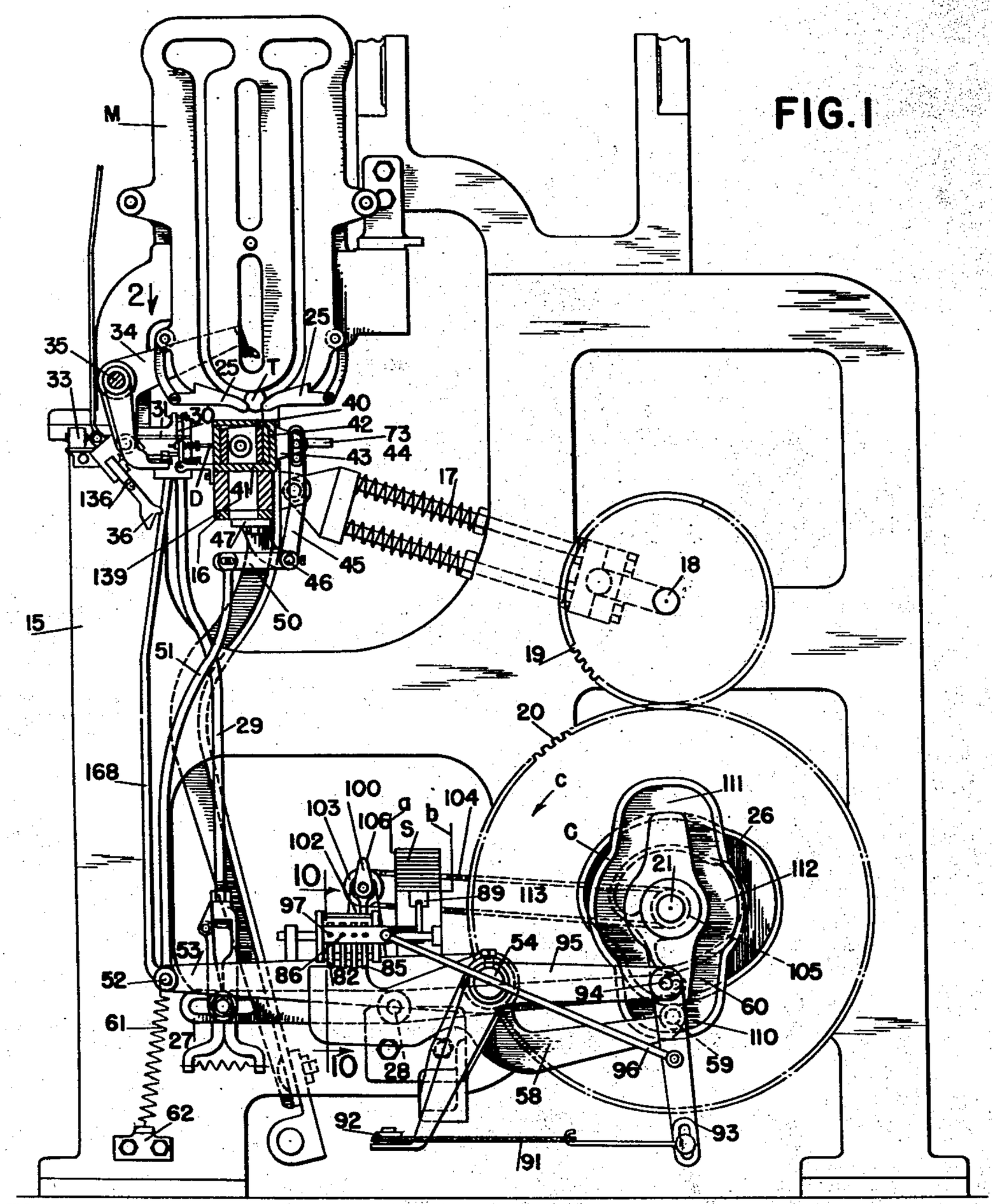
Oct. 31, 1950 C. R. KRONOFF 2,528,150

SHUTTLE BOX MECHANISM FOR WEFT REPLENISHING LOOMS

Filed March 25, 1949 4 Sheets-Sheet 1

FIG. 1



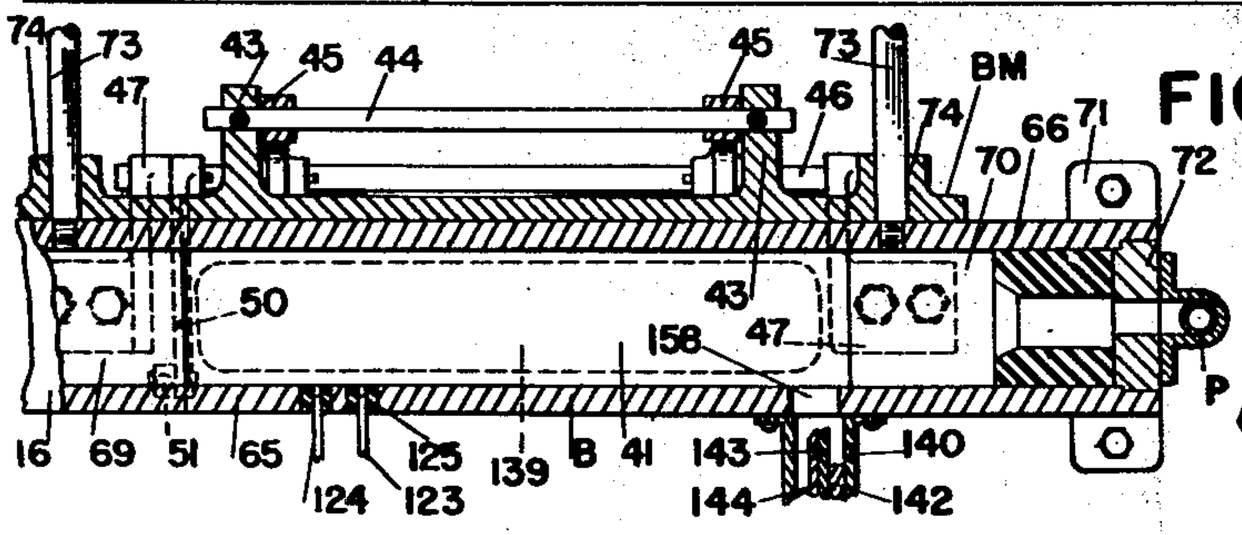


FIG. 4

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SHUTTLE BOX MECHANISM FOR WEFT REPLENISHING LOOMS

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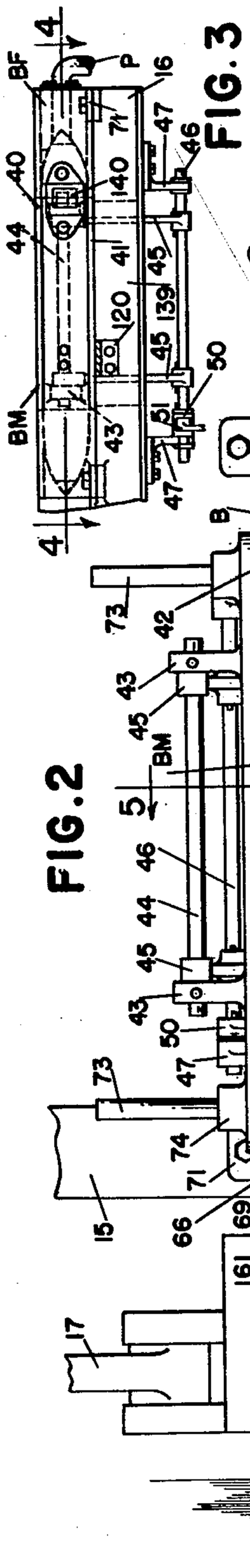

