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H. WYMAN.

SHUTTLE BOX MECHANISM FOR LOOMS.

No. 405,645. Patented June 18, 1889.

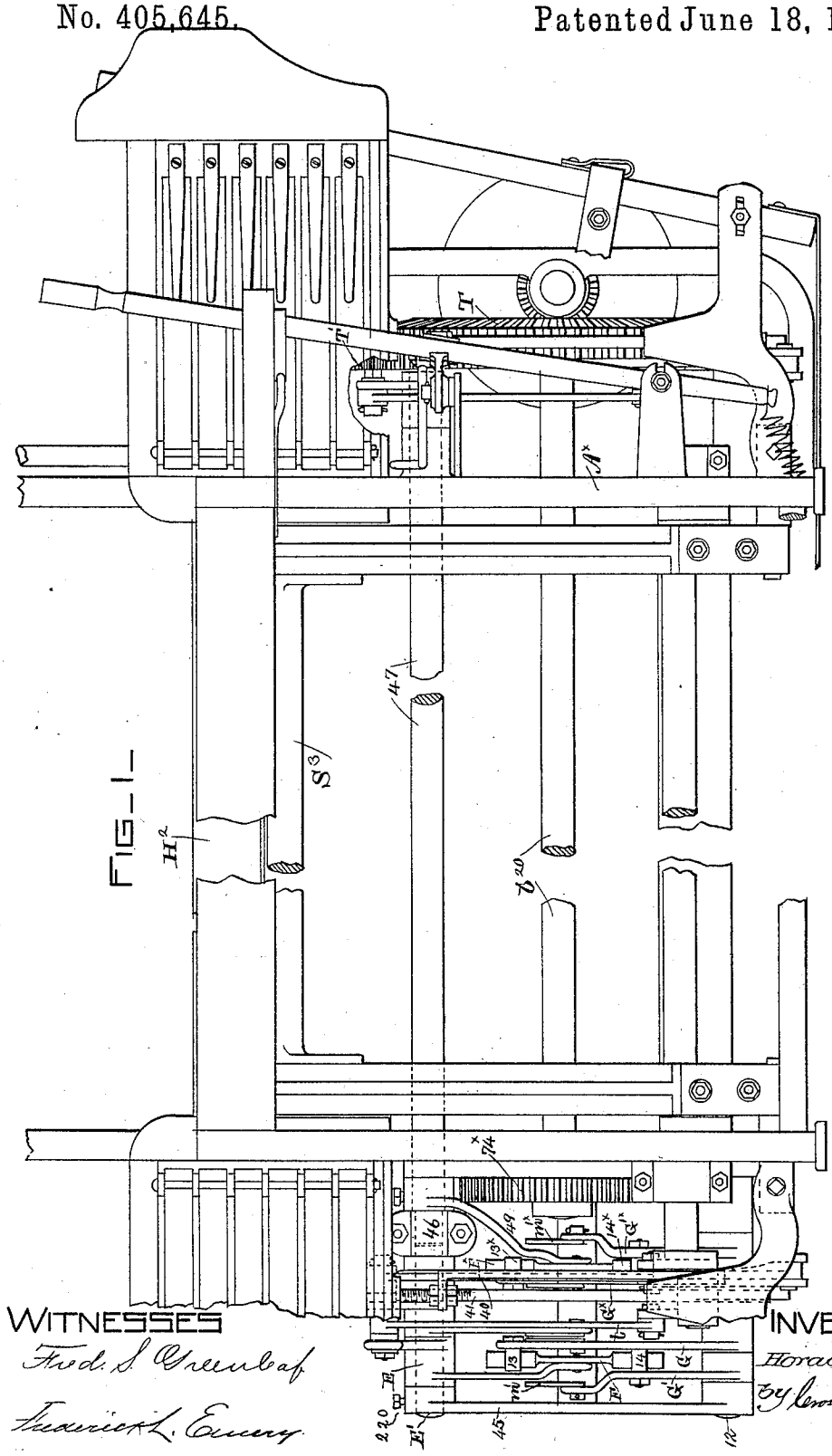


FIG. 1.

WITNESSES
Fred. S. Greenleaf
Frederick L. Emery

INVENTOR
Horace Wyman
by Crosby & Gregory
attys.

N. PETERS, Photo-Lithographer, Washington, D. C.

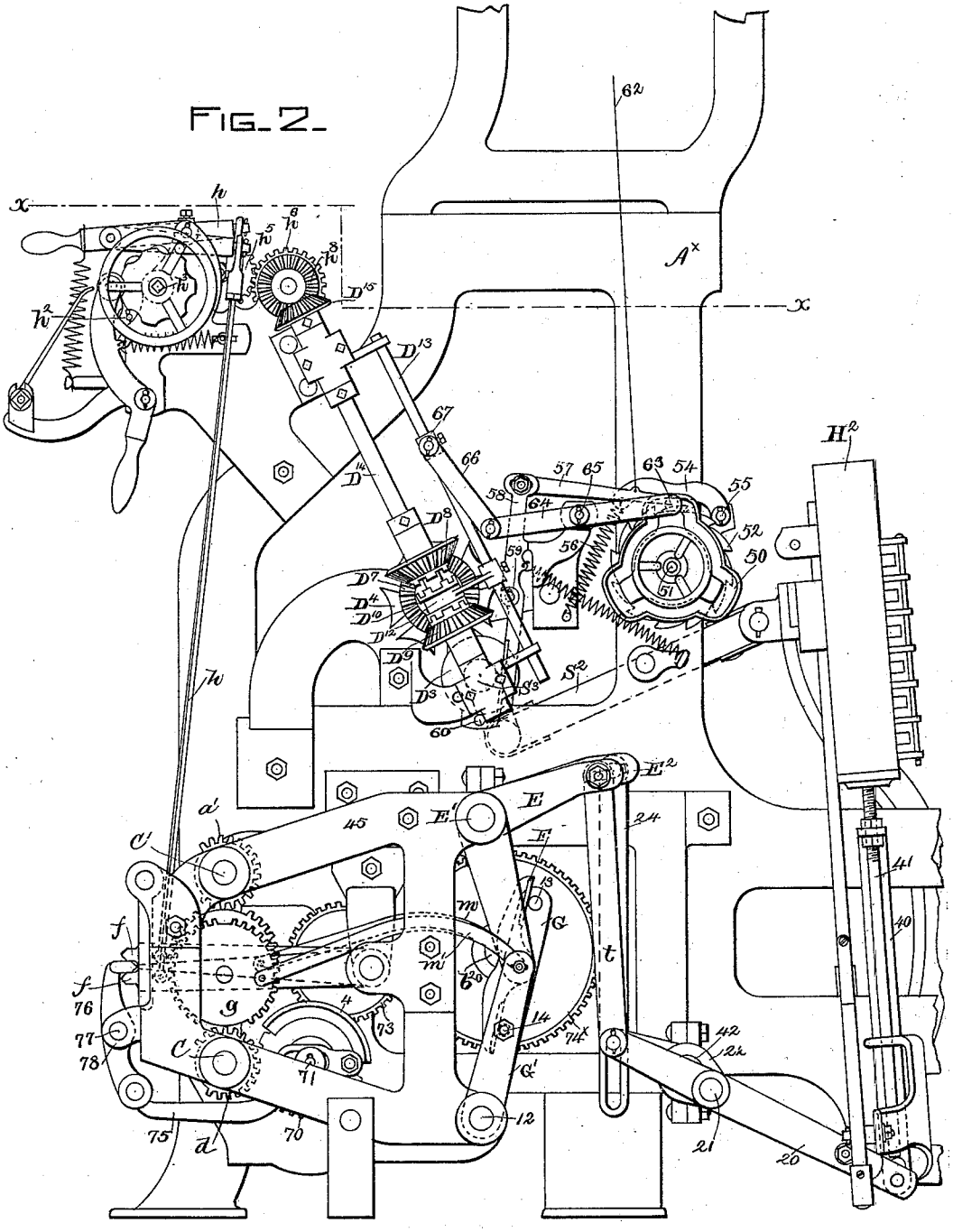
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H. WYMAN.

