No. 636,228. Patented Oct. 31, 1899.

H. I. HARRIMAN.

LOOM.

(Application filed May 8, 1899.)

(No Model.) 5 Sheets—Sheet 1.

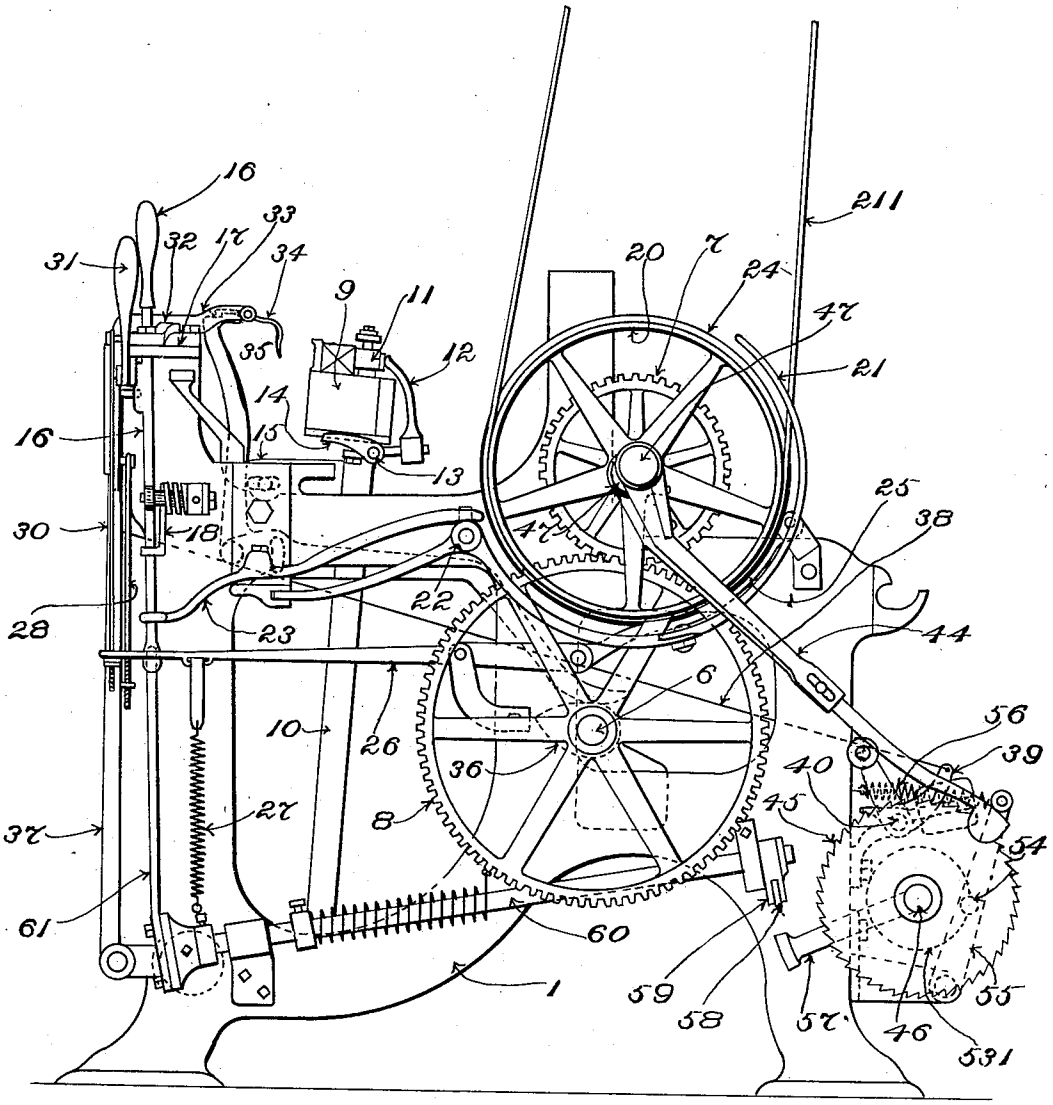

Fig. 1.

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5 Sheets—Sheet 2.

