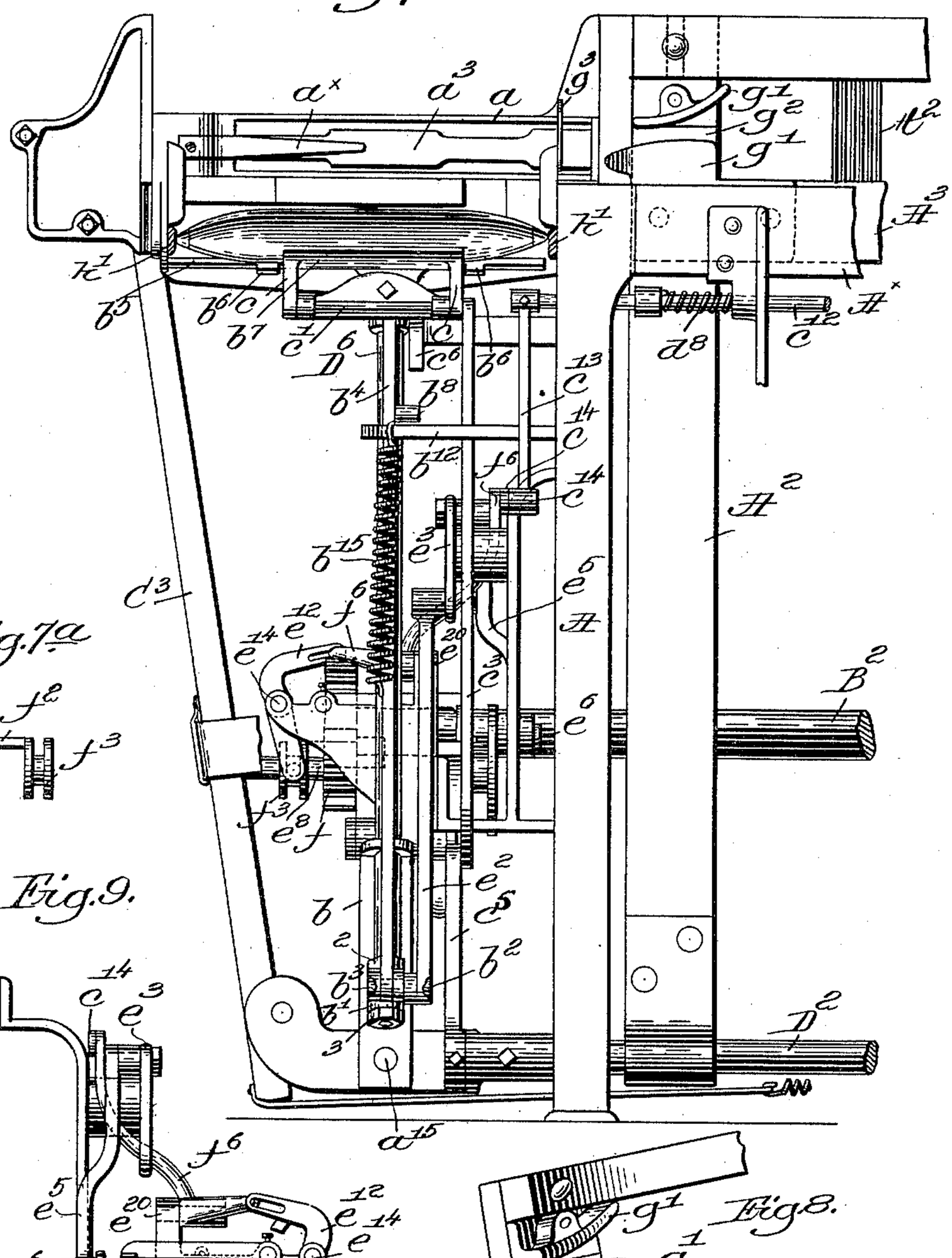
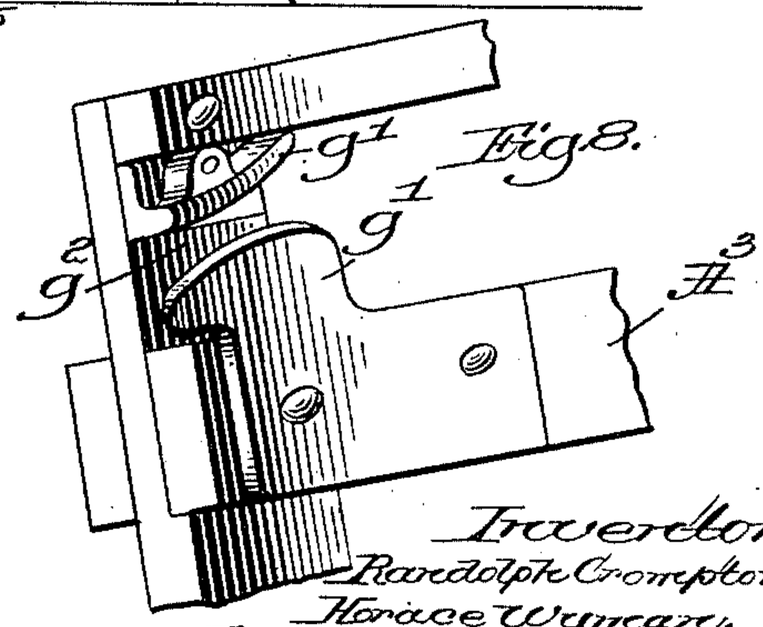


Fig. 7a.

Fig. 9.

Fig. 8.



Witnesses:
Fred. L. Gunnell
Edward F. Allen

Inventors.
Randolph Crompton.
Horace Wyman.
By Crosby & Gregory Attys.

(No Model.) 4 Sheets—Sheet 4.

R. CROMPTON & H. WYMAN.

LOOM.

No. 600,490. Patented Mar. 8, 1898.

Fig. 10.

