

APPARATUS FOR AUTOMATICALLY EXCHANGING SHUTTLES OF LOOMS.
APPLICATION FILED MAR. 19, 1912.

Patented Apr. 8, 1913.

2 SHEETS—SHEET 1.

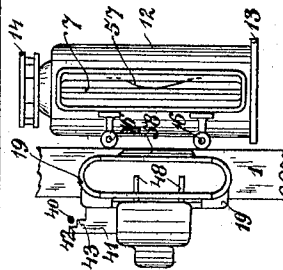
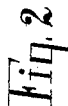


Fig. 6

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 APPARATUS FOR AUTOMATICALLY EXCHANGING SHUTTLES OF LOOMS.
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2 SHEETS—SHEET 2.

Fig. 3

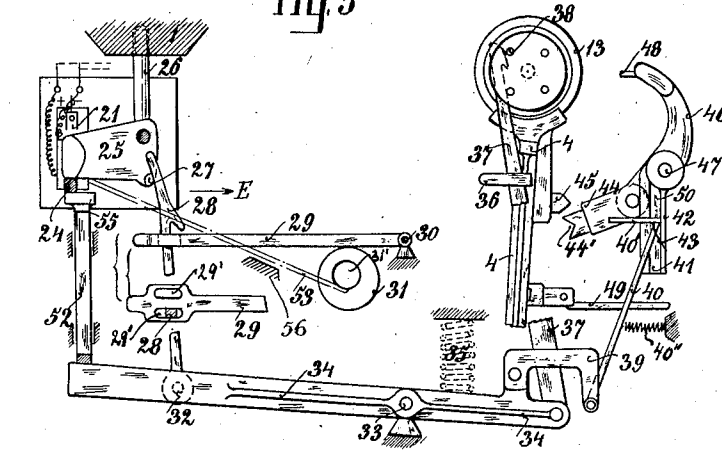


Fig. 4

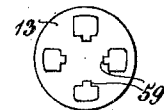
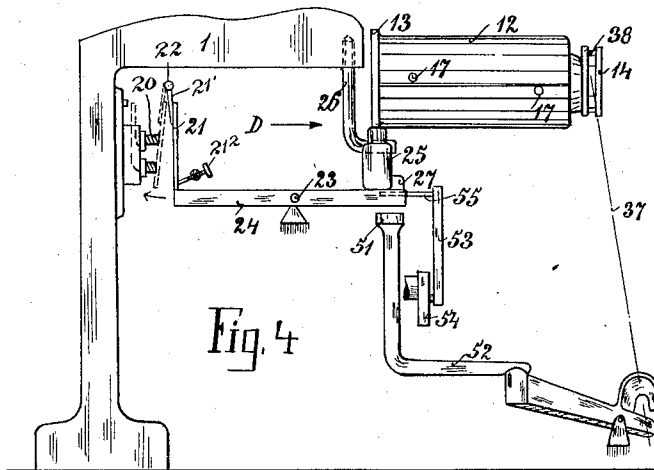


Fig. 5

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APPARATUS FOR AUTOMATICALLY EXCHANGING SHUTTLES OF LOOMS.

1,058,628.

Specification of Letters Patent.

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To all whom it may concern:

Be it known that I, RICHARD ROSENTHAL, a citizen of the German Empire, and residing at Schweidnitz, Silicia, Germany, have
5 invented a certain new and useful Improved Apparatus for Automatically Exchanging Shuttles of Looms, of which the following is a specification.

My invention relates to apparatus for automatically exchanging the shuttles of
10 looms.

A primary object of my invention is to provide apparatus for automatically exchanging the shuttles of looms while the
15 loom is running and thereby obviate this loss of time.

Essential features of my invention are that the exchange takes place without the stoppage of the entire loom and by using
20 an electric weak-current circuit of only a few volts' pressure.