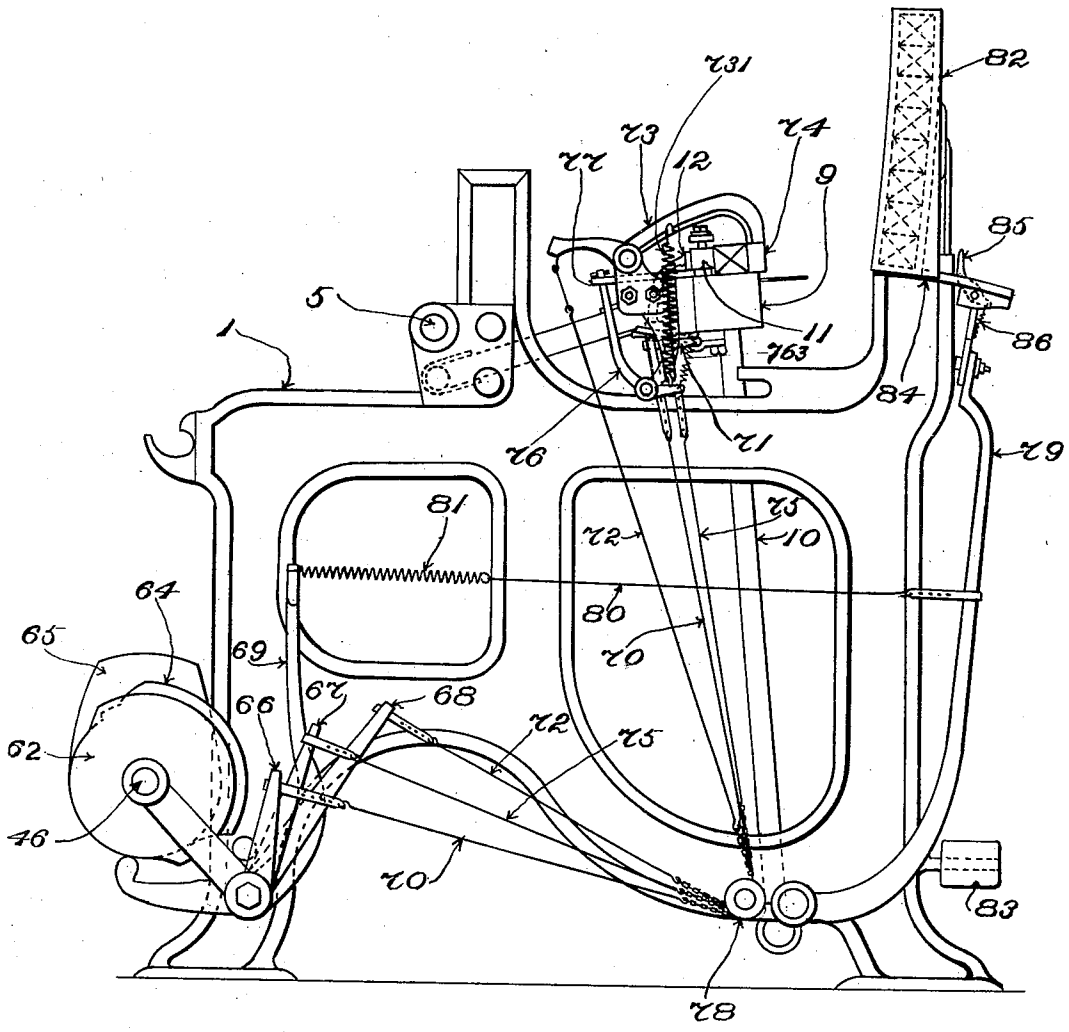

Fig. 2.

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(No Model.) 5 Sheets—Sheet 3.

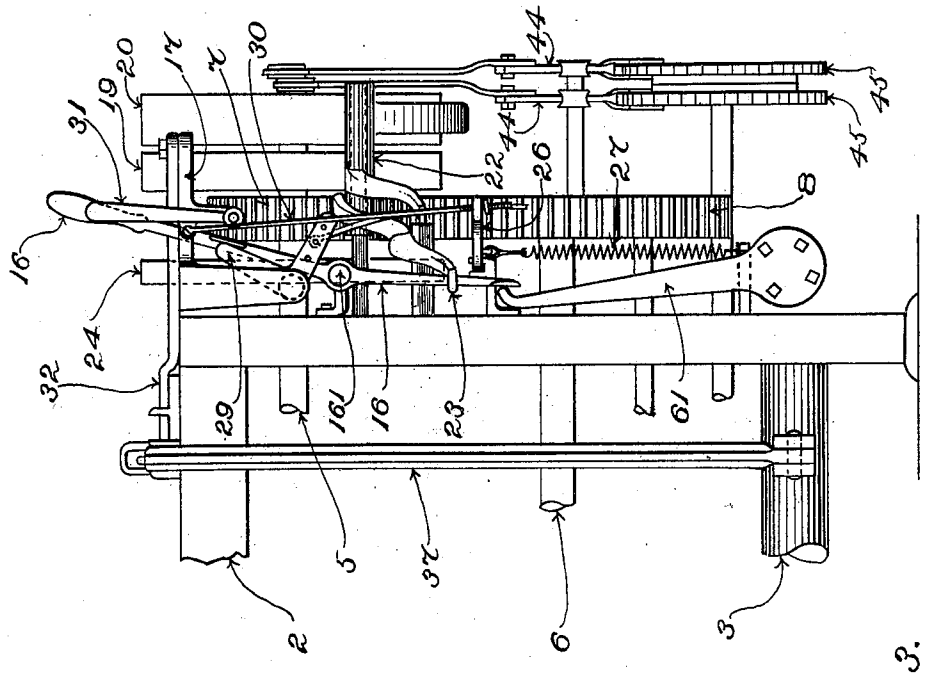
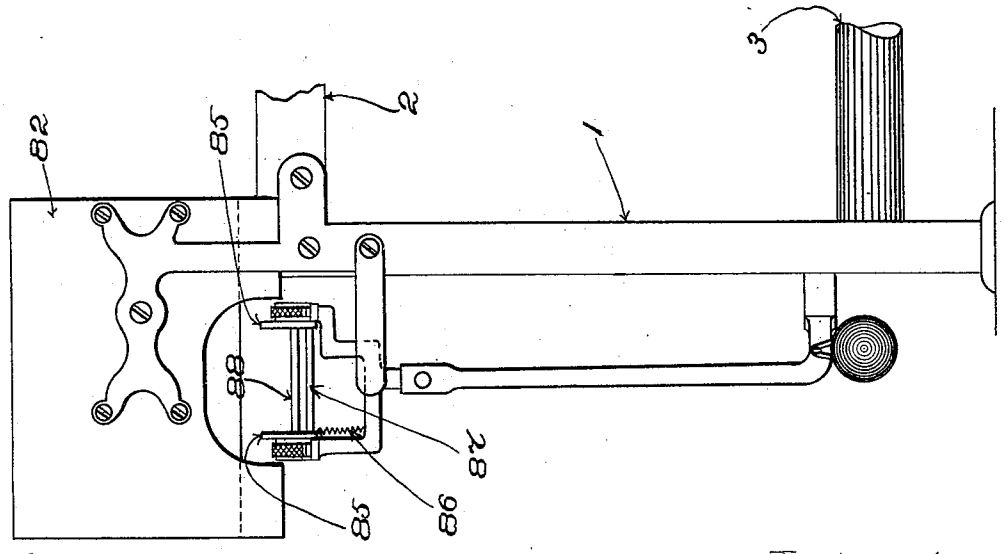


Fig. 3.



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(No Model.) 5 Sheets—Sheet 4.

