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2,696,840

SHUTTLE AND SHUTTLE-OPERATING MECHANISM FOR LOOMS

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Fig. 1.

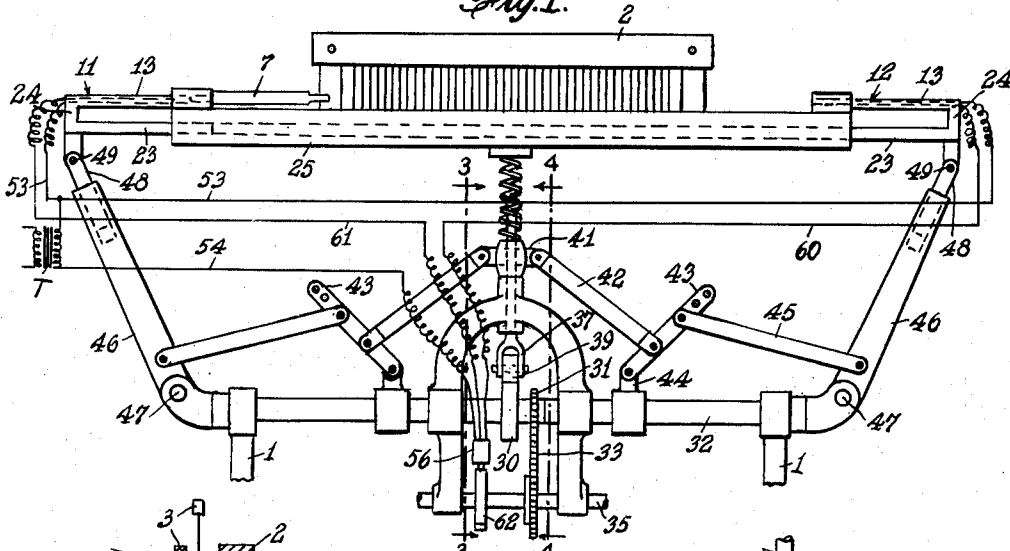
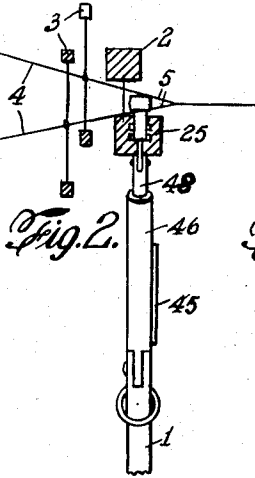


Fig. 3.

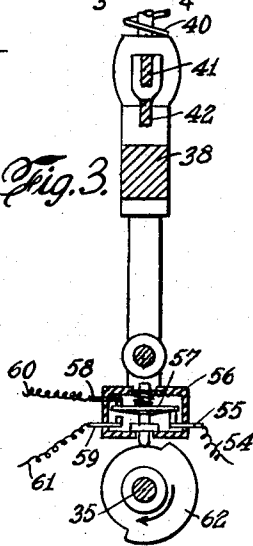


Fig. 4.

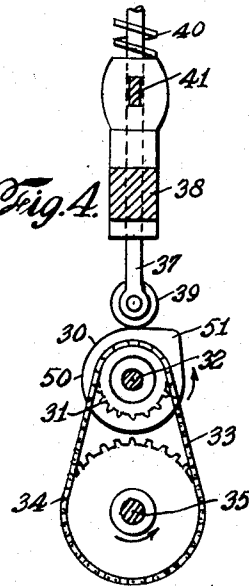


Fig. 5.

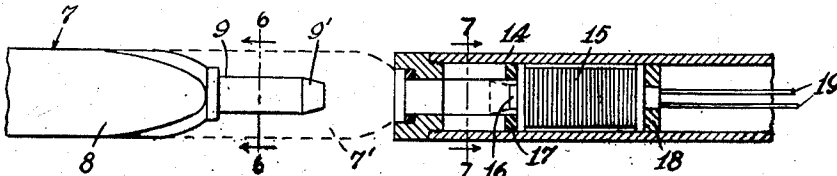


Fig. 6.

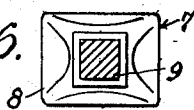
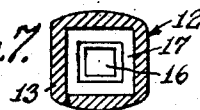


Fig. 7.



