

A. C. HOUGH.  
LOOM SHUTTLE OPERATING MECHANISM.

APPLICATION FILED APR. 26, 1902.

NO MODEL.

4 SHEETS—SHEET 1.

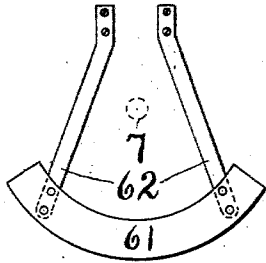


FIG. 3.

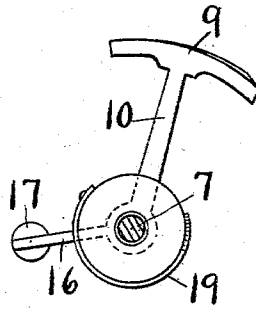


FIG. 4.

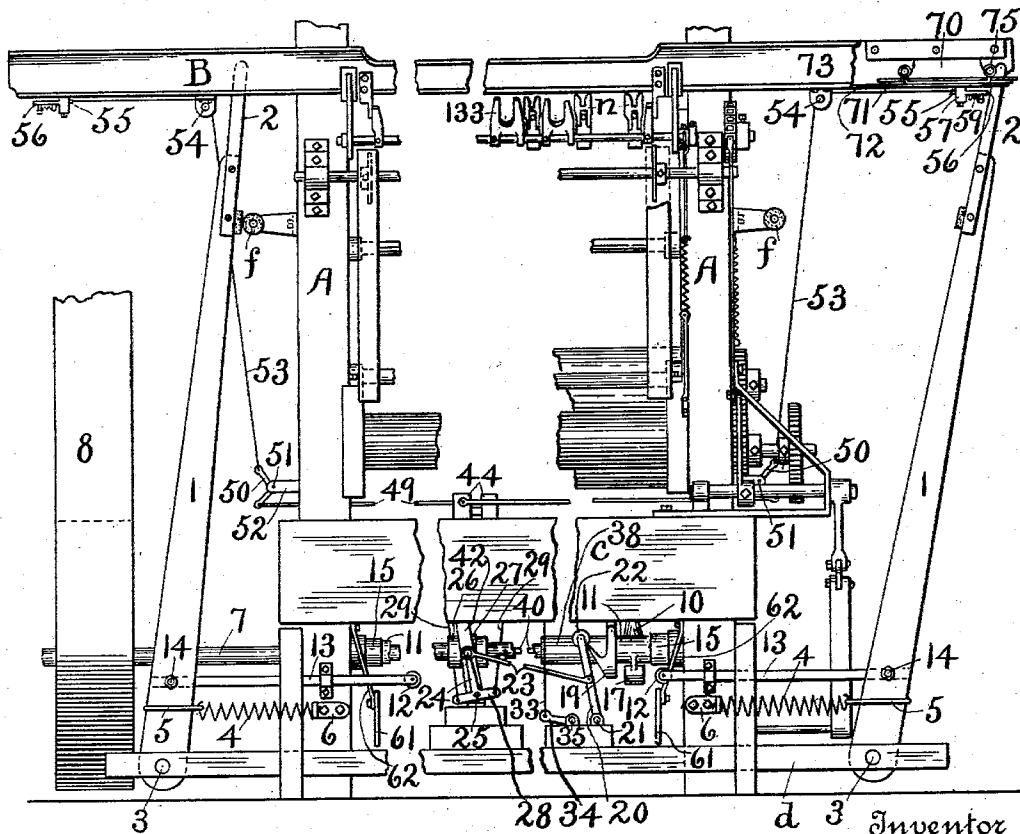


FIG. 1.

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NO MODEL.