FIG. 3

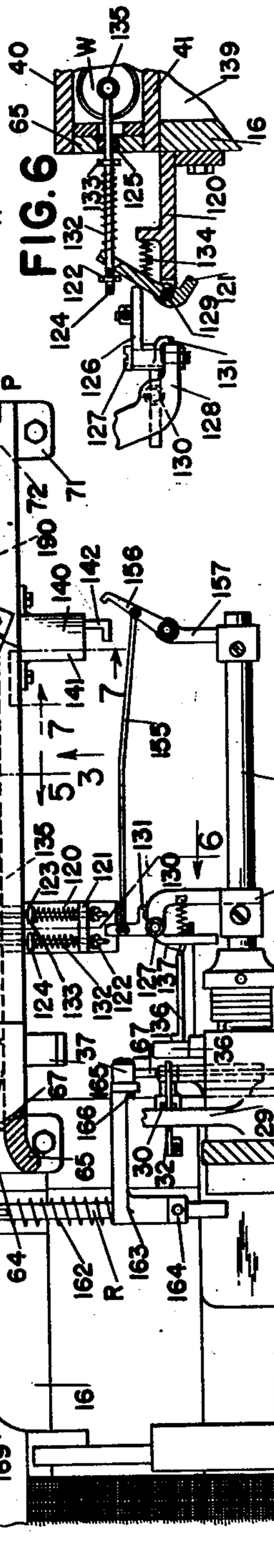

FIG. 6

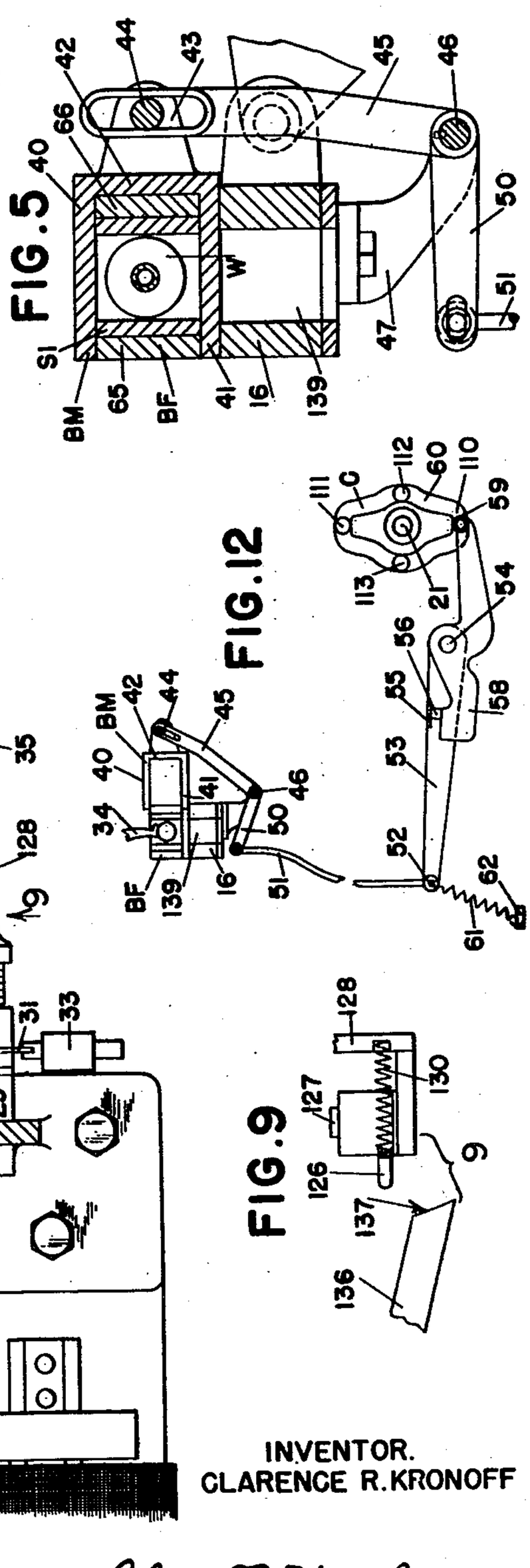

FIG. 5

FIG. 2

FIG. 12

FIG. 4

FIG. 9

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SHUTTLE BOX MECHANISM FOR WEFT REPLENISHING LOOMS

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FIG.10

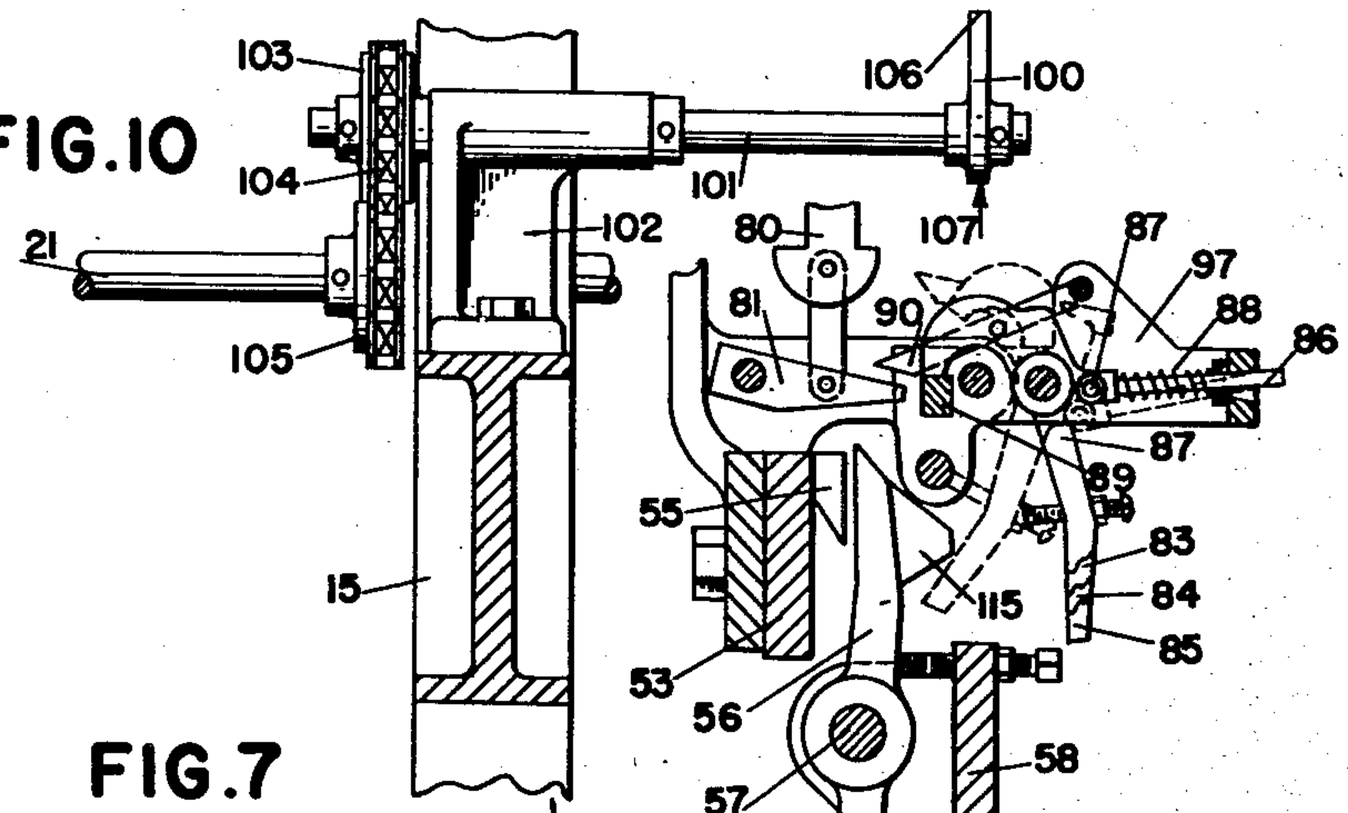


FIG.7

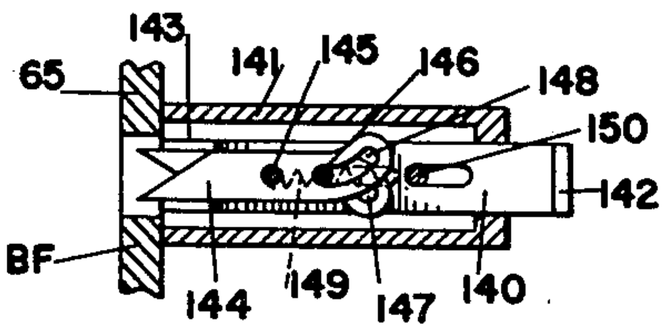


FIG.17

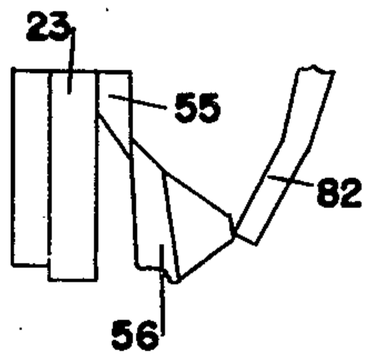


FIG.11

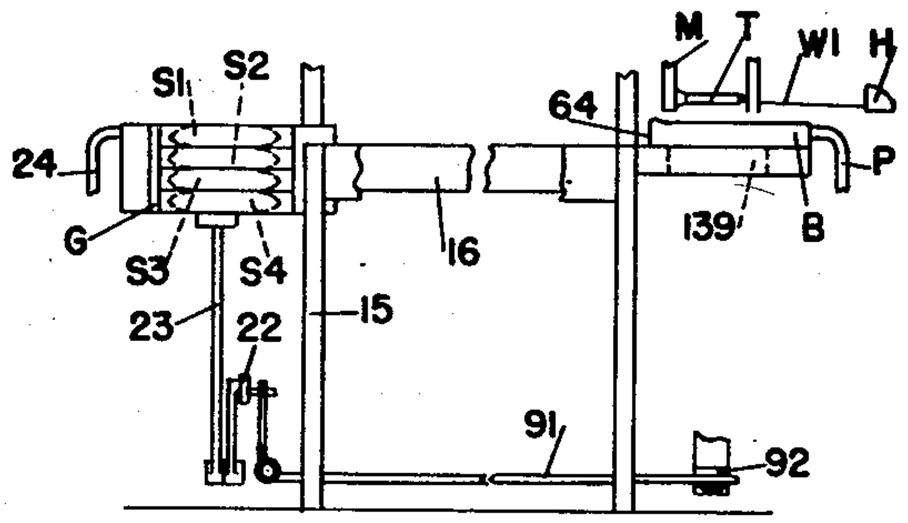
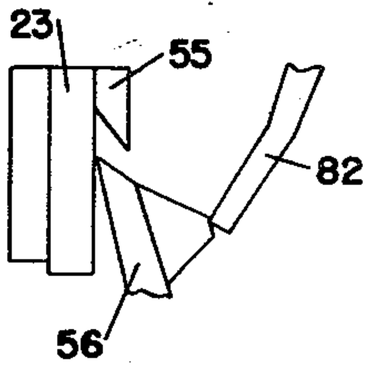