SHUTTLE BOX MECHANISM FOR LOOMS.

No. 405,645. Patented June 18, 1889.

FIG. 2.



WITNESSES

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H. WYMAN.

SHUTTLE BOX MECHANISM FOR LOOMS.

No. 405,645. Patented June 18, 1889.

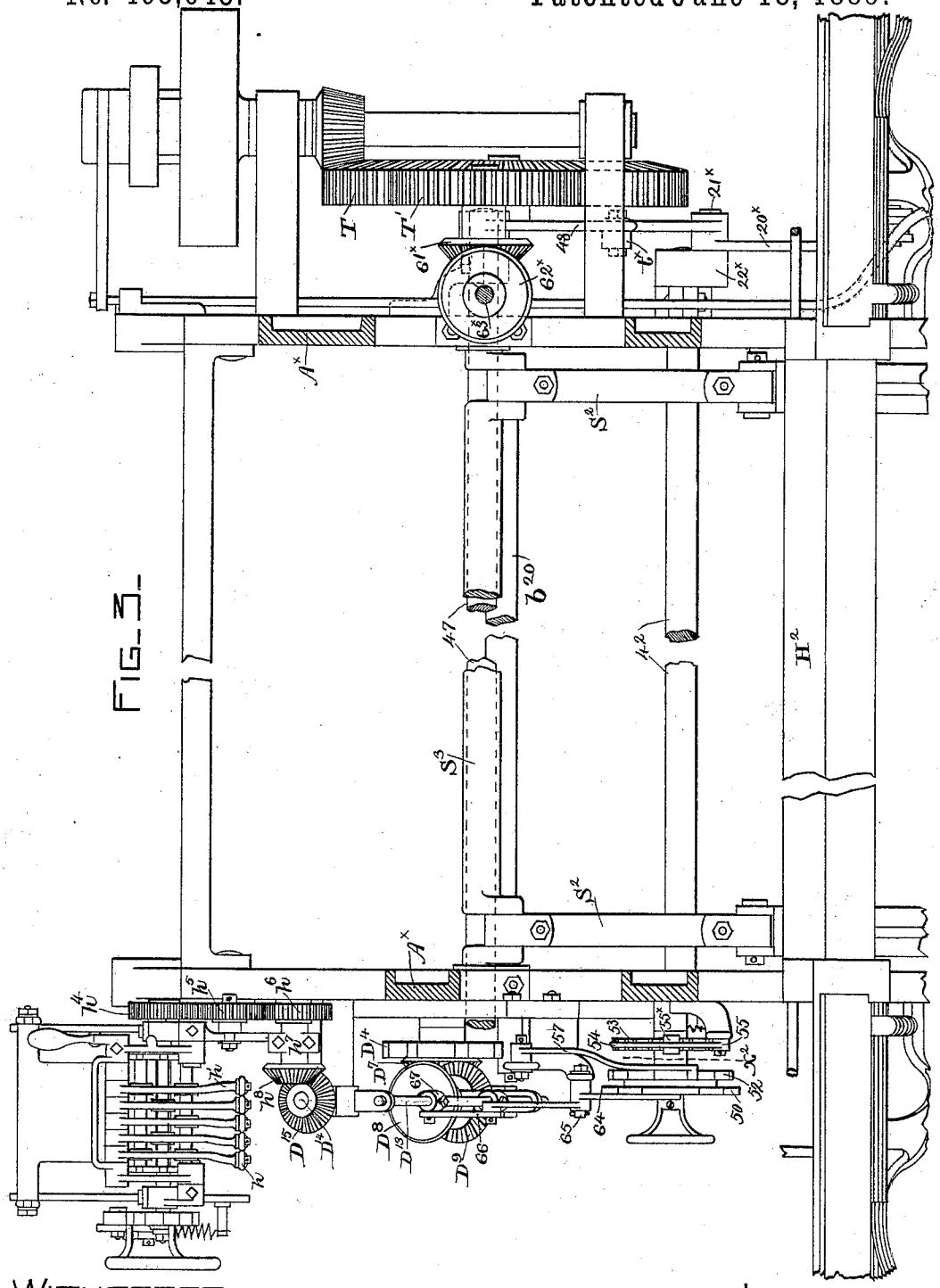


FIG. 3.

WITNESSES

Fred. L. Emery

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N. PETERS, Photo-Lithographer, Washington, D. C.

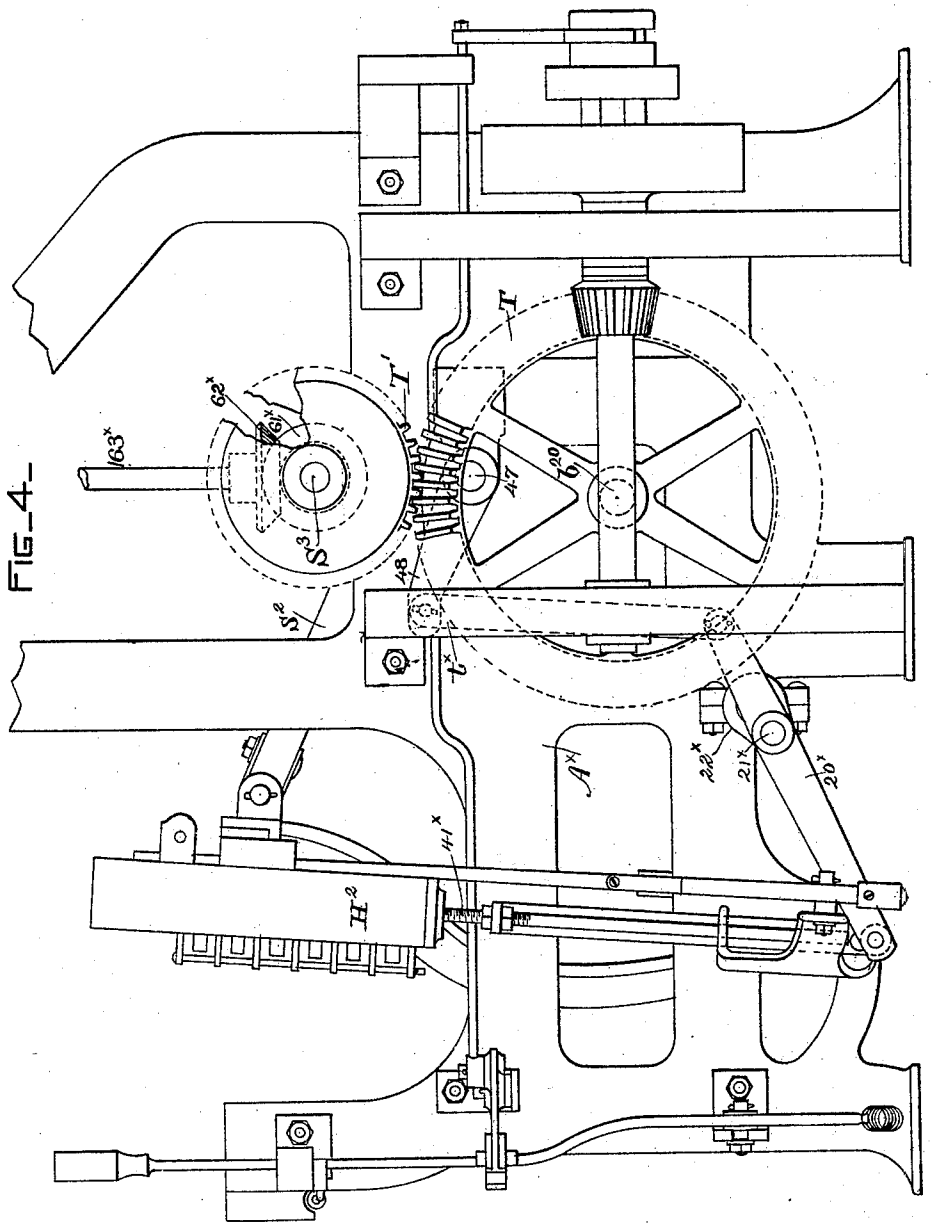
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H. WYMAN.