4 SHEETS—SHEET 2.

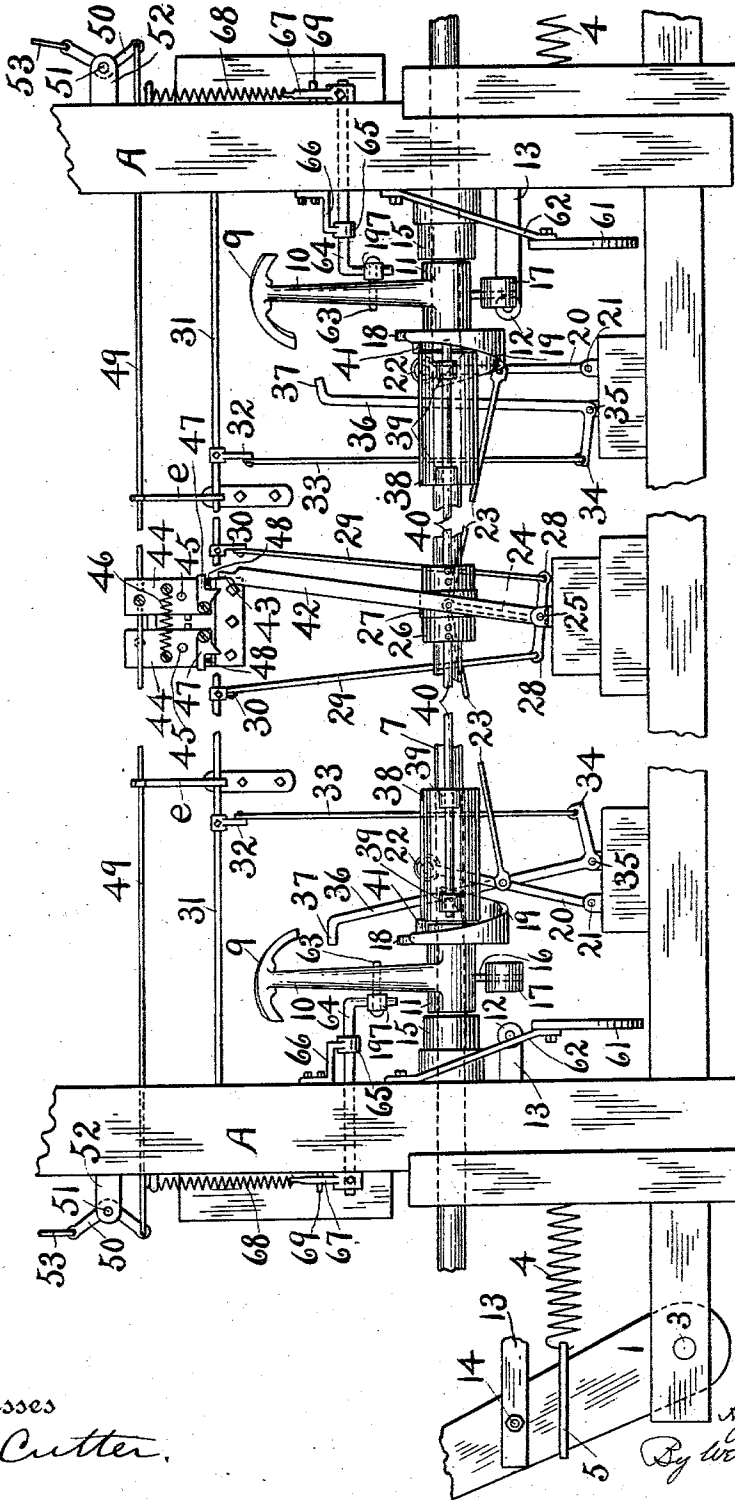


FIG. 2.

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4 SHEETS—SHEET 3.

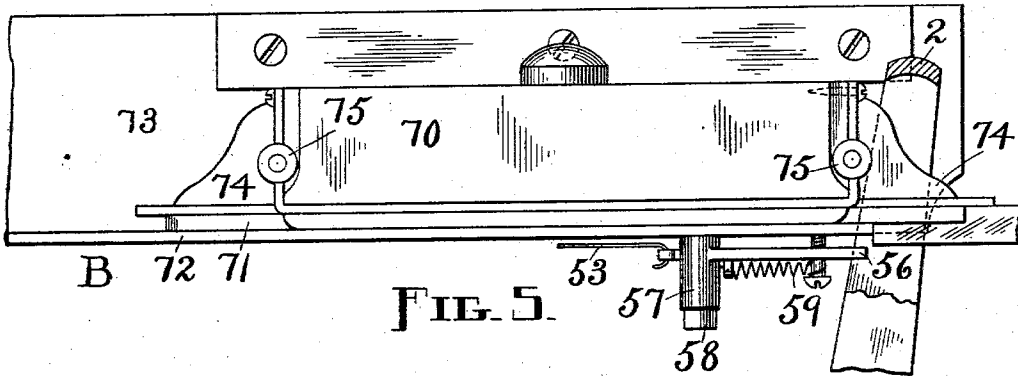


FIG. 5.

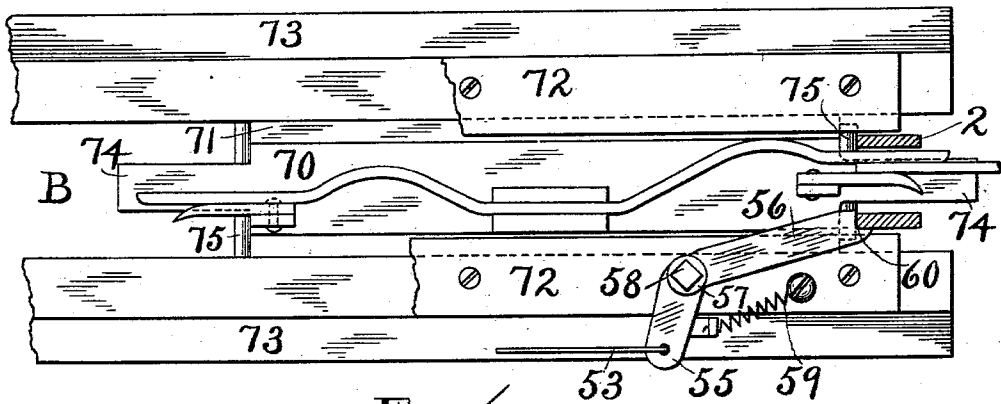


FIG. 6.