FIG.18



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SHUTTLE BOX MECHANISM FOR WEFT REPLENISHING LOOMS

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FIG.15

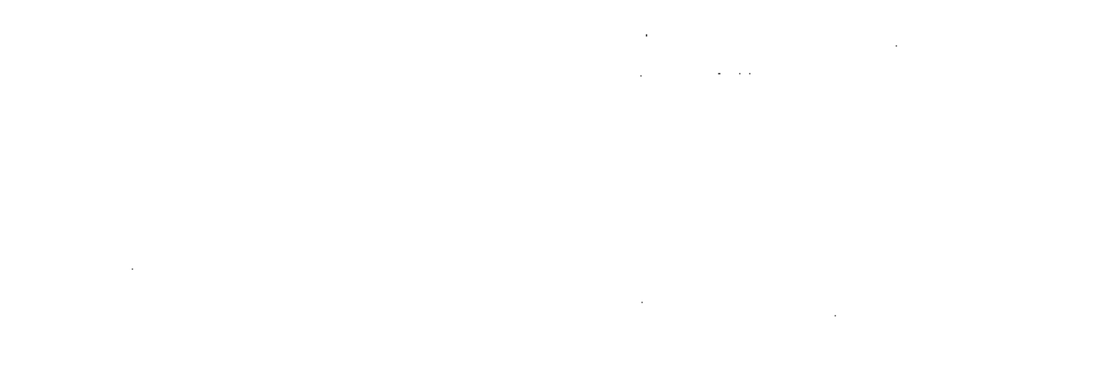


FIG.16

FIG.8

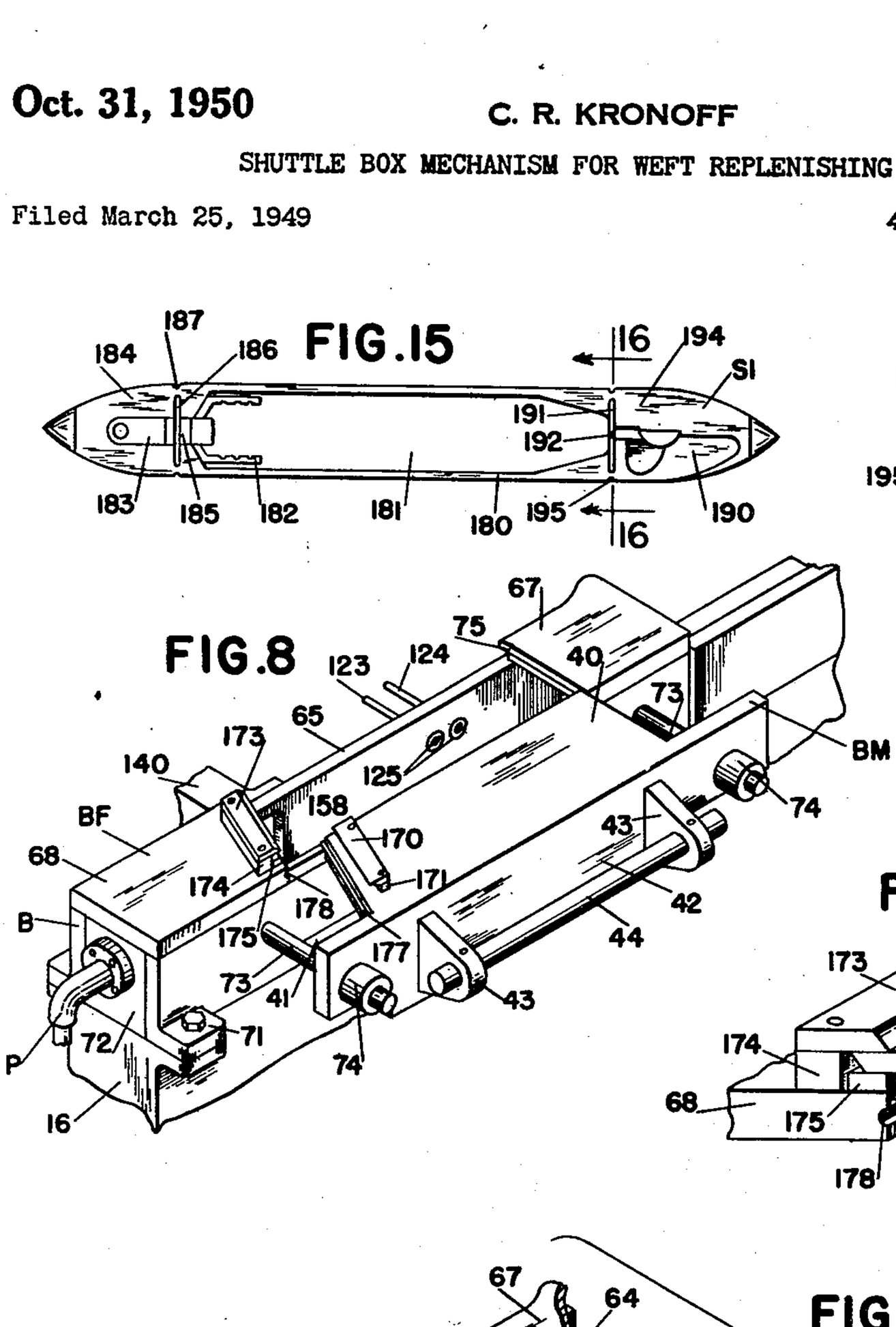
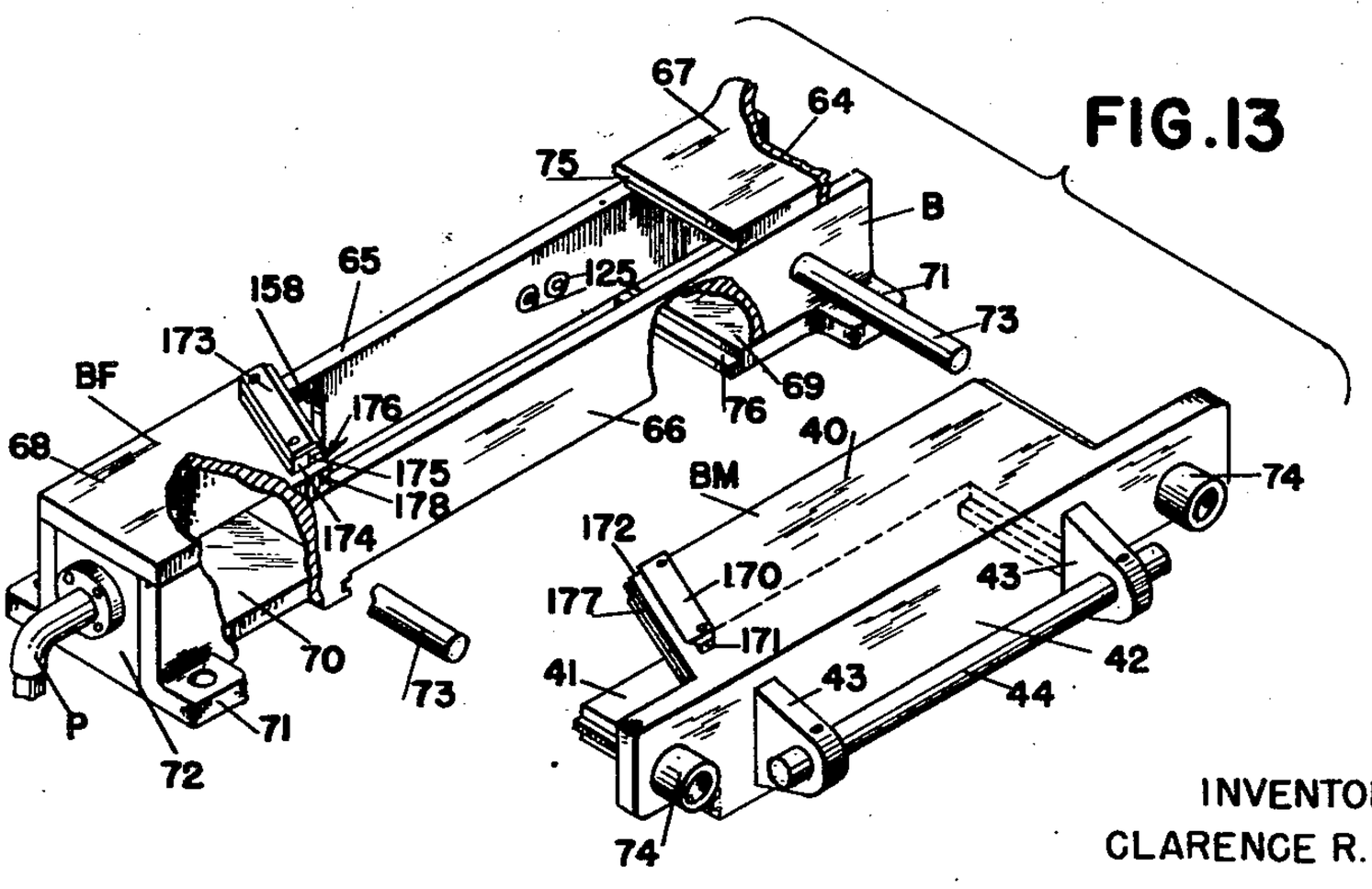


FIG.14

FIG.13



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Patented Oct. 31, 1950

2,528,150

UNITED STATES PATENT OFFICE

2,528,150

SHUTTLE BOX MECHANISM FOR WEFT REPLENISHING LOOMS

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Application March 25, 1949, Serial No. 83,432

31 Claims. (Cl. 139—233)

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This invention relates to looms and it is the general object of the invention to provide pneumatic shuttle picking means adapted for weft replenishment.