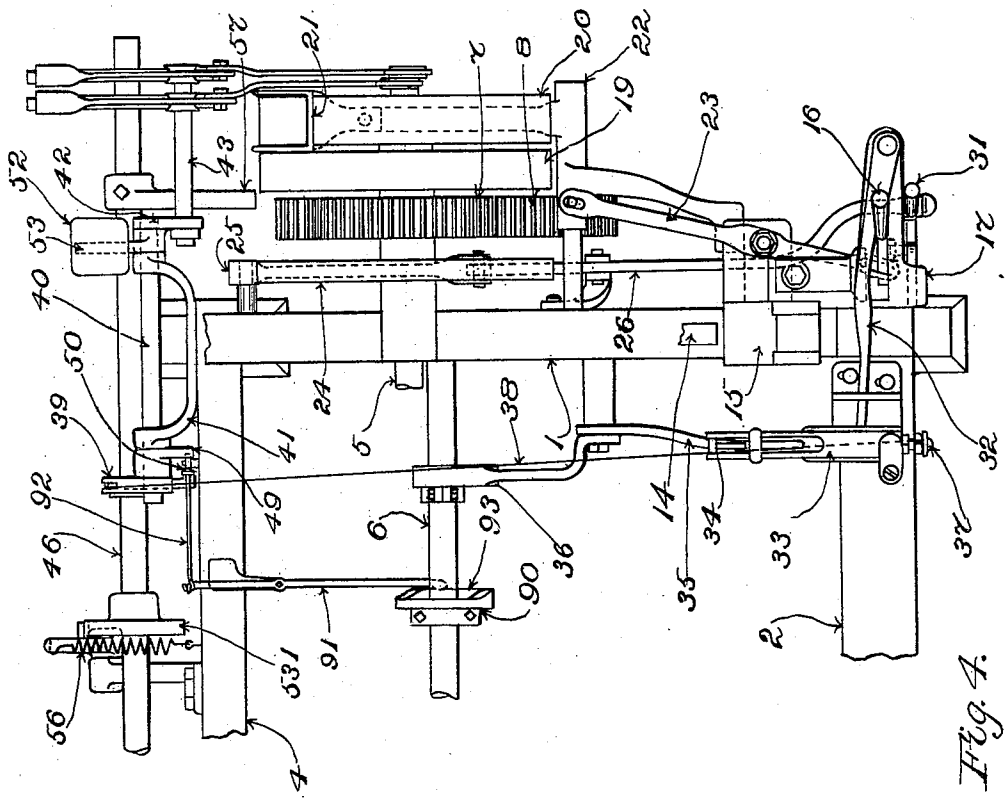
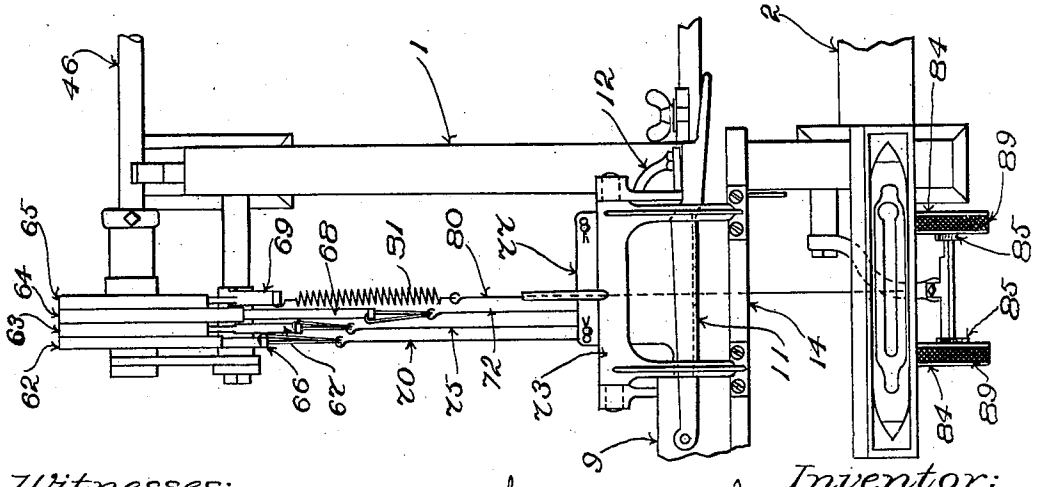


Fig. 4.



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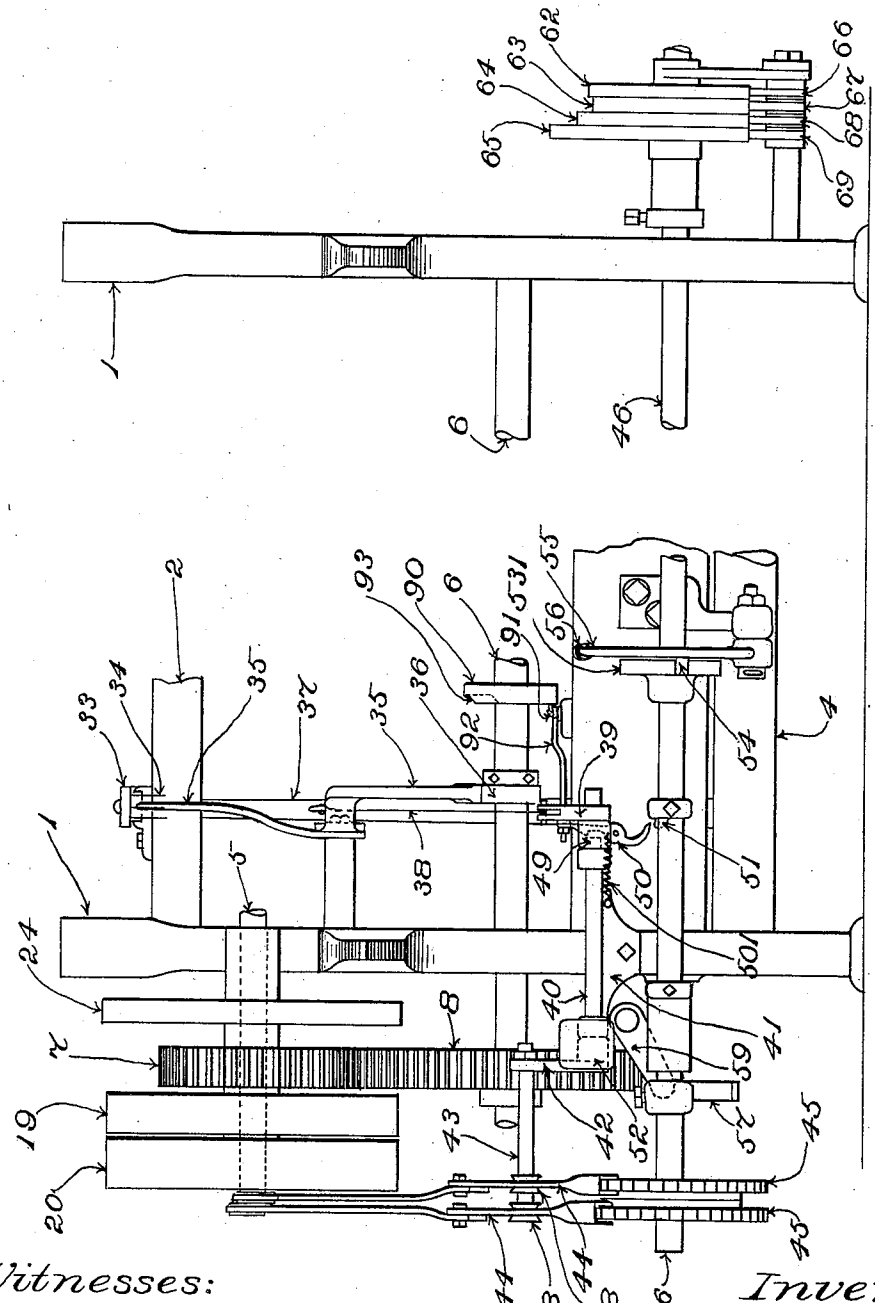