SHUTTLE BOX MECHANISM FOR LOOMS.

No. 405,645. Patented June 18, 1889.

FIG. 4.



WITNESSES

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H. WYMAN.

SHUTTLE BOX MECHANISM FOR LOOMS.

No. 405,645. Patented June 18, 1889.

FIG. 6.

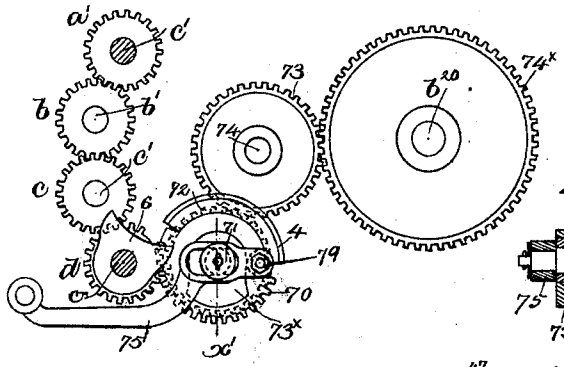
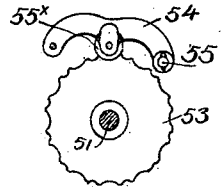


FIG. 8.



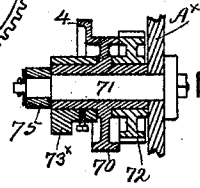


FIG. 7.

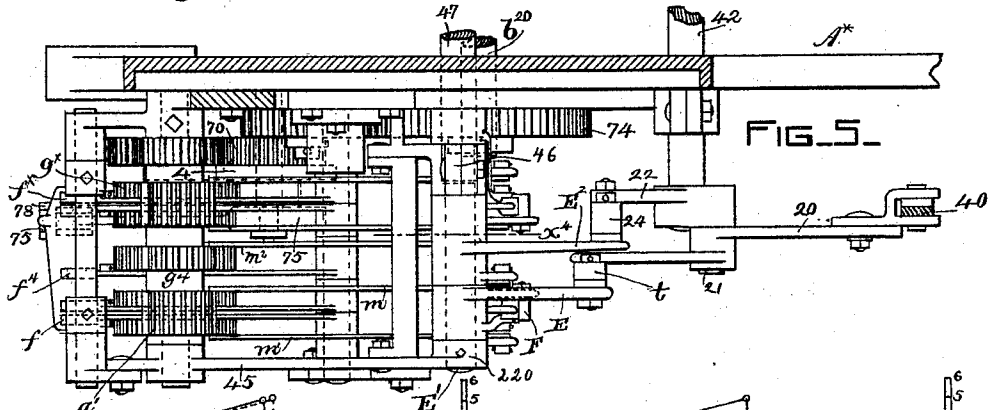


FIG. 5.

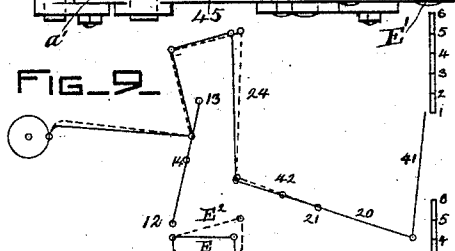


FIG. 9.

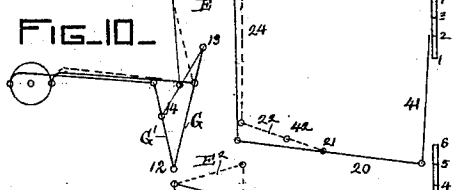


FIG. 10.

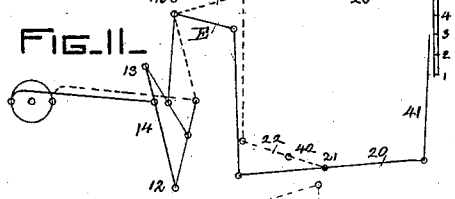


FIG. 11.

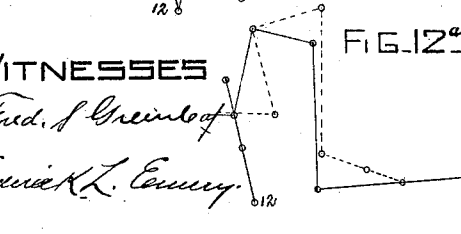


FIG. 12a.

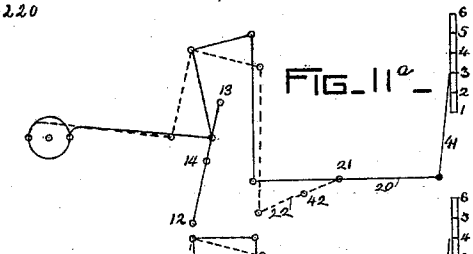


FIG. 11a.

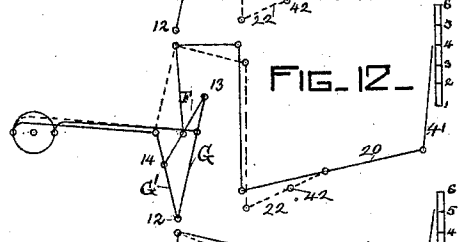


FIG. 12.

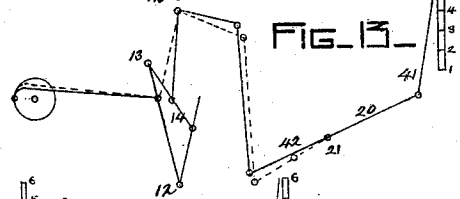


FIG. 13.

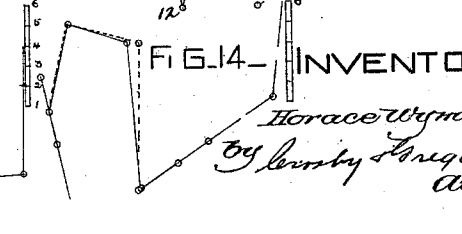


FIG. 14.

