

No. 652,224.

Patented June 19, 1900.

H. I. HARRIMAN.
LOOM.

(Application filed Mar. 28, 1900.)

(No Model.)

5 Sheets—Sheet 2.

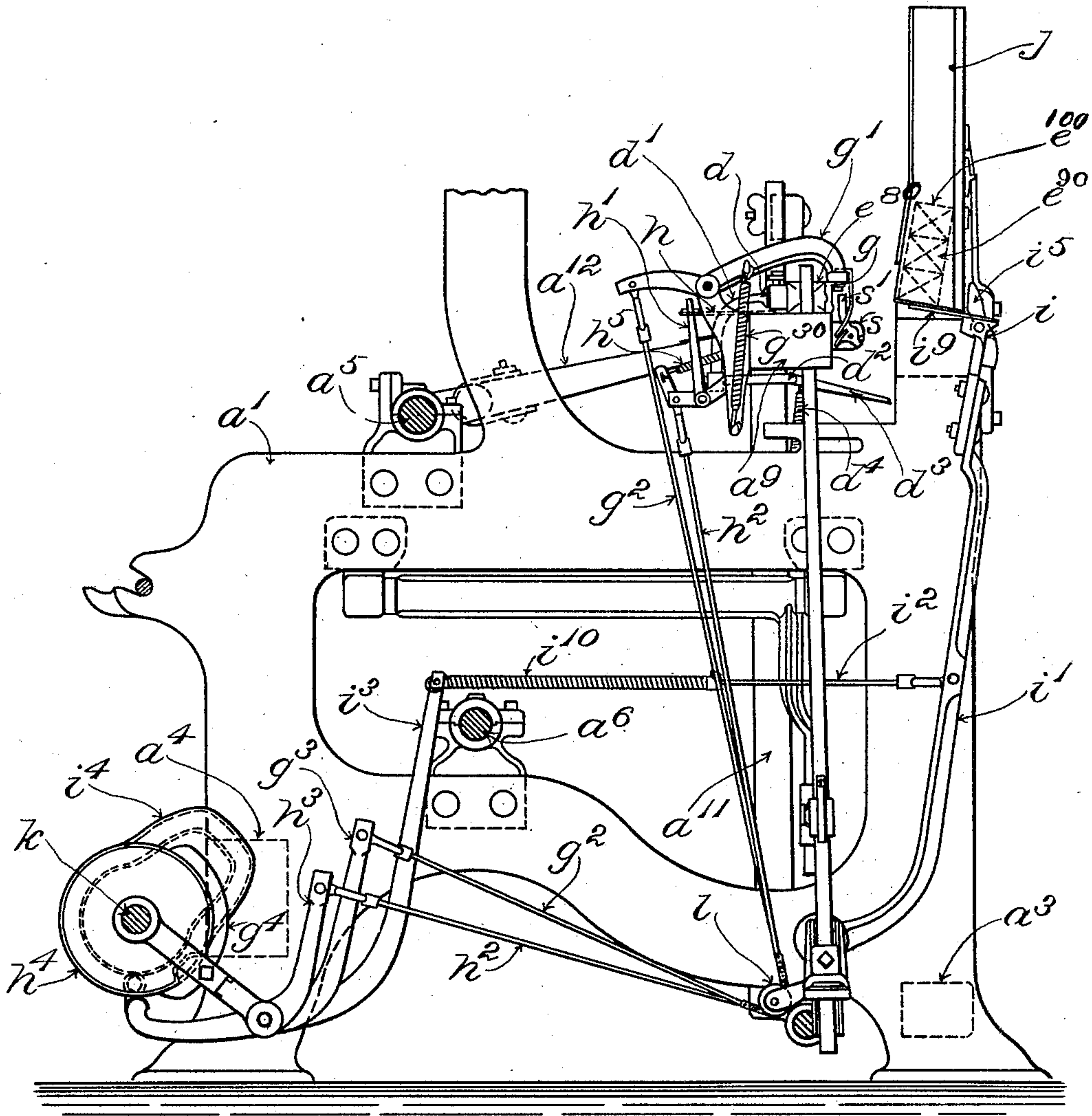


Fig. 2.