Fig. 5.

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UNITED STATES PATENT OFFICE.

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

LOOM.

SPECIFICATION forming part of Letters Patent No. 636,228, dated October 31, 1899.

Application filed May 8, 1899. Serial No. 715,907. (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 and State of New York, have invented certain new and useful Improvements in Looms, of which the following is a specification, reference being had therein to the accompanying drawings.

The invention has relation to looms of that class in which replenishment of the weft or filling that is being incorporated into the web or fabric being woven is effected automatically by the mechanism of the loom when necessity arises therefor.

More especially the invention relates to looms containing automatic instrumentalities which are operative when the condition of the working weft-supply calls for replenishment thereof to occasion a rest in the working of the weaving instrumentalities, effect a replenishment of the working weft-supply, and then cause the weaving instrumentalities to resume their normal working.

The invention consists in automatic instrumentalities, such as just referred to, of novel and improved character and mode of operation and by the employment of which improved results are attained.

The accompanying drawings represent certain portions of a plain loom of an ordinary form and in connection therewith certain instrumentalities for effecting the replenishment of the working weft-supply, the said instrumentalities being of the general character of those which are presented also in Letters Patent of the United States No. 626,834, granted to me June 13, 1899, on my application filed February 28, 1899, but having applied in connection therewith embodiments of the various features of improvement, which will presently be explained.

Figure 1 of the drawings represents in elevation the driving end of the loom aforesaid and the parts involving the present invention which are visible at such end, the usual features of the loom, which do not require to be referred to in the presentation of the invention, being omitted for the sake of securing greater clearness. Fig. 2 is an end elevation of the change end of the loom—namely, that at which the reserve supply of weft or filling is located and at which the replenishment of the working supply on the lay occurs. Fig. 3 shows in front elevation certain of the parts which are represented in Figs. 1 and 2. Fig. 4 shows in plan the parts which are represented in Figs. 1 and 2. Fig. 5 shows in rear elevation certain of the parts which are represented in Figs. 1 and 2.

As will be seen, the drawings show the end frames 1 1 of an ordinary plain loom, as well as portions of the breast-beam 2 thereof, portions of the front and rear cross-girths 3 and 4, respectively, portions of the crank-shaft 5 and cam-shaft 6, and the driving gear-wheels 7 and 8 on the said shafts. They show also the lay-beam 9, the lay-swords 10 10, the shuttle-box swells 11 11, the protector-fingers 12 12, bearing against the said swells, the protector-rod 13, the dagger 14, mounted on the protector-rod, the sliding frog 15, mounted on an end frame of the loom and adapted to be engaged and actuated by the said dagger, the shipper-handle 16, its slotted and notched holding and guiding plate 17, and the actuating-spring 18 for the shipper-handle, whereby after the latter has been dislodged by hand or otherwise from its holding-notch in the plate 17 it is moved to occasion the stopping of the loom.

I have shown ordinary arrangements for driving the loom and shipping the driving power on and off, the said arrangements comprising the usual fast pulley 19, loose pulley 20, shipper-fork 21, shipper-slide 22, and lever 23, operatively connecting the shipper-handle 16 with the shipper-slide 22; also, an ordinary brake arrangement comprising the brake-wheel 24 upon the crank-shaft, the brake-shoe 25, the brake-lever 26, the brake-lever-actuating spring 27 for pressing the brake-shoe into contact with the brake-wheel 24 when permitted to act, the brake-lever-lifting rod 28 and bell-crank 29, acted upon by the shipper-handle 16 and by means of which the shipper-handle is made operative to apply and relieve the brake-pressure, and the second brake lever-lifting rod 30 and handle 31, by means of which the pressure of the brake may be relieved by hand at any time during the stoppage of the loom.

The features which have thus far been described with reference to the drawings are merely those usual in looms of the class to which the invention is intended to be applied

and are presented herein merely to aid in the disclosure of the invention itself. Any convenient and suitable arrangement and construction thereof may be utilized in practice.

It will be understood that the weaving instrumentalities of the loom, the same not needing to be shown or described inasmuch as their character is well known, are in practice operatively combined with the crank-shaft 5 and cam-shaft 6, and it will be obvious that the said instrumentalities will either act or stand at rest, according as the driving power is thrown into or out of connection with the said shafts. The foregoing driving and power-shipping arrangements serve in the present case for the application of driving power and for shipping the power on and off, although it should be clearly borne in mind that the particular character of such arrangements is not essential to the successful reduction of the invention to practice and that other arrangements may be employed, if desired.