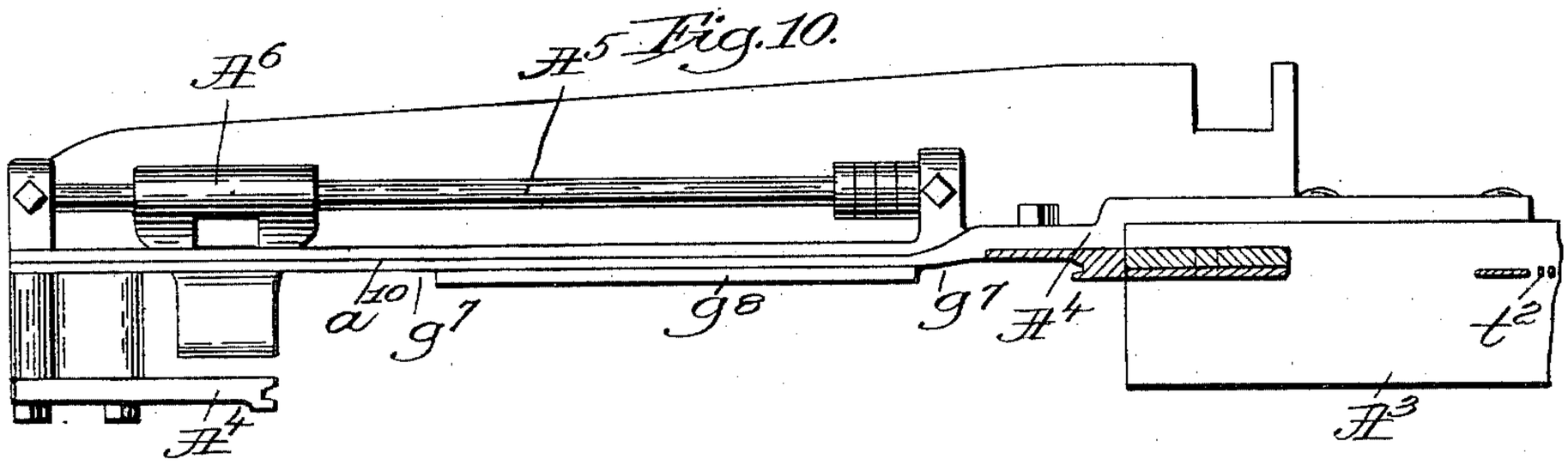


Fig. 11.

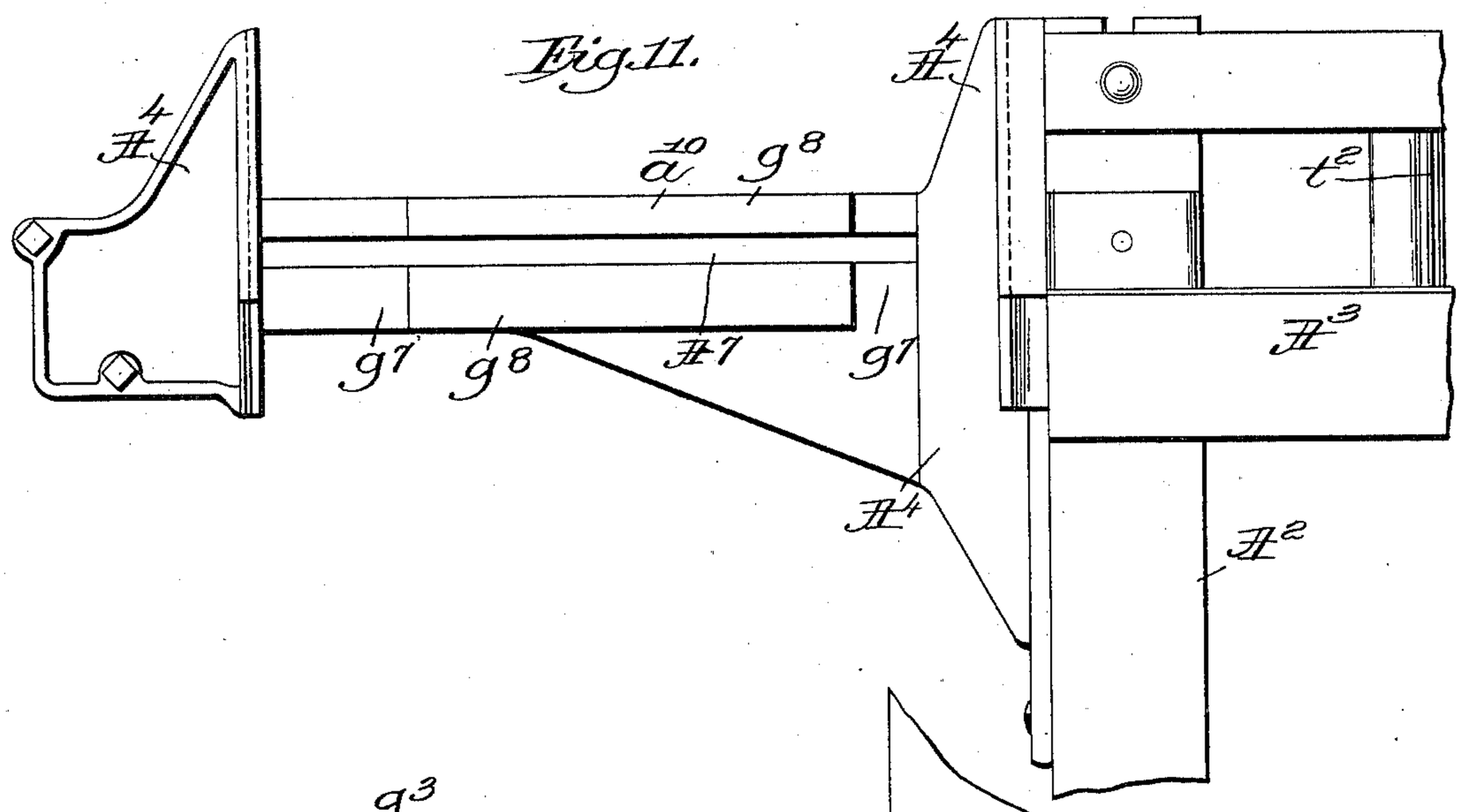
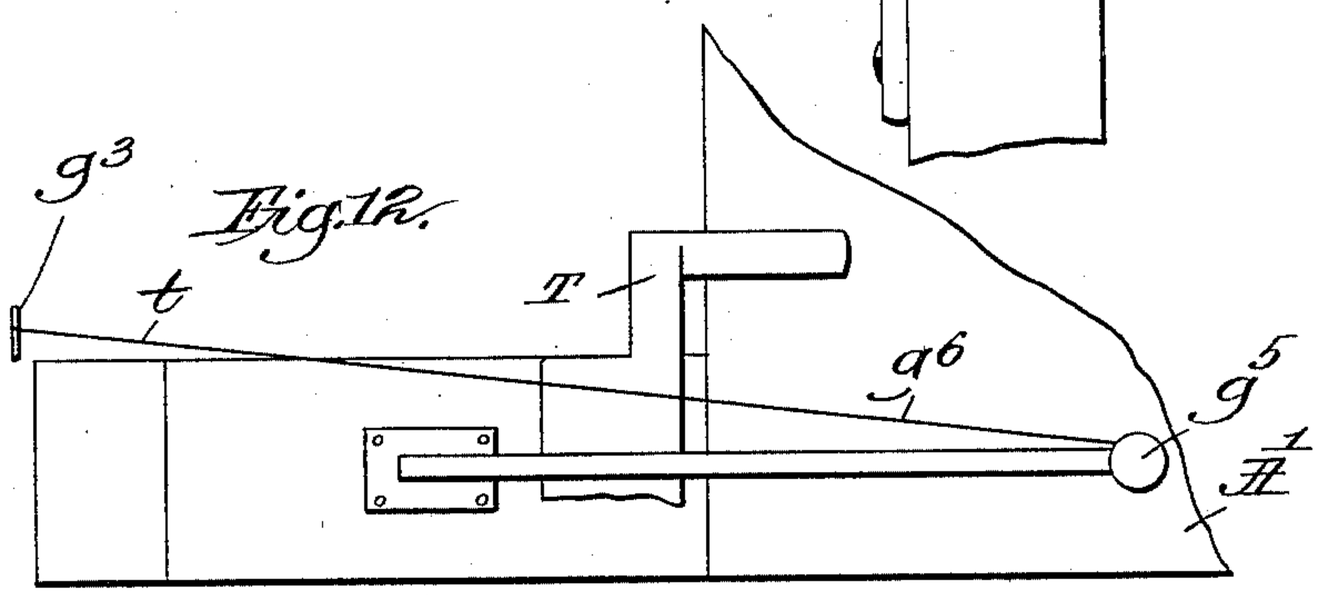