According to my invention, the almost empty shuttle, having exterior contact-plates, itself closes a circuit which contains
25 an electromagnet and, through the medium of transmission mechanism comprising levers and rods, brings about the insertion from a magazine of a freshly filled shuttle into a revolving box, swinging to and fro
30 with the slay, after this box has rotated a quarter revolution likewise owing to the operation of the said transmission mechanism. At the next quarter revolution of the box the chamber containing this new shuttle becomes the highest chamber of the revolving box and is located at the elevation
35 of the shuttle-race, while the spent empty shuttle descends a quarter revolution from its highest position in the box and is laterally ejected and caught, for example, in a basket when the new filled shuttle coming from the magazine is being inserted. All this takes place during the working of the loom without its stoppage being necessary.

One illustrative embodiment of my invention is represented by way of example in the accompanying drawing, wherein:—

Figure 1 is a front elevation of the loom, most of the well-known parts for the motion of the loom being omitted; Fig. 2 is a vertical section taken on the line A—B, and
40 Fig. 3 is a side elevation in the direction of the arrow C in Fig. 1, likewise showing only those parts required for understanding my apparatus; Fig. 4 is a rear elevation
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showing parts of the loom, Fig. 5 is a side elevation of the revolving box as seen in the direction of the arrow D in Fig. 4, and Fig. 6 is a horizontal section taken on the line E—F in Fig. 2.

All the well-known motions and transmission members for operating the loom are either omitted or only diagrammatically indicated for the sake of clearness.

The numeral 1 designates the frame of the
65 loom and 2 the shuttle-race located at the rear thereof at approximately the height of its top edge. The weft is conveyed to the fabric by the slay 3, having the reed; oscillating in well-known manner, the oscillatory motion of the slay and reed being produced in well-known manner by the arms 4 attached on the rock shaft 5. On the right-hand side of the loom is fixed the shuttle box 6 and also the picking-spindle 7, along
70 which the picker 9 is driven in known manner by the striker 8 and drives the shuttle. In Fig. 1 the front wall of the right-hand shuttle-box has been removed in order to show the flap 11 able to rock about the pivot
80 10; this flap is elastic and presses and thus holds the shuttle, resting for a moment in the shuttle-box, against the front stationary wall. In addition, I arrange in the movable flap 11 the contact for the weak-current circuit which is closed by the shuttle when the
85 cop in the shuttle is unwound, which circuit remains closed only as long as the shuttle is within the shuttle box. For the rest of the time the circuit is broken. In Fig. 1
90 the contact is shown connected to the positive pole of the circuit, while the negative pole leads from the electric system directly to the electromagnets 20 (Fig. 4).

The customary left-hand shuttle-box is re-
95 placed by a cylindrical box 12 which is mounted to participate in the reciprocatory motion of the slay and the arms 4. The inside end of this revolving box 12 is covered by a brass plate 13 (Fig. 5) having
100 four apertures corresponding to the four longitudinal chambers of the revolving box for the shuttles which are driven in well-known manner by the picker sliding on the picking spindle 7. The revolving box is
105 supported at one end by the plate 13 and at the other by the disks 14, connected by pegs, which likewise participate in the oscillatory motion of the slay and rotate the revolving box 90° at a time. Two guide rails
110

15 are arranged close above the revolving box in order to prevent the shuttle being lifted out of it. Instead of the rails 15 represented in Fig. 2 straight edges or other
 5 guides may be employed which, however, must be arranged close above the revolving box and be a distance apart less than the breadth of the shuttle, in order that the shuttle is prevented from moving upward.
 10 Attached to the rail or guide bar nearest the magazine 19 are two hooks 16 which are mounted flexibly and elastically in their brackets 16' and prevent the shuttle pressed from the magazine into the revolving box
 15 going back; the four chambers in the revolving box are so designed that the shuttle can readily be moved in them by the blow of the picker whose lower edge is guided in the grooves 59 (Fig. 5).