WITNESSES

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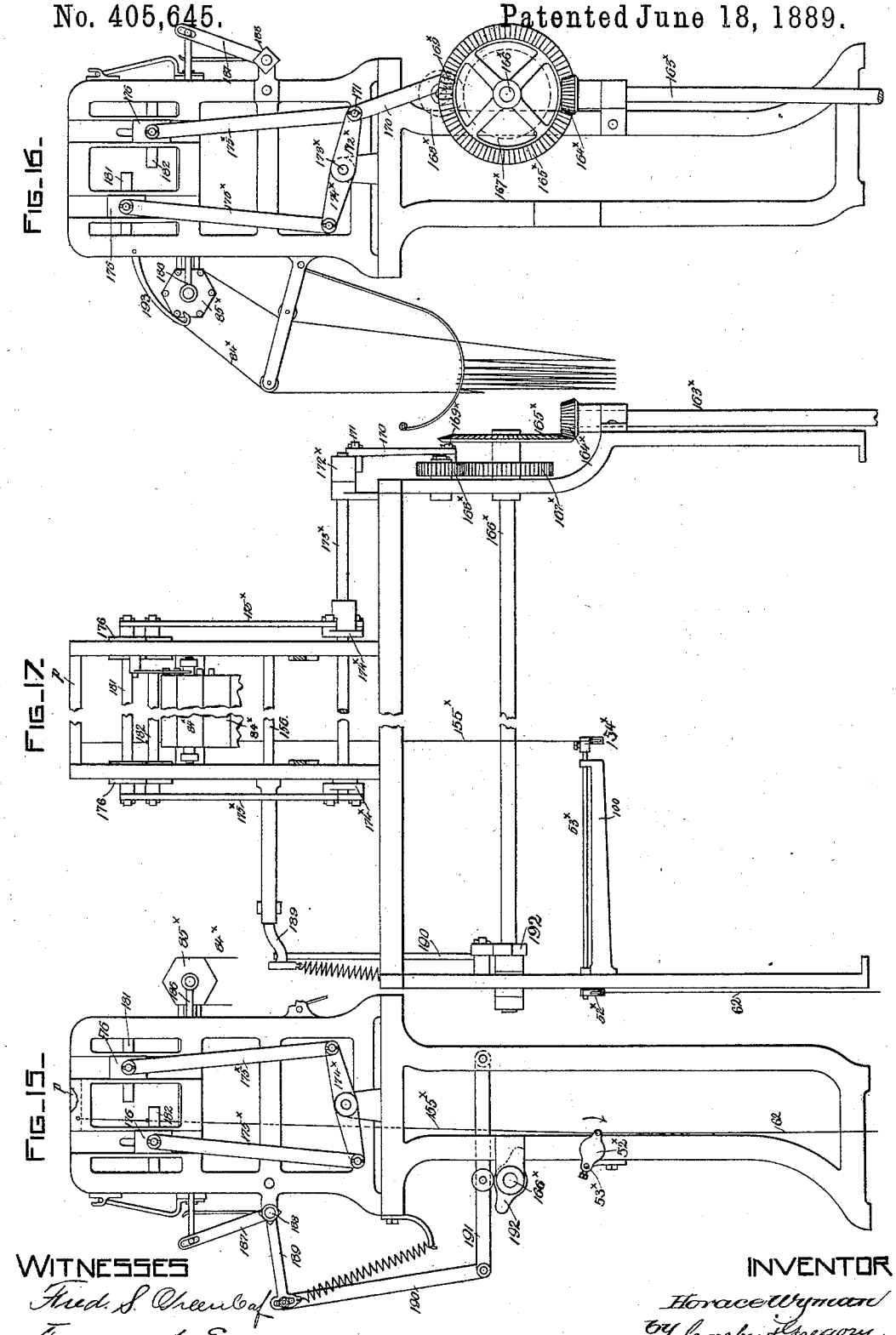
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(No Model.) 7 Sheets—Sheet 6.

H. WYMAN.

SHUTTLE BOX MECHANISM FOR LOOMS.

No. 405,645. Patented June 18, 1889.



WITNESSES

Fred. S. Greenleaf

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(No Model.) 7 Sheets—Sheet 7.

H. WYMAN.

SHUTTLE BOX MECHANISM FOR LOOMS.

No. 405,645. Patented June 18, 1889.

FIG. 20

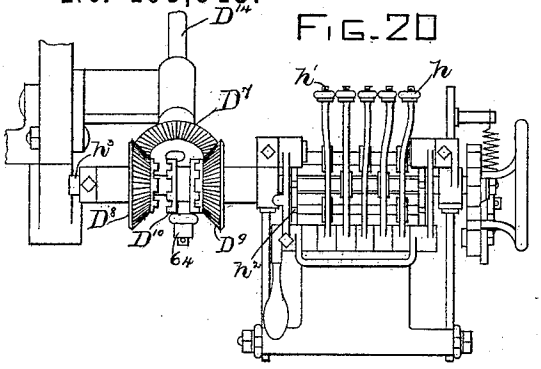


FIG. 21

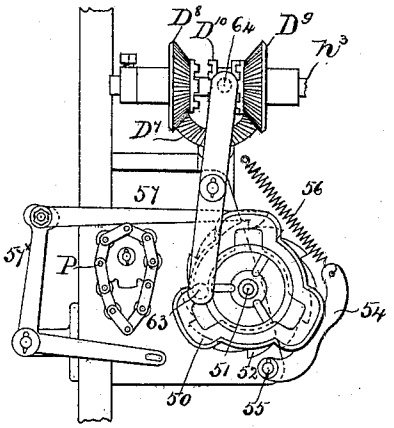
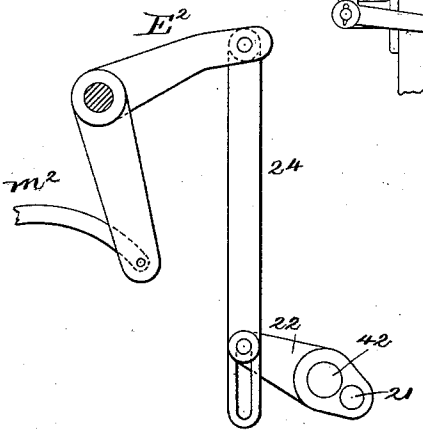


FIG. 18.



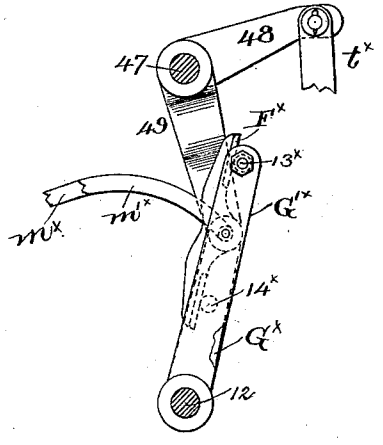


FIG. 19.

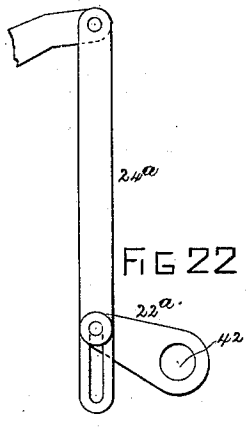


FIG 22

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UNITED STATES PATENT OFFICE.

HORACE WYMAN, OF WORCESTER, MASSACHUSETTS, ASSIGNOR TO THE CROMPTON LOOM WORKS, OF SAME PLACE.

SHUTTLE-BOX MECHANISM FOR LOOMS.

SPECIFICATION forming part of Letters Patent No. 405,645, dated June 18, 1889.

Application filed February 7, 1888. Serial No. 263,272. (No model.)

To all whom it may concern:

Be it known that I, HORACE WYMAN, of Worcester, county of Worcester, State of Massachusetts, have invented an Improvement in Shuttle-Box Mechanism for Looms, of which the following description, in connection with the accompanying drawings, is a specification, like letters on the drawings representing like parts.

This invention has for its object to improve fancy looms employing shifting shuttle-boxes in order that the shuttle-boxes at each end of the loom may be operated independently yet unerringly in both directions of their movement, the shuttle-boxes at the end of the loom opposite that containing the shuttle-box pattern chain or surface being actuated by shafting extended across the loom-frame rather than by chains, as heretofore common.

In my invention I do away with shuttle-box-moving cams at both sides of the loom.

The mechanism herein to be described is contrived to actuate a series of four shuttle-boxes at each side of the loom, each series being moved independently by or through a prime lever; and by throwing into operation a fulcrum-carrying lever at each side the loom, which may be done when desired, a series of six shuttle-boxes may be operated.