Fig. 12.



Witnesses:
Fred. L. Emerlaf.
Edward F. Allen.

Inventors.
Randolph Crompton.
Horace Wyman.
by Crosby & Gregory Attys.

UNITED STATES PATENT OFFICE.

RANDOLPH CROMPTON AND HORACE WYMAN, OF WORCESTER, MASSACHUSETTS, ASSIGNORS TO THE CROMPTON & KNOWLES LOOM WORKS, OF SAME PLACE AND PROVIDENCE, RHODE ISLAND.

LOOM.

SPECIFICATION forming part of Letters Patent No. 600,490, dated March 8, 1898.

Application filed August 2, 1897. Serial No. 646,743. (No model.)

To all whom it may concern:

Be it known that we, RANDOLPH CROMPTON and HORACE WYMAN, of Worcester, county of Worcester, and 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.

This invention has for its object the production of a novel loom by which when the filling is broken or at fault in the shuttle used that the absence of the filling in the shed will immediately call into operation the devices which will supply upon the race of the lay a spare shuttle. This spare shuttle in this our present invention while the loom is running properly is supported upon a suitable feeding device held in its inoperative position near the breast-beam, and as soon as the filling fails and the failed shuttle gets back into its running shuttle-box the latter is lifted into its inoperative or abnormal position, so that the failed shuttle may be discharged through the open side of said running shuttle-box; but prior to the lifting of the said running shuttle-box into its inoperative position the shuttle-feeding device has been moved forward toward the advancing lay and has entered, preferably, a feeding-cell connected with the under side of the running shuttle-box, so that said shuttle-feeding device is raised positively with the running shuttle-box until the spare shuttle carried by it is put at the level of the race of the lay, when the spare shuttle is immediately picked or shot from the shuttle-feeding device onto the race of the lay. Before, however, the spare shuttle so put upon the race of the lay returns the running shuttle-box, its failed shuttle having been discharged from it, drops into its operative position to receive on its return stroke the spare shuttle just put upon the race of the lay, that shuttle continuing to run and weave so long as the filling is intact. The running shuttle-box in this instance of our invention has attached to it a box-rod, and said box-rod is raised and lowered by suitable box-rod or shuttle-box shifting or moving devices. The time of operation of the box-rod-shifting device may be determined wholly by or through the action of the filling-fork, it being operated only after the failure of the filling in the shed.

The particular features in which our invention consists will be hereinafter more fully described, and designated in the claims at the end of this specification.

Figure 1 is a left-hand end view of a sufficient portion of a loom with our improvements added to enable our invention to be understood, the shuttle-box guideway and the running shuttle-box being in section. Fig. 2 is an enlarged detail of the running shuttle-box detached from the lay, the dotted line showing a part of the shuttle-feeding device in its operative position in the feeding-cell of the running shuttle-box. Fig. 3 is a detail showing the guide for the lever of the spare-shuttle-feeding device. Fig. 4 is a sectional detail showing the running shuttle-box lifted into its abnormal or inoperative position, it showing the spare-shuttle-feeding device in the feeding-cell of the running shuttle-box. Fig. 5 is a detail in top or plan view showing the positioning device for the spare shuttle and the spare-shuttle-feeding device under it in position to receive a shuttle, as represented in dotted lines in that figure. Fig. 5^a is a section to the right of the dotted line x^2, Fig. 5. Fig. 6 shows the filling-fork mounted on the breast-beam and part of the filling-fork-operating device. Fig. 7 is a partial front elevation of the loom. Fig. 7^a shows the sliding gear detached from the shifting shuttle-box mechanism. Fig. 8 is a detail showing part of the lay and its attached slotted mouthpiece; Fig. 9, a detail to the right of the dotted line x^3, Fig. 1, showing the shuttle-box-shifting mechanism. Fig. 10 shows a top view of the shuttle-box guideway and part of the lay and reed, the latter being in horizontal section; Fig. 11, a detail showing the inner side of the shuttle-box guideway and part of the lay. Fig. 12 is a detail in plan view to show the location of the stud for holding the free end of the spare-shuttle thread.

The loom-frame A, the breast-beam $A^\times$, the lay A^2, its raceway A^3, the shuttle-box guideway A^4, the lay rock-shaft D^2, the crank-shaft

B, the links B′, connecting it with and to vibrate the lay; the gears B^3 and B^4, (represented only by dotted lines,) the gear B^3 being fast on the crank-shaft and the gear B^4 fast on the cam-shaft B^2; the mutilated gear G, fast on the end of said cam-shaft and engaging at intervals the tooth 3 of the leg f^2 of a sliding toothed gear f^3 (represented in detail in Fig. 7^a and in end view in Fig. 1) to start the shaft e^8, said leg entering a notch in a partial gear f, fast on said shaft e^3, it having at its end a crank-pin e^6, which is adjustably connected by a link e^5 with one end of a lever e^3, pivoted at e^4 and having at its other end a link e^2, pivoted on a stud b^2, extended from a collar on the box-rod D^6; the lever e^{12}, pivoted at e^{14} and adapted to be moved at proper times by a lever f^6, pivoted at e^{20}, to thus slide the said sliding toothed gear f^3 in order that the said crank-shaft e^8 may be moved intermittingly for a half-rotation and be then stopped, and again moved for a half-rotation and stopped, such movement of said shaft effecting the raising of the running shuttle-box and then its lowering, and the picker guide-rod A^5, the picker A^6, it being adapted to slide in the slot A^7 of the shuttle-box guideway, are and may be all substantially as shown in our application, Serial No. 646,742, filed August 2, 1897, so need not herein be further described. Herein the running shuttle-box a (see Fig. 2) has ears a', which enter and slide in grooves of said guideway, and said running shuttle-box has a binder a^3, acted upon by a spring $a^\times$.