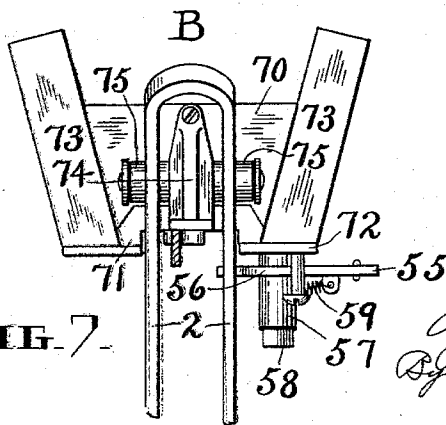


FIG. 7.

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NO MODEL.

4 SHEETS—SHEET 4.

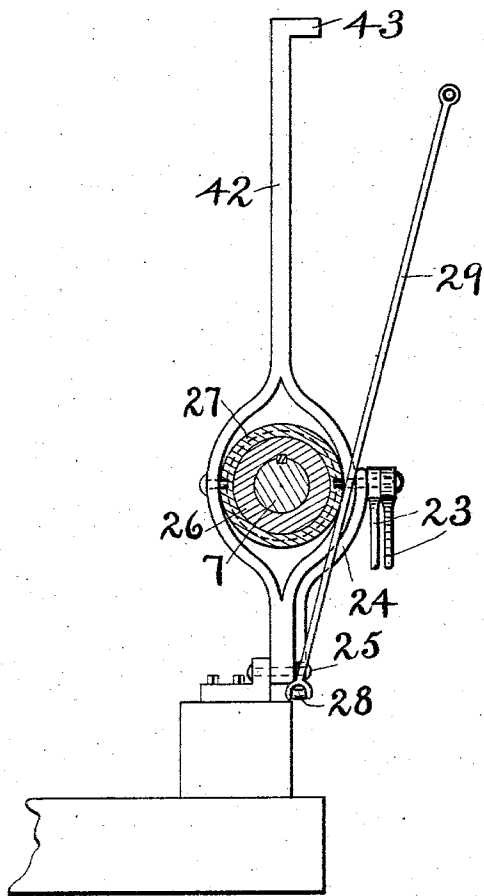


FIG. 8.

Witnesses

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# UNITED STATES PATENT OFFICE.

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## LOOM-SHUTTLE-OPERATING MECHANISM.

SPECIFICATION forming part of Letters Patent No. 740,362, dated September 29, 1903.

Original application filed October 16, 1901, Serial No. 78,791. Divided and this application filed April 25, 1902. Serial No. 104,671. (No model.)

*To all whom it may concern:*

Be it known that I, AZEL C. HOUGH, a citizen of the United States, residing at Worcester, in the county of Worcester and Commonwealth of Massachusetts, have invented a new and useful Loom-Shuttle-Operating Mechanism, of which the following is a specification, the same being a division of an application for a patent of the United States as originally filed October 16, 1901, Serial No. 78,791.

My invention relates to shuttle-operating mechanism for looms used to produce woven fabric; and the object of my invention is to provide efficient and practical mechanism which shall be capable of operating the shuttle in a substantially automatic manner; and to this end my invention consists in the various features of construction, combinations of elements, and arrangement of parts, as will be clearly understood from the description hereinafter appearing, taken in connection with the accompanying drawings, and the novel features of which will be pointed out in the claims at the end of this specification.

In the accompanying drawings, Figure 1 is a front view of my mechanism applied to parts of a loom, portions being broken away; Fig. 2, a rear elevation, on an enlarged scale, with parts broken away of the mechanism connected with the main driving-shaft for governing the throw and release of the picker-sticks; Fig. 3, a detail in elevation of a friction-brake used in connection with the main actuating-cam on the driving-shaft; Fig. 4, a detail showing the main driving-shaft, the sleeve thereon, which carries two actuating-cams, and a counterbalancing-weight; Fig. 5, an enlarged side elevation of the shuttle shown in position on the raceway, one side of said raceway being removed in order to show said shuttle, also showing the upper end of a picker-stick and the latch; Fig. 6, a bottom view of the same; Fig. 7, an end elevation of the same; and Fig. 8, an enlarged cross-section through the main shaft and picker-stick-releasing and cam-stop-operating sleeve members.

Throughout the several views similar reference characters refer to similar parts.

My invention comprises generally means for throwing back and for releasing the spring-

actuated picker-sticks by which the shuttle which supplies the weft to the shed is actuated regardless of what said weft may consist of. Parts of a loom adapted to weave a fabric in which the weft or filling consists of substantial material, as splints, cane, or straw, are shown in the drawings; but my invention may be used in connection with looms which weave fabric wholly composed of textile material proper in contradistinction from fabric having a substantial filling.

Referring to the drawings, the framework of so much of the loom as is shown is composed of standards *A A*, cross-pieces *c* and *d*, and various other supporting and stay pieces. It will be understood that the filling or weft of the fabric is supplied to the shed by a shuttle which is thrown alternately from one end to the other of a raceway by spring-actuated pivoted levers or picker-sticks, a fresh element of the weft being supplied to the shuttle at each end of the loom before it begins its movement along the raceway. Accordingly the picker-sticks and means for actuating them will first be described, reference being had more particularly to Figs. 1 and 2: The picker-sticks comprise levers 1 1, having at their upper ends yokes 2, (best shown in Fig. 7,) which are adapted to encircle the projecting ends of the shuttle. These levers are pivoted at their lower ends at 3 3 to the lower cross-piece *d*, and spiral springs 4 4, connected at one end to clips 5 5 on the picker-sticks and at the other end to suitable abutments 6 6, tend to throw these picker-sticks forward normally in the position shown at the left-hand side of Fig. 1. When thrown back against the force of this spring, the picker-stick is adapted to be caught and held by a latch, (best shown in Fig. 6,) where it is detained until released through the agency of certain mechanisms, which will be described in connection with the means by which the picker-stick is thrown back against the force of the spring.

