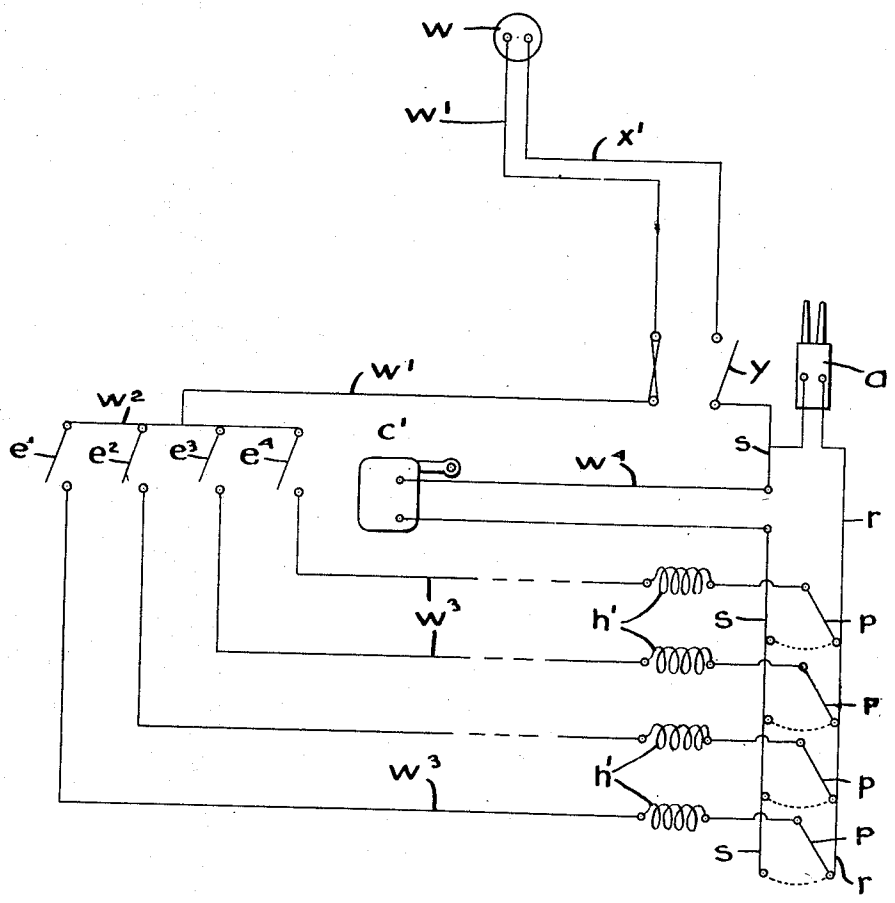
June 16, 1925. 1,542,772

D. M. HOLLINS

AUTOMATIC WEFT REPLENISHING MECHANISM FOR LOOMS

Filed June 14, 1924 5 Sheets-Sheet 1

Fig. 1

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Filed June 14, 1924 5 Sheets-Sheet 2

Fig. 2.