The running shuttle-box herein shown has added to its under side a cross-bar a^4, leaving between it and the under side a^2 of the running shuttle-box what we have denominated a "feeding-cell" a^5, the inner end of said cell (see the right of Fig. 2) being connected with the shelf a^2 by a finger a^7, leaving an open end or loop-like passage a^8, through which the spare shuttle to be supplied to the race of the lay is passed at the proper times onto the said lay.

The picker may be actuated in any usual or suitable manner by any usual or suitable picker-stick C^3—such, for instance, as common in the application referred to.

A shuttle is supplied to the race of the lay through the open-end passage a^8 of the feeding-cell when the running shuttle-box is in its inoperative or abnormal position, (shown in Fig. 4,) and in such position it will be understood that the bottom a^2 of the running shuttle-box has been lifted flush with the top bar a^{10} of the shuttle-box guideway, said bar forming the top of the picker-slot A^7, and in such position of the running shuttle-box its open side a^{12} is fully exposed and uncovered to thereby permit the discharge through said open side of the shuttle in which the filling has failed, said shuttle being discharged therefrom onto a suitable failed-shuttle receptacle m, located at the loom side.

The box-rod D^6 is passed through a suitable hole in a box-rod guide b, fast upon the rock-shaft D^2 of the lay, by a suitable set-screw a^{15}, and at or near its lower end the said box-rod is provided with two suitable studs b^2 and b^3, said studs being in this present instance of our invention extended from a knuckle or sleeve b', held in place between two nuts 2 3.

The stud b^2 has connected to it the link e^2, which is joined to the front end of the box-lever e^3 before referred to, this latter lever and its operative parts before described, including the link e^5, crank-shaft e^8, and means to rotate the same intermittingly, constituting box-rod or shuttle-box shifting mechanism to raise and lower the shuttle-boxes and spare-shuttle feeder, to be described, and instead of the peculiar shifting mechanism herein referred to we may use any other well-known shifting mechanism capable of operating the lever e^3 or other usual connection attached to the box-rod to impart movement to said box-rod up and then down and leave the same at rest until the filling again fails in the running shuttle-box.

The stud b^3 is used to connect the spare-shuttle-feeding device with the box-rod, so that it may be raised and lowered with it, said spare-shuttle feeding device as represented in this present invention being composed of a lever b^4, having at its upper end a shelf or carrier b^5, which may have at one edge one or more lips b^6. At the rear side of said shelf we have mounted a pusher b^7, to be described, it also acting at times as a binder. This lever b^4 has at one side a roller or other stud b^8, and said lever may have connected with it below said stud a wedge-shaped block 9^9, said lever being free to play back and forth in a slot b^{10} of a guide b^{12}, said guide being adjustably attached by suitable bolts b^{13} to a stand b^{14}, connected with the loom side.

In Fig. 1 the spare-shuttle feeding device is represented in its inoperative position, and it will be seen that the lever b^4 is held back in the slot of the said guideway with the wedge-shaped projection b^9 below the under side of said guide by a spring b^{15}, connected with a part of the loom side and with a pin on the said lever, said spring holding said lever and spare-shuttle feeder in its inoperative position.

The pusher or binder b^7 is carried by arms c, mounted upon a suitable pivot or rock-shaft c', located below the shelf or carrier b^5, said rock-shaft having a second arm c^2, to which is jointed a link c^3, the lower end of said link being attached to an arm c^5, fixed to the lay rock-shaft D^2.

The shuttle-box guideway has attached to it by a suitable bolt 60 a downturned projection c^6, it coöperating with the roller or other stud b^8 of the lever b^4 and constituting what is herein denominated as a "locking device" for the shuttle-feeding device.

The filling-fork c^7 is pivoted upon a filling-fork slide-bar or carrier c^8, which may be of any usual or suitable construction, it being

adapted to slide or move transversely on the breast-beam, it being herein shown as moved in a guideway c^9, secured to said beam, and when the filling-fork is not tipped by the presence of filling in the shed the said filling-fork slide will be moved backwardly, as will be described, the backward movement of said slide-bar acting upon an arm c^{10}, fixed to a rock-shaft c^{12}, extended across the loom from one to its other side, turning said rock-shaft and causing an arm c^{13} connected therewith to be moved toward the left in Fig. 1, said arm in its movement acting through a link c^{14}, connected to the lever f^6, pivoted at e^{20}, to turn said lever, causing it to act upon and turn the lever e^{12}, thus shifting the sliding gear referred to to put its tooth 3 on the leg f^2 in line with the gear G to immediately start in motion said shaft e^8, it in its rotation immediately causing the box-rod to be started upwardly. The box-rod is started in its upward movement at that forward beat of the lay next following the operation of the filling-fork due to the failure of the filling, and with it is also started the lever b^4 of the spare-shuttle-feeding device, and in its rising movement the wedge b^9 of said lever acts against the inner end of the slot in the guideway b^{12}, causing said lever to be moved toward the forwardly-moving lay, so that the projecting shelf or carrier of the shuttle-feeding device enters the feeding-cell under the running shuttle-box and places the spare shuttle in said cell, and at the same time the roller or other stud b^8 of the lever b^4 passes behind the locking device c^6 and locks the feeding device firmly in place with the running shuttle-box, (see Fig. 4,) this all happening substantially as the lay arrives at the end of said second forward stroke. While the shuttle-feeding device with its shuttle is so released that the feeding device enters the feeding-cell of the running shuttle-box, the lay goes back, and the box-rod is then further raised to put the running shuttle-box in its inoperative position and permit the failed shuttle therein to be discharged from the rear open side of said running shuttle-box, and at the same time the spare-shuttle-feeding device, it lying in the said feeding-cell, is put into proper position with relation to the raceway of the lay to enable the picker at its next stroke to act and throw the spare shuttle from the spare-shuttle-feeding device and the feeding-cell onto the race of the lay, it being understood that the failed shuttle, as soon as the weft-fork operated at the opposite end of the loom to start the movement of the box-rod-shifting mechanism, came back into the running shuttle-box, so that said running shuttle-box, when it was elevated into its inoperative position, as just described, contained said failed shuttle ready to be discharged. The spare shuttle having been thrown from the shuttle-feeding device and feeding-cell at the said backward movement of the lay, the said box-rod is quickly lowered, this being done as the lay goes forward, and in its downward movement the roller or other stud b^8 passes out from its engagement with the locking device, and the spring b^{15} immediately assumes control of the lever b^4, again putting the spare-shuttle-feeding device in its inoperative position, leaving the running shuttle-box at the level of the race of the lay, so that as the lay is next moved backwardly the spare shuttle just thrown upon the race may be received in said running shuttle-box.

