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Nov. 1, 1938. P. B. WILSON 2,135,373

MAGNETIC LOOM

Filed July 6, 1936 4 Sheets-Sheet 1

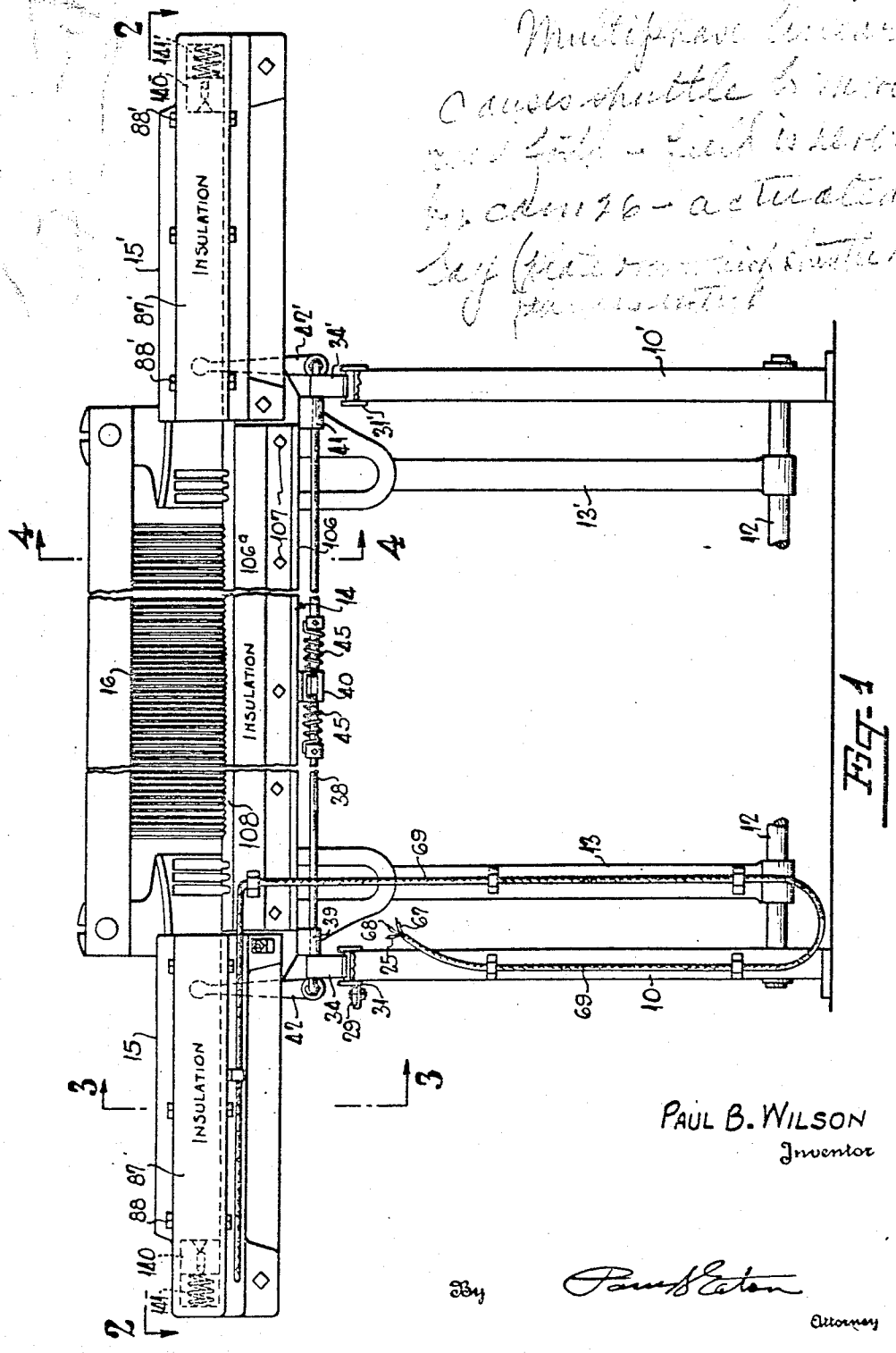


FIG-1

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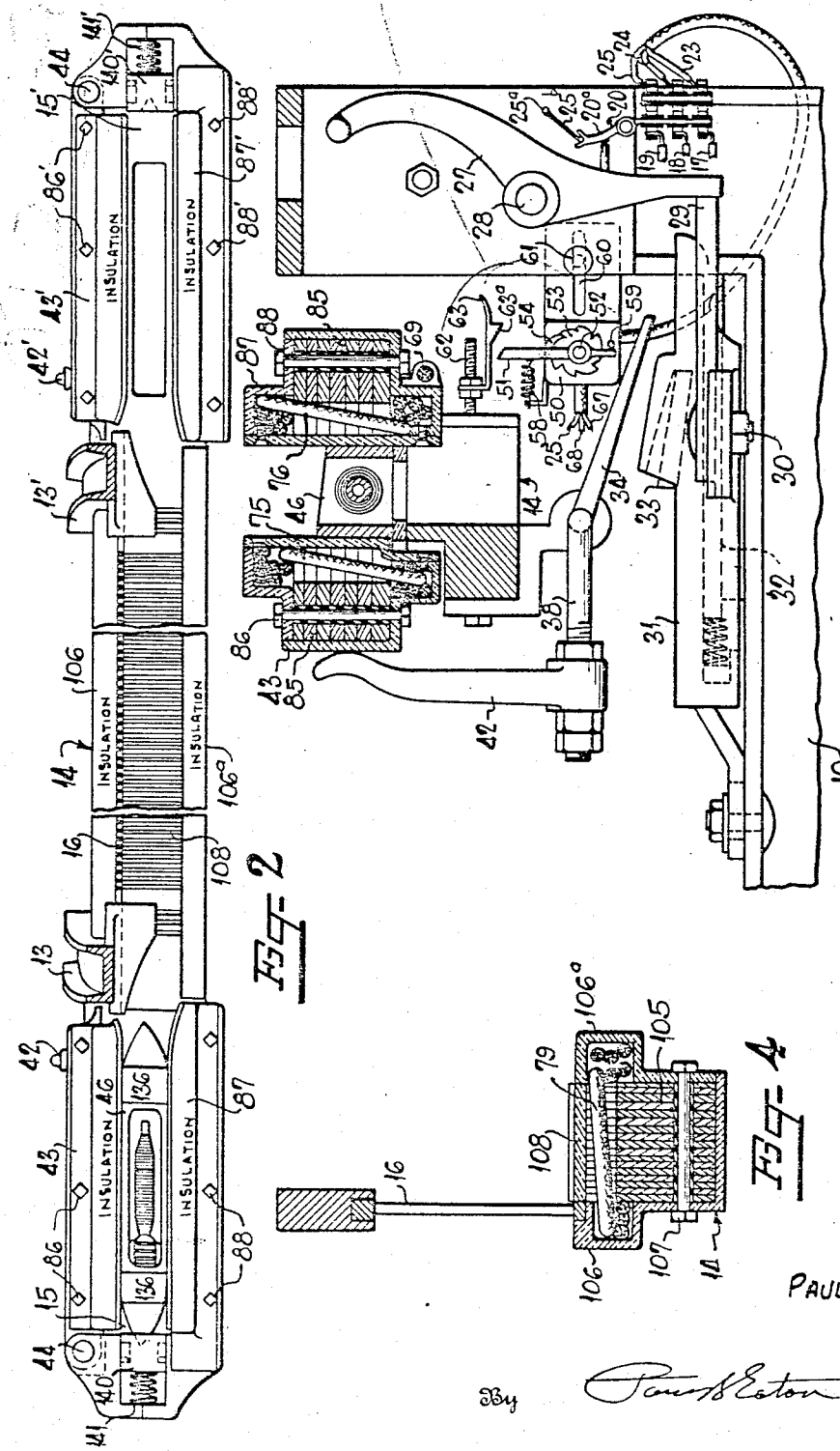