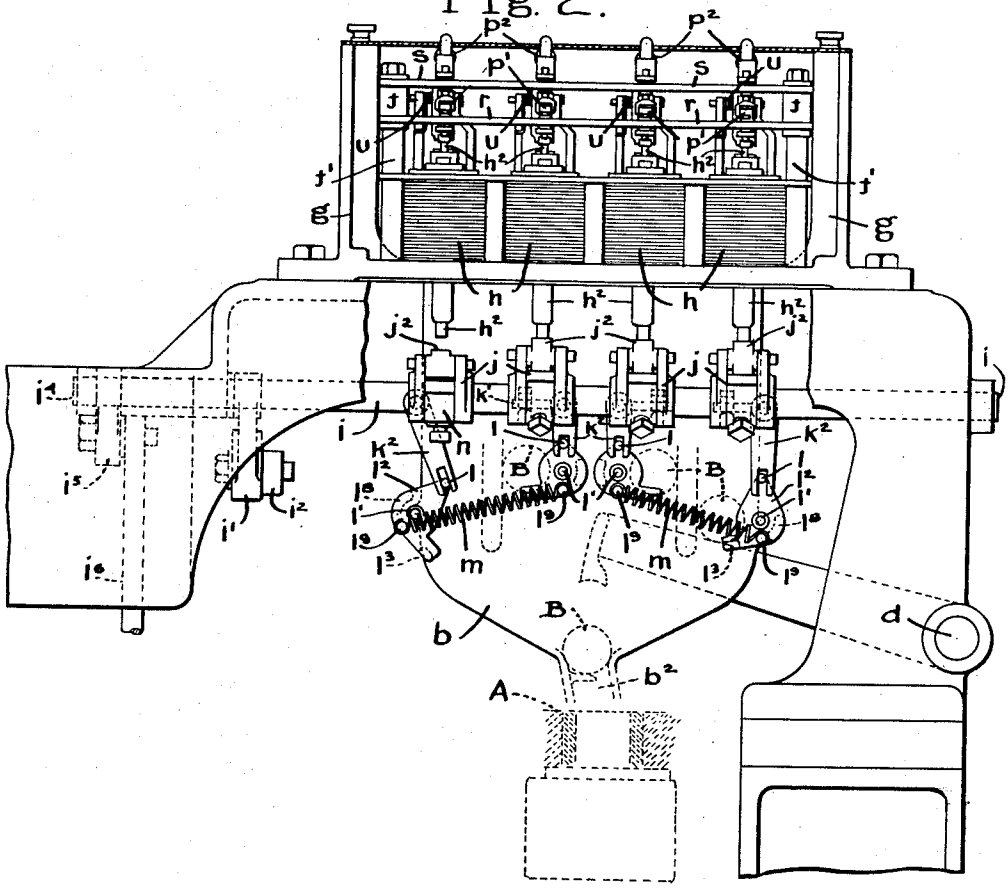


Fig. 3.

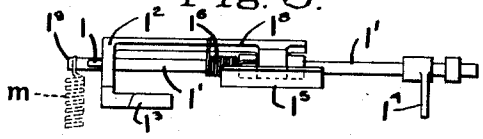


Fig. 4.

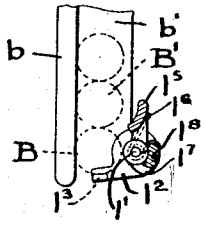
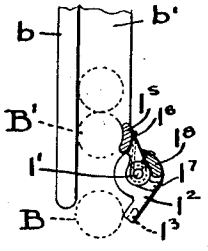


Fig. 5.



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Filed June 14, 1924. 5 Sheets-Sheet 3

Fig. 6.

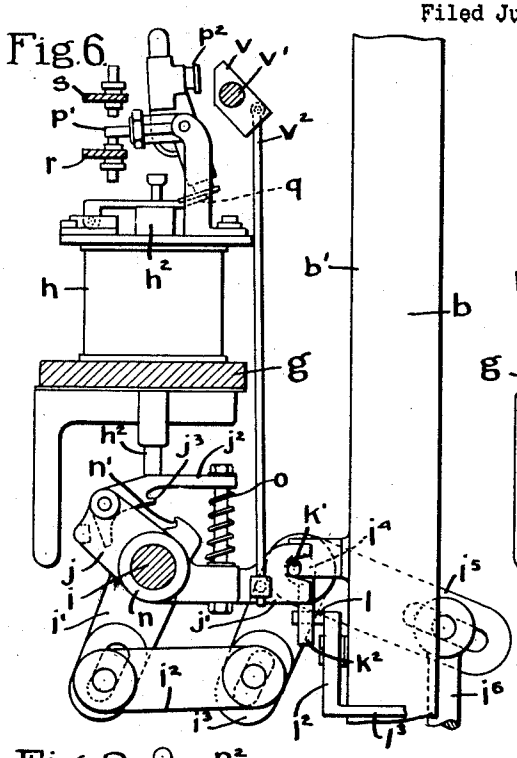



Fig. 7.