When the loom is running, it is necessary to unship the driving power from the weaving instrumentalities in order to occasion the desired rest in the working of the weaving instrumentalities during the performance of the operation of replenishing the working weft-supply. This unshipping of the driving power from the weaving instrumentalities is effected in the illustrated mechanism by shipping the driving-band 211 from fast pulley 19 to loose pulley 20, and this in turn is effected herein by disengaging the shipper-handle 16 from its holding-notch in plate 17, so as to allow the spring 18 to actuate the shifter-fork 21. In the said mechanism also the shipper-handle is adapted to be thus disengaged automatically, and this disengagement is effected herein by movement of the knocking-off lever 32, the said lever coöperating with the slide 33 of the weft-fork 34 and being actuated in usual manner by the advance of the said weft-fork slide. As will be understood, the said advance of the weft-fork slide will occur when the tail of the weft-fork is caught by the gooseneck 35 in the forward sweep of the upper end of the latter that is occasioned by the action of the gooseneck-cam 36 on the cam-shaft 6. The foregoing disengagement of the shipper-handle and unshipping of the power is accompanied in obvious manner by the automatic application of the brake, and thereby the motion of the weaving instrumentalities is almost immediately arrested.

The weft-fork 34 and gooseneck 35 constitute merely one form of instrumentalities by means of which to ascertain the condition of the working weft-supply and to indicate the arrival of the proper time for the rest in the working of the weaving instrumentalities as well as for the action of the weft-replenishing devices. 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 usually contained in plain looms. 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, I may in some cases employ weft-indicator devices operating in known manner whenever the working supply of weft or filling has become exhausted to a predetermined extent. Nor do I limit myself to the instrumentalities herein presented for effectuating the shipping under the control of the weft-indicator devices.

For the purpose of bringing the weft-replenishing devices into action the weft-indicator devices are placed in control of the power or driving connections of the latter. This may be provided for in a variety of ways, according to the character and construction of the mechanical contrivances that it is desired to embody in the loom. Herein an arm 37 is pivoted to a suitable support—as, for instance, to a bracket extending from the front cross-girth 3, Figs. 1 and 3. The upper end of the said arm stands in line with the front end of the weft-fork slide 33. When the said slide is advanced by the engagement of the gooseneck with the tail of the weft-fork, it bears the arm 37 forward. The said arm is instrumental in tripping the weft-replenishing mechanism into action. Herein it is connected by a wire 38 or other suitable means with an arm 39 on a trip-shaft 40. The said trip-shaft is mounted in bearings in a bracket 41 at the rear of the loom, and it controls the application of driving power to the replenishing mechanism. To this latter end in the present embodiment of the invention it is furnished with a second arm 42, provided with a driver-controller, which last is constituted by a laterally-projecting pin 43. The said driver-controller determines the times of action of the alternately-reciprocating drivers 44 44 upon a wheel or wheels 45 45, pertaining to the weft-replenishing mechanism. Two of the said wheels are shown in the present instance.

Herein I have embodied a change-shaft 46 such as is presented in my Letters Patent No. 626,834 aforesaid, and the wheels 45 45 are shown fast upon the said change-shaft. The said wheels are shown formed as ratchet-wheels, and the drivers 44 44 are shown constituted by pawls, these last being connected with arms which are fitted to eccentrics 47 47, fast with the hub or sleeve of the loose pulley 20. The said eccentrics are located in opposite phases, so as to reciprocate the drivers alternately in opposite directions. By this means when the drivers are permitted to enter into engagement with the ratchet wheel or wheels 45 45 they communicate a substantially continuous rotary motion to the change-shaft. It is necessary that the change-shaft should rotate quite slowly while the replenishment of weft is being effected. The devices just described operate very efficiently

and satisfactorily to reduce the exceedingly-high speed of motion of the loose pulley 20 to the required slow speed of the change-shaft. For the purpose of reducing friction antifriction-rolls 48 48 are applied to the pin 43, and over such rolls the drivers reciprocate while upheld by the driver-controller in its elevated position.

When the trip-shaft 40 is rocked to allow the drivers 44 44 to engage with the wheel or wheels 45 45, an arm or the like on the said trip-shaft, as at 49, Figs. 4 and 5, is moved into position to be engaged by a catch 50, which is acted upon by a spring 501. The said catch holds the driver-controller depressed and permits the drivers to remain in working engagement with the wheel or wheels 45 45 until the change-shaft has completed a revolution thereof. As the revolution is completed a finger 51 on the change-shaft strikes against the tail of the said catch 50 and disengages it from the arm 49, whereupon a weight 52, or it might be a spring, acting on an arm 53 of the trip-shaft 40, serves to restore the trip-shaft and driver-controller to their normal position, thereby moving the drivers 44 44 out of engagement with the wheel or wheels 45 45.

For the purpose of holding the change-shaft 46 locked in its position of rest a wheel 531 is made fast thereon, the said wheel having a notch in its periphery which receives the pin 54, carried by the locking arm or lever 55, the latter having connected therewith the spring 56, which serves to bear the pin against the periphery of the wheel.

During the rotation of the change-shaft 46 the weaving instrumentalities of the loom remain at rest. In order to restart the said instrumentalities after the weft replenishment has been effectuated, the change-shaft is operatively connected with the shipper through devices by means of which the latter is moved to ship on the power to render the shafts 5 and 6 operative once more. Thus an arm 57 is made fast upon the change-shaft, and when the change-shaft has almost completed its revolution the said arm encounters an antifriction-roller 58, carried by an arm 59, fast on the rear end of a shaft 60, extending from front to rear of the loom. The said shaft 60 is mounted in bearings on one end frame of the loom and has fast to its forward end an upwardly-extending arm 61. The arm 61 engages with the shipper-handle 16 below the pivot 161 of the latter, as shown in Fig. 3, and when arm 57 on the change-shaft acts to rock the shaft 60 the arm 61 operates to move the shipper-handle to restore it to its former position in its holding-notch, the said movement serving to ship the driving-band onto the fast pulley 19 and relieve the pressure of brake-shoe 25 upon wheel 24. Thereupon the weaving instrumentalities are restarted, shortly after which the change-shaft comes to rest through the disengagement of the drivers 44 44 from the wheel or wheels 45 45, as explained above.