Pneumatic picking mechanisms wherein the shuttle box is tubular and picks a shuttle when compressed air is introduced into it have been proposed heretofore, but so far as is known they have not been adapted for bobbin changing weft replenishment. It is an important object of the present invention to make a tubular shuttle box of separable parts which are normally closely fitted to each other to act efficiently for pneumatic picking of a shuttle, but movable apart to permit entrance of a reserve bobbin.

Weft replenishment ordinarily occurs when the lay is at front center and the shuttle is picked when the lay is at top center, and at the time of picking the shuttle box must be closed to take full advantage of the air pressure. It is a further object of the invention to control the separable parts of the shuttle box so that they will open for replenishment and then close in time for picking.

When weft replenishment occurs the weft end of the transferred bobbin extends from a thread holder into the shuttle box and should be controlled to prevent it from being whipped into the warp shed. It is another object of the invention to provide thread cutting and clamping means associated with the shuttle box structure to release part of this thread for immediate removal by the thread holder, and clamp the other part of it so that the shuttle may be threaded when it is picked.

In order that this other part of the weft end of the incoming bobbin may be released for control it is a further object of the invention to effect a second opening of the shuttle box as soon as the thread of the incoming bobbin is bound into the cloth.

In recent years pneumatic thread removing controls located between the magazine and cloth have been provided for removing the thread of the outgoing bobbin. Such control means have not ordinarily been made so that they can control the thread of the incoming bobbin, and it is a further object of the invention to provide pneumatic thread removing means which will be effective not only to remove the thread of the outgoing bobbin, as is usual, but also remove the thread of the incoming bobbin. The operating means used for the positioning of the thread remover may conveniently be the same as that employed for opening and closing the shuttle box.

The shuttle box should be tight at the time of picking and have as little leakage as possible. In multicolor weft replenishing looms it is usual to have the weft detector at the replenishing end, and it is also desirable to cut the thread of the outgoing shuttle on replenishing beats of the loom.

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It is a further object of the invention to mount the weft detector and cutter on the front of the shuttle box in such manner as to reduce air loss to a minimum, and provide an actuator or control means normally operative to move the detector into detecting position as the lay beats up on non-replenishing beats of the loom without operating the cutter, but moving out of position relatively to the detector and into operating position relatively to the cutter or replenishing beats.

With these and other objects in view which will appear as the description proceeds, the invention resides in the combination and arrangement of parts hereinafter described and set forth.

In the accompanying drawings, wherein two forms of the invention are set forth,

Fig. 1 is a side elevation of a multicolor weft replenishing loom having the invention applied thereto, the lay being shown on front center position and the shuttle box, shuttle and adjacent part of the lay being shown in cross section,

Fig. 2 is an enlarged plan view looking in the direction of arrow 2, Fig. 1,

Fig. 3 is a front elevation on a reduced scale looking in the direction of arrow 3, Fig. 2, showing details of the shuttle box operating mechanism,

Fig. 4 is an enlarged horizontal section on line 4—4, Fig. 3,

Fig. 5 is an enlarged vertical section on line 5—5, Fig. 2,

Fig. 6 is a detailed vertical section on line 6—6, Fig. 2, showing the weft detector in detecting position,

Fig. 7 is a detailed vertical section on line 7—7, Fig. 2, showing the thread cutter in normal idle or retracted position,

Fig. 8 is a perspective view showing the shuttle box in open position,

Fig. 9 is a detailed front elevation looking in the direction of arrow 9, Fig. 2,

Fig. 10 is an enlarged vertical section on line 10—10, Fig. 1,

Fig. 11 is a diagrammatic front elevation of the loom showing the drop shuttle boxes at the left end and the shuttle box forming part of the subject matter of the present invention and the adjacent magazine at the right end,

Fig. 12 is a diagrammatic view similar to part of Fig. 1, but showing the shuttle box open for bobbin transfer,

Fig. 13 is an exploded perspective view showing the two parts of the shuttle box as seen from the rear, parts being broken away,

Fig. 14 is an enlarged perspective view of part of the cutting and clamping mechanism for the thread of the incoming bobbin,

Fig. 15 is a plan view of the shuttle used with the invention,

Fig. 16 is a vertical section on line 16—16, Fig. 15, and

Figs. 17 and 18 are diagrammatic views showing two relations of the lifter dog or coupling means and operating lever for the shuttle box.

The invention shown herein is applied to a multicolor weft replenishing loom having drop shuttle boxes at the end of the lay opposite the replenishing end and having a stationary multistack reserve magazine. The magazine operates in a manner usual in multicolor weft replenishing looms and it is not thought that a full description of all the structure of the magazine is necessary. Enough will be set forth, however, to show how the magazine can be indicated from the weft detector which of itself is somewhat different from those customarily used. The drop shuttle boxes will be equipped with pneumatic picking which is not set forth in detail herein but is shown in a co-pending application, Ser. No. 83,431, filed March 25, 1949. The invention is not limited in its use to the stationary magazine shown for instance in Fig. 1, nor is the invention limited by the particular form of picking mechanism at the drop box end of the loom.

Referring more particularly to Figs. 1, 2 and 10, it will be seen that the loom frame 15 supports a lay 16 which is reciprocated in usual manner by connectors one of which is shown at 17. These connectors are driven from the top or crank shaft 18 having secured thereto a gear 19 meshing with another gear 20 of twice its size secured to the bottom shaft 21. The lay has a complete reciprocation for each beat of the loom and the bottom shaft rotates once for every second beat and is on two-pick time.

At the left side of the loom as shown in Fig. 11 there is provided a gang G of shuttle boxes which rise and fall according to pattern demands by means of lifter mechanism 22 connected to a lifter rod 23. A pipe 24 supplies compressed air for picking from the gang G whichever shuttle is in active position in alignment with the lay.

The loom frame supports a multicolor magazine M which in the present instance is adapted to support four stacks of reserve bobbins. The magazine has bobbin supports which hold a bobbin T in transfer position after it has been released from its stack. In Fig. 1 two of these supports, those for the bobbin tip, are shown at 25.

The magazine is controlled in a manner usual in multicolor weft replenishing looms by mechanism including a cam 26 secured to the bottom shaft and rocking a magazine lever 27 on a fixed pivot 28. A rod 29 leading upwardly from lever 27 is connected to an actuator lever 30 which is controlled by a pin 31. Ordinarily this pin is out of the path of the lever 30 so that the latter is free to have its right hand end as viewed in Fig. 2 descend on detecting beats of the loom. If, however, the pin 31 is moved rearwardly into the path of lever 30 the normal movement of the latter is interrupted and the cam causes it to depress a rod 32 to initiate release of a bobbin from the magazine stack corresponding to the shuttle which gives indication of weft exhaustion.

The position of the pin 31 is controlled by a solenoid 33 normally deenergized but effective when energized incident to indication of weft exhaustion by the electric weft detector designated generally at D to move the pin 31 rearwardly under the actuator lever. This operation occurs when the depleted shuttle is at the replenishing or magazine end of the loom and results in the storage of an indication in the magazine. The depleted shuttle is then picked to the opposite side of the loom and when it is about

to return to the magazine end the bobbin previously advanced is released and moves to transfer position.

The magazine includes a transferrer arm 34 pivoted on a fixed stud 35 and having a latch 36 normally out of the path of a bunter 37 on the lay. When the magazine is to have a bobbin transferring operation the latch 36 will be raised into the path of the bunter and forward movement of the lay will rock the transferrer arm to move the weft carrier or bobbin T out of the magazine and into the shuttle under the magazine. It is believed that a more extended description of the magazine is unnecessary for an understanding of the present invention, since the magazine is of well-known construction and operation and may be similar to that set forth for instance in Patent No. 1,030,748. It is thought sufficient for present purposes to state that any one of the four shuttles S1, S2, S3 and S4 indicated in Fig. 11 can be in action, and that indication of weft exhaustion by the detector D when any shuttle is at the magazine end of the loom will be followed by a bobbin changing operation when the depleted shuttle returns to the magazine end of the loom.

The invention relates more particularly to the shuttle box designated generally at B and located on the lay under the magazine. This shuttle box is generally of tubular form and is normally closed for pneumatic picking therefrom of a shuttle, and therefore is incapable in its normal position of receiving a reserve bobbin. The box is so made that on a replenishing beat of the loom it can be opened to receive a bobbin from the magazine. The shuttle box in the form of the invention shown more particularly in Figs. 2 and 13 comprises two parts BF and BM, which are respectively fixed to and movable relatively to the lay. An air pipe or tube P on part BF communicates with the interior of the box B and supplies compressed air under appropriate valve control (not shown) to drive a shuttle out of the box at the time of picking.

The box part BM as shown for instance in Figs. 1 and 13 includes top and bottom plates 40 and 41, respectively, rigid with a vertical wall 42. This wall has extending rearwardly therefrom two spaced lugs 43, see Fig. 2, through which extends a rod 44. This rod is acted upon by two arms 45 which are secured to and extend upwardly from a rock shaft 46 mounted for rotation on the lay, see Fig. 1. Rod 46 is mounted on bearing supports 47 secured to the under side of the lay.

Extending forwardly from and secured to rock shaft 46 is an arm 50 pivotally connected to the upper end of a rod 51 the lower end of which is pivoted at 52 to a normally idle operator or operating lever 53. This latter lever is pivotally mounted on a fixed stud 54. Lever 53 has a lifting lug or shelf 55, see Fig. 10, for cooperation with a coupling means or lifting dog 56 pivoted at 57 on an actuator lever 58.

