(No Model.) 3 Sheets—Sheet 1.

A. GARTNER.

SHUTTLE BOX OPERATING MECHANISM FOR LOOMS.

No. 556,968. Patented Mar. 24, 1896.

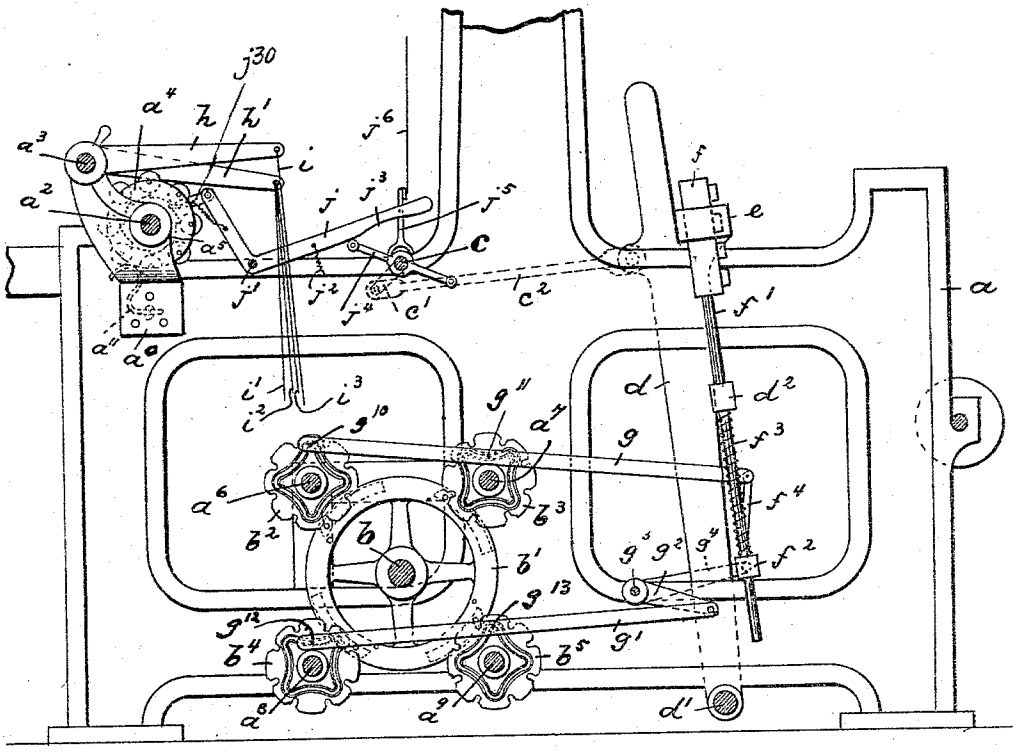

Fig. 1.

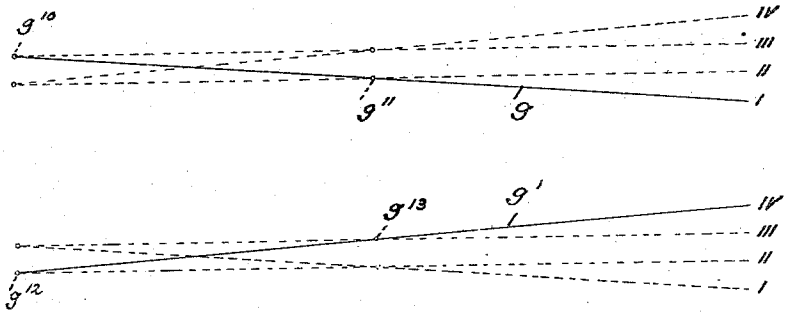

Fig. 2.

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(No Model.) 3 Sheets—Sheet 2

A. GARTNER.

SHUTTLE BOX OPERATING MECHANISM FOR LOOMS.

No. 556,968 Patented Mar. 24, 1896.