Fig. 2

Fig. 3

Fig. 4

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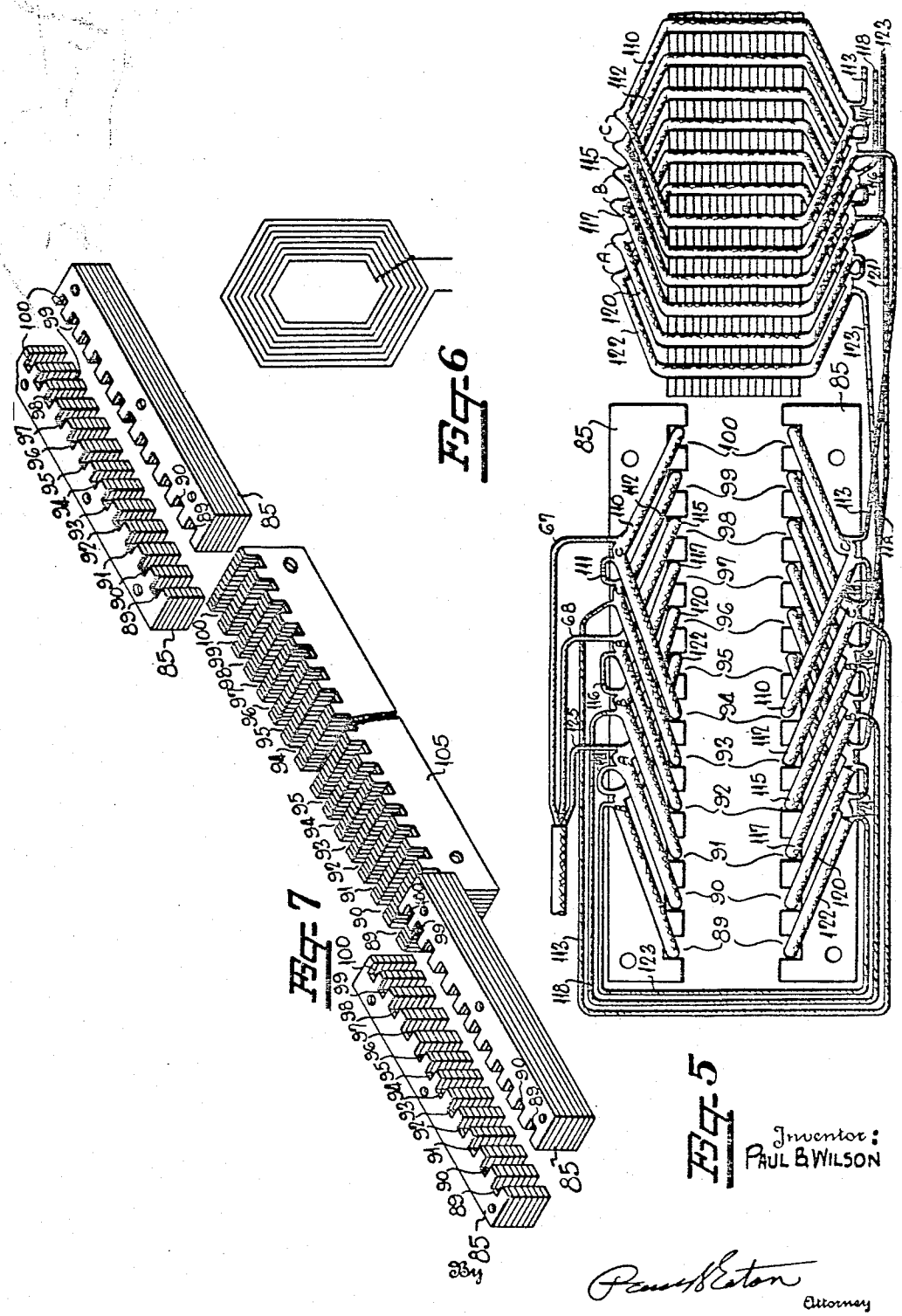