It will be understood that the means for forcing back and releasing the picker-sticks are duplicates, but they are so constructed that they act successively—*i. e.*, one picker-stick is thrown back and held and immediately thereupon the other is released, as is

necessary in the operation of the machine and as will be readily understood from the drawings. A description of these parts on one end of the loom will be sufficient except  
5 in so far as further description is necessary in order to show the successive operations.

The driving-shaft 7 of the machine is supplied with power by a pulley and belt 8, as shown, or in any other desired way. This  
10 driving-shaft has bearings in the lower ends of the standards A, and near each end is a cam 9, carried by an arm 10, projecting from a sleeve 11, which is loosely mounted upon the driving-shaft and adapted to be coupled  
15 thereto at intervals. When so coupled, the cam 9 is carried around with the driving-shaft, and its inclined face strikes friction-roller 12 on the end of a lever 13, pivoted at 14 to the picker-stick 1 and passing through a guiding-strap on the standard and gradually  
20 forces back said arm and the picker-stick therewith against the force of spring 4 until it is caught and held by the latch, to be hereinafter described. The means by which this  
25 cam 9 is clutched to rotate with the driving-shaft at intervals, so as to throw the picker-stick back at exactly the proper time, and a safety device which prevents the operation of this cam, and hence of the picker-stick, at any  
30 other than the proper point of the cycle which is performed by the various mechanism, together with connected means such that immediately after the picker-stick on one end of the loom has been thrown back in position  
35 to receive the shuttle the releasing device on the other end of the loom is actuated to release the opposite picker-stick and throw the shuttle from that end, form important parts of my invention and will now be described in  
40 detail.

The sleeve 11, which is loose on the driving-shaft 7, is prevented from endwise movement in one direction by a collar 15, fixed to the driving-shaft. This sleeve carries at the end  
45 of an arm 16 a weight 17, the inertia of which carries the sleeve past a possible dead-point, which might otherwise occur just after it is uncoupled from the driving-shaft and which  
50 dead-point in the action of the cams carried by the sleeve would be detrimental in operation. At the inner end of said sleeve a disk 18 is integrally or rigidly connected therewith, to which disk is connected a second cam 19 of a peculiar shape, as shown in the drawings, which is carried on the periphery of said  
55 disk and inclines outward and away toward the center of the loom. A lever 20, pivoted at 21, carries a friction-roller 22, which at one point in the operation of the loom stands in the path of cam 19, and thereby as the cam  
60 revolves the lever 20 is swung on its pivot toward the center of the loom. Pivotaly connected with said arm 20 is connecting-rod 23, which is pivotaly connected to the end or it  
65 may be to a central point of a second upright arm or lever 24, pivoted at 25 to the base of

the machine and shown in dotted lines in Fig. 2 and in full lines in Figs. 1 and 8.

A sleeve 26 is keyed to the driving-shaft 7, so that it may be moved longitudinally there-  
70 of, but rotates therewith. A second sleeve 27 is received into a groove in the sleeve 26, thereby providing a construction that enables the two sleeves to move longitudinally together and permits the inner sleeve to rotate  
75 without affecting the outer sleeve. Upright lever 24 is connected to sleeve 27, so that oscillation of said lever carries both sleeves with it along the driving-shaft. Right-angled  
80 arms 28 are integral with or rigidly connected to the upright 24, preferably at its pivotal point, as shown, so that the arms rock one up and the other down as the lever 24 is moved to and fro. At each end of these arms  
85 28 rods 29 connect them to arms 30 rigid with rock-shaft 31, the ends of which are suitably journaled in the standards A. This rock-shaft carries projecting arms 32, which are  
90 connected by rods 33 to arms 34 of bell-crank levers pivoted at 35. The other arms 36 of the bell-crank levers are bent at their upper ends, as at 37, and are of sufficient length  
95 that these bent ends may when the bell-crank levers are rocked forward be thrown into the path of movement of the cams 9, thereby acting as stops or safety devices, preventing movement of such cams when the bell-crank levers are rocked into such forward  
100 position. Next to loose sleeve 11 on each end of driving-shaft 7 is a collar 38 rigid with the driving-shaft and carrying lugs or  
105 bosses 39, which furnish guides for a long pin or rod 40, passing loosely through such guides and having its inner end rigidly connected to sleeve 26. When said sleeve 26 is  
110 in one position, it carries the rod 40 with it, so that its forward end will contact with a pin or projection 41 on the inner face of disk 18. A lever 42 has its lower end in the form of a loop, so that it surrounds the sleeve  
115 27 and is pivoted at this end so that it moves with the lever 24. It will be obvious that this lever might be straight without having a loop for encircling the parts connected to the driving-shaft, it only being essential that it should be mounted so as to  
120 swing with the lever 24. This is done, as shown, by pivoting it on the pin 25, on which the lever 24 is pivotally supported, and connecting it to lever 24 so that the two swing  
125 together. The construction shown, however, is merely adopted for the sake of compactness. The upper end of the lever 42 is bent at right angles to form a blade 43, which contacts with pivoted releasing-levers 44, connected to the picker-stick latches. These levers, as shown in Fig. 2, two in number, are  
130 pivoted at 45 and held in normal position by a spring 46, which connects the two. Suitable stops limit their inward motion. Pivoted at the lower end of each lever is a small escapement-dog 47, which has a part

