S. S. JACKSON.

PICK FINDER DEVICE FOR LOOMS.

APPLICATION FILED OCT. 20, 1905.

945,722.

Patented Jan. 4, 1910.

5 SHEETS—SHEET 1.

Fig. 2.

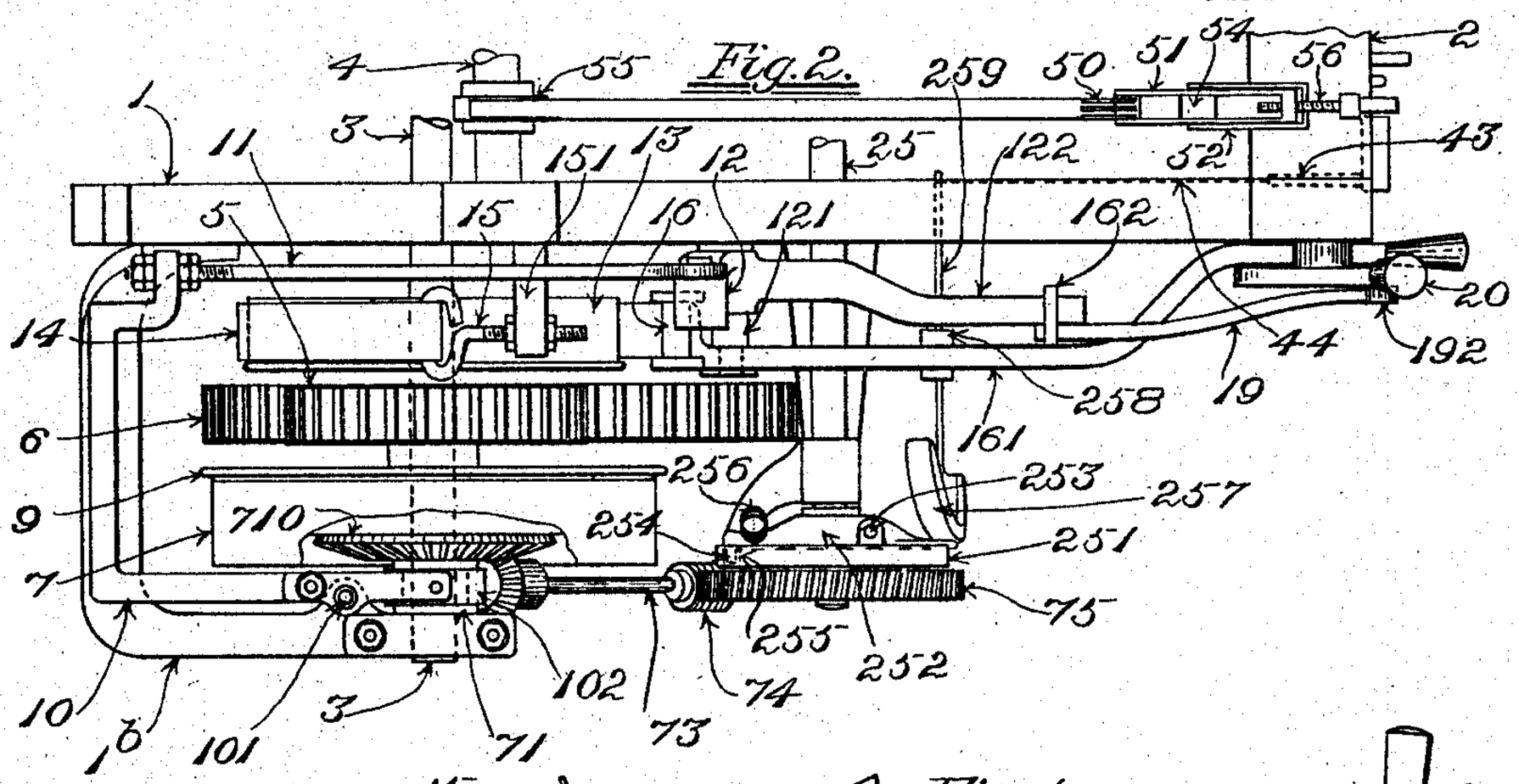
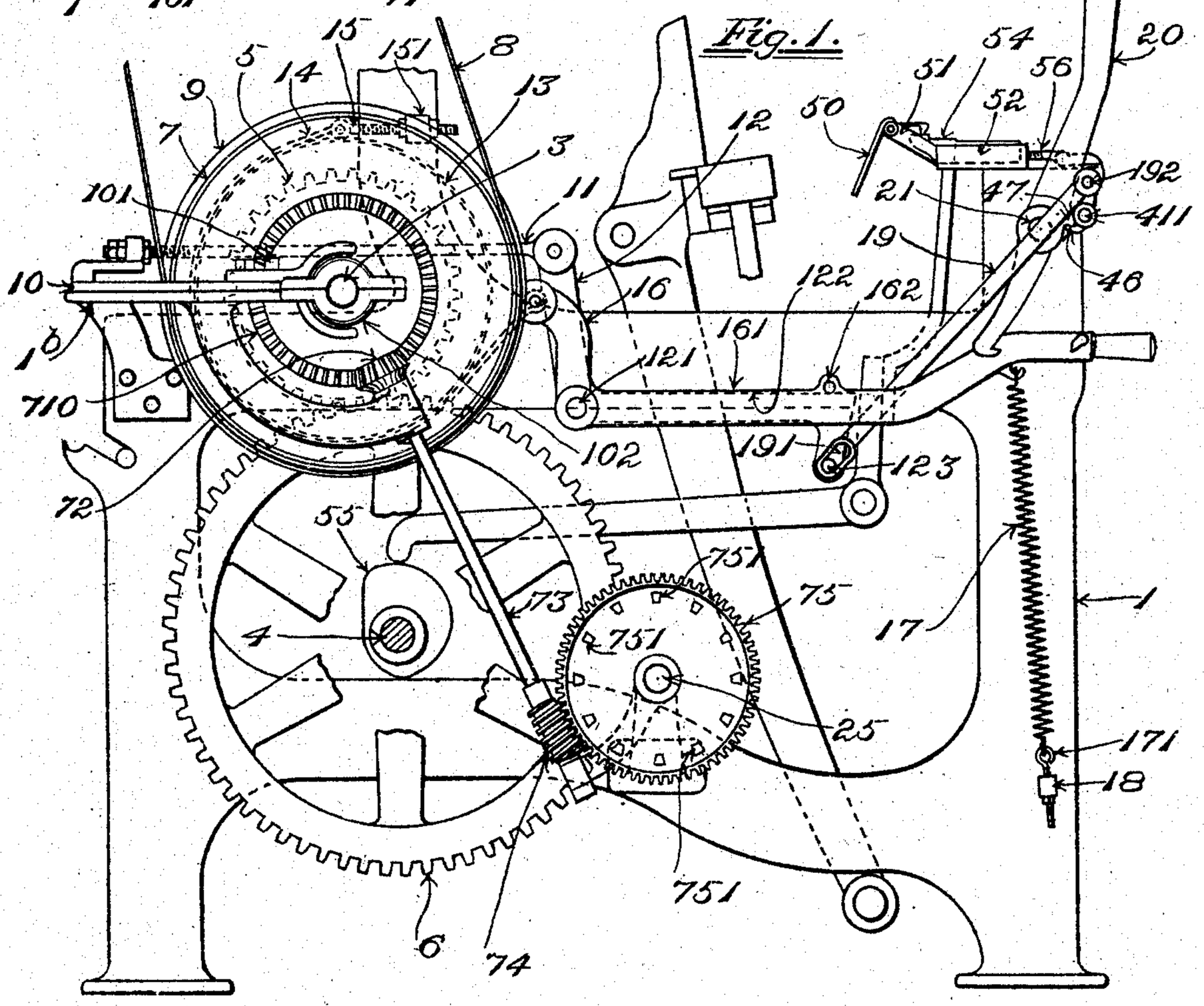


Fig. 1.



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5 SHEETS—SHEET 2.

Fig. 3.

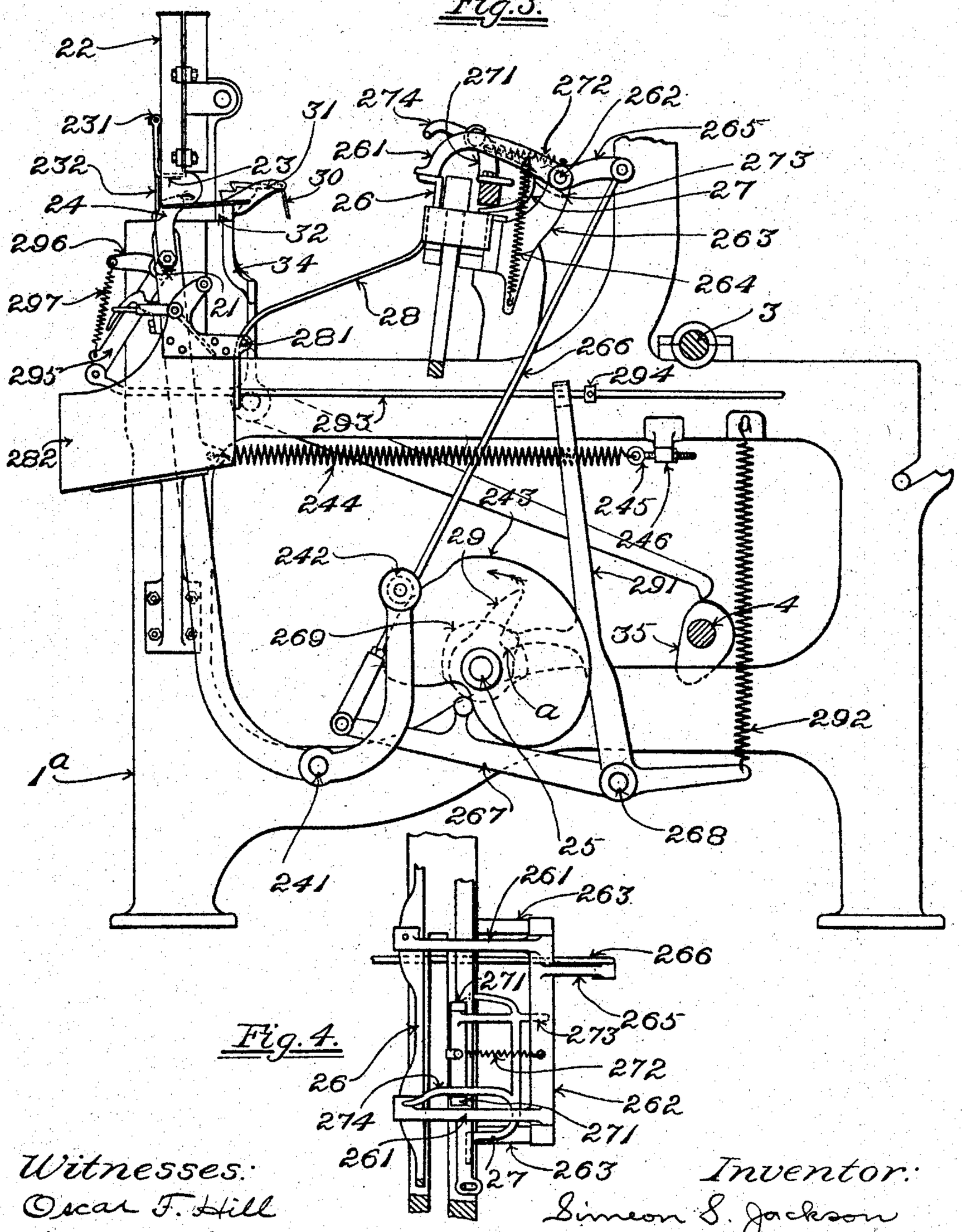

Fig. 4.