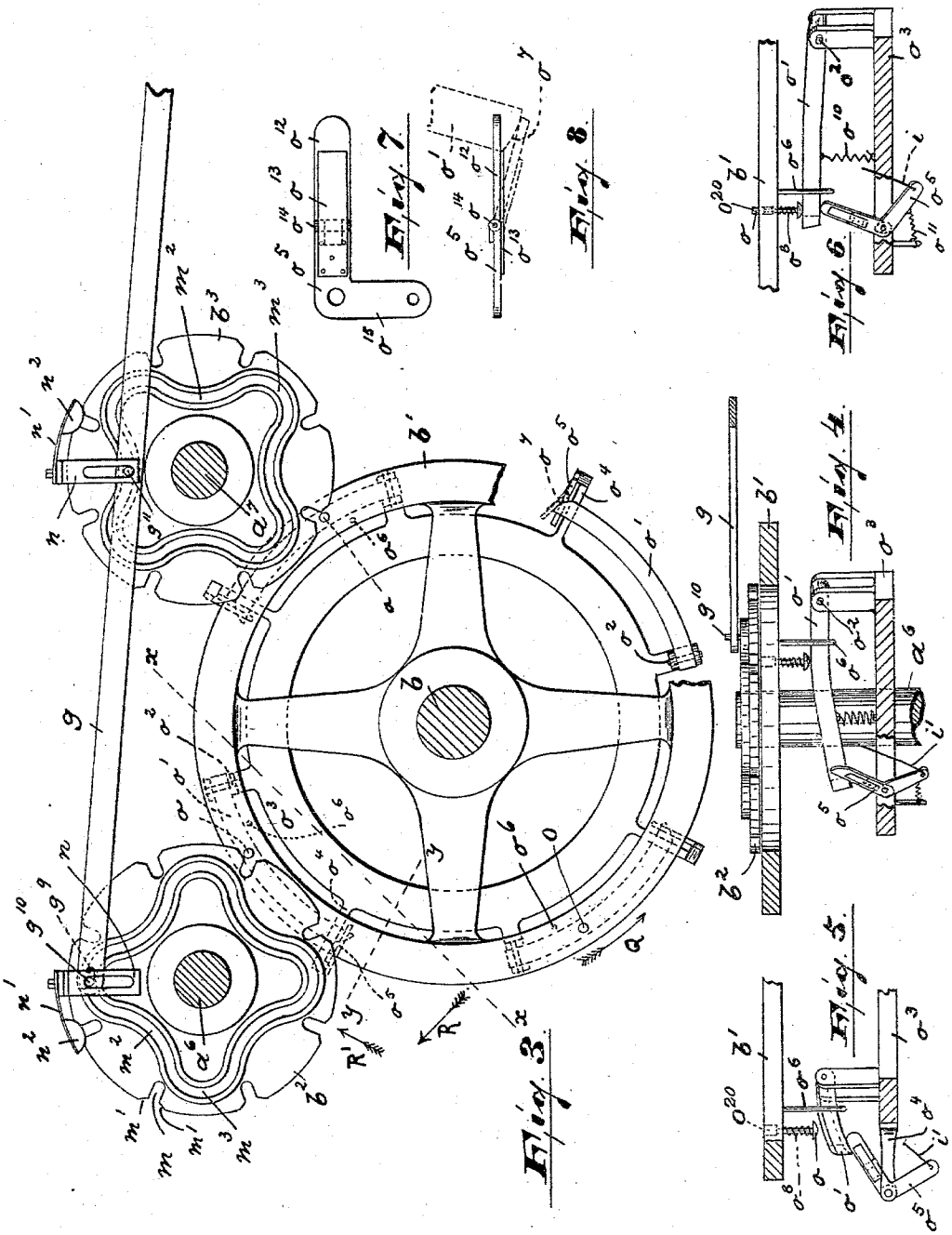

Fig. 3.

Fig. 7.

Fig. 8.

Fig. 6.

Fig. 4.

Fig. 5.

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(No Model.) 3 Sheets—Sheet 3.

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SHUTTLE BOX OPERATING MECHANISM FOR LOOMS.

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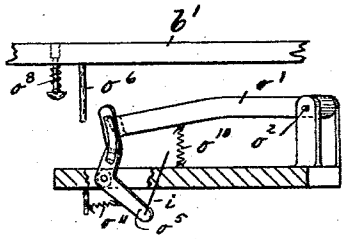

Fig. 6a.

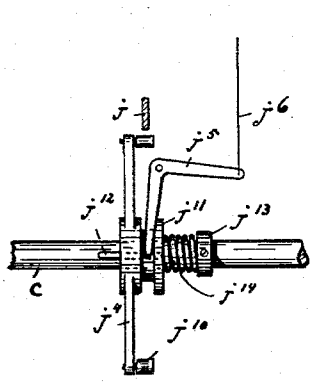

Fig. 9.

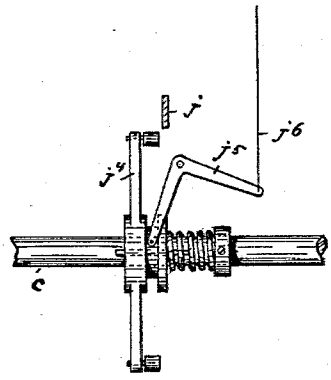

Fig. 10.