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SHUTTLE AND SHUTTLE-OPERATING MECHANISM FOR LOOMS

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1 Claim. (Cl. 139—134)

The present invention relates to looms and particularly to shuttles and shuttle-operating mechanisms for looms.

A loom customarily comprises a reed dividing the warp threads, shedding mechanism for raising and lowering selected warp threads in a predetermined sequence so as to form two lines between which the weft may be passed, picking mechanism for placing lines of weft between the divided warp and beating-up mechanism for striking the weft thread into its proper position after it has been laid between the warp threads. In a conventional loom, the picking mechanism comprises shuttle boxes at opposite ends of the shed and means for projecting or throwing a shuttle from one box and catching it in the other. This continual throwing and catching of the shuttle involves continual wear and tear. There is necessarily a considerable amount of shock and also considerable friction of the shuttle against the reeds and the warp threads. Moreover, there is the danger of accidents caused, for example, by the shuttle flying out of the shed.

It is an object of the present invention to overcome these disadvantages of present looms and to provide a smoother-working and safer picking mechanism. In accordance with the invention, the shuttle is not thrown through the shed but is passed back and forth between two reciprocating carriers having elongated portions that enter the shed from opposite ends. The shuttle is handed back and forth from one carrier to the other and is hence always held by one or the other carrier. The carriers are provided with electromagnetic means for holding the shuttle, the latter being made wholly or partly of magnetic material. The electromagnetic holding means of the respective carriers is automatically controlled so that, at the proper time, the holding means of one carrier is energized and that of the other carrier is simultaneously deenergized so that the shuttle is transferred from one carrier to the other.

The objects, characteristics and advantages of the invention will be more fully understood from the following description and claim in conjunction with the accompanying drawings which illustrate by way of example a preferred embodiment. In the drawings:

Fig. 1 is an elevation of a loom in accordance with the invention taken in a direction parallel to the warp threads, portions of the loom not directly pertinent to the invention being omitted for the sake of clarity.

Fig. 2 is a partial end view of the mechanism shown in Fig. 1.

Figs. 3 and 4 are sections taken, respectively, on the lines 3—3 and 4—4 in Fig. 1.

Fig. 5 is an enlarged view, partially in longitudinal section, showing a portion of a shuttle and an adjacent portion of one of the carriers.

Figs. 6 and 7 are cross sections taken, respectively, on lines 6—6 and 7—7 in Fig. 5.

The loom shown by way of example in the drawings has a supporting structure or frame, portions of which are designated 1, and a reed 2 for separating the warp threads. Shedding mechanism is illustrated schematically as healds 3, it being understood that, in accordance with available practice, more complicated shedding mechanism may be used. The warp threads 4 are thereby divided to form a shed 5 for passage of a shuttle carrying weft thread.

A shuttle 7 is shown on a larger scale in Figs. 5 and 6 and comprises a body portion 8 suitably formed to receive a cop of weft thread (not shown). At its opposite

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ends, the shuttle is provided with reduced end portions 9 which are preferably of rectangular or square cross section, as illustrated in Fig. 6. At least the end portions 9 of the shuttle are formed of magnetic material such as iron, for example iron of the kind used for magnet cores and relay armatures. It will be understood that the body portion 8 of the shuttle may, if desired, also be made of magnetic material but this is not necessary and it is hence permissible to use other material such as wood, plastic or aluminum. Moreover, it is not necessary for the entire projecting end portion 9 to be formed of magnetic material, providing there is a substantial tip portion 9' that is magnetic.

The shuttle 7 is carried back and forth through the shed 5 by means of two cooperating reciprocating carriers 11 and 12 (Fig. 1). As the two carriers 11 and 12 are alike although oppositely disposed, a description of one of them will suffice. Each of the reciprocable carriers has an elongated arm 13 the length of which is equal, or somewhat greater than, half the length of the shed minus half the length of the body portion 8 of the shuttle. The arms 13 are of small cross section, preferably of no greater cross section than the shuttle, so that they can readily enter the shed 5 when reciprocated in a lengthwise direction. At its inner end, i. e. the end pointing toward the central vertical plane of the loom, the elongated arm 13 is provided with means for holding the shuttle 7. As illustrated in the drawings, the inner end of the arm 13 is provided with a socket 14 adapted to receive the projecting end portion 9 of the shuttle when the shuttle is in the position indicated by dotted lines 7' in Fig. 5. Immediately adjacent the socket 14, there is provided an electromagnetic coil 15 which, when energized, is adapted to attract the magnetic projecting end portion 9 of the shuttle in order to hold said end portion in the socket 14 and thereby hold the shuttle 7 securely at the end of, and in alignment with, the elongated arm 13. The electromagnet 15 is preferably provided with an iron core 16 and is resiliently mounted inside the arm 13 by means of a rubber washer 17 and rubber seat 18. Current is supplied to the electromagnet 15 by means of beads 19 which extend back through the arm 13.