Herein it will be noticed that the box-rod-shifting device is not controlled as to its movements by or through a pattern mechanism, nor is it controlled as to its time of movement by or through the movement of the box-rod or device carrying the spare shuttle, but is controlled directly by or through the filling-fork and the movement of said fork after the failure of the shuttle to leave filling in the shed.

We believe we are the first to control the time of starting and stopping the movement of the box-rod-shifting gearing entirely by or through the filling-fork, and therefore this invention is not limited to the exact means herein shown for effecting such control; but instead we may employ any other usual or well-known suitable mechanism, as it will be obvious that the connections between the filling-fork and the box-rod or shifting shuttle-box mechanism may be variously modified with only the skill of the mechanic and without the exercise of invention.

We have attached to the end of the loom a shuttle-positioning device H, it consisting, essentially, of a bar having two extended arms h, having inclines h', upon which may rest the tips of a spare shuttle. (Shown by dotted lines in Fig. 5.) Said shuttle may be laid by hand upon the shelf or carrier b^5 of the spare-shuttle-feeding device when the latter is held stationary, as shown in Fig. 1, in its inoperative position, and in such position the pusher b^7 stands between the said arms and next the spare shuttle at its side nearest the breast-beam.

When the spare-shuttle feeder is raised and moved to the left in Fig. 1 to be coupled with and moved with the lay, the change of position of the lever b^4 causes the link c^3 to turn the rock-shaft c' and move the pusher, so that it acts against the said spare shuttle and pushes it in advance of it into the open space a^5, constituting the receiving-cell.

The filling-fork is herein shown as located at that end of the loom opposite where the spare shuttle is supplied to the shed, and this filling-fork is herein shown as operated by novel mechanism in a novel manner. For instance, we employ to reciprocate the filling-fork an operating device shown as a slide-bar d, it having an adjustable end d', provided with a heel d^2, which enters and slides in the open inner end of the stand c^9, in which the filling-fork slide works, (see Fig. 6,) said heel constituting a support for the outer end of said

slide-bar and preventing lateral movement thereof in the direction of the length of the breast-beam. This bar is shown as deriving its sliding movement from a cam d^3 on the cam-shaft, said bar, as represented, being forked at its lower end (see dotted lines, Fig. 1) to embrace the shaft B^2, and a roller or other stud d^4, carried by said bar, enters and is acted upon by said cam to move the bar. The free extremity or toe d^5 of the said operating device is shaped to meet the downturned heel 61 of the filling-fork in case said fork is not tipped by the presence of filling in the shed. The bar has a projection d^6, which normally stands under the breast-beam and prevents the free end of the bar rising too high. The adjustment of the end d' on the said bar enables the position of the said operating device to be adjusted to a nicety to the tailpiece in its normal position. When the bar d acts to move the filling slide-bar outwardly in said stand, the rock-shaft c^{12} (see Fig. 1) is turned, as described, to change the position of the sliding fork f^3 and so start the upward movement of the box-rod, and the shape of the said cam d^3 is such as to retain the said bar in its forward position, with its end d^5 in engagement with the tail of the filling-fork, thus keeping the said filling-fork from returning into its normal position until after the shuttle-box-rod-shifting mechanism has been operated sufficiently to lift the running shuttle-box and put the spare-shuttle feeder under it, and about as the lay is completing its forward movement and the spare-shuttle feeder is being locked to the running shuttle-box the cam enables the bar to free the filling-fork slide, so that it again comes into its normal position under the action of the spring d^8 (see Fig. 7) on said rock-shaft c^{12} (see Fig. 1) as the lay next goes back. The return of the filling-fork slide or carrier into its normal position enables said rock-shaft to effect the turning of the lever f^6 in the opposite direction to cause the tooth 3 of the leg f^2 to be put out of the range of movement of gear G and cause the sliding fork f^3 to be again changed in position to leave the shaft e^8 at rest and the box-rod down, with the running shuttle-box in its operative position.

In our other application the sliding fork had two legs, each leg having a tooth, but herein we have dispensed with one of said legs, and we put the tooth 4, (see Fig. 1,) which in our other application was on one of said legs, directly onto the gear f^3, and as a result of such change the said gear f^3 is rotated a half-rotation, and the tooth 4 enters the space between the two series of the teeth of the gear G, and the gear f^3 and shaft e^8 remain at rest for an instant until the second series of teeth of the gear G meet the tooth 4, when the gear f^3 and shaft e^8 are again given a semirotation, the tooth 3 having been put into its inoperative position, Fig. 9, letting the second series of teeth of gear G run out of mesh with the teeth of the gear f^3 at the space left by displacing the tooth 3, and then the said gear f^3 remains at rest until the filling-fork is again moved by the failure of the filling.

The mouthpiece g' at that end of the lay nearest the running shuttle-box is slotted, as at g^2, (see Fig. 8,) for the passage of the filling-thread t, connected with the bobbin in the spare shuttle, the outer end of said filling-thread being caught (see Fig. 12) on a suitable stud or post g^5, fixed to the loom-frame or to the breast-beam and extended over the cloth between the usual temples. The filling between the spare shuttle and the said stud is extended over a rest g^3, which rises from one of the arms of the spare-shuttle-positioning device, (see Figs. 5 and 5^a,) said rest supporting said filling at a proper height to aid it in its entrance into the slot g^2 of the mouthpiece. When the spare shuttle is thrown from the spare-shuttle feeder onto the race of the lay, the filling between the said shuttle and its held outer end passes through the opening a^8 of the receiving-cell and the slot g^2 of the mouthpiece, and the shuttle enters the shed, leaving, however, the end of the filling yet connected to said stud and extended therefrom to the selvage of the fabric being woven, and said filling is thus laid or presented on the top side of the cloth being woven, as shown at g^6, so as to pass readily through the usual temple T (only partially shown in Fig. 12) along with the cloth, said projecting end being thereafter broken off by hand or otherwise. The lips b^6 at the inner edge of the shelf or carrier b^5 of the spare-shuttle feeder, as the latter is put under the running shuttle-box to enable its spare shuttle to be thrown onto the race of the lay, enter spaces g^7 at the inner face of the shuttle-box guideway at each side of the alining-plate g^8, fixed to the inner side of said guideway and adapted to receive against it the rear side of the shuttle to be thrown onto the raceway, the face of said plate being substantially in the same vertical plane as the faces of the dents of the reed t^2 and alining any shuttle going onto the race of the lay. This alining-plate is necessary, because the running shuttle-box has not, as heretofore, any vertical side wall against which the side of the shuttle may be put in alinement with the face of the reed-dents before the said shuttle is struck by the picker to throw it across through the shed.