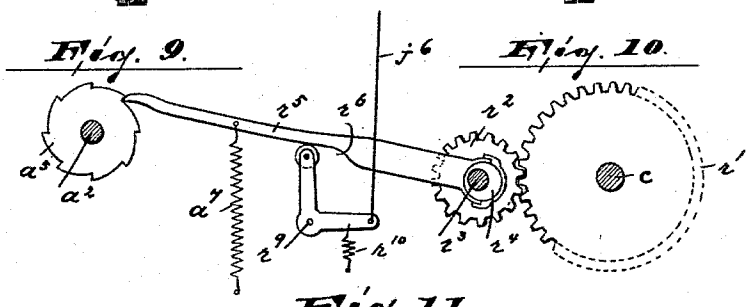

Fig. 11.

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UNITED STATES PATENT OFFICE.

ALFRED GARTNER, OF NEWARK, ASSIGNOR TO ROBERT ATHERTON, OF PATERSON, NEW JERSEY.

SHUTTLE-BOX-OPERATING MECHANISM FOR LOOMS.

SPECIFICATION forming part of Letters Patent No. 556,968, dated March 24, 1896.

Application filed July 30, 1895. Serial No. 557,614. (No model.)

To all whom it may concern:

Be it known that I, ALFRED GARTNER, a citizen of the United States, residing in Newark, county of Essex, and State of New Jersey, have invented certain new and useful Improvements in Shuttle-Box-Operating Mechanism for Looms; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same, reference being had to the accompanying drawings, and to letters of reference marked thereon, which form a part of this specification.

The object of my invention is to provide a shuttle-box-operating mechanism for looms of simple, strong, and durable construction, reliable in operation and not liable to get out of order.

The invention consists in the improved shuttle-box-operating mechanism, its lifting-levers controlling "cam-groove wheels," in the means for operating and controlling the said cam-groove wheels, and in the combination and arrangement of the various parts thereof, substantially as will be hereinafter more fully described, and finally embodied in the clauses of the claim.

Referring to the accompanying drawings, in which like letters of reference indicate corresponding parts in each of the several views, Figure 1 is a side elevation of a loom provided with my improvements, only those parts of the loom and of the said improvements being shown which are necessary to fully illustrate the nature of my invention. Fig. 2 is a diagrammatic view showing the movements of the shuttle-box-operating levers; Fig. 3, an enlarged detail view of the upper set of cam-groove wheels (controlling the movement of the upper shuttle-box-operating lever) and its operating mechanism; Fig. 4, a sectional view on the line $x\,x$ of Fig. 3, looking in the direction of arrow R; Fig. 5, a sectional view on the line $y\,y$ of Fig. 3, looking in the direction of arrow R'; Figs. 6 and 6^a, detail views similar to Fig. 4, illustrating the cam-groove-wheel-operating mechanism in two successive working positions; Figs. 7 and 8, enlarged detail views of a certain operating angle-lever, hereinafter more fully described. Figs. 9 and 10 are enlarged detail views of the pattern-chain-operating mechanism, as shown in Fig. 1; and Fig. 11, a detail view of the preferred form of said pattern-chain-operating mechanism.

In said drawings, a represents the loom-frame, in which is arranged the driving-shaft c, transmitting its motion through crank c' and pitman c^2 to the lay or batten e, supported by swords d, the latter fulcrumed, as at d', to the loom-frame. At each end of the lay are arranged the shuttle-boxes f, carried by rods f', each of which rods is guided by the block d^2 secured to the lay-sword and is surrounded by a spiral spring f^3, bearing with one end on said block d^2 and with its other end on the nut or collar f^2 secured at or near the lower end of the rod f', all said parts of the usual well-known construction.

On the shaft c (see Figs. 1, 9, and 10) is splined, by means of a feather j^{12}, a grooved collar j^{11}, carrying the two radial arms j^4, arranged diametrically opposite each other and provided at or near the outer ends with wheels or rollers j^{10}, adapted to engage the curved portion j^3 of angle-lever j, and thus to operate the same. The annular groove of the collar j^{11} is engaged by the forked portion of the fulcrumed angle-lever j^5, which latter is operated through cord j^6 from the Jacquard machine in the ordinary manner.