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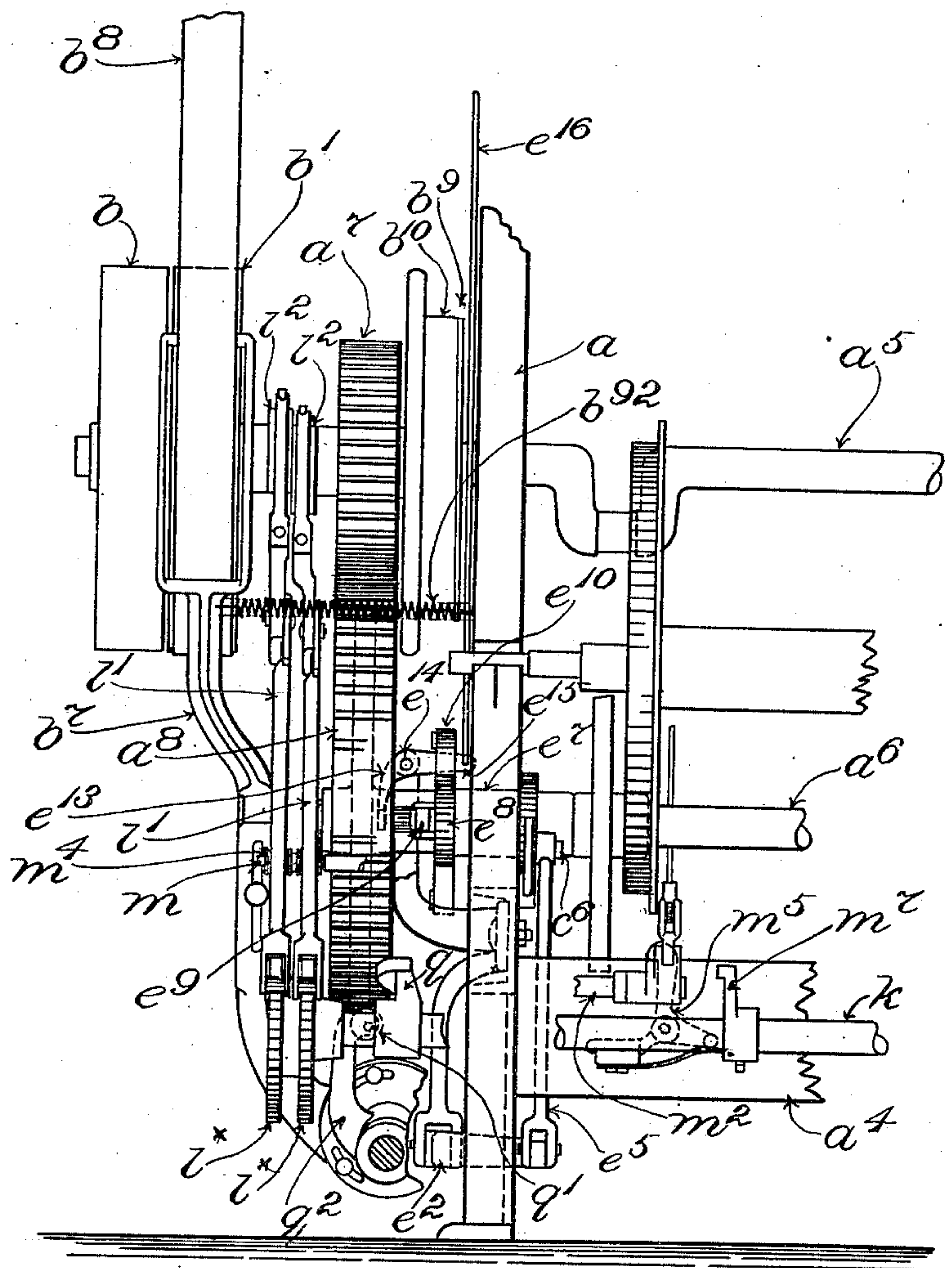


Fig. 3.

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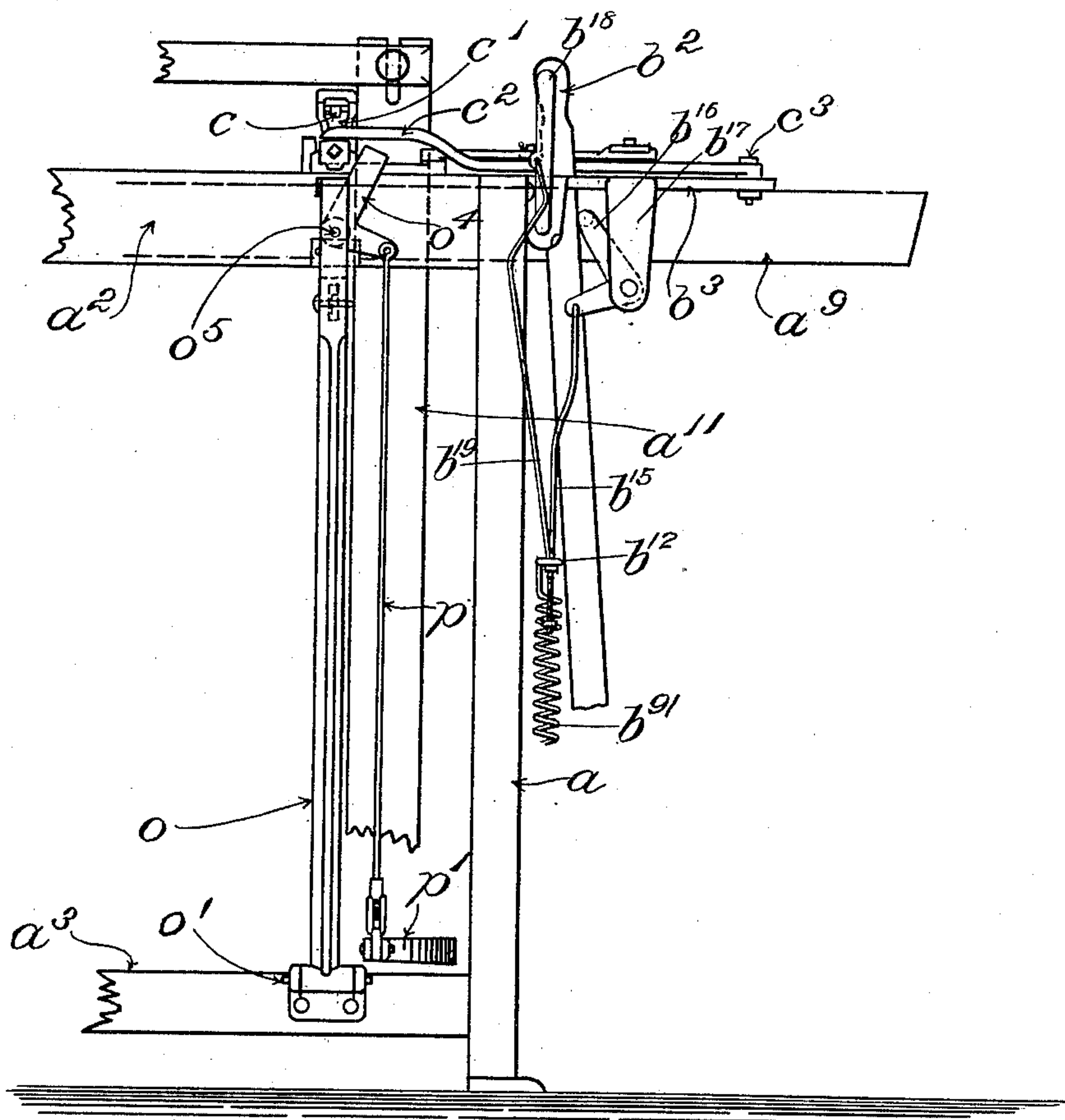


Fig. 4.