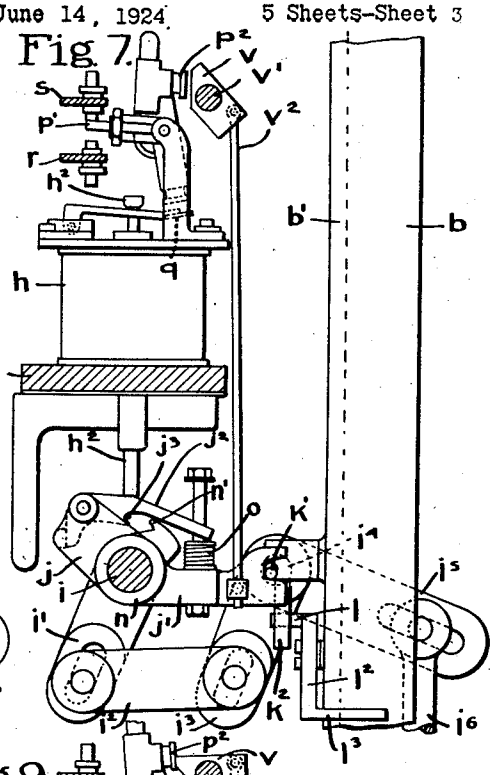



Fig. 8.

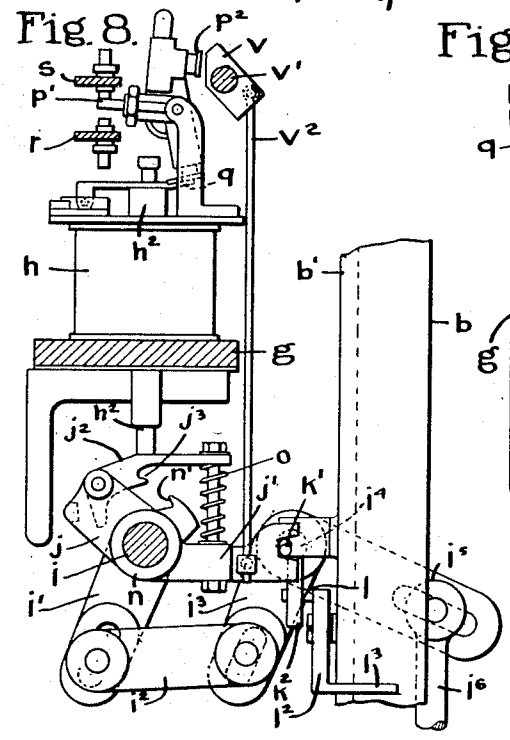
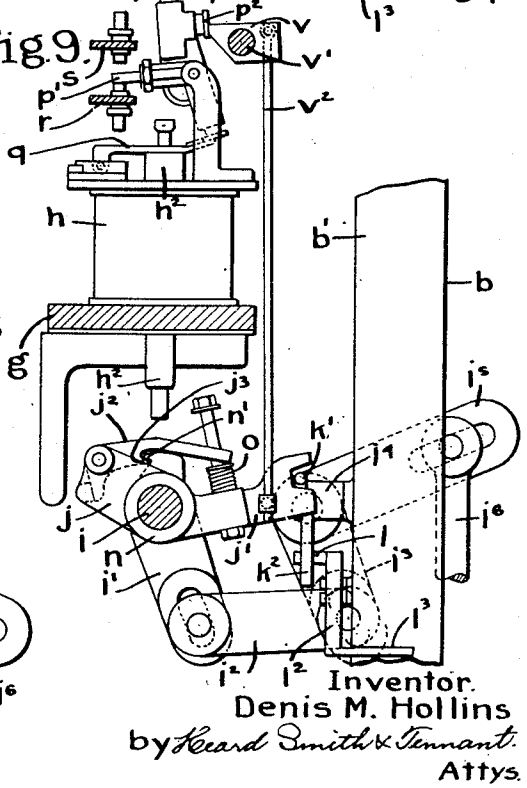



Fig. 9.