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5 SHEETS—SHEET 3.

Fig. 5.

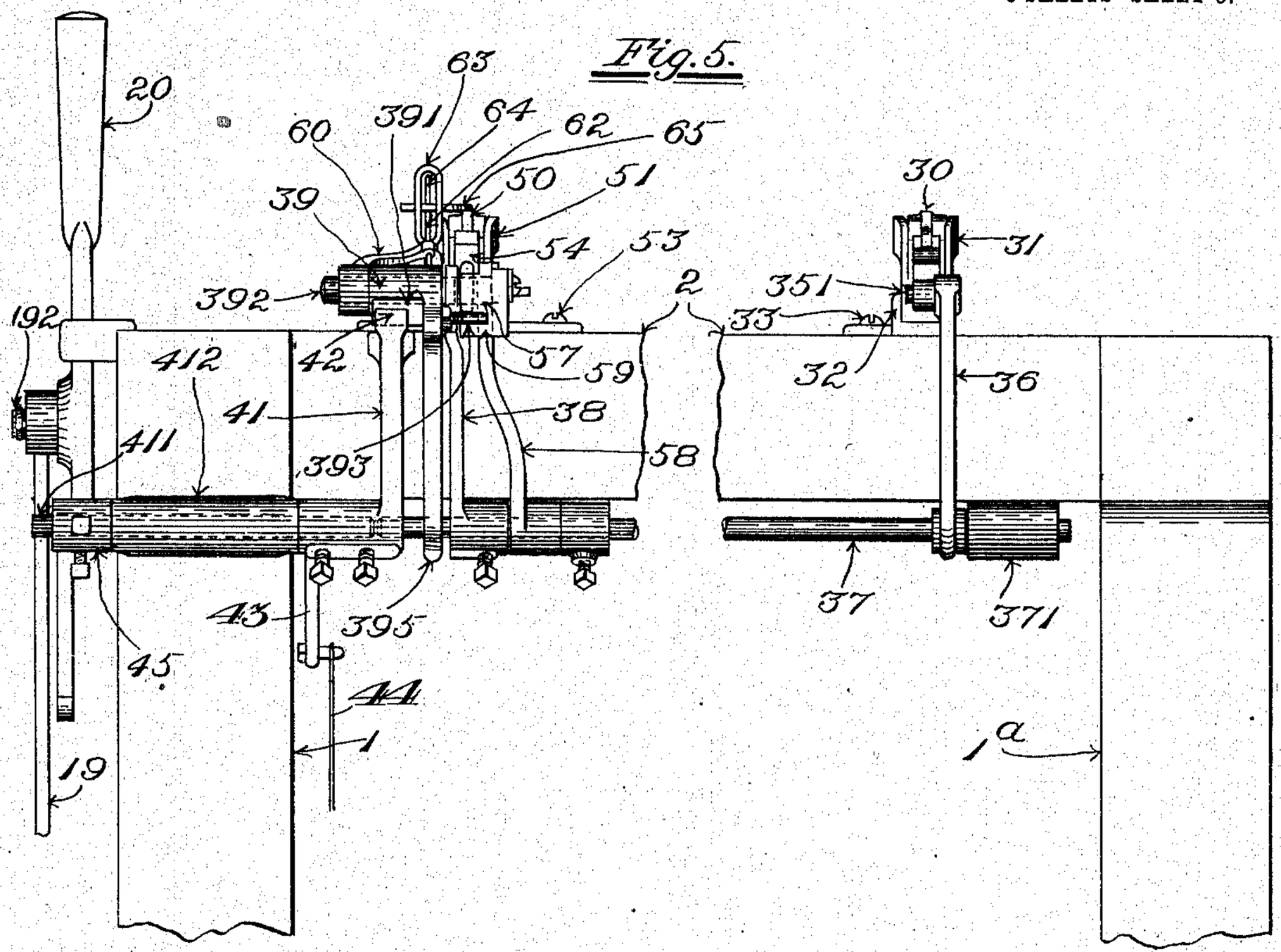
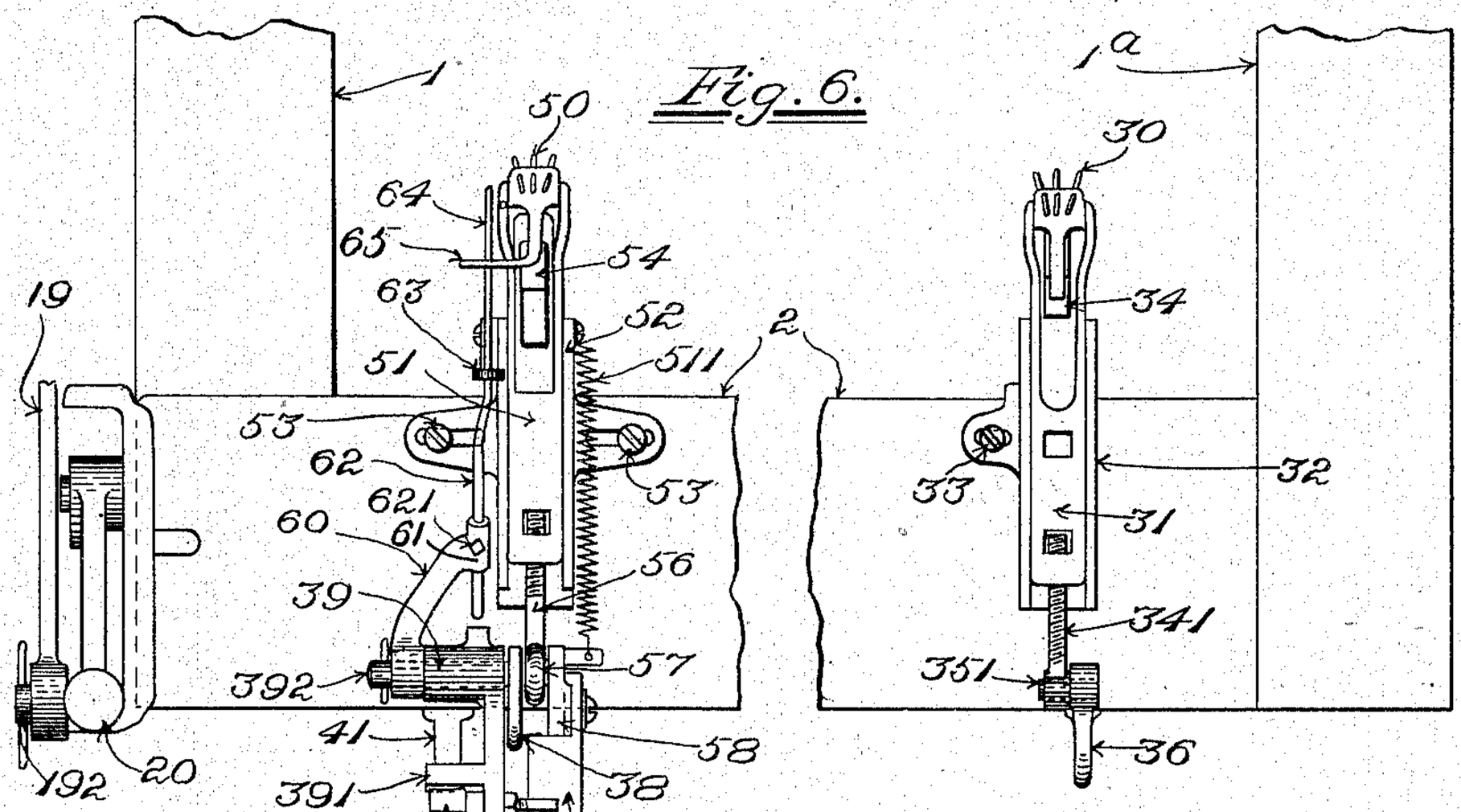


Fig. 6.



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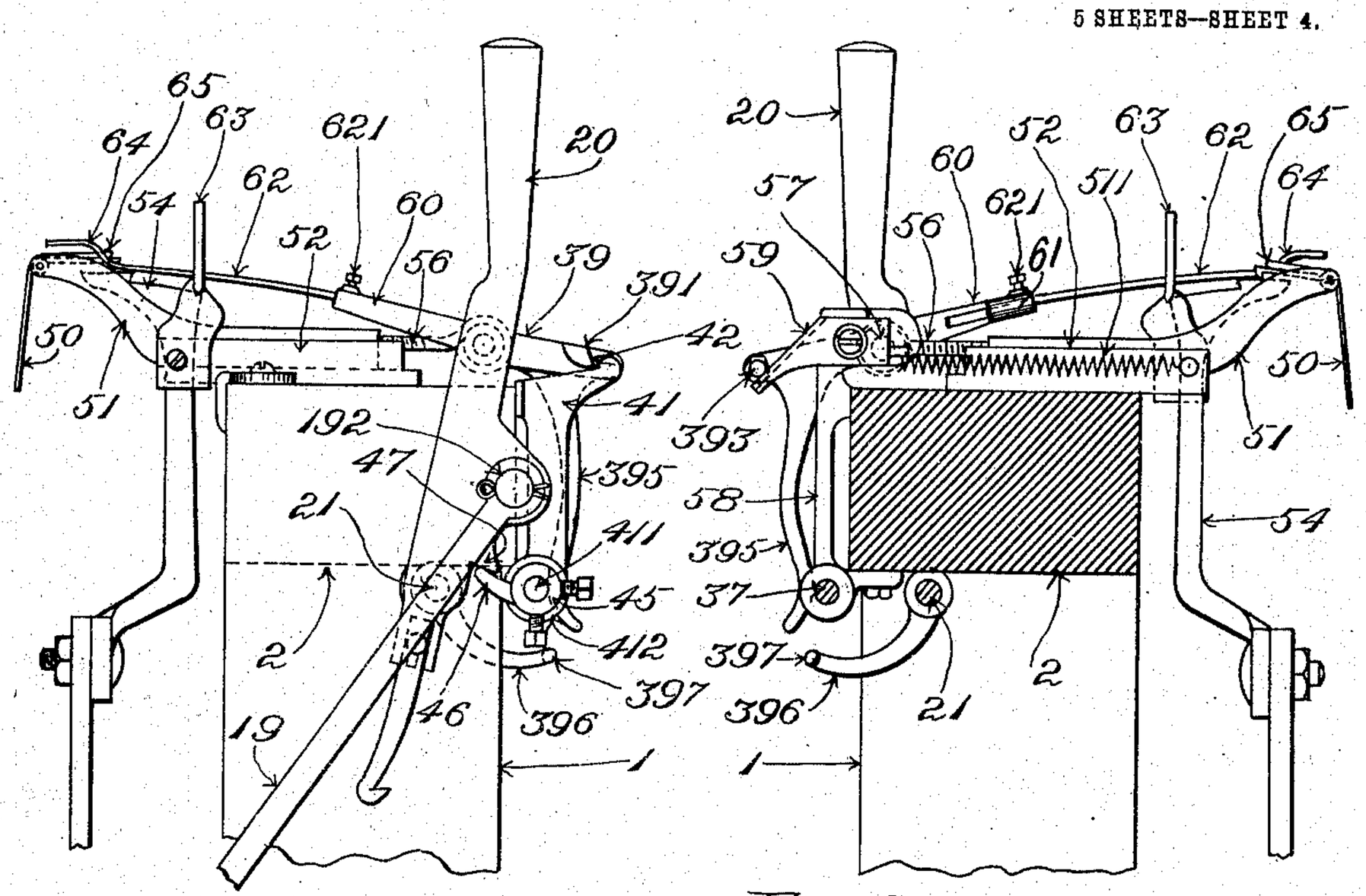

Fig. 8.