Fig-6

Fig-7

Fig-5

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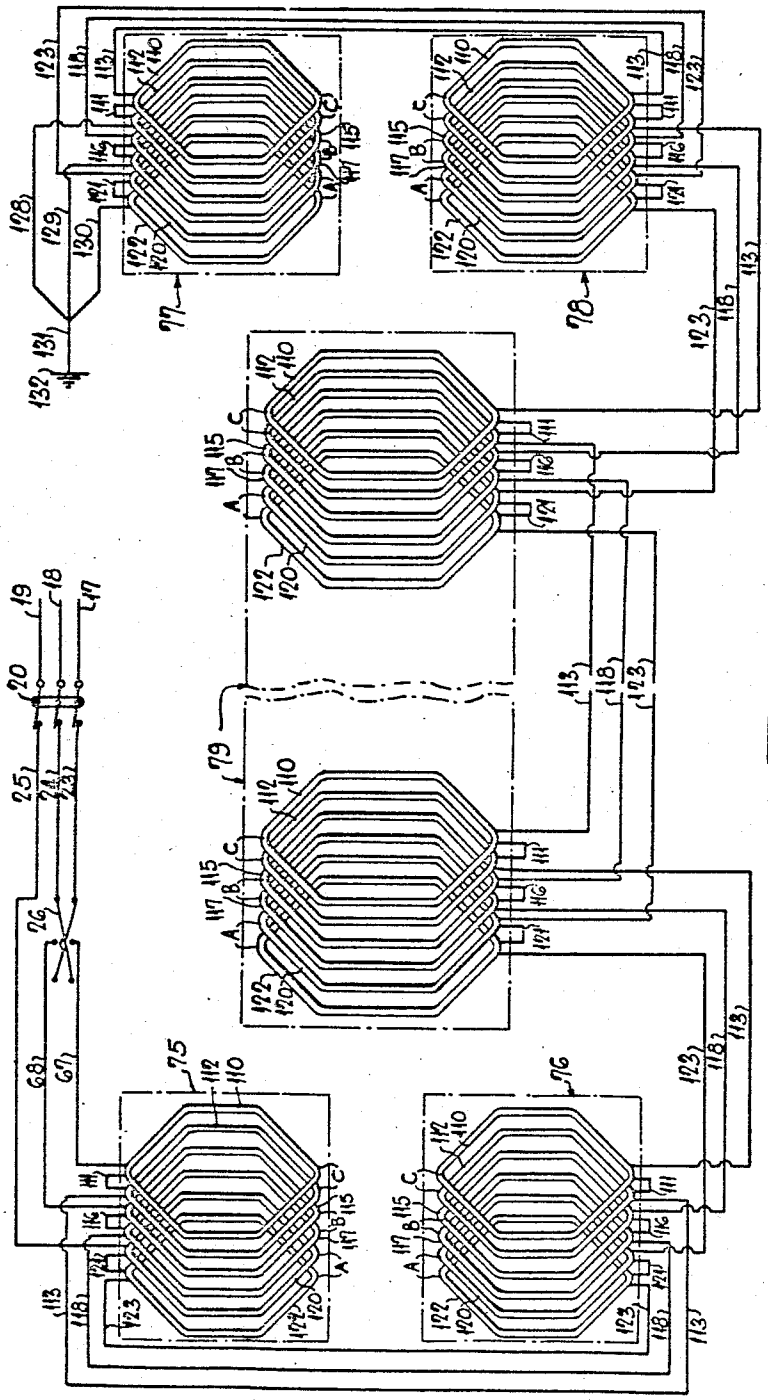


Fig. 8

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MAGNETIC LOOM

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Application July 6, 1936, Serial No. 89,101