In case the shipper-handle 16 should be prevented from reëntering its holding-notch after having been operated from the change-shaft, as just described, it would not be retained in the proper working position, and consequently the automatic restarting of the weaving instrumentalities after the operation of the replenishing devices would be impossible. Should the gooseneck 35 remain in its forward position at the time the weaving instrumentalities came to rest, holding the weft-fork slide and knocking-off lever 32 in the forward or knocking-off position, this position of the knocking-off lever would prevent the shipper-handle from reëntering its notch. In order to obviate this, the cam 36, which actuates the gooseneck, is made with a very sharp rise and an immediate drop. (See Fig. 1.) This enables the gooseneck to recede to its backward position immediately after having been advanced to feel for the weft-fork. In consequence of the engagement of the gooseneck with the weft-fork the weft-fork slide and knocking-off lever are pushed forward to dislodge the shipper-handle; but the immediate return rearward of the gooseneck before the complete stoppage of the weaving instrumentalities leaves the shipper-handle free to reënter fully into its holding-notch when it is restored to starting position.

The automatic shipping-on action and accompanying removal of the brake occasioned by the change-shaft just before it completes its revolution require the expenditure of some power, and it is necessary, moreover, that such action should be fully completed. It is necessary also that the change-shaft should continue to be driven until it has completed its revolution and returned to the starting position thereof. One aim of the present invention is to insure the complete performance of the shipping-on action and also the completion of a full revolution of the change-shaft, so as to bring the latter again into its starting position. Thus in accordance with one portion of this invention I provide for continuing positively the application of driving power to the change-shaft after the weaving instrumentalities have resumed operation. This may be effected in different ways—as, for example, either by keeping the driver or drivers for the change-shaft continuously in action during the regular working of the loom or by keeping the same in action after the shipping on until the completion of the revolution of the change-shaft is an assured fact. In the present case I have illustrated the first of these methods, it involving the employment of continuously-actuated drivers. The said drivers are in operative connection with a continuously-operating actuator which is constituted herein by the loose pulley 20, which latter I keep constantly in motion. To this end the driving-band 211 is

made sufficiently wide to enable one edge thereof to extend beyond the side of the fast pulley 19 and run on a portion of the loose pulley 20 during the regular working of the loom. This keeps the loose pulley in motion at such time. The loose pulley preferably is made wider than the fast pulley (see Figs. 4 and 5) in order to accommodate the full width of the driving-band when the latter is shifted thereupon. As described hereinabove, the motion of the drivers is taken from the loose pulley, and thus the desired result is secured.

The replenishment of the working weft-supply when called for by the action of the weft-indicator devices is effectuated under the operative control of the change-shaft 46. The replenishment may be effected in various known ways without departure from the broad spirit of my invention—as, for instance, either by replacing the working shuttle by a reserve shuttle or by replacing the cop, bobbin, or other filling-carrier within the working shuttle by a fresh one without disturbing the said working shuttle. In the present case I have illustrated devices for making a change of shuttles. In the drawings a nest of cams is mounted on the said change-shaft at the end of the loom which is opposite to that on which the driving connections are applied. (See Figs. 2, 4, and 5.) These cams are designated, respectively, 62, 63, 64, and 65. In connection therewith a series of bell-cranks or other levers is employed, as at 66, 67, 68, and 69, one arm of each lever bearing against the periphery of one of the said cams. Connection 70 extends from bell-crank 66 to a rocker 71, mounted beneath the lay-beam. Thereby the said rocker is actuated to relieve the pressure of the protector-fingers 12 12 against the swells 11 11 of the shuttle-boxes during the performance of the operations which are incident to replacing the working shuttle on the lay by a fresh one. Connection 72 extends from bell-crank 68 to a rocker 73, mounted upon the lay and carrying the movable front 74 of the shuttle-box at the change end of the loom. Thereby the said movable front is raised to permit of the ejection or discharge of the working shuttle from the said shuttle-box and the introduction of a fresh one. A spring 731, connected to rocker 73, acts to return the shuttle-box front to its normal position. Connection 75 extends from bell-crank 67 to a rocker 76, mounted upon the lay and connecting with the ejector 77, the latter working under the swell 11 at the rear of the shuttle-box at the change end of the lay. Thereby the ejector is operated to push the working shuttle out of the said shuttle-box after the movable front 74 has been carried out of the way. The spring 763 serves to move rocker 76 to retract the ejector 77. The connections 70, 72, and 75 are flexible in part, at least, to enable them to pass around guide-sheaves at 78, adjacent to the lay rock-shaft, in order that the vibrations of the lay may not operate to disturb the positions or working of the parts which are carried by the lay. In the main the parts which have just been described resemble those which are presented in my Letters Patent aforesaid, except that I have provided herein for operating the ejector 77 by different means from that in the said Letters Patent. The bell-crank 69 is joined with the arm of the injector 79 by a connection 80, including a spring 81. The throw of cam 65 is sufficiently great to occasion an excess of movement of bell-crank 69. The injector having been moved to transfer a reserve shuttle from the magazine or hopper 82 to the lay, the spring will give as soon as the said shuttle is pressed fully home into the shuttle-box. The said spring will hold the injector pressed against the shuttle as it lies in the shuttle-box until the movable shuttle-box front has been closed down before the shuttle. This spring enables the injector to accommodate itself to any position in which the lay may stand at the time of effecting the replenishment. 83 is a weight for returning the injector to its forwardly-retracted position after it has performed its work. At its upper end the injector is furnished with rearwardly-extending arms 84 84, constituting supports on which a shuttle may lie. Normally the injector stands at rest, with the rear portions of the said arms beneath the stack of reserve shuttles in hopper or magazine 82, the bottom shuttle of the said stack resting on the bottom of the hopper a slight distance above the upper sides of the said arms, whereby all the shuttles are supported. The middle portion of the bottom of the hopper is removed to allow for the passage backward and forward of the injector, and, as usual, the back of the hopper is open at the lower end thereof to permit the bottom shuttle to move rearwardly with the injector. Fingers 85 85 are provided on the injector, these fingers being mounted to turn or swing vertically thereon and having connected therewith a spring 86, by means of which they are held normally in the upwardly-extending position which is shown in Figs. 2 and 3. As the injector is moved rearwardly in the loom in order to feed a shuttle to the lay these fingers engage with the front side of the bottom shuttle and carry the said shuttle with the injector. In the ensuing forward movement or return of the injector the fingers yield on making contact with the shuttle which is now at the bottom of the hopper or magazine, and thereby descend and pass underneath the said shuttle. After clearing the said shuttle they will be caused by their spring 86 to rise in front of the same in readiness to engage therewith in the next rearward movement of the injector. Herein the fingers 85 85 are mounted to turn freely on a rod 88, carried by the injector, the depending ends of the said fingers being connected by a rod 87, so that the fingers shall move in unison. The fingers and rod 87 together constitute a rocker.