Fig. 7.

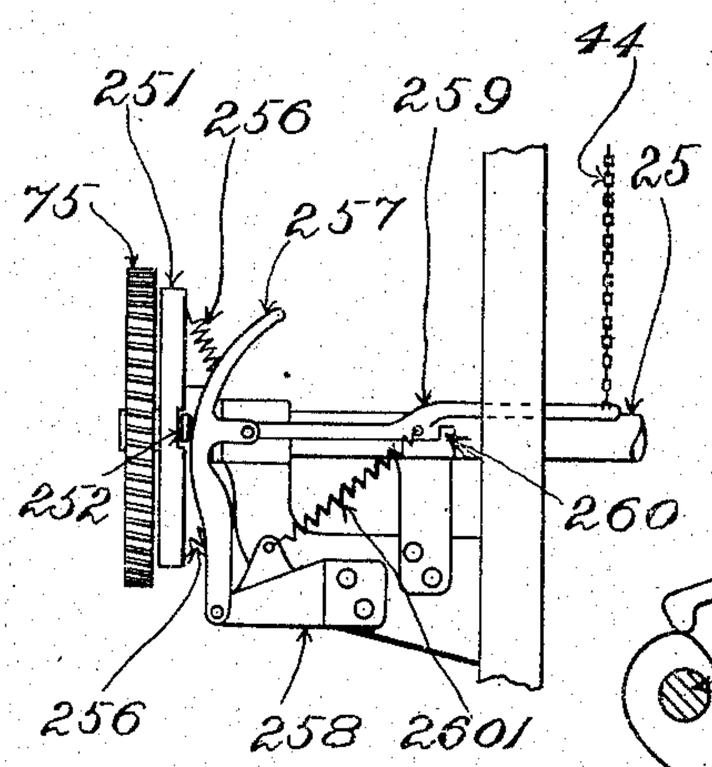

Fig. 9.

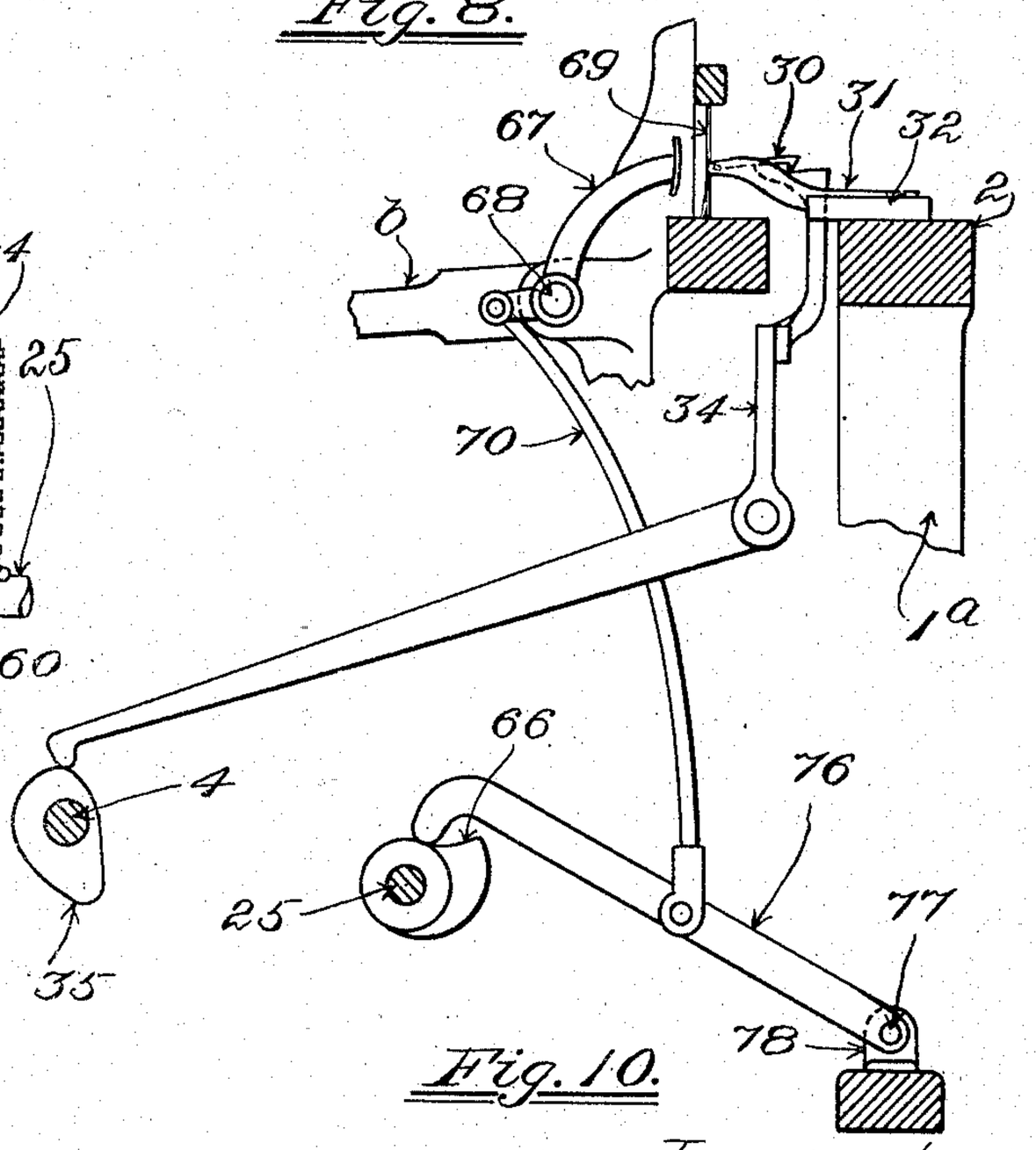

Fig. 10.

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5 SHEETS—SHEET 5.

Fig. 11.

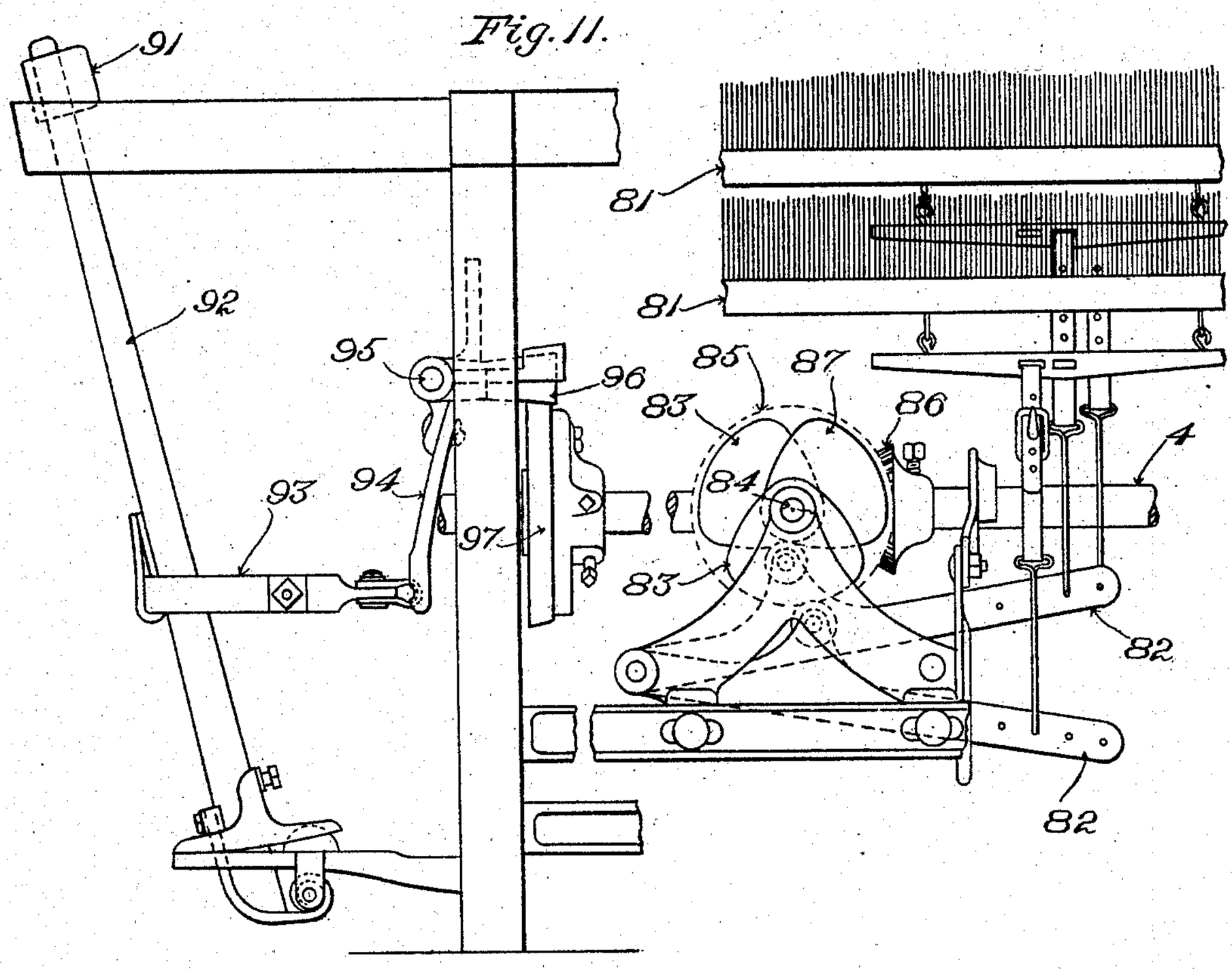
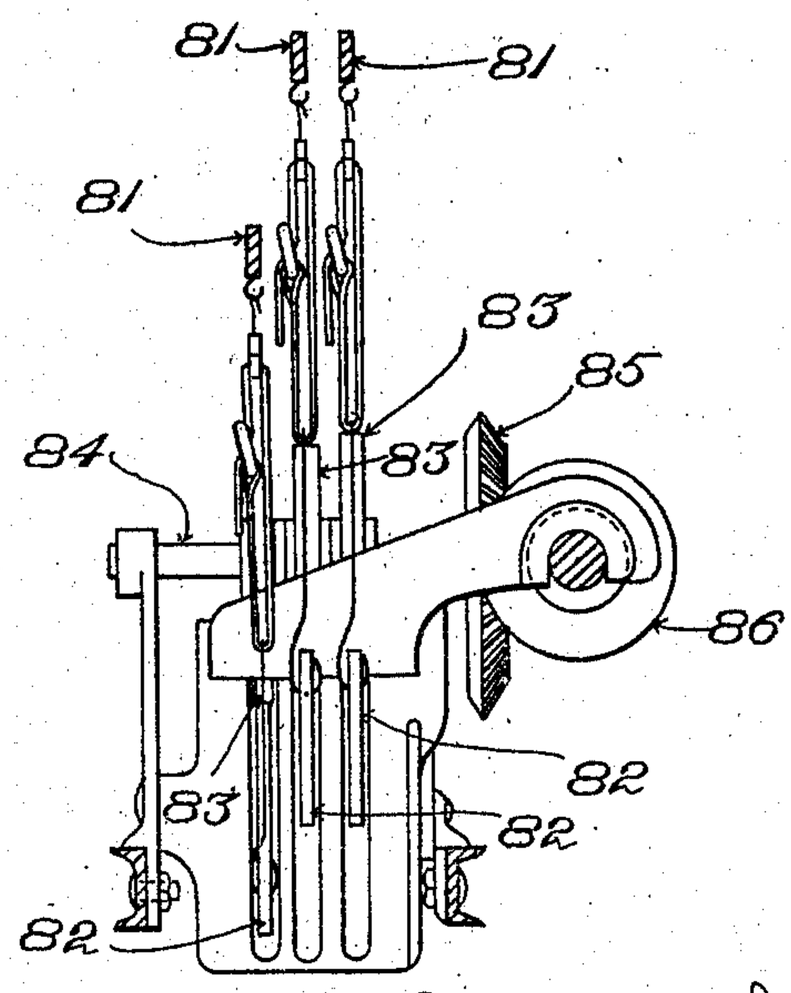