2 Claims. (Cl. 139—134)

This invention relates to a shuttle actuating mechanism for looms and more particularly to the application of a three phase alternating current winding in the lay of a loom in such a manner that the current in the winding will set up a magnetic flux in the shuttle to cause the same to be moved. When a suitable winding is placed in the lay of the loom, similar to the commonly known winding in a squirrel-cage motor and the current is introduced into this winding, the magnetic action of this current induces an opposing current in a suitable short circuited copper band around the shuttle and the reaction between the two currents drives the shuttle across the loom. In other words, the circulating current induced in the copper bands around the shuttle sets up a magnetic field in opposition to the stator field and gives the shuttle a resulting force in a direction parallel to the stator winding and at a right angle to the stator flux.

The winding in the lay of the loom corresponds to the stationary magnetic field in a standard squirrel-cage motor, whereas, the copper bands around the shuttle correspond to the rotor in said motor.

It is, therefore, an object of this invention to provide a suitable winding in the lay of a loom for using alternating current and thereby, make it possible to obtain a positive moving field at all times which will impel the shuttle back and forth across the lay of the loom.

It is a further object of this invention to provide a suitable reversing switch in the electrical hook-up which is operated by the movement of the lay to reverse the current and cause the constantly moving magnetic field to be reversed to throw the shuttle in the opposite direction. This reversal of force drives the shuttle back across the loom and the operation is repeated for every pick of the loom. The speed of the shuttle can be adjusted by varying the frequency of the alternating current.

It is a further object of this invention to provide an electrical hook-up adapted to receive alternating current for propelling a shuttle back and forth across the loom with means for reversing said current before the shuttle has reached the end of the lay, thereby, providing a magnetic brake for stopping the shuttle and reversing its direction of travel. By making this reversing switch adjustable it is possible to eliminate check straps and the like, which are necessary in the conventional loom for arresting the shuttle at the proper time.

Some of the objects of the invention having been stated, other objects will appear as the description proceeds when taken in connection with the accompanying drawings, in which:—

Figure 1 is a front elevation of portions of a loom showing the invention applied thereto;

Figure 2 is a sectional plan view taken along the line 2—2 in Figure 1;

Figure 3 is a transverse sectional view taken along the line 3—3 in Figure 1;

Figure 4 is a transverse sectional view taken along the line 4—4 in Figure 1;

Figure 5 is a plan view of the left-hand end of the lay of the loom showing the windings and their relation to the laminated plate structure;

Figure 6 is a schematic view showing the windings in each of the coils shown in Figure 5;

Figure 7 is an isometric view showing the laminated structure with slots therein which are adapted to receive the three phases of alternating current winding;

Figure 8 is a schematic wiring diagram of the invention.

Referring more specifically to the drawings, the numerals 10 and 10' indicate suitable end frames of a loom. In the lower portion of the loom there is mounted for oscillation a suitable rocker shaft 12. Fixedly secured to shaft 12 are swords 13 and 13' which have mounted on the upper ends thereof a suitable lay broadly indicated by the reference character 14 which has secured to its ends shuttle boxes 15 and 15' for receiving the shuttle and expelling it therefrom in its reciprocatory movement across the loom. Secured to the upper portion of the lay of the loom and at the central portion thereof is a conventional reed 16 through which the warp is drawn.

In the regular operation of the loom the lay oscillates back and forth about the rocker shaft 12 while the shuttle in the lay of the loom moves longitudinally on the lay to carry the filling back and forth through the warp. Heretofore, it has been necessary to provide suitable picker sticks at each end of the lay for imparting to the shuttle the necessary inertia to cause it to be thrown back and forth across the loom.

This invention provides a standard alternating current winding in the lay of the loom for obtaining a positive moving field which will carry the shuttle across the loom in one direction and means for reversing the direction of this field at the proper time are also provided to cause the shuttle to be carried in the opposite direction.