A spring 86 is attached to one of the fingers and acts to hold the engaging ends thereof normally in their operative upraised position.

In order to guard against slipping of the shuttle out of place on the arms of the injector while being carried rearwardly to the lay, the said arms have their upper surfaces provided with frictional material herein constituted by sheets or pads of india-rubber 89 89.

The passage-way for shuttles down within the hopper or magazine 82 is inclined rearwardly or bent at its lower end, as shown in Fig. 2, and the bottom of the said hopper or magazine is inclined downward toward the front of the loom. This inclination of the said bottom causes the bottom shuttle to tend to move forwardly and overcomes the tendency of the said shuttle to work out through the opening at the back of the hopper or magazine in consequence of the shake and jar of the loom. The upper surfaces of the arms of the injector assume this same inclination when the injector is in its position of rest, and the plane in which the under side of the bottom shuttle in the hopper or magazine lies is substantially tangent to the arc in which the said arms move. The said arc is substantially identical with that in which the upper surface of the lay-beam moves, and hence it is possible for the injector to act to transfer a shuttle to the lay in all positions of the latter, and therefore regardless of where it may come to rest when the driving power is unshipped by the action of the weft indicator devices and coöperating instrumentalities.

It is desirable to provide against accidents of the class which arise in consequence of the presence of two shuttles on the lay at one time. To this end I have contrived protector devices for controlling the working of the replenishing devices and operating to prevent a reserve shuttle from being transferred to the lay except as provided for. Thereby I prevent a reserve shuttle from being transferred to the lay except after the ejection or discharge of the shuttle previously working on the lay. The said protector devices herein are constituted by the cam 90 on the cam-shaft 6, the lever 91, actuated by the said cam, and the connection 92, extending from the lever 91 to the catch 50. These devices operate to prevent the catch 50 from engaging with the arm 49 of the trip-shaft 40 except when the depression 93 of the cam 90 is presented to lever 91. Consequently it is only when the weaving instrumentalities come to rest with the said depression in position to receive the end of lever 91 that the weft-replenishing instrumentalities will be made operative. The angular position of the depression 93 of cam 90 is selected to cause it to be presented to the lever 91 only at the alternate revolutions of the crank-shaft corresponding with the times when in the regular working of the loom the working shuttle should be in the shuttle-box at the change or supply end of the loom. It will be understood that unless the working shuttle is in position in the said shuttle-box it will not be ejected by the working of the replenishing instrumentalities, and consequently if the said instrumentalities should be permitted to transfer a reserve shuttle to the lay there would then be two shuttles on the latter, which would result in accident and injury. By making the depression extend around one hundred and eighty degrees of the cam, as in the drawings, the weft-replenishing instrumentalities may be permitted to come into operation regardless of the position in which the lay may come to rest, which is an important characteristic of the present invention.

It has been explained herein that the cam 36, which actuates the gooseneck, is shaped to permit the gooseneck to recede to its backward position immediately after having been advanced to feel for the weft-fork and before complete stoppage of the weaving instrumentalities occurs in consequence of engagement of the gooseneck with the weft-fork. This enables arm 37 to recede also immediately after having been pushed forward by the advance of the slide 33 of the weft-fork. The backward return of arm 37 leaves the trip-shaft 40 free to resume its normal position as soon as catch 50 is disengaged from the arm 49 on said shaft. It has been pointed out that this resumption of normal position by the trip-shaft 40 discontinues the driving action of the power appliances by which the change-shaft is rotated. Should the trip-shaft be prevented from resuming its normal position at the end of a revolution of the change-shaft, the said power appliances would remain in operative engagement with the change-shaft and the working of the replenishing devices would be continued so long as the trip-shaft occupied its abnormal position.

In lieu of the herein-described arrangement for operating the change-shaft under the control of the weft indicator devices I may utilize any convenient arrangement of driving connections including a clutch device or fast and loose pulleys and provided with a shipper or shifter device under the control of trip-shaft 40. I contemplete also in some cases taking the motion for the said change-shaft from a counter-shaft and the employment of a worm and worm-gear for the purpose of reducing speed sufficiently.

I claim as my invention—

1. In a loom, in combination, power appliances for driving the weaving instrumentalities, devices to indicate when the condition of the working weft-supply necessitates replenishment thereof, instrumentalities under the control of such devices operative to bring the weaving instrumentalities to rest to permit of replenishment, and instrumentalities also under the control of such devices and operative while the weaving instrumentalities are thus at rest to automatically replenish the working weft-supply in all positions of

the lay and then restart the weaving instrumentalities.

2. In a loom, in combination, power appliances for driving the weaving instrumentalities, devices to indicate when the condition of the working weft-supply necessitates replenishment thereof, instrumentalities under the control of such devices operative to bring the weaving instrumentalities to rest to permit of replenishment, instrumentalities operative to automatically replenish the working weft-supply while the weaving instrumentalities are at rest and then restart the latter, and power appliances for said weft-replenishing instrumentalities also under the control of said devices and adapted to continue in action after the weaving instrumentalities have been restarted.