In some classes of fabric it is desirable at times to use two or, it may be, three, or more, shuttles back and forth alternately for a number of picks, and to do this and not lengthen the shuttle-box chain or surface I have combined with the usual actuating-shaft located between the shaft carrying the pattern chain or surface and the cross-shaft of the loom for turning the said actuating-shaft a controlling mechanism containing a cam which, through intermediate mechanism, shifts the usual clutching-hub on the said actuating-shaft, to thus in usual manner rotate it and the pattern chain or surface in one or the opposite direction, as may be desired. The cam of the controlling mechanism referred to is moved step by step through a pawl-and-ratchet mechanism, the pawl of which is under the control of a pattern-surface, said pattern-surface, for the best results and to gain the greatest range of pattern, being preferably of the class known as "Jacquard."

The shuttle-box mechanism to be herein described is an improvement upon that described in United States Patent No. 336,623.

My invention consists, essentially, in a shuttle-box pattern surface or chain, a shaft upon which it is mounted, reversing-gearing in operative connection with the said shaft, and a clutch-hub, combined with a cam forming part of a controlling mechanism, means to rotate it intermittingly, and with means, substantially as will be described, between the said clutching-hub and cam to move the said hub; also in a loom the following instrumentalities, viz: a rock-shaft extended across the loom and provided with fulcrum-carrying levers, means to rock the said shaft positively, two prime levers, each mounted upon one of the said fulcrum-carrying levers, a main lever, means to connect it with one of the said prime levers, a rock-shaft having arms and connections between it and the other prime lever, two series of shuttle-boxes and connections between them and the said prime levers, and means to actuate the said main lever and rock-shaft independently and positively, substantially as will be described.

Other features of my invention will be more fully set forth in the claims at the end of this specification.

Figure 1 is a partial front elevation of a loom embodying my invention, the central portion of the loom being broken out and the shuttle-boxes at the left-hand side of the loom being partially broken away to save space upon the drawings. Fig. 2 is a partial left-hand elevation of the loom shown in Fig. 1, the said figure showing some parts omitted from the left of Fig. 1. Fig. 3 is a section, but partially broken out, of a loom embodying my invention, the section being taken below the irregular line *x*, Fig. 2, the lower part of the shuttle-box-operating mechanism being omitted. Fig. 4 is a right-hand end elevation of the loom shown in Fig. 1. Fig. 5 is a top or plan view of the shuttle-box mechanism at the left-hand end of the loom-frame in Fig. 2, the said parts being omitted from Fig. 3 to avoid confusion in the drawings. Fig. 6 is a detail showing the gearing between the picking-shaft and the semi-gear employed to intermittingly actuate the usual

lifter and depressor-gears for driving the usual toothed gears or cranks of the shuttle-box mechanism. Fig. 7 is a sectional detail in the line x', Fig. 6, the stud 71 being in elevation. Fig. 8 is a sectional detail in the line x^2, Fig. 3, chiefly to show the locking mechanism for the so-called "controlling mechanism." Figs. 9 to 14 are diagrams showing the positions of the levers and their actuating mechanism employed to move the shuttle-boxes so as to place any one of the boxes opposite the race of the lay. Figs. 11^a and 12^a represent the cranks, links, and levers in positions different from those shown in Figs. 11 and 12, yet when in the positions 11^a and 12^a the third and fourth boxes may be reached, as in Figs. 11 to 12. Fig. 15 represents the upper portion of the left-hand end of the loom broken off from Fig. 2, together with a portion of a Jacquard or pattern mechanism, to be described. Fig. 16 represents a similar portion of the right-hand side of the loom, supposed to be broken off from the top of Fig. 1. Fig. 17 represents the upper portion of the loom broken off from Fig. 1. Fig. 18 is a detail showing the auxiliary main lever and some of its connections and the fulcrum-carrying lever. Fig. 19 shows the stud-carriers, arm, and secondary lever pivoted thereon at the right of the line x^1, Fig. 5, viewing the front of the loom, together with the rock-shaft, which has a second arm to be connected to the prime lever at the opposite side of the loom to actuate the shuttle-boxes at that side of the loom. Figs. 20 and 21 are respectively a plan and rear elevation of a modified form of controlling mechanism, and Fig. 22 a modification as to the actuating mechanism for the fulcrum-carrying levers.

The mechanism to be herein described is adapted to bring at predetermined times any one of six shuttle-boxes in position opposite the raceway of the lay.

Many of the parts employed herein are common to United States Patent No. 336,623, dated February 23, 1886; but in some instances the parts are somewhat differently shaped and differently located from what is shown in the said patent, and so, also, some of the parts are substantially the same as in United States Patent No. 264,864, dated September 26, 1882.

The loom-frame A* is and may be of any suitable shape to support the working parts. The picking-shaft b^{20}, the larger gear T, fast thereon, the gear T', engaged by it and fast on the crank-shaft S^3, the connecting-rods S^2, the lay H^2, the pin-wheel D^3, (see Fig. 2,) fast upon the crank-shaft S^3 at its left-hand end, the star-wheel D^4, engaged by it, fast on a sleeve rotating upon a horizontal stud fixed to the loom side, the beveled gear D^7, fixed with relation to the said star-wheel and sleeve, the actuating-shaft D^{14}, for the shuttle-box pattern chain or surface and having loose upon it beveled gears D^8 and D^9, each toothed at its inner side to form part of a clutch, the clutch-hub D^{10}, splined upon the said shaft D^{14} and toothed at each end to engage one or the other of the toothed clutch portions of the said beveled gears D^8 or D^9, the arm D^{12}, carrying the said hub, the slide-rod D^{13}, to which the said arm D^{12} is fastened, and the gear D^{15}, attached to the upper end of the said shaft D^{14}, are and may be all as shown in United States Patent No. 264,864, referred to, wherein like devices are designated by like letters, except as to the picking-shaft, which in said patent is marked b; but in the said patent the shaft D^{14} is vertical, whereas in the present case the said shaft is placed in an inclined position.

Referring to Figs. 2 and 5, the prime lever 20, having its fulcrum on a pin or stud, 21, at one end of fulcrum-carrying lever 22, the main lever E, the connecting-rod t, joining it with the said prime lever 20, the auxiliary main lever E^2 (shown in Figs. 2 and 18) and connecting-rod 24, by which to attach it to one end of the fulcrum-carrying lever 22, the secondary lever F, having its fulcrum upon a stud near the end of the main lever E, the stud-carriers G G', pivoted at 12 and having, respectively, studs 13 and 14, to act against the secondary lever F, the connecting-rods m' and m, the toothed gears g, to which they are attached, the vibrators f, upon which the toothed gears g are mounted to turn, the connector m^2, attached to one end of the auxiliary main lever, as shown in Fig. 18, and at its other end to the toothed wheel or jack g^4, mounted upon a vibrator f^4, the studs C C', fast to the side of the loom-frame, the toothed gears a d, secured to the inner ends of the hubs or sleeves, carrying the usual elevator or depressor gears, or toothed cylinders a' d' for engaging either the upper or lower sides of the like notched gears or jacks g^4, &c., arranged side by side, and the intermediate toothed gears b c, loose on studs b' c', and the locking or holding plate 6, are all substantially the same as in United States Patents No. 386,623 and No. 281,842, wherein like parts are designated nearly throughout by like letters. Some of the parts common to the said patents are herein slightly modified as to construction, and the arrangements of the parts are somewhat different from that shown in Patent No. 386,623—as, for instance, instead of making the elevator and depressor gears which rotate the toothed gears or jacks between them as single long gears, the said elevator and depressor gears have been cut away peripherally to leave spaces between their operative parts. The forward end of the prime lever 20 is connected by a link 40, or in other usual or suitable manner, with the shuttle-box rod 41, having at its upper end a series of six shuttle-boxes, there being a like series of boxes at each end of the lay in usual guides. Herein the fulcrum-carrying lever 22, at the left-hand end of the loom, is fixed to a shaft 42, which is extended across the loom-frame, and outside the frame, at the other side of the loom, has attached to it a like

fulcrum-carrying lever 22*, Figs. 3 and 4, having a stud 21*, upon which is mounted a prime lever 20*, the forward end of which is connected in like manner with the shuttle-box rod 41* at that side of the loom.