In order to furnish the necessary current for the operation of the device, to be hereinafter described, suitable lead-in wires 17, 18 and 19

are connected to one side of a suitable switch 20 for supplying the current. These wires normally contact wires 23, 24 and 25 respectively which lead to reversing switch 26 located in switch box 50. The switch 20 is normally held in closed position by any suitable means such as a flexible leaf spring 25b pivoted as at 25a to the side of the loom frame 10 and which has its lower end normally pressing into the forked upper end of switch arm 20a.

Since the spring 25 is flexible the switch arm 20a can be rotated by the shipper lever 27 which is pivoted as at 28 to the loom frame, when suitable means are actuated for stopping the loom. The shipper lever 27 operates a suitable shipper rod, not shown, when a shuttle has been improperly boxed in the loom, and the lower end of lever 27 is normally contacted by bar 29 which is secured as at 30 to frog 31. This frog is slidably mounted on guideway 32 which is integral with the frame of the loom. The frog has mounted in the central portion thereof a piece of frog steel 33 which is adapted to be engaged at times by dagger 34 to push the frog 31 to the right in Figure 3 and to thereby cause the lever 27 to be rotated in a counter-clockwise manner. This movement will actuate the switch lever 20a to break the contact between the wires 17, 18 and 19 and the wires 23, 24 and 25 respectively.

However, it should be stated that in normal operation of the loom the free end of dagger 34 does not contact the frog steel 33 and therefore the switch 20 normally remains closed. The dagger 34 is fixedly secured to one end of protector rod 38, which rod is rotatably mounted in bearings 39, 40 and 41. The other end of rod 38 has a dagger 34' identical to dagger 34 secured thereto which operates another frog 31' which is similar to frog 31.

The rod 38, at each end thereof is bent rearwardly of the lay and has secured on the bent portions suitable levers 42 and 42' which extend upwardly and contact the back of pivoted binders 43 and 43', said binders being pivoted at 44 and 44' to the lay 14. Suitable torsion springs 45 normally press the upper end of levers 42 and 42' against their respective binders.

It is evident that when a shuttle 46 is disposed within either shuttle box of 15 or 15' that the binder will not be allowed to pivot laterally after it has engaged the shuttle which might be disposed in either box. Since this is the case the lower end of dagger 34 will be held in an elevated position where it will not be allowed to contact the frog steel 33 to operate suitable mechanism to cut off the current and stop the loom if the shuttle is properly boxed at each pick of the loom.

Should the shuttle fail to box properly then the pivoted binders would be allowed to move inwardly far enough to allow the clockwise rotation of protector rod 38 so that the lower end of dagger 34 would engage the frog steel 33 and operate the loom stopping mechanism when the lay oscillates toward the front of the loom.

Reversing switch 26 is located in a suitable box 50 which has pivotally secured thereto a lever 51, said lever 51 being loosely mounted on the shaft 52 and having secured thereto a suitable pawl 54 which engages the teeth in ratchet 53. The ratchet 53 operates the reversing switch. Each time the pawl moves the ratchet a pre-determined distance the switch 26 is reversed.

A tension spring 58 normally holds the lower end of lever 51 against a suitable stop 59. The switch box 50 has a suitable slot 60 therein which is penetrated by a bolt 61 for holding the box in adjustable position with relation to the lay of the loom. The lay 14 also has projecting therefrom a suitable threaded bolt 62 upon which is secured a flexible hook member 63, said hook member being adapted to engage the upper end of lever 51 on the forward travel of the lay and cause the lever 51 to be rotated in a clockwise manner to reverse the switch 26 in box 50. It should be noted that this member 63 has a cam surface 63a on the free end thereof which is allowed to contact cam surface on the upper end of lever 51 and allow the member 63 to spring over the upper end of lever 51 on the rearward travel of the lay of the loom.

It can be seen by observing Figure 3, that on the forward travel of the lay, that is, the travel to the right, that the hook member 63 will engage the upper end of lever 51 and cause the lever to be actuated. The position of member 63 with relation to lever 51 can be adjusted by manipulating the nuts which hold the member 63 on bolts 62. Another adjustment can be obtained by varying the position of box 50. The switch box 50 is so located with relation to the member 63 that the switch will be actuated to cause the current to be reversed just as the shuttle enters one of the shuttle boxes so that a magnetic field in the opposite direction will be set up to act as a magnetic brake for stopping the shuttle.