Means is provided for mounting the carriers 11 and 12 at opposite ends of the shed 5 so as to reciprocate toward and away from one another with the elongated arms 13 in mutual alignment. As illustrated in the drawings, the carriers 11 and 12 are U-shaped, with arms 23 paralleling the aforementioned elongated arms 13 and connected thereto at their outer ends by portions 24. The arms 23 are slidable in a guideway 25 which is parallel to the elongated arms 13 and to the desired path of movement of the shuttle. The guideway 25 is suitably supported by the frame of the machine and lies underneath the shed. The U-shaped carriers 11 and 12 are thus reciprocally supported and guided by the guideway 25 so as to reciprocate toward and away from one another with the elongated arms 13 maintained in alignment with the desired path of shuttle movement.

Means is provided for reciprocating the carriers 11 and 12 in coordination with one another. The carriers are moved in opposite directions, being moved toward one another from the position shown in Fig. 1 and then away from one another. When the carriers are in their innermost positions, the shuttle 7 is approximately midway between the ends of the shed and both carriers are in engagement with the shuttle, the projecting portion 9 at one end of the shuttle being received in the socket portion 14 of one carrier and the corresponding projection at the opposite end of the shuttle being received in the socket portion 14 of the other carrier. In their outermost positions, the arms 13 of the carrier are spaced from the ends of the shed a sufficient distance that the shuttle held by one of the carriers is outside the shed and hence does not interfere with the reselection of the warp threads prior to the next passage of the shuttle. Each time the carriers come together in their innermost positions, the shuttle is transferred from one carrier to the other, as will be described more fully below, so that, starting from the position shown in Fig. 1, the shuttle 7 is first carried to a central position by the carrier 11, then

transferred to the carrier 12 and brought out to the right hand end of the shed. On the next reciprocation of the carriers, the shuttle is carried to central position by the carrier 12 and there transferred to the carrier 11 which returns it to the position shown in Fig. 1, thereby completing a cycle.

Suitable means is provided for reciprocating the carriers 11 and 12 as described above. As illustrated by way of example in the drawings, the reciprocating mechanism comprises a cam 30 which is fixed to, and rotatable with, a sprocket 31 on a stationary shaft 32. The sprocket 31 is driven by a chain 33 from a sprocket 34 on a shaft 35 driven by suitable power means (not shown). The diameter of the sprocket 31 is half that of the sprocket 34 so that the sprocket 31, and hence the associated cam 30, are driven at twice the speed of the power shaft 35. The cam 30 is engaged by a cam follower 37 shown in the form of a longitudinally reciprocable plunger slidably guided by a bracket 38 and carrying a roller 39 that engages the cam 30. The cam follower 37 reciprocates in a direction perpendicular to the shaft 32 and is urged toward the cam 30 by a relatively strong compression spring 40.

The cam follower 37 has oppositely projecting arm portions 41 which are connected by links 42 to levers 43 pivotally supported by brackets 44 mounted on the stationary shaft 32 on opposite sides of the cam 30. The levers 43 are, in turn, connected by links 45 to swinging arms 46 which are pivotally supported at 47 at opposite ends of the shaft 32. At their outer ends, the arms 46 are provided with telescopically slidable extensions 48 which are pivotally connected to the carriers 11 and 12, as indicated at 49. The levers 43 and swinging arms 46 act as third-class levers so that the movement of the cam follower 37 is amplified. The telescopically slidable extensions 48 provide transition from the swinging movement of arms 46 to the rectilinear reciprocatory movement of the carriers 11 and 12. When the cam follower 37 moves upwardly, as viewed in Fig. 1, the carriers 11 and 12 are moved inwardly from the positions shown.