20 Each two opposite chambers are connected by two pins 17 having countersunk heads which, as shown in Fig. 4, are staggered and serve for ejecting the empty shuttle 18 located to the right-hand in Fig. 2 when
 25 the filled shuttle is inserted from the magazine. The lowest chamber in the revolving box is always empty so that the pins 17 can project into it. Fig. 2 shows the parts in their position at the moment when the slay
 30 moving toward the left is about to force the bottom shuttle out of the magazine, and the revolving box is near the magazine for receiving it. When the shuttle enters into the revolving box the hooks 16 are lifted
 35 somewhat, immediately descend, however, and act as a safety device in front of the shuttle now in the revolving box; the entering shuttle presses the pin 17 to the right and ejects the empty shuttle 18. In order
 40 to hold the new shuttle securely in its proper position I provide means equivalent to the elastic flap 11 which hold the shuttle for a very short time until the striker drives it. To this end in each of the four
 45 chambers of the revolving box a leaf spring 57 facing the magazine is provided (Figs. 2 and 6) and projecting from the magazine toward the revolving box is a tongue 58 which, when the box is swung into close
 50 proximity to the magazine, will enter the chamber facing it and prior to the insertion of a shuttle compress the spring therein.

Now the magazine 19 firmly attached to the frame 1 contains the individual shuttles,
 55 each filled with a cop, placed one over another, of which the hereinafter described mechanism always supplies the lowest to the chamber in the revolving box opposite to it.

60 The exchanging mechanism for the spent shuttle operates as follows:—When the cop contained in the shuttle has run out with the exception of a small portion a contact is closed in the shuttle and the movable flap 11
 65 closes the above-mentioned circuit and the

electromagnets 20 are energized. These electromagnets 20 attract the armature 21, which is secured to a leaf spring 21' fixed to a stationary bolt or pin 22 and normally extending vertically downward. When the
 70 electromagnets are disenergized, the armature 21, owing to the spring force, will be caused to return into normal position or that shown in Fig. 4. The tension of the spring and the movement of the armature
 75 to the right can be regulated in any suitable manner as for instance by a set screw 21². This weight is pivotally mounted by a suitably bent bolt 26 or in other suitable manner on the frame. The weight swings
 80 downward about this bolt as horizontal axis and by means of its projection 27 tilts the hook 28 in the direction of the arrow E, *i. e.* to the right, in Fig. 3. This hook 28 generally runs freely in one of the two slots
 85 29' in the lever 29 which is rocked about the fulcrum pin 30 by a constantly rotating cam 31 of suitable eccentricity. When the hook 28 is moved by the falling weight in the direction of the arrow E it engages
 90 with the oscillating lever 29 and is driven upward. As the hook 28 is pivotally connected by the pivot pin 32 to the main lever 34, which in turn is arranged to rock about the axis 33 mounted in the frame, this lever
 95 34 is correspondingly rocked. After the mechanism just described has been actuated in the described manner the tensioned spring 35 arranged near the axis 33 causes the part of the main lever 34 located to the
 100 right in Fig. 3 to move upward again. To this part is connected the turning hook 37 which slides in a suitable guide 36, engages one of the pins 38 attached to the disks 14 and rotates the same and with it the revolving
 105 box 12 through an angle of 90°. Suitable means may be provided to prevent the revolving box from accidentally exceeding this angle. In Figs. 1, 2 and 4 only the geometrical central line of the hook 37 is in-
 110 dicated in dotted lines.

The main lever 34 is also provided with a bent member 39 (Figs. 2 and 3), to which is connected the rod 40, generally made of
 115 round iron, for starting the exchange motion. This rod 40 slides on a guide board 41 which is rigidly connected to the frame and is in part formed as a vertical rectilinear guide 42 and in part as a guide
 120 43 in the form of an inclined plane or cam face. By means of a spring 40'' attached to the rod 40 this is constantly pressed against one of the two guides 42 or 43. Fig. 3 shows the rest position of the shuttle-exchanging mechanism in which the rod 40
 125 bears in its highest position against the rectilinear guide 42. The horizontal arm 40' of the rod 40 has a projection horizontally directed toward the loom and, in the rest position of the mechanism, ends close
 130

in front of the pressure or thrust member 44, passes under the same, however, and lifts it when the rod 40 slides along the guide 43.

5 When the hook 28 of the lever 34 is lifted the rod 40 slides downward along the smooth vertical guide 42 (Fig. 3) and is placed by its spring onto the guide 43 along which it now rises under the action of the spring 35.