Lever 58 is also pivoted on stud 54 and extends rearwardly from the stud and has mounted thereon a roll 59 fitting groove 60 of a two-pick cam C secured to the bottom shaft. A spring 61 is connected to the forward end of lever 53 and has its lower end attached to a clip 62 fixed to the loom frame. The spring normally tends to pull the forward end of lever 53 and rod 51 downwardly, as will be apparent from Fig. 1, and by this action normally holds the box part

BM in forward box closed position, as shown in Fig. 1.

The box part BF, see Fig. 13, has front and back vertical walls 65 and 66, respectively, which support two top plates 67 and 68 located at the inner and outer ends, respectively, of box B. Inner and outer floor plates 69 and 70, respectively, are secured to the walls 65 and 66. Feet 71 provide means for securing the box part BF to the lay 16. All the parts of box section BF thus far described are secured to each other in any approved manner, and a plate 72 closing the outer end of the box B has the pneumatic pipe P secured thereto. Vertical walls 65 and 66 prevent backward motion of a shuttle in box B when part BM moves rearwardly. Top plate 67, bottom plate 69, front wall 65 and back wall 66 define a box mouth 64.

Extending rearwardly from and secured to rear wall 66 are two spaced horizontal guide studs 73 which fit bearings 74 on the rear of wall 42. When box B is closed in its normal position the part BM will be in forward position with plate 40 between top plates 67 and 68 and over the parts of walls 65 and 66 between plates 67 and 68. The floor plate 41 will be between floor plates 69 and 70 and the two sections BF and BM will normally be fitted together closely so as to form a pneumatic tubular shuttle box substantially airtight except for mouth 64. When the box B is to be opened for bobbin transfer bearings 74 will slide rearwardly on parallel guide studs 73 and top and bottom floor plates 40 and 41 will move rearwardly to provide a vertical opening or passageway through the box B. Top plate 67 has an overhanging rib 75 under which the inner part of top plate 40 fits, and similarly floor plates 69 and 70 have ribs 76 extending under the inner and outer edges of floor plate 41. The oblique edges of top plates 40 and 68 will be described in more detail hereinafter with reference to the thread cutter and clamping mechanism on box B.

The electric weft detector D, when indicating weft exhaustion, energizes a solenoid S, see Fig. 1, to raise a core 80 and lift a trip finger 81. This finger when raised will effect rocking of one or another of the dog deflectors 82, 83, 84 and 85, depending upon which of the latter is registered with the trip 81. Ordinarily all of the dog reflectors will be in the full line position shown in Fig. 10, but upon indication of weft exhaustion by the weft detector the deflector corresponding to the shuttle in box B will be rocked in a clockwise direction as viewed in Fig. 10 from the normal position thereof to the dog controlling position shown in dotted lines, Fig. 10.

Each of the deflectors has a pin or stem 86 pivoted thereto at 87 and surrounded by a compression spring 88 exerting a force to the left, Fig. 10, to hold it in normal position against a stop 89. Each deflector has a lifter finger 90 to be raised by the trip 81 to rock the associated deflector from the full to the dotted line position shown in Fig. 10 when solenoid S is energized.

The deflectors are under control of the gang G of shuttle boxes by reason of a connector 91 extending from the shuttle boxes to the magazine end of the loom and trained around a sheave 92 from which the connector extends rearwardly for attachment to a positioning lever 93 pivoted at 94 on the rear end of a support 95 fixed to the stud 54 and supporting the sheave 92.

A rod 96 is connected to a lever 93 and extends to a carriage 97 on which the deflectors are mounted. This carriage is supported by lever 63 and is slidable relatively to the latter in response to rocking of lever 93 incident to shifting of the box gang G to register the deflectors one at a time with the trip 81.

Except as noted hereinafter the structure shown in Fig. 10 is very similar to selector mechanisms which have been used heretofore on multicolor shuttle changing looms and a type of rocking magazine bobbin changing loom which has gone into general use. For further details of its construction reference may be had to prior patent to Cederlund and Holmes No. 2,054,192. It is thought sufficient for the present purposes to state that when the solenoid S is energized the deflector corresponding to the empty shuttle will be rocked from normal to indicating position with respect to the coupling means or dog 56 and will be capable of some movement due to spring 88 without losing its setting. The solenoid S is fixed on the operating lever 53 and is connected to electric wires *a* and *b*.

As heretofore used the mechanism shown in Fig. 10 has been reset upon upward movement of lever 53. The present invention contemplates two successive upward motions of this lever for each replenishing operation and for this reason it is necessary to alter the resetting mechanism for the dog deflectors.

A cam 100 is secured to a stub shaft 101 rotatable in a fixed bearing 102. A sprocket wheel 103 secured to shaft 101 is driven by a chain 104 trained over a sprocket 105 secured to the bottom shaft. Wheels 103 and 105 are of the same size so that cam 100 turns once every two picks of the loom. The cam has high and low areas 106 and 107 respectively which are located over the dog deflector in active or controlling position. When low dwell 107 faces the active deflector the latter can rise without being reset, but when high dwell 106 faces the deflector the latter is reset as it rises.

The cam C as shown more particularly in Fig. 1 is made with two high points 110 and 111 which so far as certain features of the invention are concerned are of the same height, although this is not necessary for all uses to which the invention can be put. There are two dwells on the cam one of which 112 is somewhat lower than the other indicated at 113. The cam rotates in the direction of arrow *c*, Fig. 1, and gives the dog 56 a regularly recurring two-pick cycle of movements during which the dog will be successively in its lowest or starting position when roll 59 is on low dwell 112, in its highest position when the roll is on point 110, then in its next to lowest position when the roll is on dwell 113, and then again in its highest position when the roll is on point 111, after which it returns to the starting position. This sequence of motions is normally idle so long as there is no dog deflector in indicating and controlling position relatively to the dog 56.

The cam C is set so that roll 59 is on dwell 112 on alternate beats of the loom when replenishing operations can occur as the lay is advancing toward its front center position with the shuttle to be detected approaching box B from the gang G. As soon as time has been allowed for boxing of the shuttle in box B the dog will move up from its starting position and will attain its highest position when the lay is at front center. If detector D indicates weft exhaustion

the solenoid will be energized and the deflector corresponding to the shuttle in box B will be moved to indicating position. The dog then moves down without resetting the indicated deflector and reaches the upper of its two low positions as determined by dwell 113 by the time the shuttle is picked, which will ordinarily be with the lay at top center. The indicated deflector, due to its length, will not be able to move over lug 115 on the dog and the latter will rise again and remain in up position until the lay has reached its next front center position, after which the dog descends to the lower of its two low positions as determined by dwell 112. In this position the indicated deflector moves over lug 115.

On the next up motion of the dog from starting position, assuming the same shuttle is still in action, the dog will be deflected under lifting lug or shelf 55 and lever 53 will rise to move box part BM rearwardly to open box B. This opening of the box for a transfer or replenishing period occurs after the shuttle has been received and checked in box B and between successive picking operations. Cam 100 will be in non-resetting position with its low dwell 107 facing the indicated deflector. As soon as replenishment has been completed the dog starts down and the box B is closed in time for pneumatic picking of the replenished shuttle.

When moving down the dog stops at its next to lowest position, but the shelf 55 is so shaped, see Fig. 10, that the dog cannot detach itself from the shelf and remains engaged with it while roll 59 is on dwell 113 to effect closure of box B. After the lay has again reached front center and the weft of the fresh bobbin has been beaten into the cloth the dog starts up again, thereby opening the box B a second time for release of the clamped thread, as will be explained. The dog then descends to its lowest position and detaches itself from shelf 55 and returns to normal idle position due to action of spring 116. The mechanism is now reset for another operation.

The matter thus far described will be seen to operate in such manner that the shuttle box is closed to check the shuttle by trapped air in the box, after which the box is opened for a sufficiently long time when the lay is at or near its front center position to permit weft replenishment. The box is then closed in time for picking and held closed until or slightly after the next front center, whereupon it again opens and is then finally closed to complete the replenishing cycle.

The replenishing operations already described must be initiated by the weft dictator which may be constructed and mounted as shown for instance in Figs. 2, 6 and 8. Extending forwardly from the lay is a small stand 120 on which is pivotally mounted a controller 121 made preferably of insulating material and extending upwardly behind nuts 122 one of which is on each of two electric weft detecting fingers 123 and 124. These fingers slide through the front wall 65 of the box part BF which is provided with bushings 125 of insulating material to keep the detecting fingers insulated from each other.

An actuator 126 movable pivotally at 127 on a stand 128 fixed with respect to the stud 35 is normally held in position to engage the lever 121 above its pivot 129 by a spring 130. Lever 126 is positioned by engagement of its stop 131 with support 128. Each of the detector fingers 123 and 124 is surrounded by a light compression

spring 132 the rear end of which bears against a shoulder 133 on the detector finger. Lever 121 is normally held in forward position by a compression spring 134, see Fig. 6. This spring normally holds the detector fingers forwardly out of the path of the shuttle as the latter moves into the shuttle box B. As the lay advances however the actuator 126 strikes lever 121 and moves its upper end rearwardly to the position shown in Fig. 6, thereby exerting rearward forces on the springs 132 which thereupon project the detector fingers rearwardly against the bobbin W. If the latter has sufficient weft for continued weaving the detector fingers are not connected electrically, but if the bobbin is depleted its ferrule 135 will electrically connect the two fingers the effect of which will be to cause energization of solenoid S in known manner.