The shelf or carrier b^5 (see Figs. 1 and 5) is considerably wider than the spare shuttle in cross-section, and the spare shuttle rests on the outer portion of said shelf, as in said figures, when the spare-shuttle feeder is in its inoperative position, and at such time the pusher stands at an inclination, the lower edge of the shuttle resting against said pusher; but when the spare-shuttle feeder is started upwardly with the box-rod after the failure of the filling in the running shuttle-box the link c^3, held down at its lower end by the lay rocker-shaft, causes the pusher to be turned

to act against the shuttle, and the said pusher is put into substantially upright position, and the lips b^6, extended from said shelf, enter the spaces g^7 at the end of the alining-plate g^8, and the pusher then acts on the said shuttle as a binder to put said shuttle closely against the said alining-plate, so that it may be directed properly onto the lay for a proper straight flight.

The invention herein shown and described is not in all cases limited to the particular construction shown for the operative parts, and while we have herein described substantially all the parts of a fully operative loom it will be understood that the use of less than all the parts shown and described is within the scope of our invention as designated in the claims covering operative combinations of only a part of said devices, and our invention in all the minor details includes the use of any well-known mechanical equivalents.

The shuttle-box at the opposite end of the lay, but not shown, may be of any usual or known character.

Having described our invention, what we claim as new, and desire to secure by Letters Patent, is—

1. In a loom, the following instrumentalities, viz: a lay; a running shuttle-box guided vertically and movable therewith from its operative into its inoperative position and vice versa; a spare-shuttle feeder normally held stationary in its inoperative position during the regular movements of the lay in weaving; box-shifting mechanism, and connections between said shifting mechanism and said running shuttle-box and spare-shuttle feeder to automatically and simultaneously raise and lower said running shuttle-box and spare-shuttle feeder, substantially as described.

2. In a loom the following instrumentalities, viz: a lay; a running shuttle-box vertically movable thereon from its operative into its inoperative position and vice versa; a spare-shuttle feeder normally held stationary in its inoperative position during the regular movements of the lay in weaving; box-shifting mechanism, and connections between said shifting mechanism and said running shuttle-box and spare-shuttle feeder, to automatically and simultaneously raise and lower said running shuttle-box and spare-shuttle feeder, and means to effect the locking of said spare-shuttle feeder to the lay when said feeder is in its operative position, substantially as described.

3. In a loom, the following instrumentalities, viz: a lay; a running shuttle-box vertically movable therein from its operative into its inoperative position, and vice versa; a spare-shuttle feeder normally held stationary in its inoperative position during the regular motions of the lay in weaving; a positioning device for a spare shuttle; box-shifting mechanism, and connections between said shifting mechanism and said running shuttle-box and spare-shuttle feeder, to automatically and simultaneously raise and lower said running shuttle-box and spare-shuttle feeder, and means to lock said spare-shuttle feeder to the lay when said feeder is in its operative position, substantially as described.

4. In a loom, the following instrumentalities, viz: a lay; a running shuttle-box vertically movable thereon from its operative into its inoperative position, and vice versa, said running shuttle-box being open at its rear side for the passage therethrough laterally of its shuttle; a shuttle-receiver located at the loom side; a spare-shuttle feeder normally held stationary in its inoperative position during the regular running of the lay in weaving; box-shifting mechanism, and connections between said box-shifting mechanism and said running shuttle-box and spare-shuttle feeder to automatically and simultaneously move said running shuttle-box and spare-shuttle feeder in unison, means to move the spare-shuttle feeder to meet the lay, and means to lock the said spare-shuttle feeder to the lay when said feeder is in its operative position, substantially as described.

5. In a loom the following instrumentalities, viz: a lay, a shuttle-box guideway, a running shuttle-box guided in said guideway and open at one side for the passage laterally therethrough of a failed shuttle, a failed-shuttle receiver, a spare-shuttle feeder normally held in inoperative position, box-shifting mechanism, and connections between said shifting mechanism, and said running shuttle-box and spare-shuttle feeder, to automatically and simultaneously raise and lower said running shuttle-box and spare-shuttle feeder, and means to effect the locking together of said running shuttle-box and spare-shuttle feeder when in their elevated position, substantially as described.

6. In a loom the following instrumentalities, viz: a lay, a running shuttle-box mounted therein, a box-rod operatively connected with said running shuttle-box, a spare-shuttle feeder pivoted on or with relation to said box-rod and normally held in its inoperative position, and means to lift said running shuttle-box and spare-shuttle feeder in unison after failure of the filling in the shuttle of the running shuttle-box, substantially as described.

7. In a loom, the following instrumentalities, viz: a lay; a running shuttle-box vertically movable with relation to said lay from its operative into its inoperative position, and vice versa, said shuttle-box having one side open for the discharge therethrough laterally of its shuttle; a box-rod connected with said running shuttle-box; a spare-shuttle feeder pivoted on or with relation to said box-rod and normally held in its inoperative position stationary with relation to the lay; means to move said running shuttle-box and spare-shuttle feeder in unison for the discharge of the shuttle from the running shuttle-box, substantially as described.

8. The spare-shuttle feeder composed of a

lever having a wedge-surface, and having at its top a shelf or carrier provided at one edge with a binder, combined with a guide in which the said lever is free to be slid up and down and means to move said lever in said guide, substantially as described.

9. In a loom the following instrumentalities, viz: a lay, a running shuttle-box mounted therein, a box-rod operatively connected with said running shuttle-box, a spare-shuttle feeder consisting of a lever pivoted on or with relation to said box-rod, and having a shelf or carrier, said spare-shuttle feeder being normally held in its inoperative position, combined with means to lift said running shuttle-box and with it said spare-shuttle feeder, and means to move said spare-shuttle feeder toward the lay as the box-rod rises, substantially as described.

10. In a loom the following instrumentalities, viz: a lay, a running shuttle-box mounted therein, a box-rod operatively connected with said running shuttle-box, a lever pivoted on or with relation to said box-rod, and having a spare-shuttle shelf or carrier normally held in its inoperative position, combined with means to lift said running shuttle-box and with it said lever and said spare-shuttle shelf or carrier, means to raise and move said lever toward said advancing lay as the box-rod rises, and means to lock the spare-shuttle shelf or carrier to said lay and retain it there while said spare shuttle is put onto the lay, substantially as described.