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Filed June 14, 1924 5 Sheets-Sheet 4

Fig. 10.

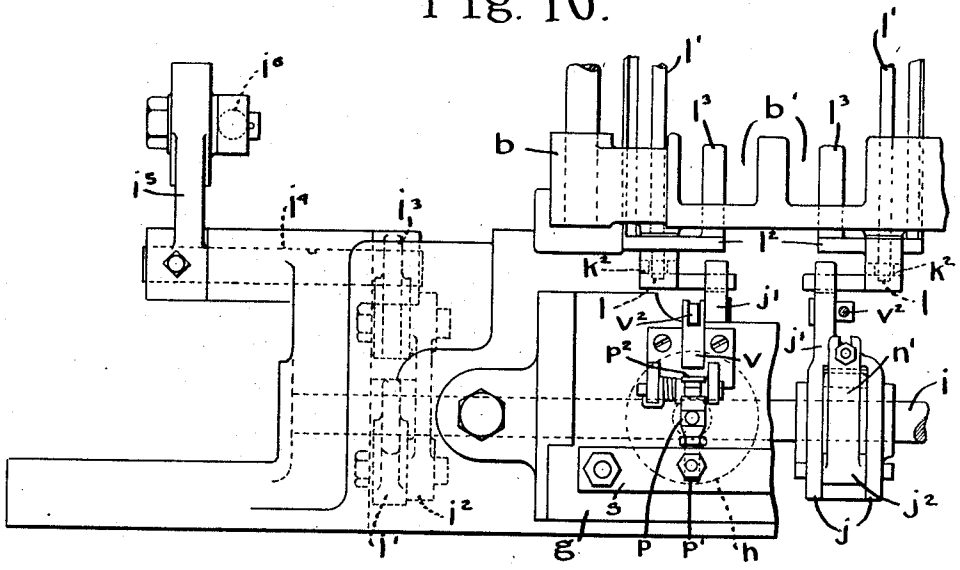
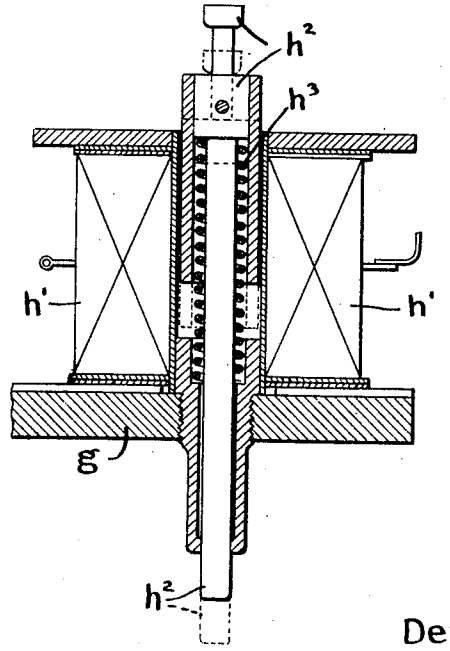



Fig. 11.

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AUTOMATIC WEFT REPLENISHING MECHANISM FOR LOOMS

Filed June 14, 1924 5 Sheets-Sheet 5

Fig. 12.

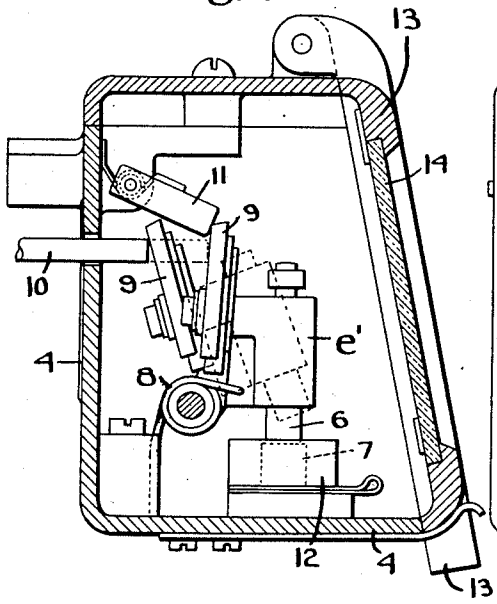



Fig. 13.