The shaft c is surrounded by a spiral spring j^{14}, bearing with one end on the grooved collar j^{11} and with its other end on a collar j^{13} firmly secured to the shaft c. The spring being compressed, angle-lever j^5, on being released, will force the collar j^{11} outward on shaft c and thus the rollers j^{10} out of the path of the angle-lever j. The said lever j is fulcrumed, as at j', to the loom-frame and is controlled by a spring j^2. To the free end of the shorter arm of said angle-lever is pivotally secured a spring-controlled pawl j^{30}, adapted to engage the teeth of the ratchet-wheel a^5 and thus to operate the same. The ratchet-wheel a^5 is mounted on shaft a^2, supported by frame a and also by a bracket-frame a^0. On said shaft is firmly secured the sprocket-wheel a^4, carrying the pattern-chain and adapted to operate the levers $h\,h'$, pivoted with one end to a stub-shaft a^3 and provided at their other ends with

cords or wires i, i', i^2 and i^3, which latter are connected with the shuttle-box-operating mechanism, as will be hereinafter more fully described. To the bracket-frame a^0 is also secured edgewise a flat but curved spring a^{11}, adapted to rest with its curved portion between adjoining rollers of the pattern-chain, and thus to hold the said pattern-chain and its sprocket-wheel in position whenever the shaft a^2 has been turned the required distance by means of the ratchet-wheel a^5 and its operating-pawl.

On the shaft b, which has its bearings in the loom-frame and which receives its revolving motion from driving-shaft c, (through a train of gear-wheels arranged on the opposite side of the loom, as in the ordinary manner, and which therefore is not illustrated in the drawings,) is secured the wheel or disk b', provided at the inner side of its rim with four headed pins o, arranged horizontally and diametrically opposite each other and having an enlarged portion o^{20}, as clearly shown in Figs. 4, 5, 6 and 6^a. Each pin is surrounded and thus controlled by a spiral spring o^8 and rests when in normal position with its enlarged portion in a hole penetrating the rim of the wheel b', but does not, when in said normal position, project beyond the outer face of said rim. (See Figs. 4 and 5.) Said pins o are adapted to be operated—that is to say, pressed outward beyond the outer face of the rim of wheel b'—by levers o', each of which is controlled by a spring o^{10} and is pivoted, as at o^2, to a bracket of the circular frame o^3, arranged in rear of the wheel b' and parallel therewith and secured to the loom-frame by bolts or in any desired manner.

There are four levers o' pivoted to their respective brackets and arranged diametrically opposite each other. Each of said levers is segment-shaped, as clearly shown in Fig. 3, and thus covers the path of the pins o when the wheel b' is rotated. The free end of each lever, which is curved, as at o^7, is engaged by one arm, o^{12}, of angle-lever o^5, pivoted to a bracket o^4 of the circular frame o^3 and controlled by a spiral spring o^{11} secured with one end to the frame o^3 in any desired manner and with its other end to the other arm, o^{15}, of the angle-lever o^5. The outer ends of said arms o^{15} of the angle-levers are connected to and thus operated by their respective cords or wires i, i', i^2 and i^3, as will be hereinafter more fully described. The arm o^{12} is hinged, as at o^{14}, to said angle-lever and is controlled by a flat spring o^{13}, as clearly shown in Figs. 7 and 8. Said arm o^{12} is adapted to be thrown out of the path of the curved end o^7 of lever o' by means of the pins o^6, which latter are firmly secured to the inner side of the rim of the wheel b' and a short distance away from the radial lines of the pins o. (See Figs. 3, 4, 5 and 6.)

The length of the pins o^6 is such that they will only engage the hinged portion o^{12} of the angle-lever when the latter has been operated by its respective cord and thus has operated the lever o'. When the hinged portion o^{12}, against the action of its flat spring o^{13}, has been forced outward by the pin o^6, it will bear against the curved end of lever o', which by that time has returned by action of spring o^{10} to its normal position. (See Fig. 6^a.)

In the frame a are journaled the shafts a^6, a^7, a^8 and a^9, which are arranged diametrically opposite each other and about opposite the middle of the levers o'. On each of these shafts is secured a wheel b^2, b^3, b^4 and b^5, respectively, provided at its outer periphery and at regular intervals with a series of eight notches m with flaring mouths m', adapted to be engaged by the pins o of the wheel b', (when said pins are operated,) and thus to be rotated one-eighth of a revolution.

On the outer face of each wheel a^6, a^7, a^8 and a^9 is arranged an endless cam-groove consisting of four concave and four convex curves m^3 and m^2, arranged alternately and symmetrically and in such a manner on the wheel that the culminating point of each curve is on a radius midway between each two adjoining notches.