projecting into the path of movement of the lever 42 presenting a right-angled face to such lever on one side and an inclined face on the other. These escapement-dogs are free to move on their pivots independently of the levers 44 in one direction; but lugs 48 prevent their independent movement in the other direction, so that as the lever 42 is carried across it will swing one lever 44 on its pivot, but will not affect the other, inasmuch as its escapement-dog 47 is simply thrown up out of the way, and on the next return movement of lever 42 the operation will be reversed. A connecting rod or wire 49 extends from lever 44 to one arm of a bell-crank lever 50, pivoted at 51 to a bracket 52, projecting from standard A, and a connecting rod, wire, or cord 53, as may be desired, extends from the other end of said bell-crank lever over a suitable friction-roller at 54 to one arm 55 of a bell-crank lever, the other arm 56 of which forms the latch for holding the picker-stick. This latch, which holds the picker-stick and which is thrown back to release said picker-stick through the mechanism just described, is best shown in Figs. 5 to 7, inclusive, and consists of a bell-crank lever pivoted, as shown, to the lower side of the shuttle-raceway (designated in a general way by B) through the medium of a sleeve 57 integral therewith, which is pivotally supported on a pin 58. A spring 59, connected to a fixed abutment on the lower side of the raceway, tends to hold the lever or latch normally in such position that the angular notch 60 in the end of its long arm stands in front of one of the side pieces of the loop 2 at the end of the picker-stick. It will be readily understood that the picker-stick in its backward movement strikes the side of the long arm of the latch and passes beyond it, when the spring 59 throws the latch to its position in front of and retains the picker-stick until it is released.

In order to secure exactness of motion, the shaft 31 and the connecting-rods 49 may pass through eyes or guides in brackets *e e*, suitably secured to an adjacent part of the framework. Buffer *f* is positioned in the path of the picker-stick.

As shown in detail in Fig. 3, a friction braking-surface composed of a curved piece 61 of suitable material is supported by spring-arms 62, secured to the framework in such position that the cam 9, immediately after it has acted upon and passed the friction-roller 12 on the end of the arm 13 and while it is still coupled to the driving-shaft, will strike such friction-brake and the momentum which it has upon being suddenly released from its load will be taken up thereby; otherwise the actuating-cam upon being suddenly released from its load without any diminution of power will jump forward with a sudden bound ahead of the rod 40 by which it is carried, which would be a great strain upon and be of great injury to the va-

rious connected parts. This strain is prevented by a friction-brake provided as above. When the actuating-cam 9 is unclutched from its driving-shaft, it comes to rest against an arm 64 through the medium of a friction-roller 197, which rolls upon pin 63, rigidly attached to arm 10, in proper position to begin its work in the next cycle of the loom. This arm 64 passes through the bearings 65, carried by bracket 66, attached to the standard, and thence passes loosely through bearings in the standard and has at its other end an arm 67 fixed to it, to one end of which is attached one end of a spiral spring 68, the other end of which is attached to an eye projecting from the standard. A pin 69 in the path of movement of the arm 67 limits movement of said arm in one direction. It will be seen that by this construction the arm 64 is normally held by the force of the spring 68, which draws the arm 67 up against the pin 69 in a predetermined position such that arm 64 will be in the path of movement of the friction-roller 197, which is pinned to cam-arm 10, and said cam-arm and its supporting-sleeve will be held by said arm 64 while the sleeve is unclutched from the driving-shaft of the machine. When, however, the sleeve has been clutched to the shaft, the spiral spring 68 will yield and the cam-arm will force the spring-retained arm 64 out of its way. As soon as the cam-arm has passed, however, the spring-retained arm 64 will be thrown back into position to arrest said arm on its return. It will be understood that the sleeve 11 is clutched to the main driving-shaft through the throwing forward of the rod 40 in position to contact with the pin or lug 41. Said rod 40 is connected to the sleeve 26, which rotates with the shaft, and accordingly when the rod is thrown behind the pin it carries the pin, disk, sleeve, and all connected parts with it in the revolution of the shaft until again withdrawn. The parts are so arranged on each end of the machine and connected to a single sleeve in the middle that when the rod and pin at one end are in engagement those at the other end are out of engagement, as will be more fully described hereinafter.