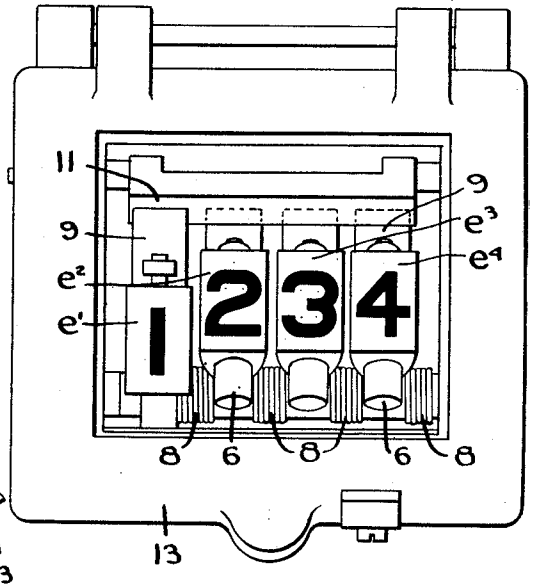
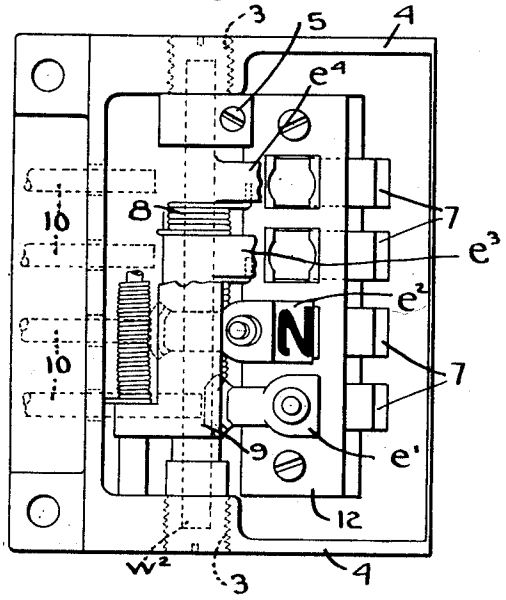



Fig. 14.

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Patented June 16, 1925. 1,542,772

# UNITED STATES PATENT OFFICE.

DENIS M. HOLLINS, OF BLACKBURN, ENGLAND, ASSIGNOR TO DRAPER CORPORATION, OF HOPEDALE, MASSACHUSETTS, A CORPORATION OF MAINE.

## AUTOMATIC WEFT-REPLENISHING MECHANISM FOR LOOMS.

Application filed June 14, 1924. Serial No. 720,020.

*To all whom it may concern:*

Be it known that I, DENIS MACHELL HOLLINS, a subject of King George V of Great Britain, residing at Blackburn, in the county of Lancaster, England, have invented a new and useful Improvement in Automatic Weft-Replenishing Mechanism for Looms, of which the following is a specification.

The invention relates to looms provided with mechanism to ascertain the condition of the weft supply on the bobbin in the running shuttle and with mechanism which, on detection of substantial exhaustion of the weft supply, is put into action to replace the exhausted bobbin by a full one.

More particularly the invention relates to a loom of this description, wherein a series of rising and falling shuttle boxes are provided at one end of the lay and a single stationary shuttle box at the opposite end of the lay. It is known in such a loom to provide, at that end of the lay at which the stationary shuttle box is located, a weft carrier magazine having a series of compartments corresponding in number to the number of rising and falling shuttle boxes at the opposite end of the lay, such magazine having associated with it means whereby, on detection of weft exhaustion in a running shuttle, a bobbin is released from that magazine compartment containing bobbins of weft of corresponding colour or character to that in the running shuttle and is allowed to drop by gravity into a position in the path of a transfer hammer by which it is forced downwards into the shuttle to take the place of the exhausted bobbin. As the running shuttle, after detection of weft exhaustion, may go out of action when it returns to the change box end of the loom and another shuttle containing weft of a different colour or character become active, means are provided whereby detection of weft exhaustion in a shuttle is caused to actuate indicating mechanism, the operation of which to initiate actuation of the bobbin release and transfer mechanism is, if the shuttle concerned goes out of action, delayed until it again becomes active.