On a replenishing beat of the loom it is necessary to prevent the detector finger from entering the shuttle box B. This is accomplished by the mechanism shown in Figs. 1 and 2. The transferrer latch 36 has secured thereto an arm 136 having a cam or beveled edge 137 normally down away from lever 126. When the transferrer latch rises preparatory to a bobbin changing operation beveled edge 137 engages lever 126 and rocks it counter-clockwise, Fig. 2, to move its rear end to the left out of register with a controller 121. The latter therefore remains at rest and the detector fingers are not moved into the box B.

In order to dispose of the thread connected to the outgoing bobbin and also the thread of the incoming bobbin the invention provides means for cutting these threads and removing them pneumatically.

A thread cutter 140 for the outgoing thread has a stand 141 mounted on the front stationary wall 65 of the shuttle box part or section BF near the shuttle eye. The stand supports a slide 142 on which two blades 143 and 144 are pivoted at 145. An operating pin 146 extends through slots 147 and 148 in the blades and is secured to the stand 141. A spring 149 between studs 145 and 150 on the stand and slide respectively normally holds the blades forward out of the shuttle box. The cutter may be similar to that shown in prior Patent No. 1,265,590.

A rod 155 pivoted to the actuator 126 extends to the right from the latter as shown in Fig. 2 and is connected to a second actuator 156 pivotally mounted on a stand 157 secured to the stud 35. This actuator will normally be at the right of slide 142 during non-transferring beats of the loom, but when weft replenishment is to occur the rod 155 will be moved to the left as actuator 126 is rocked by bevel 137, thereby moving the actuator 156 in front of the slide 142, and moving actuator 126 out of register with detector D. As the lay beats up the forward part of slide 142 strikes the actuator 156 and the slide is moved rearwardly with respect to the shuttle box and into an opening 158 in the front wall of the shuttle across which the weft thread WO extends. This thread is cut and the outgoing depleted bobbin carries with it through slot 139 in the lay that part of the thread extending from it through the shuttle eye and back to the cutter. The remainder of this thread extending from the cutter through box mouth 64 to the selvage of the cloth or fabric F is removed by a form of pneumatic thread remover located between the cloth and magazine and somewhat similar to pneumatic removers already in use but modified as to its control for the present invention so that it

has two motions from normal to thread pick-up position for each replenishing operation.

The thread remover R comprises a tube 159 having an intake mouth 160 and a depending tongue 161 projecting downwardly and forwardly from the back part of the intake mouth. The tube is surrounded by a spring 162 which holds the tube yieldingly in rear position with respect to a carrier 163 in which the tube is slidable. The stop collar 164 by engagement with part of the carrier limits rearward movement of the tube.

The carrier 163 is secured to a lever 165 pivoted on a stud 166 secured to the loom frame. An arm 167 extending toward the front of the loom from the stud 166 as viewed in Fig. 2 is connected to a downwardly extending rod 168 which as shown in Fig. 1 is connected to the stud 52 of the normally stationary operating lever 53.

The tube 159 is normally in raised position, but when the box is to be opened for a bobbin transfer and lever 53 rises as the lay advances, lever 165 will be rocked by rod 168 and the tube 159 will descend and the lip 161 will move to a position behind the thread WO as shown in Fig. 2. After bobbin transfer is completed and the lay starts to move rearwardly the weft thread WO will be caught by the lip, and since subatmospheric pressures exist within the tube 159 that part of the thread leading from the cutter 140 to the tube will be drawn into the latter. At a later time a temple cutter 169 will cut the thread at the selvage, whereupon it will be removed in its entirety by the tube 159. This operation is somewhat similar to pneumatic thread removers now in use and effects removal of the thread of the outgoing bobbin.

When the bobbin T is transferred into the box B its weft end WI will extend from a pneumatic thread holder H, or other form of thread holder, over the adjacent part of the shuttle box and down into the shuttle. A thread control means is provided for cutting and clamping this thread at the point where it enters the shuttle box B.

As shown in Figs. 13 and 14, a cutter blade 170 on a spacer 171 is secured to the movable part BM of the shuttle box and extends parallel to the oblique edge 172 of plate 40. A second blade 173 on a spacer 174 is secured to plate 68, and a thread clamp 175 is held to plate 68 and extends along its oblique edge 176. The top of the clamp is spaced below the overhanging cutting edge of blade 173 to provide a room for entrance of blade 170, see Fig. 14. A soft rubber seal 177 on edge 172 is positioned on part BM to enter a groove 178 on edge 176 of box parts BF.

When bobbin T is transferred into opened box B thread WI will pass down over blade 173 and into the box and shuttle therein. As box part BM moves to box closing position blade 170 will clamp it against clamp plate 175 and thereafter cut the thread. As the box B becomes completely closed, therefore, the thread WI is cut and clamped, the part of it extending to the holder H being drawn into the latter, and the part of it extending to the transferred bobbin being held by clamp 175 and the bottom of blade 170.

When the box is closed immediately after bobbin transfer the shuttle will be picked pneumatically and will be in flight until the lay reaches approximately the next bottom center position, after which the lay will beat up and this first pick laid by the fresh bobbin will be beaten into the cloth. During this time box B is kept closed to hold the thread connected to the fresh bobbin, enabling it to unwind its bobbin and preserve its tension.

After this incoming thread has been bound into the fabric it will no longer be necessary for it to be clamped and it can be released by the second opening of the box. At this point in the loom cycle the replenished shuttle is at the opposite or drop end of the loom. As cam point 111 acts to open the box at or shortly after front center the remover R will again descend to pick-up position and attract thread WI. The box can remain open during backward motion of the lay, but should be closed again in time to receive and check the on-coming shuttle from gang G. This will complete the replenishing operation, and normal closed condition of penumatic box B will be reestablished. At a subsequent beat-up of the lay the incoming thread will be cut by the temple cutter and will be removed by the tube 159.

Shuttle S1, shown in Figs. 15 and 16, is similar to the other shuttles and a description of it as adapted for pneumatic picking and bobbin changing replenishment will suffice for all the shuttles used in the loom. The shuttle body 180 has a bobbin compartment 181 and a bobbin holding spring jaw 182 held to the shuttle partly at least by a clip 183. This clip is usually below the top surface 184 of the shuttle. It is crossed by a filler 185 flush with top surface 184 to prevent air leakage. A turbulence groove 186 extends across the top of the shuttle, and similar grooves 187 are formed in the vertical walls of the shuttle. These grooves do not go quite to the edges of the shuttle, leaving them uninterrupted so they can pass easily through the warp shed.

The other end of the shuttle has an eye 190 which may be of usual form with a thread passage therethrough which would permit leakage of air. In order to prevent this leakage, or at least greatly reduce it, a transverse plate 191 is secured to the shuttle at the end of the weft compartment, see Fig. 16. This plate has a narrow vertical thread slot 192 and a top edge 193 which lies close to the underside of the top of shuttle box B. A turbulence groove 194 similar to groove 186 extends across the top edge 193 of plate 191, and other similar slots 195 are formed in the front and back shuttle walls. These turbulence grooves effectively prevent air from passing beyond them during the picking operation.

From the foregoing it will be seen that the invention provides a weft replenishing loom operating with pneumatic shuttle picking means wherein a normally closed tubular shuttle box is opened momentarily to receive a reserve weft carrier on replenishing beats. The shuttle box is opened after the depleted shuttle is boxed in it and is closed in time for the next picking operation. Thread cutting and clamping mechanism associated with the parts of the shuttle box cut and clamp one end of the weft end of the incoming weft carrier as the box closes subsequent to a replenishing operation. As shown herein the clamped part of the weft end is released by a second opening of the shuttle box occurring preferably after the beat up following replenishment, but certain features of the invention are not limited to this type of thread control. The thread remover is moved to pick-up position twice, once for the outgoing thread and again for the incoming thread, preferably by the same mechanism which opens the shuttle box. The weft detector and cutter for the outgoing thread are so mounted on the shuttle box as to reduce air leakage to a minimum, and these mechanisms

are operated by a controller which is in register with but one of them at a time. This controller as shown herein includes the lever 126, the rod 155 and the cutter actuator 156, and associated parts, and its position is controlled by a part which has a motion incident to a replenishing operation, such as the transfer latch 36. The deflectors 82—85 act as positioners for the dog 56, which may be considered as an operator for the box opening mechanism and forming part of the operating means including the levers 53 and 58 and cam C. The resetter returns a deflector or positioner in indicating position to non-indicating position as the lever 53 rises the second time and is not in position to effect resetting on the first up motion of lever 53.

Having thus described the invention it will be seen that changes and modifications of the foregoing specific disclosure may be made without departing from the spirit and scope of the invention.

What is claimed as new is:

1. In a weft replenishing loom operating with a source of compressed air and having a reserve weft carrier, a pneumatic shuttle box normally closed for pneumatic picking therefrom of a shuttle by compressed air derived from said source but so constructed as to be openable to receive the weft carrier, means effecting opening of the shuttle box on a weft replenishing beat of the loom, and transfer mechanism effective to move the reserve weft carrier into the shuttle box while the latter is open as the result of operation of said means.

2. In a weft replenishing loom operating with a source of compressed air and having a reserve weft carrier, a pneumatic shuttle box normally closed for pneumatic picking therefrom of a shuttle by compressed air derived from said source but so constructed as to be openable to receive the weft carrier, means effecting opening of the shuttle box for a replenishing period on a weft replenishing beat of the loom, and transfer mechanism effecting movement of the reserve weft carrier into the shuttle box during said replenishing period.