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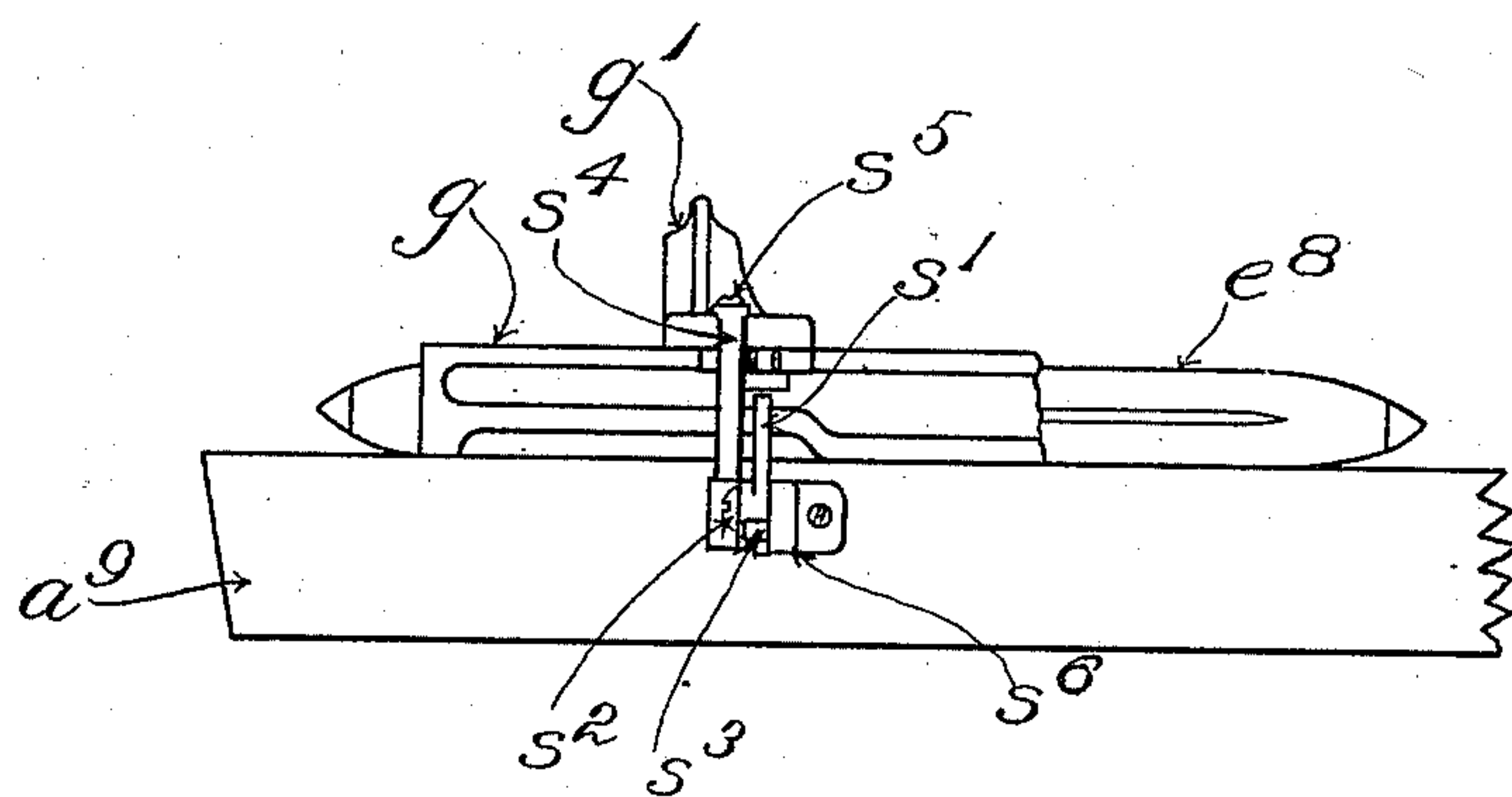
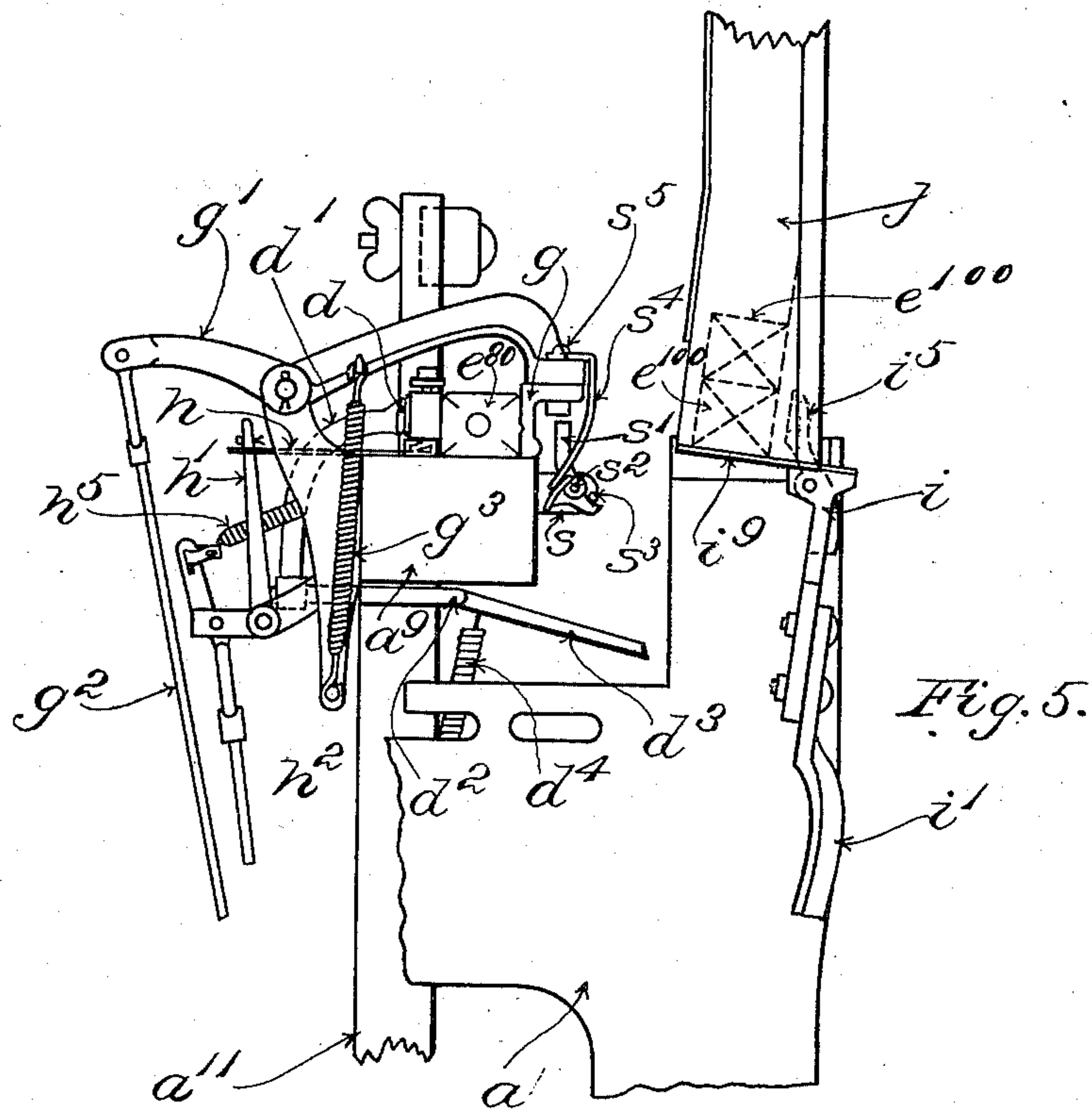
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LOOM.