The shuttle shown comprises a main frame-piece 70, which has on its lower sides shoes 71, adapted to run upon tracks formed by the side pieces 72 of the lower plate of the raceway B, which projects beneath the bars 73, forming the side walls of said raceway. The ends of the shuttle, as shown, comprise projections 74, which extend through the picker-stick loops, and the shuttle carries friction-rollers 75, against which the picker-sticks act. Such a construction, however, is optional. The lower face of the shuttle carries devices for grasping the weft material. When the shuttle arrives at one end of the raceway, a splint or other weft unit is received thereby just before said shuttle is thrown back by the operation of the picker-

stick. The weft material is discharged in any suitable manner from the shuttle into guide-fingers 133 and is pressed down by presser-fingers carried by shafts suitably supported and operated. This may be termed the "operating" point of the machine, as it is here that the actual weaving takes place, and it will be understood that devices other than those shown and specified may be employed at the operating point in connection with my invention.

From the foregoing description of parts and of the operation of various of these parts the general operation of the mechanism will be readily understood; but such operation will be briefly retraced.

If the driving-shaft is started with the parts in the position of Fig. 2, the rod 40 on the right hand of that figure in its revolution will strike the pin 41 and the actuating-cam 9 will then be carried with the driving-shaft. As the revolution continues the cam will force back the picker-stick arm and the picker-stick to the position at the right of Fig. 1. At the same time the inclined face of the cam 19 is gradually forcing the lever 20 in toward the center of the machine, and thereby, through the connections described, the sleeve 26 will be forced to the left and finally the rod 40 will be withdrawn from the pin 41 and the sleeve 11 unclutched from the driving-shaft. The cam 9 will then be brought to rest against the arm 64, and during the next revolution of the driving-shaft the loose sleeve on the right and all its connecting parts will be at rest; but when the sleeve 26 is forced to the left by the action just described the rod 40 on the left hand of the machine will be gradually thrown into position such that it will engage with the pin 41 on the left-hand disk, and when the sleeve is forced to the limit of its motion the cam-sleeve on the right of the machine will be uncoupled from the driving-shaft and the cam-sleeve on the left of the machine will be coupled. While this is taking place and immediately after the picker-stick on the right-hand side of the machine has been thrown back into position, the escapement-lever 42 will move across in the path of the two escapement-levers and the first one will be oscillated on its pivot, thereby releasing the latch on the picker-stick on the left-hand side of the machine. Such picker-stick being free will be thrown by its spring, and the shuttle, carrying a weft unit with which it has been supplied, will be thrown across the raceway until it stops in the position indicated at the right of Fig. 1. As the central sleeve 26 moves it carries with it each way the safety-stop 37 through the connections indicated, so that unless proper movement of all the parts has taken place such stop will not be thrown out of the way of the cam, and the machine cannot be operated. After the weft unit has been discharged from the shuttle into the shed and the raceway is

clear the picker-stick on the left is thrown back and the picker-stick on the right released to throw the shuttle forward for supplying another weft unit, and the cycle is repeated. It should also be noted that my construction of clutch is such that if the loom is reversed the rod 40 will simply back away from pin 41 without reversing the clutch. It will be seen that the construction is such that it is impossible for an operator to do anything to the loom which will interrupt the cycle of operation through which the various parts pass, but that whenever the loom is stopped it will always be in position to be started up with all the parts continuing the operation from the point at which they stopped. This prevents injury and breaking down which might otherwise occur in a loom, a complete cycle of which depends upon the harmonious interworking of different parts.

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

1. In a loom, in combination, a reciprocable shuttle, actuating means therefor, and means to bring about the operation of such actuating means only at regular and predetermined intervals, comprising an intermittent rotary member, a reciprocating member, and intermediate mechanism adapted to impart motion from said intermittent rotary member to said reciprocating member.
2. In a loom, a reciprocable shuttle, actuating means therefor comprising a spring-controlled picker-stick, means for throwing said picker-stick back against the tension of its spring, means for holding it releasable in such position, and means comprising a reciprocating sleeve on the main shaft for releasing said picker-stick from its holding means.
3. In a loom, a reciprocable shuttle, ways for guiding such shuttle, a picker-stick at each end of such ways for reciprocating such shuttle, means for throwing such picker-sticks, and means comprising rotary members arranged to cease their motion at intervals and oscillating safety-stops to insure such cessation of motion, for preventing the throw of the picker-stick at either end until the opposite picker-stick is in operative position.
4. In a loom, a reciprocable shuttle, ways for guiding such shuttle, means at each end of the loom for actuating the shuttle, stops in the path of such actuating means, and means comprising a reciprocating sleeve on the main shaft whereby as the shuttle is thrown from each end of the loom the stop at the other end is thrown into position.
5. In a loom, a reciprocable shuttle, a spring-controlled picker-stick at each end of the loom for actuating said shuttle, means for forcing back against the spring tension each of said picker-sticks and holding them releasably in such position, and means comprising intermittent rotary members to release the picker-

stick at one end of the loom to actuate the shuttle only after the picker-stick at the other end is in operative position.

6. In a loom, a reciprocable shuttle, a spring-  
5 controlled picker-stick at each end of the loom for actuating said shuttle, means for forcing back against the spring tension each of said picker-sticks and holding them releasably in such position, and stops for preventing the  
10 actuation of either picker-stick - holding means unless the actuating means for the other picker-stick is in proper position.