3. In a weft replenishing loom operating with a source of compressed air and having a reserve weft carrier, a pneumatic shuttle box normally closed for successive pneumatic picking operations of a shuttle therefrom by compressed air derived from said source but so constructed as to be openable to receive the reserve weft carrier, means effecting opening of the shuttle box for a replenishing period occurring between successive picking operations, and transfer means effecting movement of the reserve weft carrier into the shuttle box during said replenishing period.

4. In a weft replenishing loom having a source of compressed air and bobbin changing mechanism, a two-part shuttle box normally in closed position to form a pneumatic shuttle box which is pneumatically connected to said source, and means operating on a weft replenishing beat of the loom to effect separation of said two parts to define a passageway through the shuttle box for the incoming and outgoing bobbins.

5. In a weft replenishing loom having a source of compressed air and bobbin changing mechanism having a reserve bobbin, a shuttle box made of two separable parts which are normally in closed position to provide a pneumatic shuttle box the interior of which is pneumatically connected to said source and from which a shuttle is pneumatically picked, operating means effective on a replenishing beat of the loom to separate said parts to provide for entry of the reserve bobbin into the shuttle box, and means transferring the reserve bobbin into a shuttle in the shuttle box while said parts are separated, said operating means thereafter effecting closure of the box in time for pneumatic picking of the replenished shuttle.

6. In a loom having shuttle box supporting means and a bobbin changing mechanism above said supporting means, a shuttle box under the bobbin changing mechanism comprising a part fixed with respect to said supporting means and open at the top and bottom thereof and a second part fitting the first part and normally closing the top and bottom of the first part to form a pneumatic shuttle box from which a shuttle can be picked by introduction of compressed air into the shuttle box, and means operating incident to a weft replenishing operation of the loom to move the second part of the box relatively to first part to open the top and bottom of said shuttle box to define a vertical passageway through the shuttle box, and means transferring a bobbin from the changing mechanism along such passageway into the shuttle box.

7. In a loom having shuttle box supporting means and bobbin changing mechanism above said supporting means, a shuttle box on the supporting means below the bobbin changing mechanism comprising two parts one of which is permanently connected to the supporting means and the other of which is supported by and slidable relatively to the first part in a back and forth direction, said two parts of the box being normally closed to form a pneumatic shuttle box from which a shuttle can be picked by compressed air introduced into the shuttle box, and means operative on a weft replenishing beat of the loom to move said second part of the box rearwardly relatively to the first part to permit entrance of a bobbin from the bobbin changing mechanism.

8. In a loom having shuttle box supporting means and bobbin changing mechanism above said supporting means, a shuttle box on the supporting means comprising two parts normally in closed position, one of said parts being fixed to the supporting means and provided with spaced guides extending rearwardly therefrom and the other part being slidable rearwardly on said spaced guides and normally fitted to the first part to provide a pneumatic shuttle box, pneumatic connections attached to one of said parts communicating with the interior of the shuttle box for picking a shuttle pneumatically therefrom, and means operative on a weft replenishing beat of the loom to move the second part rearwardly on said guides to open said shuttle box for reception of a bobbin from said bobbin changing mechanism.

9. In a loom wherein weft replenishment occurs when the lay is at front center and when the picking operation occurs when the lay is at top center, a pneumatic shuttle box on the lay made of two relatively separable parts normally in closed position for pneumatic picking of a shuttle therefrom, and operating means effective on a weft replenishing beat of the loom causing separation of said parts to open the shuttle box as the lay approaches front center to receive a reserve weft carrier, said operating means thereafter effecting relative movement of said parts to close the shuttle box for picking of the repenished shuttle by the time the lay reaches top center.

10. In a loom having a supporting means and weft replenishing mechanism, a pneumatic shuttle box on the supporting means having separable parts one of which is fixed to the supporting means and the other of which is movable relatively to the latter and said one part, said parts being normally in closed position for pneumatic picking of a shuttle therefrom, a lever having operative movements at regular intervals during loom operation occurring on beats of the loom when weft replenishing operations can occur, a second normally idle lever operatively connected to said other part of the shuttle box, and means operative on a weft replenishing beat of the loom coupling said levers to effect movement of the second lever to move said other part of the box away from said one part to open the shuttle box for replenishment of the weft therein.

11. In a loom having a lay and bobbin changing mechanism, a shuttle box on the lay comprising two relatively movable parts normally fitted together to form a closed shuttle box to permit pneumatic picking therefrom of a shuttle, a lever pivoted on the lay and operatively connected to one of said shuttle box parts, and means effective on a weft replenishing beat of the loom to rock said lever in a direction to move said one part away from the other part to open the shuttle box to enable a bobbin from the bobbin changing mechanism to enter the shuttle box.

12. In a loom having supporting means and a reserve bobbin from which a weft end extends, a pneumatic shuttle box on the lay comprising relatively separable parts which are normally in closed position to enable a shuttle therein to be picked pneumatically therefrom, operating means effective on weft replenishing beats of the loom to cause relative separation of said parts of the shuttle box, means thereafter transferring the reserve bobbin into a shuttle in the shuttle box while said parts are separated, the operating means thereafter effecting a return of said parts to closed position, and cooperating means partly on each of said parts of the shuttle box effective to cut the weft end of the transferred bobbin and clamp that part thereof extending into the shuttle box.

13. In a loom having supporting means and a reserve bobbin from which a weft end extends, a shuttle box on the supporting means formed of two relatively movable parts one of which is fixed to the supporting means and the other of which is movable relatively thereto in a direction away from the first part, said shuttle box parts normally being in closed position to form a shuttle box from which a shuttle can be pneumatically picked, operating means effective on the weft replenishing beat of the loom to cause relative separation of said parts to open the shuttle box to enable the reserve bobbin to be moved into the shuttle box, a thread cutter blade on said one part of the shuttle box, and a second thread cutter blade on said other part of the shuttle box, said operating means effecting return of said parts to closed position subsequent to replenishment of the shuttle and causing said blades to cooperate to sever the weft end of the bobbin.

14. In a loom having a lay and a reserve bobbin the weft end of which extends to a thread holder, a two-part shuttle box on the lay, one of said parts being fixed to the lay and the other being movable relatively to the first part of the lay, said parts normally being in closed position to define a closed pneumatic shuttle box from which a shuttle in the box can be picked by introduction of compressed air into the shuttle box, operating means effective on a weft replenishing beat of the loom to move said other part of the shuttle box away from said one part, transfer means moving said reserve bobbin into the shuttle box, said operating means thereafter effecting return of said shuttle box parts to normal closed position, the weft end extending from the holder into the shuttle box, and means operative upon return of said shuttle box parts to normal closed position thereof to cut the weft end and clamp that part thereof within the shuttle box.

15. In a loom having supporting means and a reserve bobbin from which extends a weft end, a shuttle box on the supporting means made of relatively separable parts which are normally in closed position to define a closed pneumatic shuttle box from which a shuttle therein can be picked by compressed air introduced into the shuttle box, operating means effective on a weft replenishing beat of the loom to cause relative separation of said shuttle box parts to open the shuttle box to enable the reserve bobbin to be transferred into the shuttle box and thereafter close the shuttle box for a pneumatic picking operation occurring after replenishment, means partly on each of said parts of the shuttle box clamping the weft end of the bobbin when said shuttle box parts return to closed position, and said operating means operative on the next beat of the loom to effect a second separation of said shuttle box parts to cause said clamping means to release the clamped weft end.

16. In a loom having a lay and a reserve bobbin from which extends a weft end, the weft end of the bobbin being beaten into the cloth on the next front center position of the lay occurring after transfer of the bobbin, a shuttle box on the lay formed of two relatively separable parts normally in closed position to provide a closed pneumatic shuttle box from which a shuttle therein can be picked pneumatically, operating means effective on a weft replenishing beat of the loom to cause relative separation of said parts to open the shuttle box, means transferring the bobbin into the shuttle box while the latter is open, said operating means thereafter effecting relative movement of said parts of the box to closed position, said operating means thereafter effecting a second separation of said parts of the shuttle box subsequent to the next movement of the lay to front center position, and thread control means operative incident to closure of the shuttle box immediately after transfer of the bobbin to cut and clamp said weft end, said control means releasing the clamped weft end incident to the second opening of the shuttle box.

17. In a weft replenishing loom wherein incident to weft replenishing operation a thread remains from the outgoing bobbin on the replenishing beat of the loom and a second thread remains from the incoming bobbin on the next beat of the loom, a shuttle box formed of relatively separable parts which are normally in closed position to provide a closed pneumatic shuttle box from which a shuttle can be picked pneumatically, operating means causing relative separation of said parts to open the shuttle box on said replenishing beat of the loom to permit egress of the outgoing bobbin and entry into the shuttle box of the incoming bobbin, said operating means thereafter effecting relative movement of said

parts to cause closure of the shuttle box and then effecting a second opening of the shuttle box on said next beat of the loom, cutter means cutting the first thread in the shuttle box on said replenishing beat, thread control means cutting and clamping the second thread incident to said closure of the shuttle box and releasing the second thread incident to said second opening of the shuttle box, and a pneumatic thread remover between the shuttle box and the cloth normally out of thread receiving position and moved by said operating means toward the first thread to remove the latter incident to the first opening of the shuttle box and moved toward the second thread to remove the same incident to the second opening of the shuttle box.