11. In a loom the following instrumentalities, viz: a lay, a running shuttle-box provided at its under side with a feeding-cell, a box-rod attached to the said feeding-cell, a spare-shuttle-feeding device normally held in its inoperative position, means on the failure of the filling in the shuttle of the running shuttle-box to put the spare-shuttle-feeding device in said feeding-cell and raise said shuttle-box and said spare-shuttle feeder containing a spare shuttle, to thereby put said running shuttle-box with its failed shuttle into its inoperative position to enable the failed shuttle to be discharged, and at the same time to put the said feeding-cell and the running shuttle-box therein at the race of the lay to enable the spare shuttle to be thrown onto said raceway, and means to thereafter lower said shuttle-box, and with it said spare-shuttle feeder, substantially as described.

12. A vibrating lay, and a spare-shuttle shelf or carrier provided at one edge with a binder; combined with a lever on which the said shelf is mounted, said lever being pivoted at its lower end near the axis of motion of the said lay, and means to effect the locking of said feeder and lay together after the said feeder is in its operative position and moving with said lay, substantially as described.

13. In a loom the following instrumentalities, viz: a lay; a running shuttle-box vertically movable with relation to said lay from its operative into its inoperative position, and vice versa, said running shuttle-box being open at one side for the passage therethrough laterally of its shuttle, a binder pivoted on and carried by said running shuttle-box; a box-rod connected with said running shuttle-box; a spare-shuttle feeder pivoted on or with relation to said box-rod and normally held in its inoperative position stationary with relation to the lay; means to lift said running shuttle-box and spare-shuttle feeder in unison after failure of the filling to effect the changing of the shuttle in the running shuttle-box, substantially as described.

14. In a loom, the following instrumentalities, viz: a lay; a running shuttle-box carried thereby; a box-rod connected to said running shuttle-box; a shuttle-feeding device carried by a lever; means to hold said shuttle-feeding device stationary in its inoperative position while the running shuttle-box in its operative position moves with the lay; a box-lever located at the loom side; means to move it intermittingly to raise said box-rod and the shuttle-feeding device together, and means to lock the shuttle-feeder to said lay when said feeder is in its operative position, substantially as described.

15. In a loom the following instrumentalities, viz: a lay, a running shuttle-box, a box-rod and two studs movable with it, a spare-shuttle-feeding device pivoted on one of said studs, a link connected to the other of said studs, a box-lever connected with said link, and means to operate said box-lever to raise and lower said box-rod, substantially as described.

16. In a loom the following instrumentalities, viz: a lay, a shuttle-box-shifting mechanism, a running shuttle-box carried by said lay; a shuttle-feeder normally held stationary in its inoperative position during the regular operations of the loom; connections operatively joining the lever of the said shuttle-box-shifting mechanism with the running shuttle-box and with said shuttle-feeder to automatically raise and lower them in unison; a filling-fork; means to operate it on the failure of the filling in the shuttle of the said running shuttle-box; means intermediate said filling-fork and shuttle-box-shifting mechanism to start the latter in operation to put the running shuttle-box in its inoperative position and the shuttle-feeder in its operative position, substantially as described.

17. The running shuttle-box open at one side for the passage of a shuttle therethrough and provided at its opposite side with a binder and having a feeding-cell connected therewith, said cell presenting at its inner end an open passage through which a shuttle to be put onto the raceway of the lay is thrown, combined with a spare-shuttle feeder provided with a pusher and adapted to enter and place its spare shuttle in said feeding-cell, and means to lock said shuttle-feeder in said feeding-cell, substantially as described.

18. In a loom the following instrumentalities, viz: a lay, a running shuttle-box mounted therein, a box-rod operatively connected with said running shuttle-box, a lever pivoted on or with relation to said box-rod, and having a spare-shuttle shelf or carrier normally held in its inoperative position, combined with means to lift said running shuttle-box and with it said lever and said spare-shuttle shelf or carrier, and a locking device carried by said lay, means to raise said running shuttle-box and shuttle-feeder to lock said feeder to said lay, substantially as described.

19. In a loom the following instrumentalities, viz: a shuttle-box, its rod, shuttle-box-shifting mechanism, a spare-shuttle-feeding device pivotally mounted on the said shuttle-box rod and normally held in its inoperative position, combined with a filling-fork, and means between it and said shuttle-box-shifting mechanism to put the same in position to be operated to lift not only the box-rod but also the spare-shuttle-feeding device when the filling-fork is moved due to failure of the filling, substantially as described.

20. In a loom, the following instrumentalities, viz: a lay, means to receive a failed shuttle, a shuttle-box guideway, a running shuttle-box open at one side for the discharge of a failed shuttle, and having at its opposite side a binder and at its lower side a feeding-cell, the inner end of said cell being open at a^8 for the discharge of a spare shuttle from the said feeding-cell upon the race of the lay; a box-rod to carry said running shuttle-box, a lever pivotally connected with said box-rod, and provided at one end with a spare-shuttle feeder, a filling-fork, a box-rod-shifting mechanism, means between it and said filling-fork to start the box-rod-shifting mechanism in motion on the failure of the filling in the shuttle in the running shuttle-box, means to put the shelf or carrier of the spare-shuttle feeder into the open side of said feeding-cell, and means to lock said lever to be moved back and forth with the lay, the said box-rod-shifting mechanism in the first part of its movement exposing the open side of the running shuttle-box to permit the discharge therefrom of the failed shuttle upon the means adapted to receive it, and at the same time put the spare-shuttle carrier at the level of the race to enable the shuttle to be thrown onto the race in place of the failed shuttle, after which the running shuttle-box is again quickly moved into its operative position to receive the spare shuttle on its return stroke, and the spare-shuttle feeder is then unlocked and returned into its inoperative position to again be provided with a spare shuttle, substantially as described.

21. The guide for the filling-fork slide, a filling-fork slide therein carrying a filling-fork, a filling-fork-slide-operating device having a heel to coöperate with and be guided by the guide for said filling-fork slide, and having a projection to engage the heel of the filling-fork, combined with means to actuate said operating device, substantially as described.

22. A filling-fork-operating device consisting of a sliding bar having an adjustable end piece, and means to actuate said bar, combined with a filling-fork having a tailpiece, and a slide or carrier on which said fork is pivoted, the adjustment of said end piece on said bar determining the position of said end piece with relation to the tailpiece of the filling-fork when not tipped, substantially as described.

23. A filling-fork-operating device having its free end shaped to engage the tail of a filling-fork and having two projections, said projections acting to prevent sidewise and up-and-down movement of said operating device, combined with a filling-fork, the slide bar or carrier on which it is mounted and a cam to move said operating device, substantially as described.