3. In a loom, in combination, power appliances for driving the weaving instrumentalities, and in connection therewith a continuously-driven member, a change-shaft, instrumentalities under the control thereof for automatically replenishing the working weft-supply, power appliances for the said change-shaft operated from the said continuously-driven member, devices to indicate when the condition of the working weft-supply necessitates replenishment thereof, instrumentalities under the control of such devices for bringing the weaving instrumentalities to rest, instrumentalities also under the control of such devices for rendering the latter power appliances operative to rotate the change-shaft and occasion the weft replenishment while the weaving instrumentalities are at rest, and means for restarting the weaving instrumentalities after the weft replenishment has been effected and then discontinuing the application of power to the change-shaft.

4. In a loom, in combination, power appliances for driving the weaving instrumentalities, and in connection therewith a continuously-rotating wheel or pulley, a change-shaft, instrumentalities under the control thereof for automatically replenishing the working weft-supply, a wheel connected with the change-shaft, a driver to engage the said wheel, an eccentric rotating with the said wheel or pulley and operating the said driver, devices to indicate when the condition of the working weft-supply necessitates replenishment thereof, instrumentalities under the control of such devices for bringing the weaving instrumentalities to rest, instrumentalities under the control of such devices for establishing driving relations in the train of devices intermediate the said eccentric and the change-shaft, and means under the control of the change-shaft for restarting the weaving instrumentalities after the weft replenishment has been effected and then discontinuing the driving relations of the said train.

5. In a loom, in combination, power appliances for driving the weaving instrumentalities, and in connection therewith a continuously-rotating wheel or pulley, a change-shaft, instrumentalities under the control thereof for automatically replenishing the working weft-supply, a wheel or wheels connected with the change-shaft, a plurality of drivers to engage the said wheel or wheels, eccentrics operated by the said wheel or pulley and serving to operate the said drivers, devices to indicate when the condition of the working weft-supply necessitates replenishment thereof, instrumentalities under the control of such devices for bringing the weaving instrumentalities to rest, instrumentalities under the control of such devices for establishing driving relations in the train of devices intermediate the said eccentrics and the change-shaft, and means under the control of the change-shaft for restarting the weaving instrumentalities after the weft replenishment has been effected and then discontinuing the driving relations of the said train.

6. In a loom, in combination, weft-indicating devices operative when the condition of the working weft-supply necessitates replenishment, weft-replenishing devices, a wheel or wheels in operative connection with the said weft-replenishing devices, a plurality of drivers for engaging with the said wheel or wheels to operate the replenishing devices, a rotating wheel or pulley, eccentrics operated by the said wheel or pulley and serving to operate the said drivers, instrumentalities under the control of the weft-indicating devices for causing the said drivers to engage with the said wheel or wheels to rotate the latter and operate the weft-replenishing devices, and means to terminate the driving action of the said drivers after the weft replenishment has been effected.

7. In a loom, in combination, weft-indicating devices operative when the condition of the working weft-supply necessitates replenishment, weft-replenishing devices, a wheel or wheels in operative connection with the said weft-replenishing devices, one or more drivers for engaging with the said wheel or wheels to operate the replenishing devices, a trip-shaft having a driver-controller and operatively connected with the weft-indicating devices to cause the said drivers to become engaged with the said wheel or wheels when the condition of the working weft-supply necessitates replenishment, a catch for holding the trip-shaft in the position to which it is moved from the indicating devices, and means for disengaging the said catch after the completion of the weft replenishment.

8. In a loom, in combination, weft-indicating devices operative when the condition of the working weft-supply necessitates replenishment, a change-shaft, weft-replenishing devices under the control of the said change-shaft, a wheel or wheels connected to the said change-shaft, one or more drivers for engaging with the said wheel or wheels to operate the change-shaft, means for actuating the said drivers, a trip-shaft having a driver-controller

and connected with the weft-indicating devices to cause the driver or drivers to rotate the change-shaft when the condition of the working weft-supply necessitates replenishment, a catch for engagement with the said trip-shaft, and means for disengaging the said catch when the change-shaft has completed the required rotation.

9. In a loom, in combination, the weft-fork, the change-shaft, weft-replenishing devices under the control of the said change-shaft, a wheel or wheels connected with the change-shaft, one or more drivers for engaging with the said wheel or wheels to operate the change-shaft, means for actuating the said drivers, a trip-shaft in control of the driving relations of the train of devices for operating the change-shaft, means intermediate the weft-fork and the trip-shaft for operating the latter to establish driving relations of the said train, a catch for maintaining the parts in operative relationship while the weft replenishment is being effected, and means for discontinuing the driving relations of the said train when the change-shaft has completed the required rotation.

10. The injector having the shuttle-supporting arms provided with the frictional pads to make contact with the shuttle resting on said arms and hold it from displacement.

11. The injector having the shuttle-supporting arms, and having the yielding spring-actuated finger or fingers to engage with the shuttle which is to be fed by the said injector.

12. In a loom, in combination, weft-indicating devices operative when the condition of the working weft-supply necessitates replenishment, weft-replenishing devices, means under the control of the weft-indicating devices for actuating the replenishing devices when the condition of the working weft-supply necessitates replenishment, a controller for the actuating connections of the replenishing devices, and a protector-cam rotating in predetermined relation with the weaving instrumentalities and serving to control the position of the said controller device.

13. In a loom, in combination, weft-indicating devices operative when the condition of the working weft-supply necessitates replenishment, weft-replenishing devices, a wheel or wheels in operative connection with the said weft-replenishing devices, driving devices for engaging with the said wheel or wheels to operate the replenishing devices, a trip-shaft provided with means for controlling the action of the said driving devices, a catch for engagement with the said trip-shaft to hold it in the working position, the rotating protector-cam 90, and devices intermediate the same and the said catch to determine the engagement of the catch with the trip-shaft.

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

HENRY I. HARRIMAN.

Witnesses:

CHAS. F. RANDALL,

WILLIAM A. COPELAND.