(Application filed Mar. 28, 1900.)

(No Model.)

5 Sheets—Sheet 5.



Witnesses:

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UNITED STATES PATENT OFFICE.

HENRY I. HARRIMAN, OF NEW YORK, N. Y.

LOOM.

SPECIFICATION forming part of Letters Patent No. 652,224, dated June 19, 1900.

Application filed March 28, 1900. Serial No. 10,438. (No model.)

To all whom it may concern:

Be it known that I, HENRY I. HARRIMAN, a citizen of the United States, residing at New York, in the county of New York, State of New York, have invented a certain new and useful Improvement in Looms, of which the following is a specification, reference being had therein to the accompanying drawings.

The invention has relation in general to looms of that class in which replenishment of the working weft-supply is effected automatically by the mechanism of the loom when necessity arises therefor—as, for example, on exhaustion of the supply of weft or filling that is carried by the working shuttle on the lay or on exhaustion thereof to a predetermined extent or on loss of continuity of such weft or filling—the action of the replenishing instrumentalities being brought about or instituted through the agency of suitable forms of weft-indicator mechanism.

Certain well-known varieties of looms in common use are furnished with shifting shuttle-boxes provided with a plurality of cells holding shuttles containing wefts or fillings of different colors, qualities, or materials. These looms are employed for weaving blankets, towels, and other articles having transverse borders or similar figured portions, which last are produced at intervals in the length of the woven webs and are separated from one another in such webs by stretches of body-weave. In the operation of these looms there is a comparatively-extensive consumption of the weft or filling which is used in weaving the plain intermediate or body portions, necessitating comparatively-frequent replenishment thereof, while that or those used in weaving the borders or similar figured portions is less rapidly used up and requires less frequent replenishment.

The principal object of the present invention is to provide a loom of this class with means for effecting automatically the replenishment of the working supply of body weft or filling when necessity arises therefor, since by accomplishing this a large portion of the time which heretofore has been lost through stoppages of the loom in consequence of exhaustion or breakage of the working supply of weft or filling will be saved.

Another object of the invention is to pro-

vide means whereby automatic replenishment of the working supply of the body weft or filling shall be effected when the condition of this weft or filling is such as to call for replenishment thereof and whereby a stoppage of the loom shall be occasioned on exhaustion or the like of the figure weft or filling.

Another object which I have in view is to provide means for guarding against accidents in looms in which replenishment of the working weft-supply is effected by making a change of shuttles of the kind which would result if a fresh or reserve shuttle were placed in position for action upon the lay without the shuttle previously at work having first been discharged from the lay.

The invention consists, primarily, in a loom having shifting shuttle-boxes, automatic weft-replenishing mechanism, weft-indicator mechanism, and devices through which the weft-indicator mechanism acts to call the replenishing instrumentalities into operation when the condition of the working supply of a predetermined one of the wefts or fillings, which may be termed, for convenience, the “body-weft,” necessitates replenishment thereof. It includes also, in addition to the foregoing, means whereby when the condition of the other weft or filling, or one of the others in case of the utilization of more than two wefts or fillings, calls for replenishment thereof the working of the loom is arrested as commonly effected through the action of weft stop-motions for looms.

It consists, finally, in a device by means of which the replenishing instrumentalities are prevented from placing a fresh or reserve shuttle upon the lay until after the spent or failed shuttle previously at work on the latter has been discharged from the lay.

For the sake of fullness of disclosure as to the manner in which the invention satisfactorily may be reduced to practice I have made herein a substantially-complete presentation of those mechanisms of a loom to which it appears advisable to refer in explaining the embodiments of the different features of the invention.