10 As this guide 43 is located nearer to the pressure member 44 than the guide 42, the above-mentioned horizontal projection of the arm 40' bears against this member 44 and lifts it into the position shown in Fig. 2.

15 The pressure member has a notch 44' into which fits a wedge-shaped member 45 rocking to and fro with the slay and the arms 4, whereby the top end of the curved lever 46, pivotally connected with the pressure member 44, executes a rocking motion about the fixedly mounted axis 49 toward the revolving box. This lever 46 carries two pins 48 (Fig. 6) which enter into the magazine and force the bottom shuttle into the opposite empty chamber of the revolving box which, in order to produce the rocking motion of the lever 46, must of course have arrived close to the magazine, so that there is only a very small space between the two.

30 Fig. 2 shows the parts in that position in which the rod 40 has just placed the pressure member 44 exactly horizontal and the wedge-shaped projection 45 has begun to rock the lever 46. When the space normally separating the magazine and revolving box has been moved through by the revolving box moving to the left in Fig. 2, the pins 48 have just placed the bottom shuttle of the magazine into the revolving box, the empty shuttle 18 being ejected by the pins 17 in the above-described manner and the freshly inserted shuttle being locked by the hooks 16 and prevented from falling out. After the rod 40 has moved along the inclined plane 43, in order to return it from under the pressure member into its normal position on the rectilinear guide I secure on the support of the revolving box a tongue 49 (Fig. 3) which, when the support rocks back to the right, lifts the rod 40 from the guide 43 so that it snaps back under the action of the above-mentioned spring onto the upper part of the guide 42; the pressure member can then again take up its downwardly slanting position, shown in Fig. 3, which is limited by a stop 50 which can bear against a projection on the part 41, or can be held in any other suitable manner so that the pressure member 44 does not rock down too low below the horizontal.

60

Now in order to raise the beam 24 and the weight 25 I provide the angle bar 52, having a head 51, which when the main lever 34 is lifted, is also lifted by the hook 28 and consequently returns the beam and weight into

their normal positions. As the electric circuit is already interrupted the armature 21 is no longer attracted by the electromagnet 20, so that it again occupies the position shown in Fig. 4 and the beam 24 is prevented from rocking. When the circuit is subsequently closed the armature 21 will be drawn away from the beam 24 and the latter released for a fresh oscillatory movement, so that the cycle of operations will be repeated.

Now in order to be able to operate the apparatus with weak current of only a few volts' pressure the beam 24 must not press too firmly against the armature 21, so that this can be readily attracted when the electromagnets 20 are only weakly excited. To this end, I provide a thrust rod 53 having a pin 55 for easing the weight 25; this rod is driven by a small cam, eccentric or crank 54 fast on the same shaft as the cam 31 and slides along a guide 56 fast on the frame 1. Whenever the cam-shaft 31' is rotated the pin 55 will lift the weight 25 somewhat and thereby relieve the beam 24, so that the armature 21 can now be readily attracted by the electromagnets. The weight 25 requires to be lifted only a few millimeters, and this can be brought about by suitably selecting the amount of eccentricity of the cam and position of the guide 56. The advantage is thus obtained of being able to work with the same weak current circuit as is used for actuating the weft stop-motion.

The cycle of operations during the exchange of one shuttle takes place between two blows of the striker 8; when the circuit is closed in the right-hand shuttle-box the revolving box 12 has rotated 90° by the time the shuttle which closed the circuit has returned into it. At the next blow of the striker 8 located above the revolving box, a newly filled shuttle will have been taken into work after another shuttle has been placed into the revolving box and the used shuttle bringing about the previous contact has been ejected. If owing to an oversight of the operator, for example, the shuttle freshly taken into work should already be quite or nearly empty, the same cycle of operations will be repeated either at once or after a few blows; the circuit will be closed in the right-hand shuttle-box and exchange take place again without the loom having to be stopped.