7. In a loom, a shuttle, a picker-stick for actuating such shuttle, a spring for operat-  
15 ing said picker-stick, means for forcing said picker-stick into operative position against the tension of the spring, means for holding it releasably in such position, and means for releasing it at regular predetermined inter-  
20 vals, comprising a reciprocating sleeve on the main shaft.

8. In a loom, a shuttle, a spring-controlled picker-stick for actuating such shuttle, a cam for forcing said picker-stick into operative  
25 position against the tension of its spring, means for holding it releasable in such position, and means comprising a reciprocating sleeve on the main shaft for actuating said holding means.

9. In a loom, a shuttle, a spring-controlled picker-stick for actuating such shuttle, a cam for forcing said picker-stick into operative  
30 position against the tension of its spring, means for holding it releasably in such position, and means for periodically actuating said cam.

10. In a loom, a shuttle, a spring-controlled picker-stick for actuating said shuttle, a cam for forcing said picker-stick into operative  
40 position, against the tension of its spring, means for holding it releasable in such position, and a stop for preventing the actuating of said cam except at certain predetermined intervals.

11. In a loom, a shuttle, a spring-controlled picker-stick for actuating such shuttle, a cam loosely carried upon the driving-shaft for forcing said picker-stick into operative position against the tension of its spring, and  
50 means for periodically coupling said cam to such shaft.

12. In a loom, a reciprocable shuttle, a spring-controlled picker-stick at each end of the loom for throwing such shuttle, means  
55 for forcing said picker-sticks into operative position against the tension of their springs, and means for holding them releasably in such position, such forcing means comprising cams loosely mounted upon the driving-  
60 shaft, and means for coupling said cams successively to the driving-shaft, and stops acting with such coupling means whereby each cam may be positively held against motion while the other cam is acting.

13. In a loom, a reciprocating shuttle, a  
65 spring-controlled picker-stick at each end of

the loom for throwing such shuttle, means for forcing such picker-sticks into operative position against the tension of their springs, and means for holding them releasably in such  
70 position, such forcing means comprising cams loosely mounted upon the driving-shaft, means for coupling the cams successively to the driving-shaft, and a connection between such coupling means and the releasing means  
75 for the picker-sticks whereby the picker-stick at one end is released only after the picker-stick at the other end has been forced into operative position.

14. In a loom, a reciprocable shuttle, a  
80 picker-stick at each end of the loom for throwing such shuttle, means for forcing such picker-sticks into operative position and for holding them releasably in such position, means for forcing the picker-sticks back com-  
85 prising cams acting upon such picker-sticks, such cams being loosely mounted upon the driving-shaft, and means for coupling the cams to the driving-shaft, whereby one cam is uncoupled as the other is coupled.

15. In a loom, a reciprocable shuttle, a  
90 picker-stick at each end of the loom for throwing such shuttle, means for forcing such picker-sticks into operative position and for holding them releasably in such position,  
95 means for forcing the picker-sticks back comprising cams acting upon such picker-sticks, such cams being loosely mounted upon the driving-shaft, means for coupling said cams to the driving-shaft whereby one cam is un-  
100 coupled as the other is coupled, and connections between such coupling means and the means for releasing the picker-sticks whereby one cam is coupled to force back its picker-stick, thereupon the releasing means for the  
105 other picker-stick is actuated and next the second cam is coupled to force back the second picker-stick.

16. In a loom, a reciprocable shuttle, a  
110 spring-controlled picker-stick at each end of the loom for throwing the shuttle, spring-pressed catches for holding the picker-sticks in operative position, a driving-shaft, cams loosely mounted upon such driving-shaft for throwing back the picker-sticks, a sleeve ro-  
115 tating with said driving-shaft but movable longitudinally thereof, and means actuated by said sleeve in its longitudinal movement for coupling said cams successively to the driving-shaft.

17. In a loom, a reciprocable shuttle, a  
120 spring-controlled picker-stick at each end of the loom for throwing the shuttle, spring-pressed catches for holding the picker-sticks in operative position, a driving-shaft, cams  
125 loosely mounted upon such driving-shaft, for throwing back the picker-sticks, a sleeve rotating with said driving-shaft but movable longitudinally thereof, means actuated by said sleeve in its longitudinal movement for  
130 coupling said cams successively to the driving-shaft, and connections between such

sleeve and the catches whereby as the cam at either end is uncoupled the picker-stick-releasing means at the other end is actuated.

18. In a loom, a reciprocable shuttle, a spring-controlled picker-stick at each end of the loom for actuating such shuttle, spring-pressed catches for holding the picker-sticks in operative position, a driving-shaft, sleeves loose upon each end of said driving-shaft, cams carried by said sleeves for throwing back the picker-sticks, coupling-pins carried by said sleeves, a sleeve keyed for longitudinal movement midway of said shaft, rods carried rigidly with said sleeve, adapted to contact with the coupling-pins upon said loose sleeves whereby longitudinal movement of said sleeve through contact of said rods and pins couples the loose sleeve at one end and uncouples the one at the other end.