In each endless cam-groove is arranged and adapted to be operated thereby a pin g^{10}, g^{11}, g^{12} and g^{13}, respectively, guided by the vertically-arranged slots of the brackets n, secured to the circular frame o^3 or to the loom-frame a in any desired manner, only two of said slotted brackets being shown in the drawings. (See Fig. 3.) The pin g^{11} is firmly secured to the lever g, while the pin g^{10} is adapted to operate in the elongated slot g^9 arranged in the free end of said lever g, the other end of which is connected by the link f^4 with the collar f^2 on the shuttle-box-supporting rod f'. The pins g^{13} and g^{12} are likewise arranged in lever g', which is adapted to operate, through shaft g^2, the shaft g^3. To the opposite end of said shaft is secured the lever g^4, (shown in dotted lines in Fig. 1,) and which lever through a connection similar to link f^4 operates the shuttle-box-supporting rod on the opposite end of the loom.

The pins g^{10}, g^{11}, g^{12} and g^{13} may, if desired, be surrounded by a small cylindrical sleeve to reduce the friction during the operation.

To each bracket n is also secured in any desired manner a spring n', carrying at its free end a brake-block n^2, adapted to rest in the notches m of its respective wheel when the same has been rotated the required distance—that is to say, one-eighth of a revolution.

The operation of the device is as follows, reference being made to Figs. 1 to 10, inclusive, of the drawings: During the operation of plain weaving the shuttle-box-operating mechanism is at rest, as the collar j^{11} with its arm j^4 and rollers j^{10} has, by action of the spiral spring j^{14}, been forced out of the path of pawl-carrying lever j, Fig. 10, and the sprocket-wheel a^4 carrying the pattern-chain is thus prevented from being rotated. When the jacquard calls for the introduction of a

color to be worked in a figure or design of the fabric, the cord j^6 is drawn upward by the jack or hook of the machine, and through the angle-lever j^5 engaging the annular groove of collar j^{11} the said collar and its arms j^4 and rollers j^{10} are moved into the path of lever j. One of the rollers j^{10} (as the collar j^{11} is continually revolving with shaft c) will strike the curved portion j^3 of pivoted angle-lever j and thus operate the said angle-lever, and through its pivoted pawl j^{30}, engaging the teeth of ratchet-wheel a^5, will rotate the shaft a^2 the required distance, (in the drawings one-eighth of a revolution.) The sprocket-wheel a^4 is thus revolved, operating the pattern-chain until one of its rollers comes under and lifts one of the levers $h\,h'$. In Fig. 1 of the drawings is illustrated the position of lever g when the first compartment of the shuttle-box (from the top) is brought opposite the lay or race and ready to discharge its shuttle. Supposing that the second shuttle from the top (see also the upper portion of diagrammatic view of Fig. 2) is called for after the first shuttle has performed its operation, the lever h' is raised by its respective roller of the pattern-chain, thus lifting through its cord connection the angle-lever o^5 (corresponding with cam-groove wheel b^2) and the latter in turn depressing the lever o'. The spring-controlled headed pin o carried along by the wheel b' (revolving in the direction of arrow Q, Fig. 3) is, as soon as it reaches the said depressed lever o', engaged by the same and forced outward beyond the outer face of the rim of said wheel b' and into the notch m of cam-groove wheel b^2. The said wheel is thus rotated one-eighth of a revolution, and the guided pin g^{10}, engaged by the cam-groove on wheel b^2, is moved downward until it rests in the culminating point of the concave curve m^2. The pin g^{11} has acted as fulcrum and the lever will thus occupy the position marked "II" in the upper half of Fig. 2. Soon after the pin o has left the notch m of wheel b^2 its co-operative pin o^6 engages the hinged portion o^{12} of angle-lever o^5 and forces the same out of the path of lever o', which latter by the action of the spiral spring o^{10} is returned to its normal position, the hinged portion o^{12} of angle-lever o^5 bearing on the curved end o^7 of lever o'. (See Fig. 6[a].) This is a very important point—as, for instance, should the pick be repeated, the sprocket-wheel and the pattern-chain being prevented from rotation, the cord j^6 being released by the Jacquard machine and thus the rollers j^{10} moved out of the path of angle-lever j, as heretofore described, the wheel b^2 must remain unmoved—that is to say, the next following spring-controlled headed pin o must pass under the lever o' without being operated, and this can only be accomplished by having the lever o' returned to its normal position, notwithstanding that its respective angle-lever remains in operative position. As soon as the strain on the angle-lever is released—that is to say, its respective treadle-lever h' is lowered—said angle-lever by the action of the spring o^{11} is returned to its normal position and rests again within its hinged portion o^{12} on the top surface of the curved end of the lever o', (the hinged portion being returned to its normal position by the action of the flat spring o^{13}.) If, for instance, the fourth shuttle (from the top) is required, the sprocket-wheel and pattern-chain being again brought in operation by the Jacquard machine, the pin g^{10} must be lowered and the pin g^{11} raised. For that purpose the two levers $h\,h'$ corresponding with the wheels b^3 and b^2 are raised by the rollers on the pattern-chain, and the respective angle-levers o^5 are thus operated and the levers o' controlling the pins o thereby depressed. The wheels b^3 and b^2 are each turned by their respective pins o one-eighth of a revolution, and the lever g thus brought into the position marked "IV" in the upper half of the diagrammatic view in Fig. 2.