18. In a weft replenishing loom wherein a thread remains from the outgoing shuttle incident to a weft replenishing operation, a pneumatic thread remover normally spaced from but movable toward said thread, a pneumatic shuttle box made of separable parts which are normally in closed position to form a pneumatic shuttle box for the pneumatic picking of a shuttle therein, thread cutting mechanism effective on a weft replenishing beat of the loom to cut said thread in the shuttle box, operating means opening said shuttle box on a replenishing beat of the loom to permit egress therefrom of the outgoing bobbin, and connections between said operating means and said thread remover moving the latter toward the thread for pneumatic removal thereof when said operating means opens said shuttle box.

19. In a weft replenishing loom having a reserve bobbin from which a weft end extends, a normally closed pneumatic shuttle box openable to receive the reserve bobbin, operating means effective to open the shuttle box on a weft replenishing beat of the loom to receive the reserve bobbin and part of said weft end, said operating means thereafter effecting closure of the shuttle box and subsequently effecting a second opening of the shuttle box, thread control means effective to cut and clamp the weft end incident to said closure of the shuttle box and effective to release the weft end incident to said second opening of the shuttle box and a thread remover between the shuttle box and cloth normally in idle position but movable to thread pick-up position and connections between the operating means and remover effective to move the latter to pick-up position to remove the weft end when the operating means effects said second opening of the shuttle box.

20. In a weft replenishing loom operating with a lay having a shuttle box thereon, weft detector mechanism mounted on the shuttle box normally retracted from the latter in non-detecting position, thread cutter mechanism mounted on the shuttle box normally retracted in non-cutting position, a controller for said detector and cutter mechanisms normally in position to engage the detector mechanism on each forward set of the lay to project said detector mechanism into the shuttle box without operating the cutter mechanism, and means operative on a weft replenishing beat of the loom to shift said controller and cause the latter to engage and project the cutter mechanism into the shuttle box without engaging the detector mechanism.

21. In a weft replenishing loom operating with a lay and a shuttle box into which a reserve bobbin is transferred on replenishing beats of the loom, a weft detector mechanism on the shuttle

box normally in forward retracted position out of the shuttle box, thread cutter mechanism on the shuttle box normally in forward retracted position outward of the shuttle box, the shuttle box on a weft replenishing beat of the loom having a shuttle therein from which a thread extends, controller means normally operative when the lay beats up on non-replenishing beats of the loom to move the weft detector mechanism into the shuttle box without engaging a cutter mechanism, and means operating incident to a weft replenishing operation of the loom causing said controller means to shift with respect to said mechanisms and cause the controller means to move the cutter mechanism to cut said thread without engaging the weft detector mechanism.

22. In a weft replenishing loom operating with a lay having a shuttle box thereon, an electric weft detector mechanism including electric detector fingers on the shuttle box normally held out of the latter in non-detecting position, insulating means forming part of the detector mechanism operatively connected to the fingers and movable to project said fingers into the shuttle box, a thread cutter mechanism on the shuttle box normally held out of the latter in non-cutting position, and a controller for cooperation with but one of said mechanisms at a time when the lay beats up, said controller normally positioned to engage said insulating means to move the detector fingers into the shuttle box as the lay beats up on non-replenishing beats of the loom, and means operative on weft replenishing beats of the loom to shift the controller to cause the latter to engage the cutter mechanism and operate the latter without engaging said insulating means.

23. In a loom having a lay and a reserve weft carrier from which a weft end extends, a shuttle box made of separable parts normally fitted together to provide a closed tubular shuttle box for pneumatic picking of a shuttle, said parts being separable to open the shuttle box for reception of the weft carrier, a thread cutter and clamping mechanism for the weft end formed partly on each of said parts of shuttle box and normally in thread clamping position when the shuttle box is closed but opening to release a clamped thread when the shuttle box is open, an actuator operating on a two-pick cycle and moving in one direction at the beginning of a cycle from a starting position and reaching an extreme position when the lay is on front center on beats of the loom on which weft replenishment can occur and then moving in the opposite direction to a given position when the lay reaches picking position and thereafter moving in said one direction and then completing the two-pick cycle by returning to the starting position, the latter position being farther from said extreme position than said given position, a normally idle operator operatively connected to the shuttle box, coupling means operative on a replenishing beat of the loom to operatively connect the operator to said actuator when the latter is at said starting position, said coupling means maintaining the actuator and operator operatively connected when the actuator reaches said given position and said coupling means moving to disconnect the actuator from the operator when the actuator lever next reaches the starting position, said operator effecting opening of the shuttle box on the replenishing beat to receive the weft carrier and then effecting closure of the shuttle box to cause said cutter and clamping mechanism to cut and

clamp the weft end and then effecting a second opening of the shuttle box to release the clamped weft end.

24. In a weft replenishing loom having a reserve weft carrier and supporting means, a shuttle box under the weft carrier formed of two parts normally in closed position to form a tubular shuttle box from which a shuttle can be picked pneumatically by compressed air introduced into the shuttle box, one of said parts being fixed to the supporting means and having front and back vertical walls and the other part being movable horizontally away from the first part to open the box, mechanism effective on a weft replenishing beat of the loom to move said other part of the box horizontally relatively to said one part to open the shuttle box, a shuttle between said walls being held against substantial movement by one of said walls in the direction of movement of said other wall and means moving the weft carrier into the shuttle box while the latter is open.

25. A shuttle box for a loom having a supporting means and a source of compressed air for pneumatic picking of a shuttle, said shuttle box having a part thereof formed for mounting on said supporting means, a second part for the shuttle box capable in normal position of forming with the first part a tubular shuttle box for pneumatic picking of a shuttle, means on one of said parts for connecting said source with the interior of the shuttle box, and guide means fixed with respect to the first part on which said second part is movable away from the first part to permit entry of a reserve bobbin into the shuttle box.

26. A shuttle box for a loom having a supporting means and a source of compressed air for pneumatic picking of a shuttle, said shuttle box having a part thereof formed for mounting on said supporting means, a second part for the shuttle box capable in normal position of forming with the first part a tubular pneumatic shuttle box for pneumatic picking of a shuttle, one of said parts being formed to admit compressed air from said source to the interior of the shuttle box, and guide means deriving support from the first part on which said second part is movable away from the first part to open the shuttle box for the purpose of replenishing a weft supply in the shuttle box.

27. A shuttle box for a loom having a supporting means and a source of compressed air for pneumatic picking of a shuttle, said shuttle box having a part thereof formed for mounting on said supporting means, a second part for the shuttle box when in normal position cooperating with the first part to form a tubular pneumatic shuttle box for pneumatic picking of a shuttle, one of said parts being formed to admit compressed air from said source into the shuttle box, and parallel guide means on said first part along which the second part is slidable in a direction away from the first part for the purpose of opening the shuttle box for replenishing weft in the shuttle box.

28. A shuttle box for a loom having a supporting means and a source of compressed air for pneumatic picking of a shuttle, said shuttle box including two relatively movable parts at least one of which is constructed for attachment to said supporting means and at least one of which is constructed to admit compressed air from said source into the shuttle box, said parts when in normal position forming a tubular shuttle box for pneumatic picking of a shuttle, guide means on said one part guiding the other part for motion away from said one part so that the shuttle box can be opened for replenishment of weft therein, and cooperating thread cutting means partly on said one part and partly on the other part of the shuttle box and effective to cut a thread leading into the shuttle box when said other part moves along said guide means toward said one part of the shuttle box to normal position.

29. In a weft replenishing loom operating with a source of compressed air and having a reserve weft carrier, a normally closed tubular shuttle box from which a shuttle is picked pneumatically, said box being so constructed that it can be opened on a replenishing beat of the loom to receive the reserve weft carrier and thereafter opened on the next beat of the loom to release a clamped thread, an operator having a motion on each of said beats of the loom normally in inoperative position but effective when in operative position on each of said motions thereof to cause opening of the shuttle box, a positioner for the operator normally in non-indicating position but movable to indicating position, means moving the positioner to indicating position preparatory to a replenishing operation of the loom, said positioner when in indicating position tending to remain in such position and causing said operator to be in operative position for each of said beats of the loom, and resetter means operating on the second beat only of said beats of the loom to return the positioner to non-indicating position.

30. In a weft replenishing loom, a normally closed tubular shuttle box from which a shuttle is picked pneumatically to be opened to receive a reserve weft carrier on a weft replenishing beat of the loom and opened on the next beat of the loom to release a clamped thread, an actuator having a motion on each of said beats of the loom, mechanism including coupling means normally in inoperative position but effective when in operative position to connect the actuator operatively to the shuttle box to open the latter whenever the actuator has said motion thereof, controller means for the coupling means normally in non-indicating position but effective when in indicating position to cause the coupling means to move to operative position, means moving the controller means to indicating position preparatory to a replenishing operation of the loom to effect movement of the coupling means to the operative position thereof for each of said motions of said actuator, and means effective on said next beat only of the loom to cause return of the controller means to the non-indicating position thereof.

31. In a pneumatic shuttle box for a weft replenishing loom, said box comprising two parts normally in closed position to form a tubular shuttle box guide means on one of said parts on which the other part is movable toward said one part to closed position and away from said one part to open position, said parts having adjacent edges which are oblique with respect to the direction of movement of said other parts relatively to said one part, said edges separating upon movement of said other part to open position and moving into engagement upon movement of said other part to closed position, and a thread cutter blade on each of said parts parallel to the corresponding edge, said cutter blades having a shearing action as said other part moves to closed position.

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No references cited.