Fig. 12.



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UNITED STATES PATENT OFFICE.

SIMEON SCHOON JACKSON, OF READVILLE, MASSACHUSETTS, ASSIGNOR TO THE GEO. W. STAFFORD COMPANY, OF READVILLE, MASSACHUSETTS, A CORPORATION OF NEW YORK.

PICK-FINDER DEVICE FOR LOOMS.

945,722. Specification of Letters Patent. Patented Jan. 4, 1910.

Application filed October 20, 1905. Serial No. 283,615.

To all whom it may concern:

Be it known that I, SIMEON SCHOON JACKSON, a subject of Great Britain, residing at Readville, in the county of Norfolk, State of Massachusetts, have invented a certain new and useful Improvement in Pick-Finder Devices for Looms, of which the following is a specification, reference being had therein to the accompanying drawings.

The invention resides in pick-finder devices which are constructed and arranged to operate, in case of failure of weft, to cause the first pick after resumption of weaving with fresh weft to be introduced into a reopening of the proper shed to receive it, *i. e.*, the shed in which the failure of weft took place, in whichever direction of pick the failure of weft occurred.

The invention resides, further, in the combination with replenishing instrumentalities, in a loom in which replenishment of the working weft-supply is effected automatically, of pick-finder devices controlling the operation of such instrumentalities and operating to cause the first pick of fresh weft after replenishment to be introduced into a reopening of the proper shed to receive it, in whichever direction of pick failure of weft took place.

The invention resides, further, in the combination in a loom, with stopping means operating to arrest the loom always with the shuttle at the same side of the latter, of pick-finder devices operating the said stopping means with selective timing varied to correspond with the direction of the pick in which failure occurs.

In the drawings,—Figure 1 is an elevation of the driving end of a loom, with certain parts broken away, showing chiefly the driving and stopping arrangements. Fig. 2 is a plan of the parts which are represented in Fig. 1, omitting the lay. Fig. 3, Sheet 2, is a partial elevation of the replenishing end of the loom, certain portions being in section. Fig. 4, Sheet 2, is a partial plan of the lay and the parts which are mounted thereon at the replenishing end. Fig. 5, Sheet 3, shows in front elevation the breast-beam and portions of the opposite side-frames, together with the pick-finder devices and connected parts which are mounted thereon, the middle portion of the length of the breast-beam being broken out for convenience in showing the parts on a sufficiently large scale for clearness on one sheet of drawings. Fig. 6, Sheet 3, shows in plan the parts of Fig. 5. Fig. 7, Sheet 4, is a detail view showing the parts which are located at the left-hand end of the breast-beam, looking from the left-hand side in Fig. 5. Fig. 8, Sheet 4, is a view of the parts which are shown in Fig. 7, but looking from the right-hand side in Fig. 5, the breast-beam being represented in vertical transverse section. Fig. 9, Sheet 4, shows in front elevation a portion of the actuating mechanism and controlling connections for the change-shaft. Fig. 10, Sheet 4, is a partly sectional detail view showing chiefly the substitute weft devices. Fig. 11, Sheet 5, shows in front elevation portions of a loom, illustrating more particularly the shedding and picking instrumentalities. Fig. 12, same sheet, is a sectional side elevation showing more particularly the shed-forming mechanism.

Having reference to the drawings,—at 1, Figs. 1, 2, and 5, is the side-frame at the driving end of the loom which is shown in the drawings, 1^a in Figs. 3, 5, and 6 being the side-frame at the replenishing end of such loom.

At 2, Figs. 2, 5, 6, etc., is the breast-beam.

The crank-shaft of the loom is shown at 3, Figs. 1, 2 and 3, and the cam-shaft at 4, the usual gears by means of which motion is transmitted from the crank-shaft to the cam-shaft being shown at 5, 6, Figs. 1 and 2.

Having reference to the driving connections, and to the shipper and brake-devices of Figs. 1 and 2, a loose band-pulley 7 is mounted upon the crank-shaft 3, driving-power being transmitted to the said band-pulley by means of a suitably-actuated driving-band 8 Fig. 1 passing around the same, while 9 is a wheel fixed upon the crank-shaft, the two wheels 7 and 9 being provided with or constructed to constitute the inter-engaging members of a friction-clutch.

At 10 is a clutch-operating lever which is pivoted at 101 upon the stand 1^b, Figs. 1 and 2, attached to the loom-side 1 and extending outward therefrom, the said lever having a fork which engages with a yoke 102 in connection with the hub 71 of the loose band-pulley 7.

11 is a rod connecting the clutch-operating lever 10 with the upwardly-extending arm of the bell-crank 12, which latter is mounted upon a stud 121 carried by and projecting outward from the loom-side 1, the said bell-crank having a forwardly-extending arm 122 by means of which the same may be operated for the purpose of actuating the lever 10 to move the band-pulley 7 toward and from the wheel 9 as required in order to close and open the friction-clutch.

13 is a brake-wheel which is fixed upon the crank-shaft 3, and 14 is a brake-band which extends partly around the periphery of the said brake-wheel, one end of the said brake-band being connected to an adjustable eye-bolt 15 that is carried by a stand 151 projecting from the loom-arch, while the other end of the said brake-band is connected with the upwardly-extending arm of a bell-crank 16 that is mounted upon the said stud 121, the said bell-crank having a forwardly-extending arm 161, the forward extremity of which constitutes a handle by means whereof the bell-crank 16 may be manually operated when desired. To the said arm 161 is connected one end of the strong contracting spiral spring 17, the other end of which is connected to an eye-bolt 171 that is carried by a stand 18 projecting from the loom-side 1. Normally the arm 161 of bell-crank 16 is held upraised with the bell-crank occupying a position in which the brake-band is slack around the brake-wheel 13. When the bell-crank 16 is freed to the control of the said spring 17, the latter operates the bell-crank to tighten the brake-band 14 upon the periphery of the brake-wheel. In order that the movement of the bell-crank 16 under the action of the spring may also transmit movement to the clutch-operating lever 10, to open the clutch and thereby disconnect the driving-power, the arm 161 is furnished with a pin 162, which projects transversely from the said arm across the top of the arm 122 of bell-crank 12. When bell-crank 16 is operated by its spring 17, the descent of arm 161 causes the arm 122 of bell-crank 12 to be pressed down by the said pin 162, thereby transmitting to the clutch-operating lever 10 movement in the direction to separate the clutch-members and thus discontinue the application of driving-power.

For the purpose of enabling the bell-cranks 12, 16, to be operated simultaneously in starting the loom, so as to throw off the brake and effect the clutching of the band-pulley 7 to the crankshaft, the arm 122 of the bell-crank 12 is furnished with a laterally-projecting pin 123 Fig. 1 which extends through a slot 191 formed in the lower end of a rod 19, the said slot extending in the direction of the length of the rod, the upper end of which latter is pivoted at 192 to the shipper-handle 20, which last is fixed upon one end of the horizontal stopping rockshaft 21, the said rockshaft extending across the loom beneath the breast-beam, and being mounted in suitable bearings with which the side-frames 1, 1ª, are provided. Movement of the shipper-handle forward causes the rod to move endwise, and by engagement of the wall at the lower end of slot 191 with the pin 123 the bell-crank 12 is turned to clutch the band-pulley 7 to the crankshaft, the engagement of the arm 122 of the said bell-crank with pin 162 on arm 161 of bell-crank 16 causing the latter bell-crank to be turned so as to slacken the brake-band. In the position normally occupied by the shipper-handle during the running of the loom, the point of connection, 192, between the rod 19 and the shipper-handle is slightly forward of the center of the stopping rockshaft 21, whereby the parts are locked in working position. When the shipper-handle is moved reversely so as to carry the said point of connection to the rear side of the center of rockshaft 21, the spring 17 acts to move the bell-cranks to apply the brake and disconnect the driving-power. Other constructions and arrangements of driving, shipping, and braking devices may be employed in practice.

In Figs. 11 and 12, Sheet 5, I have shown shed-forming and shuttle-picking instrumentalities of customary character. In such figures, portions of three harness-frames are represented at 81, 81, 81, the operating treadles therefor being designated 82, 82, 82. 83, 83, 83, are the shedding cams fast upon an auxiliary shaft 84, the latter having fixed thereon a bevel-gear 85 meshing with a bevel-gear 86 on cam-shaft 4. Through the rotation of the said auxiliary shaft and the shedding cams the treadles are actuated to produce the sheds in the proper succession The picker at one side of the loom is designated 91, the picker-stick by which it is carried being shown at 92, 93 being a lug-strap which connects the said picker-stick with the arm 94 of a picking rock-shaft 95 having an inwardly projecting arm carrying a roll 96 which is acted against by a picking cam 97 on the cam-shaft 4. The picking devices are duplicated at the opposite side of the loom, as will be understood.