The main lever E and the auxiliary main lever E^2 are mounted loosely upon a stud E', supported in a stand 45 and in a bearing 46, forming part of the said stand, the said stud being secured in the said stand by means of a set-screw 220. (See Fig. 1.) This bearing 46 also serves as the bearing for the left-hand end of a rock-shaft 47, which is extended across the loom to its opposite side, where, just outside the loom-frame, the said rock-shaft has attached to it (see Figs. 4 and 19) an arm 48, which by a link t^* is attached to a stud at the rear end of the prime lever 20*, mounted on the stud 21* before referred to.

The rock-shaft 47, at the left-hand end of the loom, has attached to it an arm 49, which supports a secondary lever F*, (see Fig. 19,) like the lever F before referred to, the said lever F* referred to being acted upon by studs 13* and 14*, carried by stud-carriers G'* G*, like the stud-carriers G' and G before referred to, and mounted loosely upon the same stud 12, but farther in toward the loom side.

The stud-carrier G'* has attached to it, near its upper end, a connector m'^*, and the stud-carrier G* has attached to it a connector m^*, each of the said connectors m'^* and m^* being attached to like toothed gears g^*, mounted upon vibrators f^*, the said gears being substantially in line with the gears g, but farther toward the loom side.

The arm 49, rock-shaft 47, and its arm 48, referred to, constitute, as it were, a main lever for the prime lever 20* at the right-hand side of the loom, the said parts 49, 47, and 48 differing from the main lever E only in that the opposite arms are separated by a long shaft or connection 47, of sufficient length to enable one arm, located and operated at one side of the loom, to transmit motion to parts at the opposite side of the loom.

Each vibrator has attached to it in usual manner a connector h, which are extended up and attached to suitable fingers, as h', which rest upon the pattern chain or surface h^2, which may be of any usual construction and of suitable length, the said pattern-chain surrounding the usual pattern-barrel secured to a shaft, as h^3, the said shaft having fast to its inner end a pinion h^4, which is engaged by an intermediate pinion h^5, in turn engaged and rotated by a toothed gear h^6, fast on a short shaft sustained by a bearing h^7, (see Fig. 3,) the said shaft having at its outer end a beveled gear h^8, which is engaged and rotated by the beveled gear D^{15} before referred to, and which is secured to the shaft D^{14}, which I shall call the "actuating-shaft" for the pattern surface or chain.

From the foregoing description it will be noticed that the fulcrum-carrying lever 22, located at the left-hand side of the loom, by being attached to the rock-shaft 42 transmits its movements to and actuates in unison with it a like fulcrum-carrying lever $22^\times$ at the opposite side of the loom, and that through the rock-shaft 47 and its attached arms the prime lever $20^\times$, at the opposite side of the loom, is moved from suitable stud-carriers and secondary lever-connections located at that side of the loom where is located the pattern-surface for the shuttle-box mechanism, for it is not feasible nor practicable to have a shuttle-box pattern chain or surface at both sides of the loom. It will also be noticed by the above-described arrangements of parts that the motions of the toothed cranks supported by the vibrators are transmitted to the series of movable shuttle-boxes to place them in positions required without the intervention of any flexible connections, as has been the case heretofore, and without the employment of cams, the shuttle-boxes in this my invention being moved with a precision not attainable by the use of such linked chains or other flexible connectors, or by cams such as have been used with a system of three boxes.

It will be noticed that without the aid of the fulcrum-carrying lever the mechanism is such as to operate four boxes positively at both ends of the loom, the said boxes deriving their movement from the pattern mechanism and intermediate devices located at one side of the loom, each being actuated also independently of the other, and by calling into play the fulcrum-carrying lever six boxes may be used at either side of the loom.

For weaving patterns wherein it is desired to employ two or more colors of weft back and forth alternately for a number of successive picks, and then again two or more colors alternately for a number of picks, to thus avoid employing a very long chain, some provision must be made for moving the shaft carrying the pattern surface or chain forward and backward alternately. To do this in a simple manner, I have applied to the loom a mechanism which I denominate a "controlling mechanism," which I will now describe. This controlling mechanism consists, essentially, of a face-cam, as 50, fast upon a sleeve placed upon a stud 51, extended from the loom side, the hub of said sleeve immediately at the rear of the said cam having attached to it a ratchet-toothed wheel 52, (see Figs. 2 and 3,) and a stop-wheel 53, (shown separately in Fig. 8,) the said stop-wheel having co-operating with it a holding-lever 54, pivoted at 55 upon a stud carried by the loom-frame, the free end of the said lever having attached to it a spring 56, (see Fig. 2,) which normally keeps the roll $55^\times$ in one of the spaces in the stop-wheel, thus holding the sleeve and its attached parts in the position where it is left by the pawl 57, which engages the said ratchet-toothed wheel to rotate the cam 50 referred to. This pawl 57 is joined to the upper end of a lever 58, pivoted at 59, the lower end of the said lever 58 being acted upon by the pin 60, carried by

a projection of the pin-wheel D^3, (see Fig. 2,) once during each rotation of the crank-shaft, the said lever and pawl moving the cam 50 of the controlling mechanism one step for each complete movement of the lay, except when the said pawl is elevated from engagement with the ratchet-wheel 52 by or through the action of a suitable Jacquard or other pattern mechanism or surface, the said pawl, as herein shown, having attached to it a cord 62, which is extended, as will be described, to a Jacquard mechanism, which I have selected to illustrate my invention.

The groove in the face of the cam 50 referred to receives in it a roller or other stud 63 at one end of a lever 64, pivoted at 65, the said lever at its opposite end being connected by a link 66 with a collar 67, fast on the rod D^{13}, the movement of the said lever causing the said rod to be moved longitudinally at the proper times to engage the clutch-hub D^{10} with the clutch-teeth of either of the beveled gears D^8 or D^9, as it may be desired, to rotate the shaft D^{14} and the pattern surface or chain in one or the other direction for any number of picks.

The cam 50 of the controlling mechanism referred to, with its ratchet-wheel and sleeve carrying it, is made removable from the stud upon which they rotate, in order that cams of different shape and ratchets with a different number of teeth may be applied and used, that depending upon whether or not one, two, or three shuttles are to be used in succession, and then to be reused by a backward movement of the pattern chain or surface through the shaft D^{14} and its connections.

The cam shown in Fig. 2 is of such shape as to use two shuttles over and over again alternately, such back and forth alternate motion continuing as long as the pawl 57 is kept in engagement with the ratchet-wheel; but the alternation of the shuttle-boxes, as described, ceases as soon as the pawl is removed from the ratchet-wheel.

The sleeve or hub containing the toothed gear *d* before referred to, which in practice is attached to the usual long gear employed to rotate at suitable times the toothed wheels or jacks *g*, derives its motion of rotation from a semi-gear 70, (see Figs. 6 and 7,) mounted loosely upon a stud 71, attached to the loom side A*, the said semi-gear having fixed to it a holding-flange 4, which co-operates with the locking device 6.