19. In a loom, a reciprocable shuttle, a spring-controlled picker-stick at each end of the loom for actuating such shuttle, spring-pressed catches for holding the picker-sticks in operative position, a driving-shaft, sleeves loose upon each end of said driving-shaft, cams carried by said sleeves for throwing back the picker-sticks, coupling-pins carried by said sleeves, a sleeve keyed for longitudinal movement midway of said shaft, rods carried rigidly with said sleeve adapted to contact with the coupling-pins upon said loose sleeves whereby longitudinal movement of said sleeve through contact of said rods and pins couples the loose sleeve at one end and uncouples the one at the other end, a second cam carried by each loose sleeve, and connections whereby said keyed sleeve is reciprocated through the action of said cams.

20. In a loom, a reciprocable shuttle, a spring-controlled picker-stick at each end of the loom for actuating such shuttle, spring-pressed catches for holding the picker-sticks in operative position, a driving-shaft, sleeves loose upon each end of said driving-shaft, cams carried by said sleeves for throwing back the picker-sticks, coupling-pins carried by said sleeves, a sleeve keyed for longitudinal movement midway of said shaft, rods carried rigidly with said sleeve adapted to contact with the coupling-pins upon said loose sleeves whereby longitudinal movement of said sleeve through contact of said rods and pins couples the loose sleeve at one end and uncouples the one at the other end, a second cam carried by each loose sleeve, connections whereby said keyed sleeve is reciprocated through the action of said cams, and a connection between said keyed sleeve and the releasing means for the picker-sticks whereby one of the picker-sticks is released during each movement of said sleeve in one direction.

21. In a loom, in combination, a shuttle, picker-sticks for actuating such shuttle, a driving-shaft, sleeves 11 carrying the cams 9 and 19 and pins 41, sleeve 26 upon said driving-shaft, rods 40 connected to said sleeve, pivoted lever 20 in the path of said cam 19, and

a connection between said pivoted lever and the sleeve 26, substantially as and for the purposes set forth.

22. In a loom, in combination, a shuttle, picker-sticks for actuating such shuttle, a driving-shaft, sleeves 11 carrying the cams 9 and 19 and pins 41, sleeve 26 upon said driving-shaft, rods 40 connected to said sleeve, pivoted lever 20 in the path of said cam 19, a connection between said pivoted lever and the sleeve 26, and stops 37 operatively connected to said sleeve 26, substantially as and for the purpose described.

23. In a loom, in combination, a shuttle, picker-sticks for actuating said shuttle, a driving-shaft, sleeves 11 loose upon said driving-shaft carrying cams 9 and 19 and coupling-pin 41, sleeve 26 keyed to said driving-shaft for longitudinal movement thereof, rods 40, pivoted lever 20 in the path of cam 19, connections between said pivoted lever and said sleeve 26, spring-catches for said picker-sticks, and connections whereby one of said catches is operated at each movement of the sleeve 26 in one direction, substantially as and for the purpose described.

24. In a loom, in combination, a shuttle, picker-sticks for actuating such shuttle, a driving-shaft, sleeve 11 loose upon said driving-shaft carrying cams 9 19, counterbalancing-weight 17, and coupling-pin 41, sleeve 26 keyed to said driving-shaft for longitudinal movement thereof, rods 40 carried with said sleeve, pivoted lever 20 adapted to be moved in the path of said cam 19, and connections between said pivoted lever and said sleeve 26.

25. In a loom, in combination, a shuttle, picker-sticks for actuating such shuttle, a driving-shaft, sleeve 11 loose upon said driving-shaft carrying cams 9 19, and coupling-pin 41, sleeve 26 keyed to said driving-shaft for longitudinal movement thereof, rods 40 carried with said sleeve, pivoted lever 20 adapted to be moved in the path of said cam 19, connections between said pivoted lever and said sleeve 26, and spring-pressed stops adapted to limit the movement of said loose sleeve when uncoupled from the driving-shaft, substantially as and for the purposes described.

26. In a loom, a shuttle, a picker-stick for actuating such shuttle, a driving-shaft, a sleeve loose upon said driving-shaft, a cam 9 and pin 41 carried by said sleeve, means for interposing a part rigid with said driving-shaft behind said pin to carry said sleeve with said driving-shaft, an arm connected to said picker-stick in the path of said cam, and a braking-surface in the path of said cam adapted to prevent jumping of said cam after it passes the said picker-stick arm.

27. In a loom, a shuttle, a picker-stick for actuating said shuttle, a driving-shaft, a sleeve loose upon said driving-shaft, a cam and pin carried by said sleeve, means for interposing a part rigid with said driving-shaft behind said pin to carry said sleeve with said driving-shaft, an arm connected to said

picker-stick in the path of said cam, and a friction-brake 61 in the path of said cam, substantially as and for the purpose set forth.

28. In combination, a raceway having inwardly-extending track-pieces 72, a shuttle comprising a main frame with shoes 71 projecting below the bottom plane thereof and adapted to run on said track-piece, and picker-sticks for throwing said shuttle, substantially as shown and described.

29. A shuttle comprising a body-piece 70, shoes 71 extending below the bottom of said

body both sides of the center, end projections 74 narrower than the body, and rollers 75 both sides of the projections, substantially as and for the purpose set forth.

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

AZEL C. HOUGH.

Witnesses:

ALONZO HUBBARD,  
BOYD C. GARDNER.