24. In a loom the following instrumentalities, viz: a lay, a shuttle-box guideway, a running shuttle-box movable in said guideway, a spare-shuttle feeder normally held in its inoperative position and provided at one edge with a rock-shaft having an attached pusher or binder, a connection between one arm of said rock-shaft and the lay rock-shaft, and shifting shuttle-box mechanism, to simultaneously raise said shifting shuttle-box and said spare-shuttle feeder, and at the same time, as the said spare-shuttle feeder rises, turn said pusher or binder toward the spare shuttle carried by it, substantially as described.

25. A filling-fork, guideway, a filling-fork slide or carrier therein provided with a filling-fork, a lay, a running shuttle-box, shifting shuttle-box mechanism normally at rest while the filling is unbroken, connections between said filling-fork slide or carrier and said shifting shuttle-box mechanism to start the same to lift the running shuttle-box, combined with a cam-shaft, a cam thereon, and means between said cam and said filling-fork to engage said filling-fork and move it and its slide or carrier on the failure of the filling in the said running shuttle-box, said cam being shaped to cause the said filling-fork to be held pressed back during the next succeeding forward movement of the lay while the running shuttle-box is being lifted, and permitting the said filling-fork to come forward again into its normal position at the second back stroke of the lay following that forward stroke at which the said filling-fork was first moved, the return of said filling-fork into its normal position preventing the movement of the shifting shuttle-box mechanism for more than one complete rotation and leaving the running shuttle-box in its operative position, substantially as described.

26. In a loom the following instrumentalities, viz: a lay, a running shuttle-box, a spare-shuttle feeder, shuttle-box-shifting

mechanism, means to rotate it to raise said running shuttle-box and with it said spare-shuttle feeder, a filling-fork, means between it and said shuttle-box-shifting mechanism to move the latter to move the said shuttle-box and feeder to put the former into its inoperative position and the latter into its operative position, combined with means to engage said filling-fork, move it and its slide on the failure of the filling in the running shuttle-box, said means holding said filling-fork pressed back during the next succeeding forward movement of the lay while said running shuttle-box and spare-shuttle feeder is being lifted, said means permitting said filling-fork to come forward again into its normal position at the second back stroke of the lay following the forward stroke at which the said filling-fork was first moved on the failure of the filling, the return of said filling-fork into its normal position preventing the movement of the shifting shuttle-box mechanism for more than one complete rotation, the final semirotation of said shifting shuttle-box mechanism leaving the running shuttle-box and the spare-shuttle feeder down, the former in its operative, and the latter in its inoperative position, substantially as described.

27. In a loom, a continuously-rotating gear having a plurality of series of teeth; a shuttle-box-shifting lever, a link attached thereto, a shaft having a crank engaged by one end of said link, a bearing on which said crank is mounted; a mutilated toothed gear fixed to said shaft, a coöperating sliding gear having a tooth to stand in or to be withdrawn from a space in said mutilated gear, a filling-fork, and means between it and said sliding gear to move its tooth into the space of said mutilated gear when said gear is to be rotated, substantially as described.

28. In a loom, a continuously-rotating gear having a plurality of series of teeth; a shuttle-box-shifting lever, a link attached thereto, a shaft having a crank engaged by one end of said link, a bearing on which said crank is mounted; a mutilated toothed gear fixed to said shaft, a coöperating sliding gear having a tooth to stand in or to be withdrawn from a space in said mutilated gear, a filling-fork and means between it and said sliding gear to move its tooth into the space of said mutilated gear when said gear is to be rotated, and a spring to effect the reverse movement of said sliding gear to remove its tooth from said space when the said sliding gear is to be left at rest, substantially as described.

29. In a loom, a lay, a running shuttle-box movable in said lay and having a box-rod, a spare-shuttle feeder composed of a lever and a wall or plate carried thereby, a guide embracing said lever, a cam to effect the movement of said lever toward the lay, and locking means to confine said lever to said lay while a change of shuttle is being effected, substantially as described.

30. The lay having an attached finger c^6, and the spare-shuttle feeder provided with a stud, combined with means to raise said lever and cause said stud to engage said finger to lock the said shuttle-feeder to the lay, substantially as described.

31. In a loom, the following instrumentalities, viz: a lay, a running shuttle-box carried thereby, open at its rear side for the passage of the shuttle, and movable thereon from its operative into its inoperative position, and vice versa; a spare-shuttle feeder normally stationary in its inoperative position and presenting a shelf in which is laid a spare shuttle; a horizontally-pivoted binder located at one edge of said shuttle-feeder and adapted to swing in the arc of a circle, shifting shuttle-box mechanism to raise said shuttle-feeder and put it into its operative position, and means connected to said binder to move it toward the lay and the shuttle on the said feeder, as the latter is raised, and to turn said binder away from said lay when said feeder is lowered, substantially as described.

32. In a loom, the following instrumentalities, viz: a lay, a running shuttle-box at one end of the lay to receive a running shuttle in the ordinary operation of the loom, a filling-fork, and its carrier, a spare-shuttle feeder, it normally occupying an inoperative position, and means controlled as to its time of operation by the filling-fork carrier to place the running shuttle-box in its inoperative position to have its shuttle discharged therefrom, and means to place the spare-shuttle feeder with its shuttle in operative position to supply said shuttle to the lay, substantially as described.

33. In a loom, a continuously-rotating gear having a plurality of series of teeth, a shuttle-box-shifting lever, a shaft having a crank, a bearing for said shaft, a mutilated gear fixed to said shaft, a coöperating sliding gear having a tooth to stand in or to be withdrawn from a space in said mutilated gear, a filling-fork, and means between it and said sliding gear to move its tooth into the space of said mutilated gear when said gear is to be rotated, substantially as described.

34. A lay, means to move it, a running shuttle-box carried by and movable on said lay from its operative into its inoperative position and vice versa, a spare-shuttle feeder normally stationary apart from the lay in inoperative position, a connected shifting-lever, and operating devices therefor, combined with means to lock said spare-shuttle feeder to the lay in its operative position and keep it locked in place with the moving lay while the shuttle in said shuttle-feeder is thrown therefrom onto the lay, substantially as described.

35. A lay, means to move it, a shuttle-feeder normally stationary in its inoperative position apart from the lay and free to be swung about a pivot below the raceway of the lay near its fulcrum and means to lock said shuttle-feeder in its operative position with

the moving lay and retain it locked that it may travel back and forth in unison with the lay while the shuttle in said feeder is thrown onto the lay and means to then unlock said feeder from the lay and put it in its inoperative stationary position, substantially as described.

In testimony whereof we have signed our names to this specification in the presence of two subscribing witnesses.

RANDOLPH CROMPTON.
HORACE WYMAN.

Witnesses:
GEO. W. GREGORY,
EMMA J. BENNETT.