The mode of operation of the lower cam-groove wheels b^4 and b^5 and the connecting-lever g' is the same as that of the upper series, except that they are operated through cords i^2 and i^3, connected to a second set of treadle-levers similar to the levers h and h'. The lever g' operates, through crank g^2, shaft g^3, and lever g^4, the shuttle-box-supporting rod on the opposite side of the loom.

In Fig. 11 of the drawings I have illustrated a modified form of device for operating the sprocket-wheel a^5 on shaft a^2.

On the shaft c, Fig. 11, is firmly secured a gear-wheel r' meshing with a gear-wheel r^2 on shaft r^3. Said gear-wheel r^2 is one-half the diameter of the gear-wheel r'. On shaft r^3 is also arranged an eccentric r^4, provided with an arm r^5, having a pawl-shaped end and on its under side a cam r^6 and being controlled by a spiral spring r^7. Pivoted to the loom-frame, as at r^9, is the angle-lever r^8, controlled by spring r^{10} and connected with one arm through cord j^6 with the Jacquard mechanism. The other arm of said angle-lever r^8 is provided with a roller r^{11} adapted to bear on the under side of the arm r^5, which latter with its pawl-shaped end engages the teeth of the sprocket-wheel a^5. During the operation of plain weaving the cord j^6 is lowered and the angle-lever r^8, by the action of the spring r^{10}, is brought under the cam r^6 of arm r^5, thus raising the arm out of engagement with the teeth of the sprocket-wheel a^5 and thus preventing the shaft a^2 from being rotated. As soon as the cord j^6 is drawn upward the angle-lever r^8 is returned to its normal position and the pawl-shaped end of arm r^5 again thrown into engagement with the teeth of the sprocket-wheel, as will be manifest.

Having thus described my invention, what I claim as new, and desire to secure by Letters Patent, is—

1. The combination with the shuttle-box-lifting lever, of a series of pins arranged on said lifting-lever, a series of crank-shafts, a

disk on each of said crank-shafts, each of said disks having a series of concave and convex connecting cam-grooves arranged alternately and symmetrically with relation to the crank-shaft of its respective disk, the cam-groove of each disk being adapted to engage its respective pin of the lifting-lever, and means for intermittingly rotating said disks, all said parts, substantially as and for the purposes described.

2. The combination with the shuttle-box-lifting lever, of a series of pins on said lifting-lever, a series of crank-shafts, a disk on each of said crank-shafts, each of said disks having a series of concave and convex connecting cam-grooves arranged alternately and symmetrically with relation to the crank-shaft of its respective disk, the cam-groove of each disk being adapted to engage its respective pin of the lever, a fixed slotted guide-bracket for each pin, and means for intermittingly rotating said disks, all said parts, substantially as and for the purposes described.

3. The combination with the shuttle-box-lifting lever, of a series of pins on said lifting-lever, a series of crank-shafts, a disk on each of said crank-shafts, each of said disks having a series of concave and convex connecting cam-grooves arranged alternately and symmetrically with relation to the crank-shaft of its respective disk, the cam-groove of each disk being adapted to engage its respective pin of the lever, a fixed slotted guide-bracket for each pin, means for intermittingly rotating said disks, and a spring-controlled brake-block for each disk, all said parts, substantially as and for the purposes described.

4. The combination with the shuttle-box-lifting lever, of a series of pins on said lifting-lever, a series of crank-shafts, a disk on each of said crank-shafts and provided at its outer periphery with a series of notches arranged at regular intervals, each of said disks having a cam-groove consisting of a series of concave and convex curves arranged alternately and symmetrically with relation to the crank-shaft and notches of its respective disk and adapted to engage its respective pin of the lifting-lever, a fixed slotted guide-bracket for each pin, a spring-controlled brake-block secured to each bracket and adapted to engage the notches of its respective disk, and means for intermittingly rotating said disks, all said parts, substantially as and for the purposes described.