The hub of the semi-gear 70 is extended in opposite directions and has fast upon it between the said semi-gear and the loom side a toothed gear 72, which is engaged by an intermediate gear 73 loose on a stud 74, sustained at the loom side, said intermediate gear 73 being engaged and rotated by a gear $74^{\times}$, fast on the cross-shaft b^{20}. The portion of the hub of the semi-gear 70 farthest from the loom side (see Fig. 7) has fast upon it a cam $73^{\times}$, which actuates the arm 75, joined at its outer end to the lower end of a locking device 76 for the series of vibrators carrying the toothed gears or jacks, the outer ends of the said vibrators being beveled in opposite directions, (see Fig. 2,) so that the upper end of the said locking device may engage either bevel at the upper or lower side of the vibrator and hold the said toothed gears carried by the said vibrators in engagement with the long gears referred to, which are employed to rotate them partially and positively in one or in the opposite direction, that depending upon the pattern chain or surface. This locking device 76 is shown as a lever having its fulcrum upon a stud 77 in suitable ears 78, attached to the frame-work A*. The arm 75 has a slot and a roller-stud 79, the slot embracing the stud 71 and the cam $73^{\times}$ coming into contact with the said roller-stud, to hold the said locking device and lock the vibrators in position, while the long-toothed gears, serving as elevators or depressors, are in engagement with the toothed gears or jacks *g*, &c., and are moving the latter gears to effect changes in the shuttle-boxes.

The diagrams, Figs. 9 to 14, inclusive, show different views of the shuttle-box rod and its actuating devices, starting with the toothed gears or cranks. The diagrams show each but one toothed gear; but it will be supposed that there are other like gears in line with it. The dotted line connecting-rod is that attached to the auxiliary lever E^2, it and the link 24 and fulcrum-carrying lever 22 being also shown by dotted lines. The lever 20 is shown by full lines, and also the stud-carriers G G′ and lever F.

From the foregoing description and the letters on the said diagrams, it will be obvious just what positions the various connecting-rods, levers, and carriers will occupy when the shuttle-box rod is to be placed in such position as to place any one of its six shuttle-boxes in the line of the raceway.

The diagrams referred to each have a scale marked off and numbered in like manner from 1 to 6, and the shuttle-box rod in the diagram is made to act as a pointer and to rise and fall with relation to the said scale, to thus show the various positions of the top of the box-rod when operating six shuttles.

Referring to the drawings, Fig. 11 shows the links, levers, &c., in a position to operate the third box; but the same box may be reached when the parts are in the position shown in Fig. 11^a. So, also, Fig. 12 shows the parts in position to reach the fourth box; but the same box may be reached when the parts are in the position shown in Fig. 12^a, for it so happens in these two instances that the resultant of these different changes of position is the same.

Referring to Figs. 3, 4, 15, 16, and 17, the crank-shaft S^3, just behind the toothed gear T′, is provided (see Figs. 3 and 4) with a bevel-gear $61^{\times}$, which engages a bevel-gear $62^{\times}$ on a shaft $163^{\times}$, (see Figs. 4 and 17,) having at its upper end a small bevel-gear $164^{\times}$, which en-

gages a bevel-wheel 165×, fast to one end of the main shaft 166× of the Jacquard mechanism.

The main shaft 166× of the jacquard has attached to it a toothed gear 167×, (see Figs. 17 and 18,) which engages and rotates a toothed pinion 168×, mounted on a suitable stud and having a crank or wrist 169×, upon which is fitted a connecting-rod 170, the upper end of which in turn engages a pin 171 of a crank 172× on the shaft 173×, the said shaft having attached to it two like cross-arms 174×, which by links 175× are joined to like slides 176, carrying the usual trap-boards 181 182. The Jacquard needle, through which the cord 155× will be extended, will be actuated in usual manner by one of a series of Jacquard cards 84×, carried by a lantern or other wheel 85×, rotated in usual manner, the said devices being actuated as when in usual manner the jacquard is employed to move the warps to form sheds. Herein the said lantern-wheel is shown as mounted in boxes at the ends of slide-rods 186, actuated by arms 187, attached to a rock-shaft 188, having an arm 189 (see Fig. 15) extended backward from the loom and attached by links 190 to one end of a lever 191, which is moved by a cam 192, (see Fig. 16,) secured to the main shaft 166× of the jacquard, said cam acting upon a roller or other stud projecting from the side of the said arm: A pawl 193 engages usual studs at the end of the lantern-wheel and rotates the same intermittingly.

Instead of the particular Jacquard mechanism herein shown, I may employ any other usual or well-known mechanism, or any usual, well-known, and suitable pattern mechanism.

If the ratchet-wheel 52 is to be engaged and moved step by step by the pawl 57, then the cord 62 and devices to operate it would be unnecessary. When the pawl 57 is to engage the ratchet-wheel 52, attached to the sleeve carrying the cam 50, the said arms 52× and 154× occupy their lowest position, as in Figs. 15 and 17. When the pawl is to be lifted by means of a Jacquard card and needle the lifting-board is caused to engage and move the cord 155×, thus lifting the arm 154×, turning the rock-shaft 53×, and lifting the arm 52×, and by the cord 62 the pawl 57 referred to is lifted.

The pawl 57 (see Fig. 2) has connected to it a cord 62, which (see Figs. 15 and 17) is extended upward, where it is attached to the arm 52× of rock-shaft 53×, the said arm being shown as weighted and as projecting in the same direction as the pawl 57, all co-operating to turn the said rock-shaft in the direction of the arrow (see Fig. 15) when the cord 155× is disengaged. The cord 155× is extended upward through a hole in the usual guide-board 156, thence through one of the usual needles, and through a hole in one of the usual lifting or trap boards, above which it is attached to a top board p, the said cord extended through the trap-board having a knot to be trapped, as usual, through the operation of the Jacquard cards 84× on the needles, so that the cord may be lifted whenever desired. The shaft 53× has one of its bearings in the bracket 100. The bevel-wheels D^8 and D^9, having clutch-teeth, and the intermediate driven bevel-gear D^7, constitute what I call the "reversing-gearing," and the teeth on the hubs of the gears D^8 D^9, co-operating with the teeth of the hub D^{10}, constitute a clutch.

Instead of moving the chain-shaft h^3, as shown in the drawings, Fig. 2, through intermediate gearing between the reversing mechanism and the chain-shaft, the reversing-gearing can be placed directly upon the chain-shaft h^3, as shown in Figs. 20 and 21, the pattern chain or surface being moved outwardly from the loom side sufficiently to allow the beveled gear D^7 to be attached to the upper end of the shaft D^{14} and come between the two gears D^8 D^9.

The controlling mechanism can also be placed directly below this clutch-gearing, the lever 64, moved by the cam 50 of the controlling mechanism in such modification, engaging the groove of the clutching-hub D^{10}, the pawl 57 for actuating the controlling mechanism being attached to an elbow-lever 57×, which by a suitable link may be actuated from a crank, eccentric, or cam on any rotary shaft of the loom to vibrate the said lever, the said pawl resting directly upon a pattern-surface, as P. (See Fig. 21.)

Instead of the fulcrum-carrying lever 22 being fixed to the shaft 42, it may be mounted loosely thereon, in which case as link 24, which moves the said lever, will move only the lever 22 and not the rock-shaft 42, and to move the said rock-shaft and with it the lever 22* at the opposite side of the loom, the said rock-shaft at the side of the loom where is located the pattern-surface will have fastened to it an arm 22^a, (see Fig. 22,) which will be engaged and moved by a link 24^a, like the link 24, the link 24^a being operated in the same manner as the link 24, Fig. 18, and in this way each of the fulcrum-carrying levers 22 and 22* can be moved independently of the other.