I claim:—

1. In a loom, the combination with a shuttle race, of a stationary shuttle box at one end of the race, a magazine for shuttles near the opposite end of the race, a revolving shuttle box adjacent and parallel to said magazine, a weak electric circuit comprising an electromagnet and contact pieces in said stationary shuttle box which contact pieces are adapted to be closed when the cop in the shuttle is unwound and counter-balanced

means controlled by the armature of said electromagnet and means operatively connected to said first named means and adapted on the closure of the electric circuit to impart a fraction of a revolution to said revolving shuttle box and to discharge a filled shuttle from the said magazine into and simultaneously expel the empty shuttle from the said revolving box.

2. In a loom, the combination with a shuttle race, of a stationary shuttle box at one end of the said race, a magazine for shuttles near the opposite end of the said race, a revolving shuttle box adjacent and parallel to said magazine, an electric circuit comprising an electromagnet and contact pieces arranged in the said stationary shuttle box and adapted to be closed when the cop in the shuttle is unwound, a lever, a weighted means controlled by the armature of the said electromagnet and influencing said lever and means operatively connected to the said lever and adapted on the closure of the circuit to impart a fraction of a revolution to the said revolving shuttle box and to discharge a filled shuttle from the said magazine into and simultaneously expel the empty shuttle from the said revolving shuttle box.

3. In a loom, the combination with a shuttle race, of a stationary shuttle box at one end of the said race, a magazine for shuttles near the opposite end of the said race, a revolving shuttle box adjacent and parallel to the said magazine, an electric circuit comprising an electromagnet and contact pieces arranged in the said stationary shuttle box and adapted to be closed when the cop in the shuttle is unwound, a constantly rocking lever, a spring actuated main lever, weighted means controlled by the armature of the said electromagnet for temporarily coupling said first named lever with the said main lever and thereby rocking the latter when the electromagnet is energized and means operatively connected to said main lever and adapted on the closure of the said circuit to impart a fraction of a revolution to said revolving shuttle box and to discharge a filled shuttle from the said magazine into and simultaneously expel the empty shuttle from the said revolving shuttle box.

4. In a loom, the combination with a shuttle race, of a stationary shuttle box at one end of the said race, a magazine for shuttles near the opposite end of the said race, a revolving shuttle box adjacent and parallel to the said magazine, an electric circuit comprising an electromagnet and contact pieces arranged in the said stationary shuttle box and adapted to be closed when the cop in the shuttle is unwound, a constantly rocking lever, a spring actuated main lever, weighted means controlled by the armature of the said electromagnet for temporarily coupling said first named lever with the said main lever

and thereby rocking the latter when the electromagnet is energized, a hook pivoted to said main lever and adapted to engage the said revolving shuttle box to impart thereto on the closure of the said electric circuit a fraction of a revolution and means controlled by said main lever and adapted to discharge a filled shuttle from the said magazine into and simultaneously expel the empty shuttle from the said revolving shuttle box.

5. In a loom, the combination, with a frame having a shuttle-race, a slay rock-shaft journaled in the frame, a magazine for shuttles fixed on the frame near one end of the shuttle-race, a shuttle-box fixed at the other end of the shuttle-race, a support having a projection fast on said rock-shaft, and a revolving box carrying a plurality of pins and having a plurality of chambers rotatably carried by said support in operative relation to and parallel with the magazine, of a low-tension weak-current electric circuit comprising an electromagnet, and contact-pieces in said fixed shuttle-box adapted to be electrically connected together by an empty shuttle; a constantly rocking lever, a spring-pulled main lever, and weighted means controlled by the armature of said electromagnet for temporarily coupling said former lever with said main lever and thereby rocking the latter lever when the electromagnet is energized; a hook pivoted to said main lever and adapted to engage said pins and rotate said revolving-box a part of one revolution, and means controlled by said main lever and driven by said projection for driving the bottom shuttle out of the magazine into a chamber in the revolving box.