5. The combination with the continuously-revolving shaft *b*, of a series of crank-shafts intermittingly rotated by said shaft, a disk secured to each of said crank-shafts and each disk having a series of concave and convex connecting cam-grooves arranged alternately and symmetrically with relation to the crank-shaft of its respective disk, the shuttle-box-lifting lever operated by two of said series of connecting convex and concave cam-grooves, and means for intermittingly transmitting the motion of the revolving shaft to the said crank-shaft, all said parts, substantially as and for the purposes described.

6. The combination with the continuously-revolving shaft *b*, of a series of crank-shafts intermittingly rotated by said shaft, a disk secured to each of said crank-shafts, each of said disks having a series of concave and convex connecting cam-grooves arranged alternately and symmetrically with relation to the crank-shaft of its respective disk, the shuttle-box-lifting lever operated by two of said series of cam-grooves, means for intermittingly transmitting the motion of the revolving shaft to said crank-shafts, and means for holding said crank-shafts and disks in their respective positions, all said parts, substantially as and for the purposes described.

7. The combination with the continuously-revolving shaft *b*, of a series of crank-shafts intermittingly rotated by said shaft, a disk secured to each of said crank-shafts, each of said disks having a series of concave and convex connecting cam-grooves arranged alternately and symmetrically with relation to the crank-shaft of its respective disk, the shuttle-box-lifting lever, a series of pins on said lifting-lever, each of said pins being adapted to be engaged by the cam-groove of its respective disk, a fixed guide-bracket for each pin, and means for intermittingly transmitting the motion of the revolving shaft to said crank-shafts, all said parts, substantially as and for the purposes described.

8. The combination with the continuously-revolving shaft *b*, of a series of crank-shafts intermittingly rotated by said shaft, a disk secured to each of said crank-shafts, each of said disks having a series of concave and convex connecting cam-grooves arranged alternately and symmetrically with relation to the crank-shaft of its respective disk, the shuttle-box-lifting lever, a series of pins on said lifting-lever, each of said pins being adapted to be engaged by the cam-groove of its respective disk, a fixed guide-bracket for each pin, means for intermittingly transmitting the motion of the revolving shaft to said crank-shafts, and means for holding said shafts and disks in their respective positions, all said parts, substantially as and for the purposes described.

9. The combination with the continuously-revolving shaft *b*, of a series of crank-shafts intermittingly rotated by said shaft, a disk on each crank-shaft and provided at its outer periphery with a series of regularly-arranged notches, each of said disks having a cam-groove consisting of a series of concave and convex curves arranged alternately and symmetrically with relation to the crank-shaft of its respective disk, the shuttle-box-lifting lever, a series of pins on said lifting-lever and adapted to be engaged by the cam-grooves of their respective disks, a fixed guide-bracket for each of said pins, a spring-controlled brake-block on each of said brackets and adapted to engage the notches of its respect-

ive disk, and means for intermittingly transmitting the motion of the revolving shaft to said crank-shafts, all said parts, substantially as and for the purposes described.

10. The combination with a continuously-revolving shaft, of a wheel secured to said shaft, a series of spring-controlled pins arranged horizontally and at regular intervals in the rim of said wheel, a series of crank-shafts parallel with said revolving shaft, a disk secured to each crank-shaft and provided at its outer periphery with a series of regularly-arranged notches, each disk being also provided with an endless cam-groove consisting of a series of concave and convex curves arranged alternately and symmetrically with relation to the crank-shaft of its respective disk, the shuttle-box-lifting lever operated by said cam-grooves, and means for bringing said spring-controlled pins into the notches of said disks, all said parts, substantially as and for the purposes described.

11. The combination with a continuously-revolving shaft, of a wheel secured to said shaft, a series of spring-controlled pins arranged in the rim of the wheel horizontally and at regular intervals, a series of crank-shafts parallel with said revolving shaft, a disk secured to each crank-shaft and provided at its outer periphery with a series of regularly-arranged notches, each disk being also provided with an endless cam-groove consisting of a series of concave and convex curves arranged alternately and symmetrically with relation to the crank-shaft of its respective disk, the shuttle-box-lifting lever operated by said cam-grooves, means for bringing said pins into the notches of said disks and a spring-controlled brake-block for each disk and adapted to engage the notches of the same and to thus hold its respective disk in position after it has been rotated the required distance, all said parts, substantially as and for the purposes described.