In mechanism corresponding in general respects to that herein shown, for operating both the harness and shuttle-boxes of looms, it is old to employ a vibrating locking device which engages with the ends of the vibrators after they have been shifted in position. This I therefore do not broadly claim. It is also old in mechanism for operating the harness of looms to provide the harness-operating levers with double-beveled ends, which ends are engaged by a vibrating locking-bar, and to this feature I do not seek to lay claim. My invention resides in the combination, with the vibrators constructed with the doubly-beveled or inclined ends, and a vibrating locking device having a doubly or reversely

inclined projection for engagement with the ends of the vibrators, of the compact and convenient form of devices herein illustrated for operating the said locking device.

I claim—

1. The shuttle-box pattern surface or chain, a shaft h^3, upon which it is mounted, reversing-gearing in operative connection with the said shaft, and the clutch-hub, combined with the cam of the controlling mechanism, means to rotate it intermittingly, and with means, substantially as described, between the said clutching-hub and cam to move the said hub, substantially as described.

2. The shuttle-box pattern surface or chain, a shaft h^3, upon which it is mounted, an actuating-shaft for imparting motion to the shaft h^3, gearing between the said shafts, clutch mechanism and means to rotate the clutch-mechanism gearing, a lever and intermediate connections to move the clutch-hub of the clutch mechanism, and controlling mechanism to actuate the said lever, combined with a pawl to engage the ratchet of the controlling mechanism, means to reciprocate the said pawl, and a pattern mechanism or jacquard, substantially as described, to determine when and for how many reciprocations the said pawl shall engage the said ratchet, as set forth.

3. The crank-shaft, the pin-wheel thereon, the sleeve having the star-wheel and gear D^7, the actuating-shaft D^{14}, the loose gears D^8 and D^9, having clutch-teeth, the clutch-hub splined on the said shaft between the said gears, the pattern surface or chain for the shuttle-box mechanism, its shaft h^3, gearing intermediate the shafts D^{14} and h^3, the lever 64, means to connect it with the said clutch-hub, the controlling mechanism, containing a cam and a ratchet-wheel, a pawl, and means to actuate it to rotate the controlling mechanism, combined with a series of shuttle-boxes and shuttle-box-actuating mechanism, substantially as described, to actuate the said shuttle-boxes under the control of the said pattern surface or chain, as set forth.

4. The rock-shaft 42, extended across the loom, fulcrum-carrying levers attached to the said shaft at opposite sides of the loom, an auxiliary main lever, means to move it, and connections between it and the said rock-shaft, two prime levers at opposite sides of the loom and having their fulcra on studs moving with the fulcrum-carrying levers, two series of shuttle-boxes and means to connect them with the said prime levers, a shaft 47, having arms 48 49, and connections between it and that one of the prime levers most distant from the shuttle-box pattern-surface, combined with the main lever, connections between it and the other prime lever, and means to actuate the said main lever and the said rock-shaft 47 independently, whereby two series of shuttle-boxes may be operated positively in both directions, substantially as described.

5. In combination, the following instrumentalities, viz.: a rock-shaft 42, extended across the loom and provided with fulcrum-carrying levers, means to rock the said shaft positively, two prime levers, each mounted upon one of the said fulcrum-carrying levers, a main lever, means to connect it with one of the said prime levers, a rock-shaft 47, having arms, and connections between it and the other prime lever, two series of shuttle-boxes and connections between them and the said prime levers, and means to actuate the said main lever and rock-shaft independently and positively, substantially as described.

6. The rock-shaft 42, extended across the loom, the fulcrum-carrying levers attached thereto at opposite sides of the loom, the two prime levers 20 $20^{\times}$, sustained by the said fulcrum-carrying levers, the rock-shaft 47, means between it and the prime lever $20^{\times}$ to actuate the latter, and two series of shuttle-boxes and connections between them and the said prime levers, combined with means to actuate the said rock-shafts, and with means to move the prime lever 20 independently of the prime lever $20^{\times}$, substantially as described.

7. A pattern surface or chain, its carrying-shaft h^3, a shaft, as D^{14}, its two reversely-moving loose gears, gearing between the said shaft D^{14} and the said carrying-shaft, a gear to actuate the said loose gears, and a clutching-hub co-operating therewith to effect the rotation of the said pattern-shaft in one or the other direction, a controlling mechanism, its ratchet, the actuating-pawl, and means to move the pawl, combined with intermediate parts, substantially as described, between said controlling mechanism and said clutching-hub, whereby said hub may be caused to engage either of the reversely-moving gears, as determined by the controlling mechanism, substantially as described.

8. The main pattern surface or chain and means to rotate it intermittingly both in a forward and in a reverse direction, as described, combined with the controlling mechanism, its ratchet and pawl, means to move the pawl to turn the ratchet, and with means to control the time of engagement of the pawl with the ratchet, whereby through the controlling mechanism and the said means for rotating the main pattern-surface the said main pattern-surface may be oscillated, when desired, substantially as described.

9. The shaft h^3, the main pattern surface or chain, means to rotate the said shaft in one and then in the opposite direction, the controlling mechanism and devices, substantially as described, and means to actuate the cam of the controlling mechanism, combined with a supplementary pattern-surface, and means between it and the pawl for moving the cam of the controlling mechanism, whereby the controlling mechanism may be moved or left at rest, substantially as described.

10. The vibrators having their outer or free

ends beveled in opposite directions, the toothed gears carried by the said vibrators, and gears to engage and move the same as desired, the lever 76, having the doubly or reversely inclined projection to act upon the said vibrators, and the sliding link 75, connected to the said lever and slotted at its other end and provided with a stud, combined with the cam $73^{\times}$, and a stud to guide the said link, the combination being in operation, substantially as shown and described.

11. The rock-shaft 42, extended across the loom, an auxiliary main lever E^2, means to move it, connections between the said lever and the said rock-shaft, a fulcrum-carrying lever attached to the opposite end of the said rock-shaft, a prime lever pivoted thereon, a series of shuttle-boxes and connections between it and one end of the said prime lever, a shaft 47, having arms 48 and 49, connection between it and the other end of the said prime lever, and means to actuate the said shaft 47 independently of the rock-shaft 42, substantially as described.

12. The auxiliary main lever, means to move it, and connections between it and the rock-shaft 42, combined with the said rock-shaft, the fulcrum-carrying lever $22^{\times}$, mounted upon a stud attached to the opposite end of the said rock-shaft, the prime lever $20^{\times}$, pivoted upon the said fulcrum-carrying lever, a series of shuttle-boxes, connections between it and the said prime lever, and means to actuate the prime lever, substantially as described.

13. The rock-shaft 47, its arms 48 and 49, fast thereon and constituting a main lever, means to actuate the said rock-shaft, the rod $t^{\times}$, and the prime lever $20^{\times}$, and a fulcrum for the said prime lever, combined with the series of shuttle-boxes and with connections between the said prime lever and the series of shuttle-boxes, to operate substantially as described.

14. A shaft, as D^{14}, two reversely-moving gears loose thereon and having clutching-teeth, a gear to rotate the said loose gears in unison, a clutching-hub splined on the said shaft between the said loose gears and having teeth to be engaged by the clutch-teeth of one or the other of the said loose gears according to the direction it is desired to rotate the said shaft D^{14}, combined with a controlling mechanism, its ratchet and actuating-pawl, and means to move said pawl, and with intermediate parts, substantially as described, between said controlling mechanism and said clutching-hub, whereby said hub may be caused to engage either of the reversely-moving gears, as determined by the controlling mechanism, substantially as described.

In testimony whereof I have signed my name to this specification in the presence of two subscribing witnesses.

HORACE WYMAN.

Witnesses:
JUSTIN A. WARE,
SAMUEL B. SCHOFIELD.