The cam 30 has a concentric dwell portion 50 (Fig. 4) for about 270° of its circumference and a projecting nose portion 51 in the remaining 90°. Hence, as the cam 30 rotates, for example in a counterclockwise direction as viewed in Fig. 4, the carriers 11 and 12 will be moved inwardly to their inner positions during the first 45° of rotation of the cam, will return to their outer positions under the action of the spring 40 during the next 45° and will remain in their outer positions during the next 270°. This provides ample time for operating the healds to change the selection of warp threads.

The electrical circuit controlling the electromagnets 15 of the carriers 11 and 12 is shown schematically in Fig. 1. One lead of a suitable power supply, which may, for example, be a battery or rectifier but is shown as a transformer T, is connected by leads 53 to the electromagnets of both carriers. The other terminal is connected by a lead 54 to the common terminal 55 of a two-way switch 56 (Fig. 3). The switch 56 has an armature 57 that is movable between two positions so as to connect the terminal 55 with one or another of two terminals 58 and 59 connected, respectively, to the other leads of the two electromagnets by conductors 60 and 61. The switch 56 is operated in timed relation with the reciprocation of the carriers 11 and 12 so that the armature 57 is moved from one position to the other each time the carriers come together in their inner positions. As illustrated in the drawings, the switch is actuated by a cam 62 on the aforementioned shaft 35 (Fig. 1). The cam 62 has a concentric lower portion for 180° of its circumference and a concentric higher portion for the remaining 180° so that the common terminal 55 is connected to the terminal 59 of the switch during half a revolution and to the terminal 58 during the other half revolution of the cam. Since the shaft 35 runs at half the speed of the cam 30 that actuates the carriers 11 and 12, the electromagnet 15 of one carrier is energized during the

half cycle that it carries the shuttle while the electromagnet of the other carrier is energized during the other half cycle. The cam 62 actuating the switch 56 is synchronized with the cam 30 actuating the carriers so that one electromagnet is deenergized and the other is energized each time the carriers come together in their inner positions. Hence, a transfer of the shuttle from one carrier to the other is thereby effected.

The operation of the loom will be readily understood from the foregoing description. In the position shown in Fig. 1, the electromagnet of carrier 11 is energized so as to hold the shuttle 7. When the carriers move in to their inner positions, the right hand end portion of the shuttle will be received in the socket portion 14 of carrier 12. The electromagnet of carrier 11 is thereupon deenergized and that of carrier 12 is energized so as to transfer the shuttle from carrier 11 to carrier 12. The shuttle is then brought out of the right hand end of the shed by carrier 12. When the carriers are again moved to their inner positions, the shuttle is transferred back to carrier 11 by deenergizing the electromagnet of carrier 12 and energizing that of carrier 11; whereupon the shuttle is returned to the position shown in Fig. 1 when the carriers again move to their outer positions.

While only one shuttle and a single set of carriers have been shown, it will be understood that the mechanism may be duplicated in order to provide two or more shuttles. It will also be understood that the loom is provided with suitable beating-up, letting off and taking up mechanism, etc. in accordance with recognized loom practice, these parts having been omitted from the drawings in order to simplify them. While a preferred embodiment of the invention has been shown by way of example in the drawings, the invention is in no way limited to the specific form particularly shown and described.

What I claim and desire to secure by Letters Patent is:

In a loom, means for dividing the warp threads to form a shed, a shuttle having end portions formed of magnetic material, two reciprocable carriers having elongated arm portions adapted to enter the shed and having at their ends means for receiving and holding the shuttle by its magnetic end portions, said holding means including an electromagnet adapted to attract and thereby hold the magnetic end portion of the shuttle when the electromagnet is energized, operating mechanism comprising a rotating shaft, a cam on said shaft, a cam follower reciprocated by said cam when said shaft rotates, linkage connecting said cam follower with both of said carriers to reciprocate said carriers between an outer position in which both carriers and the shuttle are clear of the shed and an inner position in which the shuttle is approximately at the middle of the shed and both carriers are in engagement with the shuttle, means for supplying electric current to energize said electromagnets including switch means movable from one position in which current is supplied to one of said electromagnets and a second position in which current is supplied to the other of said electromagnets, a cam on said rotating shaft for moving said switch means from one position to the other in timed relation with the reciprocation of said carriers so that one electromagnet is energized during a half cycle while the carriers move from the inner position to the outer position and back to the inner position and the other electromagnet is energized during the succeeding half cycle while the carriers move from the inner position to the outer position and back to the inner position, the shuttle being thereby carried by one carrier during the first half cycle and by the other carrier during the next half cycle.

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