12. The combination with a continuously-revolving shaft, of a wheel secured to said shaft, a series of spring-controlled pins arranged in the rim of the wheel, horizontally and at regular intervals, a series of crank-shafts parallel with said revolving shaft, a disk secured to each crank-shaft and provided at its outer periphery with a series of regularly-arranged notches, each disk being also provided with an endless cam-groove consisting of a series of concave and convex curves arranged alternately and symmetrically with relation to the crank-shaft of its respective disk, the shuttle-box-lifting lever, a series of pins on said lifting-lever and engaging said cam-grooves, a fixed guide-bracket for each of said pins, a spring-controlled brake-block secured to each guide-bracket and adapted to engage the notches of its respective disk, and means for bringing said pins into engagement with the notches of said disks, all said parts, substantially as and for the purposes described.

13. The combination with the continuously-revolving shaft, of a wheel secured to said shaft, a bracket-frame in rear of said wheel, a series of spring-controlled pins arranged at regular intervals in the rim of said wheel, a segmental lever in rear of each pin and fulcrumed on said bracket-frame, a series of crank-shafts parallel with said revolving shaft, a disk secured to each crank-shaft and provided at its outer periphery with a series of regularly-arranged notches, the shuttle-box-lifting lever operated by two of said disks, means for operating the fulcrumed levers and thus to bring the said spring-controlled pins into engagement with the notches of said disks, and means for returning said levers to their normal positions, all said parts, substantially as and for the purposes described.

14. The combination with the continuously-revolving shaft, of a wheel secured to said shaft, a bracket-frame in rear of said wheel, a series of spring-controlled pins arranged at regular intervals in the rim of said wheel, a segmental lever in rear of each pin and fulcrumed to said bracket-frame, a series of crank-shafts parallel with said revolving shaft, a disk secured to each crank-shaft and provided at its outer periphery with a series of regularly-arranged notches, adapted to be engaged by said spring-controlled pins, the shuttle-box-lifting lever operated by two of said disks, an angle-lever pivotally secured to the bracket-frame and in rear of each segmental lever and resting with one arm on the free end of the same, means for operating said angle-lever and means for returning the segmental lever to its normal position, all said parts, substantially as and for the purposes described.

15. The combination with the pattern-chain and the treadle-levers operated thereby, of a continuously-revolving shaft, a wheel secured to said shaft and provided in its rim with a series of spring-controlled pins, a bracket-frame in rear of said wheel, a lever in rear of each pin and fulcrumed to said bracket-frame, a pivoted angle-lever in rear of each fulcrumed lever and resting with one arm on the free end of said fulcrumed lever, the other arm being connected by a cord or wire with its respective treadle-lever, a series of crank-shafts parallel with the revolving shaft, a disk secured to each of said crank-shafts and provided at its outer periphery with a series of notches, adapted to be engaged by the spring-controlled pins, each disk being also provided with a cam-groove consisting of a series of concave and convex curves alternately arranged, of the shuttle-box-lifting lever, a series of pins on said lifting-lever and engaging the cam-grooves of their respective disks, and means for holding said disks in position after they have been rotated the required distances, all said parts, substantially as and for the purposes described.

16. The combination with the pattern-chain and the treadle-levers operated thereby, of a

continuously-revolving shaft, a wheel secured to said shaft and provided in its rim with a series of spring-controlled pins, a bracket-frame in rear of said wheels, a spring-controlled lever in rear of each pin and fulcrumed to said bracket-frame, a pivoted angle-lever in rear of each fulcrumed lever and connected with one arm by a cord or wire to its respective treadle-lever, the other arm of said angle-lever being provided with a hinged portion resting on the free end of its respective fulcrumed lever, of a series of pins secured to the rim of the wheel and adapted to engage the hinged portions of said angle-levers, a series of crank-shafts parallel with the revolving shaft, a disk on each of said crank-shafts and provided with a series of notches adapted to be engaged by the spring-controlled pins in the rim of the wheel, and of the shuttle-box-lifting lever operated by said disks, all said parts, substantially as and for the purposes described.

17. The combination with the shaft *c* and with the pattern-chain-carrying shaft, of a shaft parallel with the said shaft *c* and operated thereby, an eccentric on said parallel shaft, a spring-controlled arm projecting from said eccentric and provided with a pawl-shaped end, a ratchet-wheel secured to the pattern-chain-carrying shaft and adapted to be engaged by said arm, a spring-controlled pivoted angle-lever provided at one arm with a roller and adapted to engage the arm projecting from the eccentric, and means for operating said angle-lever, all said parts, substantially as and for the purposes described.

In testimony that I claim the foregoing I have hereunto set my hand this 29th day of July, 1895.

ALFRED GARTNER.

Witnesses:
WM. D. BELL,
H. B. GRIFFITH.