The invention is capable of being embodied in different forms and of being utilized in connection with looms of various constructions with different forms of shuttle-box mo-

tions and with different varieties of weft-replenishing instrumentalities. It will be understood, therefore, that the invention is not limited to the precise construction, arrangements, relations, &c., hereinafter presented.

In the drawings, Figure 1 shows in elevation the driving end of the said loom, certain parts being broken away for the sake of clearness. Fig. 2 shows in elevation the opposite or change end of the loom. Fig. 3 shows in rear elevation the driving end of the loom. Fig. 4 shows in front elevation certain parts at the driving end of the loom. Fig. 5 shows in side or end elevation certain parts at the change end of the loom. Fig. 6 shows in front elevation a portion of what is represented in Fig. 5.

The drawings show the end frames a a' of the loom, the breast-beam a^2 thereof, the front and rear cross-girths a^3 and a^4 , respectively, the crank-shaft a^5 , the cam-shaft a^6 , and the driving gear-wheels a^7 and a^8 on the said shafts. They show also the lay-beam a^9 , the lay-swords a^{11} a^{11} , and the pitmen or connecting-rods a^{12} a^{12} , joining the lay with the crank-shaft.

The main power or driving arrangements employed in practice in a loom embodying the present invention may be of any suitable or approved character. I have represented in the accompanying drawings fast and loose band-pulleys b b' of usual character, mounted on the crank-shaft a^5 , and a convenient form of shipper mechanism comprising the shipper-handle b^2 , working in a slot in the usual holding-plate b^3 at one end of the breast-beam, and a rearwardly-extended shipper rock-shaft b^4 , mounted in bearings b^5 b^6 on the end frame a and having the said shipper-handle b^2 affixed to its forward end and the shipper-fork b^7 affixed to its rear end, the said shipper-fork coacting in usual manner with the driving-band b^8 . As will be understood, when the shipper-handle b^2 is in its usual holding-notch at the outer end of the slot in which it works in the holding-plate b^3 the shipper-fork b^7 will be retained in position to keep the driving-band b^8 on the fast band-pulley b , and when the shipper-handle is disengaged from the said notch the shipper rock-shaft b^4 will be partially rotated by the action of a suitable spring, herein represented at b^{92} , and the shipper-fork b^7 will thereby be moved to place the driving-band b^8 on the loose band-pulley b' .

The brake mechanism may be of any approved character capable of acting quickly to destroy the momentum of the loom after the driving-band has been shifted in the manner just explained from the fast band-pulley b to the loose band-pulley b' . The brake mechanism illustrated in the drawings comprises, essentially, the brake-wheel b^9 , fast on the crank-shaft, the brake-band b^{10} , partly encircling the said brake-wheel and having one end thereof connected with a fixed part of the

loom, as at b^{11} , Fig. 1, a bell-crank b^{12} or its equivalent, pivoted at b^{13} on a suitable bracket b^{14} , carried by the end frame a , the said bell-crank having one end of the said brake-band connected with one arm thereof, as at b^{14} , a link b^{15} , adapted for engagement with the forwardly-extending arm of the said bell-crank, and a second bell-crank or lever b^{16} , pivotally mounted on a downwardly-extending projection b^{17} , carried by the breast-beam. (See Figs. 1 and 4.) A projection on the said lever b^{16} extends into the path of movement of the shipper-handle b^2 , so that when the latter is moved into position to shift the driving-band b^8 onto the fast band-pulley b it acts against the said projection of the lever b^{16} , and thereby moves the same and the bell-crank b^{12} in a manner to relax the pressure of the brake-band b^{10} upon the periphery of the brake-wheel b^9 . The spring b^{91} acts upon the bell-crank b^{12} with a tendency to apply the pressure of the brake-band b^{10} against the brake-wheel b^9 , and thus when the shipper-handle is allowed to move into the position which places the driving-band b^8 on the loose band-pulley b' the movement of lever b^{16} , which is permitted to occur, enables the said spring to move the said bell-crank b^{12} and apply the brake-pressure. The usual hand-lever for use in relieving the brake-pressure when desired is indicated at b^{18} , Figs. 1 and 4, it being supported by the breast-beam and having combined therewith a rod b^{19} , which connects with the brake-lever b^{12} .

The drawings show weft-indicator mechanism in the shape of weft-fork mechanism of usual character, the same comprising a weft-fork c , Fig. 4, a slide c' , on which the said weft-fork is pivoted in customary manner, a knocking-off lever c^2 , having its inner end arranged to be acted upon by the said slide c' , the said lever being pivoted at its outer end, as at c^3 , to the outer end of the plate b^3 and arranged to coact with the shipper-handle b^2 in ordinary fashion, a gooseneck c^4 , pivoted at c^5 and adapted to engage with the tail of the weft-fork, and a cam c^6 on the cam-shaft a^6 , acting to vibrate the said gooseneck. As will be understood, should the weft or filling not be present at the weft-fork when the gooseneck moves forward the engagement of the gooseneck with the tail of the weft-fork will cause the slide c' to be advanced, and the resulting movement of the knocking-off lever c^2 will effect the disengagement of the shipper-handle b^2 from the holding-notch in the plate b^3 , so as to permit the driving power to be unshipped and the brake to be applied.

The swell or binder of the shuttle-box at the change end of the loom is indicated at d , Figs. 2 and 5, and the protector-finger acting in connection therewith at d' . The protector-shaft, on which the said protector-finger is mounted, is indicated at d^2 , the dagger on the protector-shaft at d^3 , and the spring acting on the protector-shaft with a tendency to press the pro-

tector-finger d' against the swell or binder d is indicated at d^4 .