Figs. 3 and 4 show certain weft-replenishing instrumentalities. In the said figures, 22 is a hopper for fresh or reserve shuttles, the said hopper being supported in place at the replenishing end of the loom, adjacent one end of the breast-beam. 23 is a shuttle-support, which is pivotally mounted at 231 in connection with the hopper, and furnished with rearwardly-projecting fingers that normally occupy a position beneath the bottom shuttle in the hopper, supporting such shuttle and the others which rest upon

the latter. 24 is the injector, its supporting lever being mounted pivotally at 241 upon the lower part of the loom-frame. The short arm of the said lever is provided with a roll 242, which latter is held pressed in contact with the periphery of an edge-cam 243 that is carried by the change-shaft 25 by the tension of a contracting spiral spring 244 having one end thereof engaged with the injector-lever and the other end thereof engaged with the eye of a bolt 245, applied to a bracket 246 which is attached to the loom-frame.

Normally the change shaft, together with the cams which are fast thereon, stands motionless in the position represented in Fig. 3, and the injector occupies the position beneath the hopper which it occupies in such figure. When the change-shaft is caused to rotate, a preliminary movement of the injector toward the front of the loom occasioned by cam 243 carries the injector against a downwardly-extending finger 232 of the shuttle-support, moving the latter forward so as to withdraw its rearwardly-extending fingers from beneath the bottom shuttle in the hopper and permit the contents of the hopper to drop until the bottom shuttle rests upon the horizontal shuttle-supporting portions of the injector. The spring 244 next operates to move the injector with yielding force rearward toward the lay, under the control of the cam 243, to place the shuttle which is held thereby within the shuttle-box at the replenishing end of the loom, after which the said cam acts to communicate positive movement to the injector in the opposite direction, namely forward toward the breast-beam, and thereby restores the injector to its normal position shown in Fig. 3. As the injector moves toward the lay to place the shuttle resting on the injector in position within the shuttle-box of the lay, the shuttle-support 23 swings rearward so as to carry its horizontal portions in beneath the ends of the shuttle next above that resting on the injector, thereby enabling the shuttle-support to receive and support the said shuttle.

At 26 is the front-plate of the shuttle-box at the replenishing end of the loom, it being movable to enable the same to be withdrawn from its normal position at the front of such shuttle-box, to open the box to permit the spent working shuttle on the lay to be discharged from the shuttle-box and a fresh or reserve shuttle to be inserted into the latter through the action of the injector. The front-plate 26 is carried by forwardly-projecting arms 261, 261, forming part of a rocker 262, the rockshaft of which last is pivotally mounted in bearings that are provided in brackets 263, 263, which are attached to the lay-beam and rise at the rear thereof. Normally the front-plate 26 is held depressed in its working position, so as to keep the shuttle-box closed, by means of a contracting spiral spring 264, Fig. 3, having one end thereof connected to one of the forwardly-projecting arms 261 of the rocker and the other end thereof connected to one of the brackets 263. For the purpose of operating the rocker to raise the front-plate to open the shuttle-box to permit of the discharge of the spent working shuttle and the introduction of a fresh or reserve shuttle, the rocker is provided with a rearwardly-projecting arm 265 having connected therewith one end of a connecting-rod 266, the opposite end of which is connected to an arm 267, which is pivotally mounted at 268 and provided with a projection that is engaged by the periphery of an edge-cam 269 which is fast upon the change-shaft. In the rotation of the change-shaft, the cam 269 transmits movement through the arm 267 and connecting-rod 266 to the rocker to raise the front-plate from its normal closed position and thereby open the shuttle-box. The spring 264 acts to move the rocker in the reverse direction under the control of the cam 269, to lower the front-plate to its normal position and thereby close the shuttle-box again.

An ejector 27 is mounted by means of brackets 271, 271, upon the back of the shuttle-box, the said ejector being formed as a rocker having journals which are fitted to bearings in the said brackets, and having fingers which project into openings at the rear of the shuttle-box as indicated in Figs. 3 and 4. The ejector is held retracted normally by the tension of the contracting spiral spring 272, the latter having one extremity thereof engaged with a screw or the like projection carried by the rockshaft of the ejector, while the other end of the said spring is connected with a strap that wraps part way around the rockshaft of the ejector and is attached by its inner end to the said rockshaft. A finger 273 projecting from the ejector takes against the under side of the rockshaft of the rocker 262, and serves to limit the extent of the retraction of the ejector under the action of the spring 272. A finger 274 projecting forwardly from the ejector is pressed against by one of the arms 261 of the rocker 262 in the movement of the rocker by which the front-plate of the shuttle-box is raised, and thereby the ejector is actuated to eject the spent working shuttle from the opened shuttle-box. The ejected shuttle falls from the said shuttle-box on to a flexible apron 28, the latter being connected at its upper end with the front of the lay-beam and passing forward from the lay-beam over a transverse rod 281 which is supported at the rear of the shuttle-receiving box 282, the latter being attached to the adjacent side-frame of the loom. The shuttle slides from the apron into the said box.

The apron plays back and forth over the rod 281 as the lay vibrates, and thereby accommodates itself to the varying positions of the lay, it serving to conduct the ejected shuttle into the box 282 whatever may be the position of the lay at the time of the ejection.

The change-shaft normally stands at rest. For the performance of the replenishing operation the change-shaft with its various cams is called into action. A dwell in the working of the weaving instrumentalities is brought about by causing the shipping devices to unclutch the band-pulley 7 from the wheel 9, and by also causing the braking devices to apply the brake. On the conclusion of the replenishing operation the said weaving instrumentalities are restarted by again clutching the band-pulley to the wheel 9 and taking off the friction of the brake, after which the change-shaft comes to rest. The means of communicating rotary motion at the proper time to the change-shaft, and subsequently discontinuing such motion, is shown in Figs. 1, 2, and 9, of the accompanying drawings. In Figs. 1 and 2 the loose band-pulley 7, has fast therewith a bevel-gear 710 meshing with a bevel-pinion 72 which is fast upon the upper end of an inclined shaft 73, the said shaft at its lower end being furnished with a worm 74 meshing with a worm-gear 75 that is mounted upon the change-shaft 25 with capacity to turn freely thereon. Through the driving-connections between the loose pulley 7 and the worm-gear 75, the latter is constantly rotated. During the ordinary running of the loom, this rotation of the worm-gear is unaccompanied by motion of the change-shaft. When the change-shaft and its cams are required to act, the worm-gear is clutched to the change-shaft. To enable the clutching to be effected, a disk 251, Figs. 2 and 9, is fixed upon the change-shaft, with the outer face thereof close to the inner face of the worm-gear. To the inner face of the said fixed disk 251 a clutching-lever 252 is pivoted at 253, Fig. 2. The said lever extends diametrically with relation to the disk 251, and swings toward and from the disk. One arm of the said lever is furnished with a projection 254 working in a hole 255 that is made through the disk. In the worm-gear 75 is formed a circular series of holes 751, 751, etc., Fig. 1, each adapted to receive the projection 254 when in position in line with the latter. The lever 252 is acted upon by a spring 256, the latter tending to turn the lever into a position in which the projection 254 shall project through the disk 251 and enter into one of the holes 751, 751, of the worm-gear 75. So long as the lever occupies a position with its projection withdrawn from the worm-gear 75 into the hole 255, the worm-gear is free to turn upon the change-shaft, independently of the latter, and the change-shaft remains motionless.

The lever is held normally in its withdrawn or disengaged position, against the tendency of the spring 256 to turn the same so as to carry the projection 254 toward the worm-gear 75, by means of an unclutching arm 257, Figs. 2 and 9, which is pivoted at its lower end upon a fixed stand 258, its upper end being obliquely disposed with relation to the plane of rotation of the disk 251, and somewhat rounded. To the said arm is pivotally connected a latch 259, that is adapted to engage with a shoulder 260 on a bracket connected with stand 258, the said latch being held normally in engagement with the said shoulder by means of a contracting spiral spring 2601 having one end thereof joined to the latch and the other end thereof joined to the outer portion of stand 258. The said spring is arranged to cause its action to take place along a line inclined downward and outward, the result of which is to force the unclutching arm 257 outward toward the disk 251 and also draw the latch downward and hold it in engagement with the shoulder 260. Normally, the acting portion of the arm 257 remains in engagement with the tail of the lever 252, holding the said lever turned into the inoperative position thereof, with its projection 254 withdrawn from engagement with the worm-gear 75. When, in the working of the loom, the latch is raised so as to disengage the same from the fixed shoulder, at which time the action of the lay and other weaving instrumentalities has been arrested by causing the shipping rockshaft 21 to be turned so as to bring about the action of the shipping and brake-mechanism to unclutch the loose band-pulley 7 and apply the brake, the spring 256 acts to turn the lever 252, pressing back the arm 257 against the resistance of the weaker spring 2601, and carrying the projection 254 toward worm-gear 75 and into that one of the holes 751 which first arrives in line with the projection. Thereby the worm-gear is clutched to the change-shaft and the latter is caused to begin to rotate. As soon as the rotary motion of the change-shaft has carried the tail-end of lever 252 away from the engaging portion of the unclutching arm 257, the spring 2601 restores the said arm to its outer or normal position, and causes the latch 259 to engage again with the fixed shoulder 260 so as to hold the arm against tendency to movement inward. As the change-shaft approaches the completion of one rotation thereof, the replenishment having been effectuated, the tail of lever 252 is carried into contact with the engaging portion of the arm 257, which arm at this time is latched firmly in position, and by such contact the lever is turned to disengage its projection

254 from the worm-gear, thereby unclutching the change-shaft from its driving mechanism.

The devices for restarting the weaving instrumentalities after the replenishment has been completed are shown in Fig. 3, and comprise the cam 29 on the change-shaft 25, the lever 291 pivoted at 268 and having a projecting portion which is held pressed against the periphery of the said cam by the action of the contracting spiral spring 292, a rod 293 which is provided with an adjustable collar 294 to be engaged by the said lever 291 in the movement of the latter that is produced by the action of the prominence of such cam, an arm 295 which is mounted loosely upon one end of the shipper-rockshaft 21 and with which the forward end of the rod 293 is connected pivotally, an arm 296 which is fast upon the said rockshaft, and a stiff spring 297 connecting the said arms with each other and serving to transmit motion with yielding force from arm 295 to arm 296. The said spring yields to avoid breakage in case the shipper-rockshaft is prevented from being turned by the restarting mechanism at a time when the dagger of the protector mechanism is in engagement with the frog. The cam 29 acts, through the intermediary of the connections which have been described, to turn the shipper-rockshaft in the direction to replace the shipper-handle in the position which it occupies during the regular running of the loom, and also operate the shipping mechanism to clutch the band-pulley 7 with the fixed wheel 9, as well as relieve the pressure of the brake 14 upon the brake-wheel 13. As the unclutching of the worm-gear 75 takes place, the projection of arm 291 enters a notch at *a* in the periphery of the cam 29, thereby locking the change-shaft against accidental motion, with the tail of the clutching lever 252 remaining in engagement with the unclutching arm 257, whereby the said clutching lever is retained in inoperative position.