6. In a loom, the combination, with a frame having a shuttle-race, a slay rock-shaft journaled in the frame, a magazine for shuttles fixed on the frame near one end of the shuttle-race, a shuttle-box fixed at the other end of the shuttle-race, a support having a projection fast on said rock-shaft, and a revolving box carrying a plurality of pins and having a plurality of chambers rotatably carried by said support in operative relation to the magazine, of a low-tension weak-current electric circuit comprising an electromagnet, and contact-pieces in said fixed shuttle box adapted to be electrically connected together by an empty shuttle; a constantly rotating cam, a lever having a slot rocked by the cam, a spring-pulled main lever, a hook pivoted to the main-lever and passing through said slot, and a pivoted weight controlled by the armature of said electromagnet and coacting with said hook for temporarily coupling said former lever with said main lever and thereby rocking the latter lever when said circuit is closed; a turning hook pivoted to said main lever and adapted to engage said

pins and turn said revolving-box a part of one revolution, and means controlled by said main lever and driven by said projection for driving the bottom shuttle out of the magazine into a chamber in the revolving box.

7. In a loom, the combination, with a frame having a shuttle-race, a slay rock-shaft journaled in the frame, a magazine for shuttles fixed on the frame near one end of the shuttle-race, a shuttle-box fixed at the other end of the shuttle-race, a support having a projection fast on said rock-shaft, and a revolving box carrying a plurality of pins and having a plurality of chambers rotatably carried by said support in operative relation to the magazine, of a low-tension weak-current electric circuit comprising an electromagnet, and contact-pieces in said fixed shuttle box adapted to be electrically connected together by an empty shuttle; a constantly rotating cam-shaft having a cam, a lever having a slot rocked by the cam, a spring-pulled main lever, a hook pivoted to the main lever and passing through said slot, a two-armed lever having one arm normally held by the armature of said electromagnet, and a pivoted weight loading the other arm of the two-armed lever and coacting with said hook for temporarily coupling said former lever with said main lever and thereby rocking the main lever when the armature is removed from the two-armed lever; a turning hook pivoted to said main lever and adapted to engage said pins and turn said revolving-box a part of one revolution, and means controlled by said main lever and driven by said projection for driving the bottom shuttle out of the magazine into a chamber in the revolving box.

8. In a loom, the combination, with a frame having a shuttle-race, a slay rock-shaft journaled in the frame, a magazine for shuttles fixed on the frame near one end of the shuttle-race, a shuttle-box fixed at the other end of the shuttle-race, a support having a projection fast on said rock-shaft, and a revolving box carrying a plurality of pins and having a plurality of chambers rotatably carried by said support in operative relation to and parallel with the magazine, of a low-tension weak-current electric circuit comprising an electromagnet, and contact-pieces in said fixed shuttle-box adapted to be electrically connected together by an empty shuttle; a constantly rocking lever, a spring-pulled main lever, and weighted means controlled by the armature of said electromagnet for temporarily coupling said former lever with said main lever and thereby rocking the latter lever when the electromagnet is energized; a hook pivoted to said main lever and adapted to engage said pins and rotate said revolving-box a part of one revolution; a curved lever mounted to rock at the side of the magazine away from the

revolving box for pushing the bottom shuttle out of the magazine into the revolving box, a thrust member pivotally attached to the curved lever and adapted to coact with said projection and rock the curved lever, and a bent rod pivotally connected to the main lever for causing said thrust member to coact with said projection.

9. In a loom, the combination, with a frame having a shuttle-race, a slay rock-shaft journaled in the frame, a magazine for shuttles fixed on the frame near one end of the shuttle-race, a shuttle-box fixed at the other end of the shuttle-race, a support having a projection fast on said rock-shaft, and a revolving box carrying four pins and having four chambers arranged in pairs one opposite another rotatably carried by said support in operative relation to and parallel with the magazine, of headed pins extending from each chamber into the opposite one, the bottom of each chamber being countersunk for receiving the heads of the pins therein, a low-tension weak-current electric circuit comprising an electromagnet, and contact-pieces in said fixed shuttle-box adapted to be electrically connected together by an empty shuttle; a constantly rocking lever, a spring-pulled main lever, and weighted means controlled by the armature of said electromagnet for temporarily coupling said former lever with said main lever and thereby rocking the latter lever when the electromagnet is energized; a hook pivoted to said main lever and adapted to engage said pins and rotate said revolving-box a part of one revolution, and means controlled by said main lever and driven by said projection for driving the bottom shuttle out of the magazine into a chamber in the revolving box, and thereby ejecting a shuttle out of the opposite chamber.