At the driving end of the loom is shown a tier of shifting shuttle-boxes e , which in the present instance comprise two cells. (See more especially Fig. 1.) The box-rod is designated e^1 , and the box-lever e^2 , the said box-lever being pivoted at e^3 to a convenient support e^4 , which is attached to the end frame a . For the purpose of actuating the box-lever I have shown connected therewith a known form of operating connections, (shown in Figs. 1 and 3,) the said connections comprising a rod e^5 , having its lower extremity pivoted to the box-lever and its upper extremity pivoted to a crank e^6 , the said crank being connected with a short shaft which is journaled at e^7 in a bearing on the end frame a . With the said shaft are connected a mutilated pinion e^8 and a diametrical lever e^9 . A master-gear e^{10} is mounted on the cam-shaft a^6 . The said master-gear is furnished with opposite toothed segments e^{11} e^{11} and intermediate plain segments e^{12} e^{12} . The mutilated pinion e^8 has opposite toothed segments, to be engaged by the toothed segments of the master-gear e^{10} , and intermediate plain or untoothed portions in which the periphery of the master-gear works between the times at which the mutilated pinion is being rotated by means of the master-gear. Normally the mutilated pinion stands at rest, with the periphery of the master-gear turning within one of the untoothed spaces of the said pinion. When, however, it is necessary to impart a semirevolution to the mutilated pinion, so as to shift the position of the shuttle-boxes e , the diametrical lever e^9 is caused to move so as to bring an end thereof within the path of movement of the starting-tooth of one of the toothed segments e^{11} of the master-gear e^{10} , in order that as such starting-tooth comes around it may, by its contact with the diametrical lever, shift the mutilated pinion far enough around to enable the succeeding teeth of the said toothed segment of the master-gear to engage with the teeth of one of the segments of the mutilated pinion and the crank e^6 , connected therewith. The engagement of the diametrical lever with the starting-teeth on the master-gear is determined through pattern connections, the latter comprising in the present instance a finger e^{13} , arranged to bear against the said diametrical lever, a rock-shaft e^{14} , on which the said finger is mounted, a second finger e^{15} on the said rock-shaft, and a wire or other connection e^{16} , extending from the said finger e^{15} to the pattern devices proper. The particular shuttle-box motion herein shown is more fully presented and described in United States Letters Patent No. 626,960, granted June 13, 1899.

The weft-replenishing instrumentalities which are presented herein embody certain of the principles of those which are presented in Letters Patent of the United States, granted to me June 13, 1899, No. 626,834; October 13, 1899, No. 636,228, and December 26, 1899, No.

639,975, to which reference may be had. They operate by replacing the spent or failed working shuttle on the lay by a fresh or reserve shuttle. The change of shuttle is effected at the end of the loom opposite that at which the driving appliances and shifting shuttle-boxes are located. Herein the replenishing instrumentalities comprise a device to open the shuttle-box at the change end of the loom by withdrawing the front of the said shuttle-box from its normal position, a device to expel or eject the spent or failed working shuttle from the said shuttle-box, a device to introduce a fresh or reserve shuttle into the said shuttle-box, and a hopper or magazine to contain a reserve supply of shuttles loaded with weft or filling and threaded up in readiness for weaving, the various operative parts being under the control of a so-called "change-shaft." The said instrumentalities are shown herein as follows: The movable front of the shuttle-box at the change end of the lay is designated g , and the rocker with which the said front is connected is designated g' , it being mounted upon the lay, as heretofore. The ejector for expelling or ejecting the spent or failed working shuttle, as e^{80} , Figs. 2 and 6, from the said shuttle-box after the front g has been withdrawn is designated h , and the rocker with which the same is connected is shown at h' , it being mounted upon the lay, as heretofore. The injector for introducing a fresh or reserve shuttle into the said shuttle-box is shown at i , it being carried by an arm i' , pivoted to the loom-frame, as heretofore. The hopper or magazine for fresh or reserve shuttles is shown at j mounted at one end of the breast-beam, as heretofore, the reserve shuttles within the same being designated e^{90} . The change-shaft is shown at k . The connections extending from rockers g' , h' , and arm i' of injector i are designated, respectively, g^2 , h^2 , and i^2 , the levers with which the said connections are joined are designated, respectively, g^3 , h^3 , and i^3 , and the cams on change-shaft k which engage with the said levers are designated, respectively, g^4 , h^4 , and i^4 . The sheaves around which connections g^2 and h^2 pass are designated l . The spring acting upon rocker g' to return the shuttle-box front g to its normal position after the change of shuttles has been effected is designated g^{30} . The spring which acts in connection with rocker h' to advance the ejector h to effect the expulsion or ejection of the spent or failed working shuttle from the shuttle-box is designated h^5 .

i^5 represents the fingers with which the injector is provided to engage with the bottom shuttle in the hopper in the rearward movement of the injector, so as to carry the said bottom shuttle, with the injector, toward the lay, the said fingers being pivoted, as heretofore, so as to yield on coming in contact with a shuttle in the hopper in the succeeding forward or return movement of the injector.

i^9 designates the rearwardly-extending

arms with which the injector is provided for the support of the shuttle which is being carried to the lay by the injector.

i^{10} is the spring, which is included in the connection i^3 between the injector and the bell-crank i^3 , so that, the injector having been moved rearwardly by the action of cam i^4 , the said spring i^{10} may yield as soon as the shuttle carried by the injector is pressed fully home into the shuttle-box.

As in my United States Letters Patent No. 636,228, the change-shaft herein is arranged to be driven by means of ratchet-wheels $l^x l^x$ thereon, drivers in the shape of pawls $l' l'$, adapted for engagement with the said ratchet-wheels, and eccentrics $l^2 l^2$, which are fast with the hub or sleeve of the loose pulley b' on the crank-shaft a^5 , the said eccentrics being located in opposite phases, so as to reciprocate the drivers alternately in opposite directions. The drivers are held normally out of engagement with the said ratchet-wheels $l^x l^x$ by means of a driver-controller m , this last being constituted by a pin carried by an arm m' on a trip-shaft m^2 , mounted at the rear of the loom, the said trip-shaft having a weighted arm m^3 , operating to hold the said driver-controller m normally elevated in position to keep the drivers out of engagement with the ratchet-wheels $l^x l^x$.

m^4 designates the antifriction-rolls, which are applied to the pin m for the purpose of reducing the friction which is due to the movement of the driver-pawls.