The wires 23 and 24 are connected through reversing switch 26 to the wires 67 and 68. After leaving the switch box 50 the wires 67, 68 and 25 are placed in a suitable cable 69 which cable leads downwardly along the side of loom frame 10 and then upwardly along surface of sword 13 from whence it leads into the shuttle box 15.

The windings in the shuttle box 15 are divided into two parts which are identical in all respects, there being a winding on each side of the box, whereas, a similar winding in shuttle box 15' is disposed therein in two sections. Between the shuttle boxes 15 and 15' another series of windings is disposed within the lay of the loom below the path of travel of the shuttle which winding is likewise similar to the other windings. It is necessary to place the windings in two sections in the shuttle boxes 15 and 15' since in ordinary looms a slot must be provided in the bottom of at least one of the shuttle boxes to allow an empty bobbin to be expelled from the shuttle while the shuttle is being replenished with a full bobbin. Therefore, in Figure 8 the section of winding in the back binder of the shuttle box 15 will be denoted by the reference character 75, the windings in the box front of shuttle box 15 will be denoted by reference character 76, the windings in the back binder in shuttle box 15' will be denoted by reference character 77, and the windings in the box front in shuttle box 15' will be denoted by reference character 78. The plurality of windings disposed in the lay of the loom between the shuttle boxes 15 and 15' are broadly denoted by reference character 79. Each section of winding is identical and therefore a description of one section and the connections leading therefrom is deemed to be sufficient for all.

Disposed within each of the pivoted binders 43 and 43' is a section of laminated iron plates 85 which plates are secured therein by any suitable means such as bolts 86 and 86' properly insulated therefrom. The box fronts 87 and 87' likewise have similar sections 85 secured therein by any

suitable means such as bolts 88 and 88' which are also insulated from the plates. The casings in which these plates are located are made of a suitable insulating material.

Each of the sections of plates 85 have a plurality of vertically disposed slots cut in one edge thereof which will be denoted by reference characters 89 to 100 inclusive in which suitable windings are inserted. Located in the central portion of the lay is another section of laminated iron plates which is denoted by reference character 105 and this section has a plurality of slots 89 to 100 cut in the face thereof for receiving similar coils. The construction of section 105 may be so that it can be divided into a plurality of sections with slots 89 to 100 therein or it may be made in one continuous section having these same slots placed therein in repeated form.

The section 105 is enclosed in a casing comprising members 106 and 106a which section is held therein by any suitable means such as insulated bolts 107. Disposed on top of section 105 is a bed plate 108 which is made of a suitable insulating material and which has serrations in the upper surface thereof for accommodating the warp threads. The shuttle 46 travels over this plate.

The wiring which is adapted to be placed in the slots 89 to 100 inclusive in the laminated plate is essentially that of the windings of a three-phase induction motor. The section of winding 75 which is adapted to be placed in the laminated section 85 will be described and its connection with the subsequent section of winding 76. Since the winding in the sections 76, 77, 78 and 79 is identical a repeated description will not be made. The windings in the plates 85 comprise phase A, phase B and phase C, each of said phases comprising a pair of coils and each of the coils having a plurality of turns therein such as shown in Figure 6. In this particular case each coil has eight windings therein, however the windings may be varied to accommodate different designs.

The wire 67 leads into coil 110 which coil consists of a number of turns such as are shown in Figure 6, and from this coil a wire 111 leads therefrom which is connected to another coil 112. Both of these coils comprise phase C of this particular winding and it should be noted that the coils are adapted to be inserted in the slots in the laminated section of plate 75 in a manner shown in Figure 5. From the coil 112 a suitable wire 113 leads to the next succeeding coil 110 in phase C of the section of winding 76 disposed in laminated plate structure 85.