Having reference, now, to the pick-finder devices; these consist, essentially, in weft-detector means detecting for the successive picks to the respective sides of the loom, and controlling the operation of the loom-mechanism with timing to cause the first pick of fresh weft to be introduced into a reopening of the shed in which failure took place, after one or a plurality of rounds or cycles of shed-formations. The said pick-finder devices are combined herein with the stopping mechanism and the replenishing mechanism. In the drawings,—30 is a weft-fork which is located at the replenishing end or side of the loom, at 31 is the weft-fork slide or carrier on which the said weft-fork is pivotally mounted, at 32 is the guide for said slide or carrier, the said guide being secured by a screw 33 to the breast-beam 2, at 34 is the weft-hammer or gooseneck cooperating with the said weft-fork 30, and at 35, Fig. 8, is the cam, upon cam-shaft 4, by means of which the weft-hammer or gooseneck 34 is actuated. The cam 35 is shaped and timed to cause the weft-hammer or gooseneck 34, while the lay is forward after the pick to the replenishing side, to advance far enough to engage the tail of the weft-fork 30 in case the weft should have failed in such pick, then dwell until after the pick of the spent or failed shuttle to the driving side of the loom, and complete its advance after the return pick of such shuttle to the replenishing side. It will be perceived that, counting the pick toward the replenishing side of the loom in which failure of weft took place as the first, the return pick to the replenishing side is the third pick of the sequence. It also will be perceived that if the harness-movements comprise three shed-formations to the round or cycle, the shed for the pick which should next succeed from the replenishing side, namely the fourth shed, will be the same as the shed for the pick in which the said failure took place. If, therefore, after the return of the spent or failed shuttle to the replenishing side of the loom on the third pick the working weft-supply be replenished, either by manual intervention or automatically, prior to the occurrence of the fourth pick, the first pick of fresh weft will be introduced into a reopening of the proper shed to receive it, such reopening occurring after a round or cycle of shed-formations. The weft-fork devices at the replenishing side of the loom shown in the drawings are operatively connected and arranged to operate normally to cause replenishment to occur automatically following the said third pick. For such purpose, the weft-fork slide or carrier 31 has applied thereto a stud 341 projecting forward and provided in its forward end with a transverse hole or slot receiving a stud or pin 351 which projects laterally from an arm 36 rising from a rod 37 on which such arm is fixed. The said rod 37 is supported in position adjacent the lower front edge of the breast-beam, and extends crosswise of the loom. At one end thereof it is fitted to a bearing 371, Fig. 5, which is attached to the breast-beam. The other end of the same enters the central eye of the hub of arm 41 hereinafter described, see Fig. 5, and fits loosely therein, whereby such end is supported. Upon the end of said rod adjacent the driving side of the loom a second upwardly-extending arm 38, Figs. 5 and 6, is fixed. The said arm 38 has pivotally mounted upon a stud 392 projecting laterally from its upper end a dog 39, Figs. 5, 6, and 7, which is provided with a lateral engaging

projection 391. The said projection extends over the upper end of an arm 41 rising from a short rod 411 which is supported in line with rod 37 by a fixed bearing 412, and upon the inner end of which rod the arm 41 is fixed. The said upper end of arm 41 is provided with a shoulder 42 with which the projection 391 is adapted to engage. When the rod 37 is turned or rocked forward in consequence of the final portion of the advance of the weft-fork slide or carrier 31, the result of such engagement of projection 391 with shoulder 42 is to rock the arm 41 and rod 411.

For the purpose of controlling the replenishing instrumentalities, the rod 411 is furnished with an arm 43, Fig. 2, projecting rearwardly therefrom and joined by a flexible or other connection 44 with the latch 259, Figs. 2 and 9, so that when the parts are rocked as just mentioned the said latch is disengaged from the fixed shoulder 260 and the unclutching arm 257 is unlatched or unlocked, allowing the spring 256 to turn the clutching lever 252 and clutch the worm-gear 75 to the change-shaft. For the purpose of transmitting movement to the shipper-handle 20 to bring about the stoppage of the weaving instrumentalities with the shuttle in the shuttle-box at the replenishing end of the loom, the rod 411 has fixed thereon a hub 45, Figs. 5 and 7, having a projection 46, Figs. 1 and 7, for engagement with a projection 47 from the shipper-handle. When rod 411 is turned as aforesaid, the action of projection 46 against projection 47 operates to turn the shipper-handle to carry the line of draft that is transmitted by means of the rod 19 from brake-lever 12 to the shipper-handle 20 to the rear of the center of shipper-rockshaft 21, unlocking the shipper-devices, whereupon the spring 17 acts to effectuate the unclutching of the band-pulley 7 and the application of the brake. For the purpose of varying the timing in the event of failure of the weft in the pick from the replenishing side of the loom to the driving side thereof, a supplemental weft-fork 50 is located at the driving side of the loom, 51 being the weft-fork slide or carrier on which the said weft-fork is pivoted. 52 is the guide in which the said slide or carrier 51 is fitted, the said guide being secured upon the breast-beam by screws 53, 53, Figs. 5 and 6. 54 is the weft-hammer or gooseneck coöperating with the supplemental weft-fork 50, and 55, Fig. 1, is a cam upon cam-shaft 4 by means of which the weft-hammer or gooseneck 54 is actuated. The weft-fork slide or carrier 51 has applied thereto a stud 56, projecting from the front end thereof toward the front of the loom, and having in its free end a transverse hole or slot receiving a pin or the like, as at 57, projecting laterally from an arm, 58, which is sleeved upon the rod 37 with capacity to turn freely thereon. Movement imparted to the weft-fork slide or carrier 51 is communicated to the arm 58 by means of the stud 56 and its engagement with the projection 57 of the said arm. Upon the upper end of the arm 58 is fastened a disengaging piece 59, the latter having an inclined cam-portion for action against a pin or other projection, 393, extending transversely from the dog 39 across the front of the said disengaging piece. The said inclined cam-portion of the disengaging piece is designed to act against the said pin or projection 393 under certain conditions, when the weft-fork slide or carrier 51 and arm 58 are moved toward the front of the loom in consequence of the engagement of the weft-hammer or gooseneck 54 with the tail of weft-fork 50, and when the cam-portion acts against the said pin or projection it operates to lift the dog 39 so as to raise its engaging projection 391 above the shoulder 42 of the arm 41. Thereby the rocking of the rod 37 and its arm 38 toward the front of the loom, resulting from the action of weft-hammer or gooseneck 34 in connection with the weft-fork 30, is rendered ineffective to operate the controlling and transmitting device. A contracting spiral spring 511, having one end thereof attached to the fixed guide 52 and the other end thereof attached to a lug projecting laterally from arm 58, acts to move the said arm and the weft-fork slide or carrier 51 rearward in the loom, after they have been advanced toward the front by the action of the weft-hammer or gooseneck 54, as soon as the spring is permitted so to do by the rearward return stroke of the said weft-hammer or gooseneck.

The cam 55 by which the weft-hammer or gooseneck 54 is operated is shaped and timed to advance the latter, following a pick from the replenishing side of the loom to the driving side, far enough to engage with the tail of the weft-fork 50 in case of failure of weft in such pick, then cause the said weft-hammer or gooseneck to move very slowly toward the front until after the pick from the driving side to the replenishing side, and then cause the same to dwell in its advanced position until after the first portion of the advance of the weft-hammer or gooseneck 34 at the replenishing side of the loom has taken place. Upon the pin or stud 392, projecting laterally from the arm 38 of rod 37 and upon which the dog 39 is hung, is also pivotally hung an arm 60 having its free rear end formed with a socket 61 within which is fitted a wire 62 extending rearwardly alongside the weft-fork slide or carrier 51 through a guide 63 with which the fixed guide 52 is provided. The rear portion of the said wire is bent upward at 64, as shown best in Fig. 7, to form an in-

cline for action upon a lateral projection 65 from the tail of the weft-fork 50. The result, in the working of the loom, of the action of the supplemental weft-fork 50 and the associated parts, on detection of failure of weft in a pick to the driving side of the loom, is to retard the effective operation of the detector-mechanism and postpone the stopping of the weaving instrumentalities, and also the replenishment, until following a return pick to the replenishing side subsequent to that on which the weft-detector mechanism at the replenishing side normally occasions the said action.

In a loom in which the return pick to the replenishing side of the loom preceding stoppage, or stoppage and replenishment, corresponds with the final shed of an even multiple of a round or cycle of shed-formations comprising three, as in the present instance, or other uneven number of shed-formations, the first succeeding pick of fresh weft will be introduced into a reopening of the first shed, namely, that in which failure of weft occurred, which is the proper shed to receive such pick in order to avoid a defect in the weaving. It has been explained that the weft-fork 30 and parts more immediately associated in action therewith, acting on failure of weft in a pick to the replenishing side of the loom, are arranged to control the operation of the stopping mechanism and replenishing mechanism so as to cause the same to act with timing to arrest the working of the weaving instrumentalities and effect the replenishment after the round or cycle of three shed-formations, and thereby secure the introduction of the first pick of fresh weft into the proper shed to receive it after such round or cycle, namely the fourth shed, which is a reopening of the shed in which failure occurred. The supplemental weft-fork 50 and associated parts, on the other hand, are arranged to act on failure of weft in the pick toward the driving side of the loom so to control the timing that the action of the stopping mechanism and replenishing mechanism is deferred until following the sixth pick, which corresponds with the final shed of an even multiple (2) of the round or cycle of shed-formations, whereby the first pick of fresh weft is caused to be introduced into the seventh shed, which is a reopening of that in which the failure of weft occurred. Thus, in case the weft should fail in the pick from the replenishing side of the loom to the driving side, the weft-hammer or gooseneck 54 at the latter side will engage with the tail of the weft-fork 50 as such weft-hammer or gooseneck begins to move forward. As a result of such engagement, the weft-fork slide or carrier 51, and arm 58 with its disengaging cam 59, will be advanced toward the front of the loom and be held forward until after the occurrence of the first portion of the advancing movement of the weft-hammer or gooseneck 34 at the replenishing side of the loom. In such advance of arm 58 and the disengaging cam 59 the said cam will raise the dog 39 so as to lift its engaging projection 391 above the shoulder 42 of the arm 41, prior to the said portion of the movement of weft-hammer or gooseneck 34.