In order to permit the drivers $l' l'$ to engage the ratchet-wheels $l^x l^x$, the trip-shaft m^2 must be rocked, so as to lower the driver-controller m . When the trip-shaft has been thus rocked, a pivoted catch m^5 (shown in dotted lines in Fig. 3) engages with an arm m^6 (see dotted lines, Fig. 1) on the said trip-shaft and holds the driver-controller depressed, permitting the drivers to remain in working engagement with the ratchet-wheels $l^x l^x$ until the change-shaft has completed a revolution thereof. As the revolution is completed a finger m^7 on the change-shaft strikes against the tail of the said catch m^5 , whereupon the weighted arm m^3 serves to restore the trip-shaft and the driver-controller to their normal position, thereby moving the drivers $l' l'$ out of engagement with the wheels $l^x l^x$.

n is the locking-arm, which is employed for holding the change-shaft k locked in its position of rest, the said arm having connected therewith the spring n' and being provided with the projection n^2 , which enters a notch in the periphery of the disk n^3 , fast on the change-shaft k .

o is the upright arm, which is pivoted at its lower end at o' upon a bracket applied to the front girth a^3 and joined by a connection o^2 with a curved arm o^3 on trip-shaft m^2 , the forward movement of this arm serving to rock the trip-shaft, as aforesaid, and enable the drivers $l' l'$ to come into engagement with the ratchet-wheels $l^x l^x$. As in Patent No.

636,228 aforesaid, the arm o is arranged to be advanced by the weft-fork slide c' when the latter is forced forward in consequence of the engagement of the gooseneck with the tail of the weft-fork. Herein, however, in carrying the present invention into effect, instead of being arranged to be carried forward by every advance of the weft-fork slide, as in the said patent, and so as thereby to bring the weft-replenishing mechanism into action every time the weft-indicator mechanism acts to indicate the occurrence of the predetermined condition, fault, or emergency in connection with the weft or filling, the arm o is arranged to be swung forward automatically only when replenishment of the body-weft is needed. To this end in the present embodiment of the invention a movable piece o^4 is connected with the upper portion of the arm o —as, for instance, as by being pivoted thereto at o^5 . The said movable piece o^4 is adapted to be placed in and out of the range of movement of the weft-fork slide c' . When it is in such range, the forward movement of the weft-fork slide will cause the latter to engage the piece o^4 , and thereby communicate movement to the arm o , bringing about the action of the replenishing mechanism. When the piece o^4 has been moved out of the range of movement of the weft-fork slide c' , the forward movement of the said slide will be incapable of operating the arm o , and hence the weft-replenishing mechanism will not be brought into action. For the purpose of controlling and determining the position of the movable piece o^4 I connect it with the devices by means of which the position of the shifting shuttle-boxes is determined, so that when the said shuttle-boxes are shifted to bring the shuttle containing the body-weft into line with the shuttle-race the movable piece o^4 shall be placed within the range of movement of the weft-fork slide, and so, also, that when the said shuttle is out of position for being picked the said movable piece shall be out of the range of movement of the weft-fork slide. In the present instance I connect the movable piece o^4 with the box-lever e^2 through the intervention of a rod p , which last is connected at its upper end with an arm on the said movable piece, a lever p' having the lower end of the said rod connected to one arm thereof, and a rod p^2 connecting the other arm of the said lever p' with the box-lever e^2 , the said lever p' being pivotally mounted, as at p^3 , on a bracket applied to the loom-frame.

The loom to which the features of the present invention are shown applied herein is like the looms of my prior Letters Patent Nos. 636,228 and 639,975 in this that while the operations which are incident to effecting the replenishment of the working weft-supply are being performed a rest is occasioned in the working of the said weaving instrumentalities. Herein, as in the looms of the said patents, this rest is brought about by unshipping the driving

power from the weaving instrumentalities and applying the brake. These things are effectuated through the agency of the various instrumentalities which have been explained, the weft-indicator mechanism serving to detect the occurrence of the predetermined fault, contingency, or emergency in the case of the weft or filling and acting to occasion the unshipping and braking. I prefer thus to occasion a rest in the working of the weaving instrumentalities until after the replenishing operations have been performed; but it should be stated that in some cases the features of the present invention will be utilized by me in looms in which the replenishing operations are effected without disturbing the general driving of the loom.

It will be understood that the weaving instrumentalities of the loom, the same not needing to be shown or described herein, inasmuch as their character is well understood, are in practice operatively combined with the crank-shaft a^5 and cam-shaft a^6 . The said weaving instrumentalities will either act or stand at rest, according as the driving power is thrown into or out of connection with the said shafts.

In order to restart the weaving instrumentalities after the weft replenishment has been effectuated, the arm q , Fig. 3, on the change-shaft k is arranged, as in prior patents to me, so that when the change-shaft has almost completed its revolution the said arm will encounter an antifriction-roll q' , carried by an arm q^2 , fast on the shipper rock-shaft b^4 . Thereby the said rock-shaft will be rocked so as to shift the driving-band b^8 onto the fast band-pulley b and restore the shipper-handle b^2 to its former position in its holding-notch in the plate b^3 , this movement of the shipper-handle causing it to act against the lever b^{16} , and thereby relieve the pressure of the brake-band b^{10} upon the periphery of the brake-wheel b^9 . Thus the weaving instrumentalities are restarted.