The wire 68 which leads to coil 115 is similar in all respects to the coil 110 just described but being disposed in different slots and also being disposed in overlapping relation to the other coils. This coil has a wire 116 leading therefrom which is connected to another coil 117 placed in overlapping relation to coil 115 and being likewise disposed in suitable slots in the plate. Coils 115 and 117 comprise phase B of the winding. From coil 117 a wire 118 leads to the next succeeding coil 115 of phase B in the section 76 of the winding.

The wire 25 leads into a coil 120 which is also placed in slots in the laminated plate structure 85 and has a wire 121 leading therefrom which is connected up in series to a coil 122, both of the coils 120 and 122 are placed in overlapping relation to each other and with respect to the other coils in the phase and comprise the phase A of the winding. From the other side of the coil 122 a wire 123 leads therefrom which is connected to the next succeeding coil 120 of phase A in the winding 76.

This method of winding is continued through section 76 and section 79, section 78 and section 77. The section 79 is divided up into a plurality of windings such as have been previously described in the section of winding 75, and the number of sections of windings in the section 79 being determined by the length of the lay and the design of the loom. Leading from coils 112, 117 and 122 in the section 77 are suitable wires 128, 129 and 130 which are joined together and connected to a wire 131, said wire 131 being grounded as at 132.

The showing of the windings in the drawings has been enlarged for the sake of clearness. It is to be understood that each coil would cross the laminated structure at very much closer intervals than those shown in order to prevent excessive speed of the shuttle.

Referring to Figure 2 it is seen that the shuttle 46 has suitable copper bands or rings 136 on each end thereof which correspond to the rotor of an induction motor. Since the windings in sections 75, 76, 77, 78 and 79 correspond to the field coil or stator in the induction motor except that they are in a developed form instead of being disposed in a circle it is quite evident that by introducing current into the winding in sections 75 to 79 that a circulating current will be induced in the copper bands 136 which will set up a magnetic field in opposition to the stator field and give the shuttle a resulting force in a direction parallel to the stator windings and at right angles to the flux. Immediately before the shuttle has reached the box on the other side of the loom the current will be reversed by means of the reversing switch 26 which will not only cause a magnetic brake to be applied to stop the shuttle, but will in time, reverse the direction of travel thereof. Disposed in shuttle boxes 15 and 15' are suitable impact members 140 and 140' which are held in extended position by springs 141 and 141'. These impact members assist in checking the shuttle in the shuttle boxes.

In the drawings and specification there has been set forth a preferred embodiment of the invention, and although specific terms are employed, they are used in a generic and descriptive sense only and not for purposes of limitation, the scope of the invention being set forth in the appended claims.

I claim:

1. In a loom having an electro-dynamic apparatus for effecting rectilinear movement of a filling carrier through a warp shed comprising a lay having a filling carrier box in each end thereof, a stator field disposed in the entire length of said lay and on each side of said boxes, each stator field having a plurality of phase windings therein, a non-conductive base plate disposed upon said lay and over said windings, said plate having a plurality of transversely disposed serrations in the top surface thereof for the accommodation of the warp threads, a filling carrier having an electrically conductive body adapted to move back and forth between said boxes along the top of the lay, means for admitting alternating current to said windings to produce a flux of variable density in said windings which flux acts to induce current and create a positively moving magnetic field passing through said electrically conductive body to cause the shuttle to be impelled across the lay.

2. In a loom having a shuttle with an induction element therein, a lay having a shuttle box on each end thereof for confining the shuttle in its travel across the lay, a polyphase field winding in the entire length of said lay and shuttle boxes, means for creating a constantly moving field in said field winding which passes through said induction element to impel the shuttle from one shuttle box to the other, and means operable upon the absence of a shuttle in one of the shuttle boxes upon the completion of a pick of the loom for eliminating said induced constantly moving magnetic field, a non-conductive base plate disposed over said lay and over said windings for supporting the shuttle, said plate having a plurality of grooves therein for receiving the warp thread as the shuttle travels across the lay.

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