10. In a loom, the combination, with a frame having a shuttle-race, a slay rock-shaft journaled in the frame, a magazine for shuttles fixed on the frame near one end of the shuttle-race, a shuttle-box fixed at the other end of the shuttle-race, a support having a projection fast on said rock-shaft, and a revolving box carrying four pins and having four chambers arranged in pairs one opposite another rotatably carried by said support in operative relation to and parallel with the magazine, of headed pins extending from each chamber into the opposite one, the bottom of each chamber being countersunk for receiving the heads of the pins therein, two guides arranged longitudinally of the revolving box above the same, and vertically movable, hooks mounted on one of said guides and projecting between the magazine and the revolving box; a low-tension weak-current electric circuit comprising an electromagnet, and contact-pieces in said fixed shuttle-box adapted to

be electrically connected together by an empty shuttle; a constantly rocking lever, a spring-pulled main lever, and weighted means controlled by the armature of said electromagnet for temporarily coupling said former lever with said main lever and thereby rocking the latter lever when the electromagnet is energized; a hook pivoted to said main lever and adapted to engage said pins and rotate said revolving-box a part of one revolution, and means controlled by said main lever and driven by said projection for driving the bottom shuttle out of the magazine into a chamber in the revolving box, and thereby ejecting a shuttle out of the opposite chamber.

11. In a loom, the combination, with a frame having a shuttle-race, a slay rock-shaft journaled in the frame, a magazine for shuttles fixed on the frame near one end of the shuttle-race, a shuttle-box fixed at the other end of the shuttle-race, a support having a projection fast on said rock-shaft, and a revolving box carrying a plurality of pins and having a plurality of chambers rotatably carried by said support in operative relation to and parallel with the magazine, of a low-tension weak-current electric circuit comprising an electromagnet, and contact-pieces in said fixed shuttle-box adapted to be electrically connected together by an empty shuttle; a constantly rocking lever, a spring-pulled main lever, and weighted means controlled by the armature of said electromagnet for temporarily coupling said former lever with said main lever and thereby rocking the latter lever when the electromagnet is energized; a hook pivoted to said main lever and adapted to engage said pins and rotate said revolving-box a part of one revolution; a curved lever mounted to rock at the side of the magazine away from the revolving box for pushing the bottom shuttle out of the magazine into the revolving box, a thrust member pivotally attached to the curved lever and adapted to coact with said projection and rock the curved lever, a guide board having a vertical rectilinear guide and a slanting guide, and a spring-pulled bent rod pivotally connected to the main lever and guided by said slanting guide to pass under the thrust member, and a tongue mounted on said support for removing said rod from the slanting guide onto the vertical guide.

12. In a loom, the combination, with a frame having a shuttle-race, a slay rock-shaft journaled in the frame, a magazine for shuttles fixed on the frame near one end of the shuttle-race, a shuttle-box fixed at the other end of the shuttle-race, a support having a projection fast on said rock-shaft, and a revolving box carrying a plurality of pins and having a plurality of chambers rotatably carried by said support in operative

relation to the magazine, of a low-tension weak-current electric circuit comprising an electromagnet, and contact-pieces in said fixed shuttle box adapted to be electrically connected together by an empty shuttle; a constantly rotating cam-shaft having a cam, a lever having a slot rocked by the cam, a spring-pulled main lever, a hook pivoted to the main lever and passing through said slot, a two-armed lever having one arm normally held by the armature of said electromagnet, and a pivoted weight loading the other arm of the two-armed lever and coacting with said hook for temporarily coupling said former lever with said main lever and thereby rocking the main lever when the armature is removed from the two-armed lever; an angle-bar adapted to be lifted by the main lever, to rock the two-armed lever, lift the loaded arm and depress the former arm under the armature; a turning hook pivoted to said main lever and adapted to engage said pins and turn said revolving-box a part of one revolution, and means controlled by said main lever and driven by said projection for driving the bottom shuttle out of the magazine into a chamber in the revolving box.