Following the pick of the spent or failed shuttle from the driving side of the loom to the replenishing side thereof, (which is the second pick of the sequence beginning with the pick to the driving side in which the failure of weft took place) the weft-hammer or gooseneck 34 at the latter side, in being given its preliminary movement toward the front of the loom, will engage with the weft-fork 30 in consequence of the absence of weft to tilt the said fork, and will communicate a partial advancing movement to the weft-fork slide or carrier 31, partially rocking the rod 37 far enough to cause the engaging projection 391 of dog 39 to pass forwardly beyond the shoulder 42 of the arm 41, but as at this time the said dog is held in an uplifted position by the disengaging cam 59 the forward movement of the dog will take place without engagement of the dog with the said shoulder. The dwell in the forward movement of weft-hammer or gooseneck 34 will retain the forward edge of the engaging projection 391 of dog 39 slightly at the front of the shoulder 42 of arm 41. The wire 62 is moved to the front a short distance as a result of the forward movement that is communicated to arm 38 by the rocking of rod 37. As the weft-hammer or gooseneck 54 moves rearward in the loom, the spring 511 draws the weft-fork slide or carrier 51 rearward also. In this movement of the said slide or carrier, the projection 65 from the tail of supplemental weft-fork 50 rides upon the said incline 64, tilting the weft-fork so as to raise its hooked tail out of reach of weft-hammer or gooseneck 54. By the rearward movement of the disengaging cam 59 occurring in unison with that of the slide or carrier 51, the dog 39 is lowered until its engaging projection comes to rest upon the top of arm 41 at the front of the shoulder 42. When now the weft-hammer or gooseneck 34 at the replenishing side of the loom completes its movement to the front, the engaging projection 391 of dog 39 simply plays forward idly. Following the succeeding pick from the replenishing side of the loom to the driving side (which is the third pick of the sequence) the weft-hammer or gooseneck 54 makes its beat toward the front of the loom. The weft-fork 50 having been tilted, however, by the incline 64 of the wire 62, such beat occurs without engagement of the said weft-ham-

mer or gooseneck with the said weft-fork. The beat therefore is an idle one. Consequently, the weft-fork slide or carrier 51 and disengaging cam 59 remain in their rearward positions, and dog 39 is permitted to occupy its normal lowered position in readiness to engage with the shoulder 42 of the arm 41. The return movement of the weft-hammer or gooseneck 34 toward the rear allows the rod 37 to turn reversely under the influence of spring 371, carrying the arm 38 back so as to place the engaging projection 391 at the rear of shoulder 42 of arm 41, and restoring the weft-fork slide or carrier to its normal position. The backward movement of arm 38 also moves the wire 62 rearward so as to withdraw incline 64 from contact with projection 65 of weft-fork 50 and permit such weft-fork to assume its normal position.

On the return of the spent or failed shuttle to the replenishing side, (namely on the fourth pick of the sequence) the weft-hammer or gooseneck 34 at such side again acts, engaging with the weft-fork 30. Its preliminary movement toward the front causes the dog 39 to be moved forward far enough to cause its engaging projection 391 to become engaged with shoulder 42 of arm 41, whereupon the dwell of such weft-hammer or gooseneck takes place. This preliminary movement operates to turn the rod 37 so as to move the wire 62 forward again far enough to secure its incline 64 to tilt the weft-fork 50 so that the succeeding movement or beat of weft-hammer or gooseneck 54 shall be an idle one. The shuttle now is picked to the driving side, (making the fifth pick). The weft-hammer or gooseneck 54 makes an idle beat as just described. While the lay is still forward following this pick, the weft-hammer or gooseneck 34 at the replenishing side of the loom completes its movement to the front. This time, in consequence of the fact that the engaging projection 391 of dog 39 is in position to act against the shoulder 42 of the arm 41, the said arm and the rod 411 are turned to call the stopping mechanism and replenishing mechanism into action. The shuttle is picked from the driving side as the lay goes back (making the sixth pick) and immediately afterward, as the lay arrives at or near back center, the weaving instrumentalities are brought to rest, the shuttle continuing its flight until it is boxed at the replenishing side. It will be understood that, corresponding with the six picks beginning with that in which failure of weft occurred and ending with the stopping of the weaving instrumentalities, six sheds are formed in the warp-threads in succession, such number constituting a multiple of the round or cycle of shed-formations. When weaving operations are resumed after the replenishment has been effected, the shed that is opened for the introduction of the first pick of fresh weft is the seventh counting from the shed in which the failure of weft occurred; that is to say such shed is a reopening of the latter shed, it being a recurrence of the same succeeding a multiple of the round or cycle of shed-formations. Consequently, the said first pick of fresh weft will be introduced into the proper shed to obviate a defect in the weaving.

Assuming failure of weft to occur in the pick toward the replenishing side of the loom, and detection of the failure by the weft-detector devices at such side, with resulting preliminary action of such devices producing the partial advance of the dog 39 which places its projection 391 in engagement with the shoulder 42 of arm 41, the weft-detector devices at the driving-side of the loom will act after the pick of the spent or failed shuttle to the latter side and in consequence of the engagement of the tail of the weft-fork 50 by the weft-hammer 54, and the resulting partial advance of the weft-fork slide or carrier 51, the connected disengaging cam 59 will be moved toward the pin or stud 393 of the dog 39. However, before the said disengaging cam reaches the said pin or stud and acts against the same to raise the dog and thereby shift the engaging projection 391 of the dog out of engagement with the shoulder 42 of the arm 41, the final portion of the movement of the weft-hammer 34 at the replenishing side of the loom will take place, with the result that the controlling and transmitting member will be operated to call the replenishing mechanism and stopping mechanism into action, as already explained.

The devices which have just been described constitute differential delaying mechanism controlled by weft absence which permits an even number (two) of idle picks and an even number (two) of harness changes before the fresh weft is supplied, in case the weft-absence detector at the replenishing or magazine side of the loom first detects weft-absence, and which permits an additional number of idle picks and of harness changes when the companion detector first detects weft-absence, said additional number of harness changes being an odd number and equal to the number of harnesses.

In consequence of the fact that the stoppage of the weaving instrumentalities, for purposes of replenishment, that is occasioned by the action of the automatic devices which have been described is caused to take place almost simultaneously with the pick from the driving side to the replenishing side, and before the weft-fork mechanism at the replenishing side has performed its action corresponding with such pick, and in consequence further, of the fact that after the re-

starting of the said instrumentalities the said weft-fork mechanism will act while the lay is forward in making its first beat, it is necessary to make provision for preventing the replenishing mechanism from being called immediately into action again by reason of the fact that the first pick from the replenishing side after replenishment leaves no weft in position to act upon the weft-fork 30 at the replenishing side. In the loom shown in the drawings, this result is attained by means of the substitute-weft devices which are shown in Fig. 10, Sheet 4. In the said figure, 67 is a lever which is pivoted at 68 upon or in connection with the lay-sword at the replenishing side of the loom, in this instance upon the pin or stud joining the corresponding connecting rod or pitman *b* with the said lay-sword. The free end of one arm of the said lever is broadened somewhat to extend across or bridge one or more of the spaces of the grate 69 which is provided on the lay at one end of the reed, for coöperation with the weft-fork 30. The other arm of the said lever is joined by means of a connecting rod 70 with a lever 76, the latter being pivoted at 77 upon a stand 78 which is attached to some convenient portion of the loom-framing. The lever 76 is operatively controlled by means of a cam 66 upon the change-shaft 25. While the change-shaft is at rest, the cam 66 permits the parts to occupy a position in which the working end of the substitute-weft lever 67 is withdrawn from proximity to the weft-grate 69, thus permitting the tines of weft-fork 30 to pass through the openings of the weft-grate in the absence of weft in front of the latter. By the rotation of the change-shaft the cam 66 is caused to actuate the parts to move the working end of the lever 67 into position against the back of the grate to enable it to act against the tines of the weft-fork 30 as the lay goes forward in the beat thereof succeeding the first pick after replenishment, so as to tilt the said weft-fork in the same manner as it would be tilted by weft if such were present. The final or concluding portion of the rotation of the change-shaft, occurring shortly after the weaving instrumentalities have been restarted, presents the drop of the cam 66 to the lever 76, permitting the substitute-weft lever 67 to assume its normal position with its working end withdrawn from the weft-grate 69.

In view of the fact that the worm-gear 75 is constantly driven from the band-pulley 7 as long as the driving-band 8 passing around said band-pulley is in motion, it is necessary to make provision against the accidental starting up of the change-shaft during an ordinary stoppage of the loom brought about by manual operation of the shipper-handle 20. For instance, it is necessary to provide against the starting-up of the change-shaft in consequence of the action of the weft-fork mechanism while the loom is being turned by hand during stoppage, as frequently is the case in practice. To this end, I furnish the dog 39 with a prolongation or extension 395, Figs. 5, 7, and 8, extending downward therefrom, and I mount upon the shipper rock-shaft 21 an arm or finger 396 which is set-screwed to the said rock-shaft and provided at its free extremity with a transverse projection 397 suitable to make contact with the said prolongation or extension 395 when the said rock-shaft is turned for the purpose of occasioning a stoppage of the loom-mechanism. The action of the arm or finger 396 against the prolongation or extension 395 turns the said dog 39 upon its pivotal stud 392 on the arm 38, raising the engaging-projection 391 of the said dog above the shoulder 42 of the arm 41. The rod 37 may now be turned, as in consequence of the action of the weft-fork mechanism at the replenishing side of the loom, without affecting the arm 41 and rod 411, and consequently without bringing about the disengagement of the latch 259 from the fixed stop 260.

The stems of the studs 341 and 56 are screw-threaded, and are fitted to screw-threaded holes which are tapped in the front ends of the weft-fork slides or carriers 31, 51, respectively. The said studs are adjustable lengthwise by screwing them into or out of the said slides or carriers, for convenience in setting the parts. To permit wire 62 to be adjusted lengthwise to secure the proper time of action for its incline 64, the said wire is held in socket 61 of the arm 60 by means of a clamping screw 621. Upon loosening the said clamping screw, the wire may be given the desired position, after which it may be secured in such position by tightening up the screw.

The features of the invention are not necessarily restricted in all cases to employment in connection with weft-replenishing mechanism of the same type as that which is shown and described herein, and in some cases the said features may be employed in connection with replenishing mechanism of different types without necessarily involving a departure from the spirit of the invention. In the present embodiment of the invention, stoppage of the weaving instrumentalities of the loom is occasioned as an incident in connection with the weft replenishment, and for the purposes of the latter. In some cases, provisions for effecting stoppage for the purposes of the replenishment may be dispensed with, and the replenishment may be caused to take place without the stoppage. In other instances, I contemplate the utilization of certain of the features of the invention to bring about stoppage

of the loom-mechanism with the shuttle always in the shuttle-box at the same side of the loom, the introduction of fresh weft for a continuation of the weaving being performed manually.

Various features which are described herein, and which are embodied in the loom shown in the drawings, but which do not in themselves involve the pick-finder principle, have been made the subject of a divisional application filed May 19, 1909, Serial No. 496,975.