It will be apparent that every time the gooseneck engages with the tail of the weft-fork and forces the weft-fork slide c' forward the knocking-off lever c^2 will be operated to dislodge the shipper-handle b^2 , and thereby bring about the unshipping of the power and the application of the brake. If the shifting shuttle-boxes happen at the time of this action to be in the position which brings into action the shuttle containing the body-weft, the slide c' will engage with the movable part o^4 on lever o and operate in the manner which will be understood from the foregoing to bring about the action of the weft-replenishing mechanism, and the complete performance of the replenishing operations will be followed by an automatic restarting of the loom. In a different position of the shuttle-boxes, bringing into position for action a shuttle containing a different weft or filling, the shift of the movable portion o^4 into inoperative position will prevent slide c' from engaging there-

with. Consequently the advance of slide c' will bring about only the arrest of the loom without calling the weft-replenishing and restarting instrumentalities into action at all.

The weft-fork c and its accessories constitute merely one form of instrumentalities by means of which to ascertain the condition of the working weft-supply and indicate the arrival of the proper time for the action of the weft-replenishing instrumentalities. I do not desire to limit myself in all embodiments of the invention to the use of this particular form or kind of weft-indicator devices. The latter is merely the kind that is in most general use. It is operative to ascertain breakage or running out of the working weft-supply. Other forms of devices having the same end in view are known and may be substituted in practice. So, also, in some cases I may employ weft-indicator devices operating whenever the working supply of weft or filling has become exhausted to a predetermined extent. Various forms of devices of this latter kind are known.

I will now describe the safety device or guard by means of which the transfer of a fresh or reserve shuttle to the lay is prevented in case the shuttle previously at work on the lay has not been discharged or removed from the latter—as, for instance, when such shuttle has failed to return to the shuttle-box at the change end of the loom.

Reference should be made more particularly to Figs. 2, 5, and 6. In these figures, s designates a small bracket which is affixed to the front of the lay-beam a^9 at the change end of the loom, and s' is a dog which is pivoted to the said bracket, as at s^2 , Figs. 5 and 6. This dog normally projects upward across the path which a shuttle takes in being transferred by the injector i from the hopper or magazine j to the lay or in being ejected from the shuttle-box at the change end of the loom. A fixed stop s^3 on bracket s is provided to prevent the dog from yielding to any rearwardly-directed pressure which may be applied to the same. The dog, however, is free to be swung forwardly upon its pivot. When the replenishing instrumentalities are brought into play and the ejection of a working shuttle from the shuttle-box at the change end of the lay is effected properly, such shuttle in being ejected or discharged acts against the dog s' and swings it forward down out of the path which a fresh or reserve shuttle must follow in being carried by the injector over to the lay from the hopper or magazine. This leaves the said path clear of obstruction. Should no shuttle be ejected from the said shuttle-box, the dog s' will remain in its normal position and will constitute an obstruction which will act to prevent the injector from placing a fresh or reserve shuttle on the lay. For the purpose of restoring the dog s' to normal position after having been turned out of the way by a discharging shuttle a replacer s^4 is mounted to move in unison with the

shuttle-box front *g*. Thus the said replacer is fastened by a screw *s*⁵ to the front end of rocker *g*'. As the shuttle-box front *g* is restored to normal position after having been withdrawn to permit of the ejection or discharge of the spent or failed shuttle from the lay the said replacer acts against the dog *s*' and turns it back into the said normal position.

10 What I claim is—

1. In a loom, in combination, shifting shuttle-box mechanism for a plurality of shuttles, weft-replenishing instrumentalities, coacting with a reserve supply of one of the wefts, and weft-indicator devices having operative control over said instrumentalities when such weft is in use and at other times out of such control, substantially as described.

2. In a loom, in combination, shifting shuttle-box mechanism, weft-replenishing instrumentalities for one of the wefts, weft-indicator devices, and means to place the said devices in and out of operative control of the said instrumentalities as the shuttle-boxes are shifted, substantially as described.

3. In a loom, in combination, shifting shuttle-box mechanism, weft-replenishing instrumentalities, weft-indicator devices adapted to have operative control over the said instrumentalities, and connections from said mechanism whereby the said control is established or disestablished in accordance with the shifts of the shuttle-boxes, substantially as described.

4. In a loom, in combination, shifting shuttle-box mechanism, weft-replenishing instrumentalities, an arm or lever in operative control of the said instrumentalities and through which the latter may be caused to act, weft-indicator devices, and means under control of the said shuttle-box mechanism whereby to govern the operation of the said arm or lever from the said devices, substantially as described.

5. In a loom, in combination, shifting shuttle-box mechanism, weft-replenishing instrumentalities for one of the wefts, loom-driving mechanism, and weft-indicator devices operative in one position of the shuttle-boxes to

call the said instrumentalities into action to effect replenishment of the said weft, and in a different position of the shuttle-boxes to arrest the working of the loom, substantially as described.

6. In a loom, in combination, shifting shuttle-box mechanism, driving appliances for the weaving instrumentalities, replenishing instrumentalities for one of the wefts, weft-indicator devices adapted to have operative control over the said driving appliances and replenishing instrumentalities and thereby to institute the performance of the replenishing operations and meanwhile occasion a dwell or rest in the working of the said weaving instrumentalities, and means to vary the control of the said devices over the said replenishing instrumentalities according as the shuttle-boxes are shifted, substantially as described.

7. In a loom, in combination, the lay, means to effect the discharge of a spent or failed shuttle therefrom, means to introduce a fresh or reserve shuttle onto the lay, and a guard to prevent such introduction in case the said discharge fails to take place, substantially as described.

8. In a loom, in combination, the lay, means to effect the discharge of a spent or failed shuttle therefrom, means to introduce a fresh or reserve shuttle onto the lay, and the pivoted guard mounted on the lay and serving to prevent such introduction in case the said discharge fails to take place, substantially as described.

9. In a loom, in combination, the lay, the guard movably mounted thereon at the change end of the loom and arranged to be acted upon by the discharging shuttle, and the movable shuttle-box front provided with means to restore the said guard to its normal position, substantially as described.

In testimony whereof I affix my signature in presence of two witnesses.

HENRY I. HARRIMAN.

Witnesses:

CHAS. F. RANDALL,
LEPINE HALL RICE.