13. In a loom, the combination, with a frame having a shuttle-race, a slay rock-shaft journaled in the frame, a magazine for shuttles fixed on the frame near one end of the shuttle-race, a shuttle-box fixed at the other end of the shuttle-race, a support having a projection fast on said rock-shaft, and a revolving box carrying a plurality of pins and having a plurality of chambers rotatably carried by said support in operative relation to the magazine, of a low-tension weak-current electric circuit comprising an electromagnet, and contact-pieces in said fixed shuttle-box adapted to be electrically connected together by an empty shuttle; a constantly rotating cam-shaft having a cam, a lever having a slot rocked by the cam, a spring-pulled main lever, a hook pivoted to the main lever and passing through said slot, a two-armed lever having one arm normally held by the armature of said electromagnet, and a pivoted weight having a projection loading the other arm of the two-armed lever and coacting with said hook for temporarily coupling said former lever with said main lever and thereby rocking the main lever when the armature is removed from the two-armed lever; an angle-bar adapted to be lifted by the main lever, to rock the two-armed lever, lift the loaded arm and depress the former arm under the armature; a rod driven by the cam-shaft and bearing under the projection of said weight for easing the same; a turning hook pivoted to said main lever and adapted to engage said pins and turn said revolving-box a part of one revolution, and

means controlled by said main lever and driven by said projection for driving the bottom shuttle out of the magazine into a chamber in the revolving box.

5 14. In a loom, the combination, with a frame having a shuttle-race, a slay rock-shaft journaled in the frame, a magazine for shuttles fixed on the frame near one
10 end of the shuttle-race, a shuttle-box fixed at the other end of the shuttle-race, a support having a projection fast on said rock-shaft, and a revolving box carrying a plu-
15 rality of pins and having a plurality of chambers rotatably carried by said support in operative relation to and parallel with
20 the magazine, of a flap carrying two contact-pieces pivotally mounted in the fixed shuttle-box, said contact-pieces being adapted to be connected by an empty shuttle, and
25 a low-tension weak-current electric circuit comprising an electromagnet, and said contact-pieces; a constantly rocking lever, a spring-pulled main lever, and weighted
30 means controlled by the armature of said electromagnet for temporarily coupling said former lever with said main lever and thereby rocking the latter lever when the
35 electromagnet is energized; a hook pivoted to said main lever and adapted to engage said pins and rotate said revolving-box a part of one revolution, and means controlled by said main lever and driven by said projection for driving the bottom shuttle out of the magazine into a chamber in the revolving box.

15. In a loom, the combination, with a frame having a shuttle-race, a slay rock-shaft journaled in the frame, a magazine

for shuttles fixed on the frame near one end of the shuttle-race, a shuttle-box fixed 40 at the other end of the shuttle-race, a support having a projection fast on said rock-shaft, and a revolving box carrying a plurality of pins and having a plurality of 45 chambers rotatably carried by said support in operative relation to and parallel with the magazine, of a low-tension weak-current electric circuit comprising an electromagnet, and contact-pieces in said fixed shuttle-box adapted to be electrically connected together 50 by an empty shuttle; a constantly rocking lever, a spring-pulled main lever, and weighted means controlled by the armature of said electromagnet for temporarily coupling said former lever with said main lever 55 and thereby rocking the latter lever when the electromagnet is energized; a hook pivoted to said main lever and adapted to engage said pins and rotate said revolving-box a part of one revolution, and means controlled 60 by said main lever and driven by said projection for driving the bottom shuttle out of the magazine into a chamber in the revolving box; a leaf spring in each chamber of the revolving box for friction- 65 ally securing a shuttle therein, and a tongue pivoted on the magazine for depressing the spring in the chamber nearest to the magazine when a shuttle is being inserted in this chamber. 70

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

RICHARD ROSENTHAL.

Witnesses:

LOUIS H. KATZ,
ERNST BLEIORT.