I claim as my invention:—

1. In a weft-replenishing loom, the combination with controlling means for the replenishing instrumentalities, of pick-finder devices comprising detector mechanism acting in the absence of weft in a pick to the replenishing side of the loom and normally operating to cause replenishment following the return pick to such side, and a detector operating on failure of weft in the pick to the opposite side of the loom to retard the effective operation of the said detector-mechanism and postpone the replenishment until following a subsequent return pick to the replenishing side.

2. In a weft-replenishing loom, the combination with replenishing instrumentalities, of pick-finder devices operating in case of failure in the pick in one direction to cause the first pick of fresh weft to be laid in a given reopening of the shed in which such failure occurred, and in case of failure in the pick in the opposite direction to cause the said first pick of fresh weft to be laid in a subsequent reopening of the shed in which the latter failure occurred after a multiple of the shed cycle.

3. In a loom, the combination with devices for effecting replenishment, of opposite detectors detecting successively for the picks to the respective sides of the loom, controlling the operation of the said devices with timing to cause the first pick of fresh weft to be introduced into a reopening of the proper shed to receive it after a round or cycle of shed-formations, and a multiple of the round or cycle, respectively.

4. In a weft-replenishing loom, the combination with devices for effecting replenishment, of a detector operating in the absence of weft in the pick to the replenishing side of the loom to occasion replenishment and normally acting to cause the same to take place following a predetermined subsequent pick to such side, and a detector operating on failure of weft in the pick to the opposite side of the loom to control the time of the replenishment and cause the latter to follow a predetermined later pick to the replenishing side, whereby the first pick of fresh weft is introduced into the proper shed to receive it, in whichever direction of pick the failure of weft occurred.

5. In a weft-replenishing loom, the combination with devices for ejecting a spent or failed shuttle from the shuttle-box at the replenishing side of the loom and supplying a fresh shuttle to the said shuttle-box, of a detector operating in the absence of weft in the pick to the replenishing side of the loom to occasion replenishment and normally acting to cause the same to take place following a predetermined subsequent pick to such side, and a detector operating on failure of weft in the pick to the opposite side of the loom to control the time of the replenishment and cause the latter to follow a predetermined later pick to the replenishing side, whereby the first pick of fresh weft is introduced into the proper shed to receive it, in whichever direction of pick the failure of weft occurred.

6. In a weft-replenishing loom in which the replenishment is effected at one side thereof, the combination with controlling means for the replenishing instrumentalities, of pick-finder devices operating the said means on failure of weft in either direction of pick with selective timing varied to correspond with the direction of the pick in which failure occurs and causing the first pick of fresh weft to be introduced into the proper shed to receive it.

7. In a weft-replenishing loom in which the replenishment is effected at one side thereof, and in which the shed-cycle comprises three or more harness-movements, the combination with controlling means for the replenishing instrumentalities, of pick-finder devices operating the said means on failure of weft in either direction of pick with selective timing varied to correspond with the direction of the pick in which failure occurs and causing the first pick of fresh weft to be introduced into the proper shed to receive it.

8. In a loom, the combination with stopping means, of pick-finder devices operating the said means on failure of weft in either direction of pick with selective timing varied to correspond with the direction of the pick in which failure occurs, to produce the arrest of the loom always with the shuttle at the same side of the latter, and cause the first pick of fresh weft on restarting the loom to be thrown through a reopening of the shed in which failure occurred.

9. In a loom, the combination with stopping means operating to arrest the loom always with the shuttle at the same side of the latter, of a detector operating in the absence of weft in the pick to the said side to occasion the action of the said means and normally causing the stoppage to take place following a predetermined subsequent pick to such side, and a detector operating on failure of weft in the pick to the opposite side to control the time of the stoppage and cause the latter to follow a later pick to the

side first-mentioned of the loom, whereby the first pick of fresh weft on restarting the loom will be thrown through a reopening of the shed in which failure occurred.

10. In a loom, the combination with stopping means operating to arrest the loom always with the shuttle at the same side of the latter, of opposite detectors detecting successively for the picks to the opposite sides of the loom and operating the said stopping means with timing varied to correspond with the direction of the pick in which weft-failure takes place, to cause the first pick of fresh weft on restarting the loom to be thrown through a reopening of the shed in which failure occurred.

11. In a loom, the combination with a weft-fork, a gooseneck coöperating with the said weft-fork, and motion-transmitting connections operated in consequence of engagement of the said gooseneck with the said weft-fork, of a second weft-fork, a gooseneck coöperating therewith, and means operating in consequence of engagement of the latter gooseneck with the second weft-fork to retard the transmission of motion by the said connections.

12. In a loom, the combination with stopping means, of a weft-detector located at one side of the loom and operating the said stopping means on failure of the weft in the pick to such side, and a second weft-detector located at the other side of the loom and operating on failure of the weft in the pick to the latter side to retard the stopping action until the pick to the side first-mentioned.

13. In a weft-replenishing loom, the combination with weft-replenishing instrumentalities, of a weft-detector located at one side of the loom and operating on failure of weft in the pick to such side to call for replenishment, and a second weft-detector located at the other side of the loom and operating when the failure of weft takes place in the pick to the latter side of the loom to retard the replenishing action.

14. In a loom, the combination with a weft-fork, a gooseneck coöperating with the said weft-fork, and motion-transmitting connections operated in consequence of engagement of the said gooseneck with the said weft-fork, of a second weft-fork, a gooseneck coöperating with said second weft-fork, retarding means operating in consequence of engagement of the latter gooseneck with the second weft-fork to retard the transmission of motion through the said connections, and means operated from the first weft-fork to disestablish the action of the said retarding means, to thereby enable the transmission of motion to be effectuated.

15. In pick-finder devices for looms, the combination with a weft-detector located at one side of a loom, a dog actuated by the said weft-detector, in the absence of weft in the pick to that side, and a movable member engaged and actuated by the said dog on movement of the latter communicated through the action of the said weft-detector, of a second weft-detector located at the other side of the loom, in operative control of the engagement of the dog with the movable member, and operating on failure of weft in the pick to the latter side to prevent such engagement, and means operating on subsequent action of the first weft-detector to disestablish the control of the second weft-detector over the dog.

16. In a weft-replenishing loom the combination with replenishing instrumentalities, a weft-detector located on the replenishing side of the loom, a dog actuated by the said weft-detector in the absence of weft in the pick to that side, a movable member operatively connected with the replenishing instrumentalities and engaged and actuated by the said dog on movement of the latter communicated through the action of the said weft-detector, of a second weft-detector located at the other side of the loom, in operative control of the engagement of the dog with the movable member, and operating on failure of weft in the pick to the latter side to prevent such engagement, and means operating on subsequent action of the first weft-detector to disestablish the control of the second weft-detector over the dog.

17. An automatic weft-replenishing loom having, in combination, shedding mechanism; a weft-supplying mechanism at one side; two weft-absence detectors at opposite sides respectively; and differential delaying mechanism controlled by weft-absence which permits a different number of idle picks and of idle shed formations after detection of weft-absence and before weft-replenishment depending on which detector first detects weft absence.

18. An automatic weft-replenishing loom having, in combination, shedding mechanism; a weft-supplying mechanism at one side; two weft-absence detectors at opposite sides respectively; and differential delaying mechanism controlled by weft-absence which permits a different number of idle picks after detection of weft-absence and before weft-replenishment depending on which detector first detects weft absence.

19. An automatic weft-replenishing loom, having in combination, shedding mechanism; a weft-supplying mechanism at one side; two weft-absence detectors at opposite sides respectively; and differential delaying mechanism controlled by weft-absence which permits a different number of idle shed formations after detection of weft-absence and before weft-replenishment depending on which detector first detects weft absence.

20. An automatic weft-replenishing loom having, in combination, a weft-supplying mechanism; two weft-absence detectors on opposite sides; and actuating mechanism for the weft-supplying mechanism delaying the operation thereof for a predetermined number of revolutions greater than two of the crank-shafts of the loom in case one detector first detects, and for a duration of time in case the other detector first detects weft-absence less than that occupied when the first named detector first detects.

21. An automatic weft-replenishing loom having, in combination, shedding mechanism; a weft-supplying mechanism; detecting-mechanisms operative to detect weft-absence for picks in both directions; and differential delaying mechanism controlled by weft-absence which permits a different number of idle picks and of idle shed formations after detection and before replenishment depending upon the direction of the pick preceding detection.

22. An automatic weft replenishing loom having, in combination, picking mechanism, harness actuating mechanism, and means for operating said mechanisms coincidently after detection of weft absence, a weft supplying mechanism at one side, two weft absence detectors at opposite sides respectively, and differential delaying mechanism controlled by weft absence which delays the insertion of fresh weft until the true shed is presented.

23. An automatic weft replenishing loom having, in combination, shed changing mechanism, picking mechanism operated during the movement of said shed changing mechanism, a weft supplying mechanism at one side, two weft absence detectors at opposite sides respectively, and differential delaying mechanism controlled by weft absence which delays the insertion of fresh weft until the true shed is presented by the shed changing mechanism.

24. An automatic weft-replenishing loom having, in combination, a weft-supply at one side, two detectors at opposite sides respectively, and differential delaying mechanism controlled by weft-absence which permits two idle picks and two harness changes before the fresh weft is supplied in case the magazine detector first detects weft-absence, and which permits five idle picks and five harness changes when the companion detector first detects weft absence.

25. An automatic weft-replenishing loom having, in combination, a weft-supply at one side, two detectors at opposite sides respectively, and differential delaying mechanism controlled by weft-absence which permits an even number of idle picks and an even number of harness changes before the fresh weft is supplied in case the magazine detector first detects weft-absence, and which permits an additional number of idle picks and of harness changes when the companion detector first detects weft-absence, said additional number of harness changes being an odd number and equal to the number of harnesses.

26. An automatic weft-replenishing loom having, in combination, a weft-supply at one side, two detectors at opposite sides respectively, and differential delaying mechanism controlled by weft-absence which permits a different number of idle picks and of harness changes depending on which detector first detects weft-absence, the harnesses running in regular order only.

27. An automatic weft-replenishing loom having, in combination a weft-supply at one side, two detectors at opposite sides respectively, and differential delaying mechanism controlled by weft-absence which permits a different number of idle picks and of harness changes depending on which detector first detects weft absence, the difference equaling the number of harnesses.

28. An automatic weft-replenishing loom having, in combination, a weft-supply at one side, two detectors at opposite sides respectively, and differential delaying mechanism controlled by weft absence which permits a different number of idle harness-changes after detection of weft absence and before weft-replenishment, depending on which detector first detects, the harnesses running in regular order only.

29. An automatic weft-replenishing pick-matching loom having, in combination, picking and shedding mechanisms; a weft-supplying mechanism at one side only of the loom; two weft-absence detectors, one at each side of the loom, which control the action of the weft supplying mechanism, and connections between the two detectors to render one detector inactive when the other detector detects weft-absence.

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

SIMEON SCHOON JACKSON.

Witnesses:
CHAS. F. RANDALL,
EDITH J. ANDERSON.