The present invention has for its object to improve upon the weft replenishing mechanisms at present employed in looms of the type referred to, that is to say having a series of rising and falling shuttle boxes at one end of the lay and a single stationary shuttle box at the other end of the lay, the invention having particular reference to looms provided with electrically operated means to effect selection and transfer to the running shuttle of a bobbin containing weft of the colour or character desired.

The invention consists in the novel construction and arrangement of mechanisms which will be described with reference to the accompanying drawings, in which:—

Fig. 1 is a diagram illustrating the general arrangement and electrical connections of the improved mechanism;

Fig. 2 is an inner side view of a magazine, having four vertical compartments for receiving bobbins of four different colours or characters, having the improved mechanism applied thereto;

Fig. 3 is a detached plan view of one of the rocking cradles, by which the bobbins are supported in a magazine compartment and by which, at the required time, the lowest bobbin in the compartment is released and allowed to drop by gravity into transfer position;

Fig. 4 is a detail sectional view shewing a rocking cradle in normal position;

Fig. 5 is a similar view to Fig. 4 but shews the rocking cradle as having been operated to release the lowest bobbin in the compartment, and illustrates how, when so operated, a part associated with the cradle acts to engage yieldingly the next lowest bobbin in the compartment and, by such engagement, to hold up the remaining bobbins until return of the rocking cradle to normal position;

Fig. 6 is a side view of the operating mechanism for the rocking cradle of one magazine compartment, shewing the parts on the positions they occupy during normal running of the loom;

Figs. 7, 8 and 9 are similar views to Fig. 6, but shewing the parts in the successive positions assumed upon indication of weft exhaustion and during the operation of releasing a bobbin from the magazine compartment concerned;

Fig. 10 is a plan view of part of the inner end frame of the magazine, shewing in plan the operating mechanism for the rocking cradles;

Fig. 11 is a sectional elevation of one of the solenoid devices employed for the purposes of the invention; and

Figs. 12, 13 and 14 are, respectively side, front and plan views of the means whereby the coming into action of a shuttle is caused to set up an electric circuit, and vice versa.

Referring to the drawings, the general organization and arrangement of the loom may be of any ordinary known form including a feeler, indicated at *a* in Fig. 1, designed to enter the stationary shuttle box at each beat up of the lay and, on substantial exhaustion of weft in the active shuttle, to complete an electric circuit through coming into contact with a metallic sleeve on the bobbin, in known manner.

A magazine *b*, located at the stationary shuttle box end of the loom has a series of vertical compartments *b'* corresponding in number to the rising and falling shuttle boxes at the opposite end of the lay and has means, in the form of rocking cradles, whereby the bobbins are supported in the respective compartments and the lowest bobbin in a compartment released when required and allowed to drop by gravity into transfer position over a discharge opening $b^2$ common to all the compartments and disposed over the stationary shuttle box A. A transfer hammer *c* mounted upon a rock shaft *d* is provided to engage a bobbin when in transfer position, to force same into the shuttle presented beneath it and expel the exhausted bobbin. To actuate the transfer hammer at the required time, means of known construction actuated by an electromagnet are provided, this electromagnet being indicated at *c'* in Figure 1.

All of the above parts do not in themselves form any part of the present invention and may be of any approved known construction with the exception of the rocking cradles by which the bobbins are supported in and released from the several magazine compartments and which are preferably of the construction hereafter described.

According to the invention there are provided, in connection with the motion for controlling the movements of the rising and falling shuttle boxes in accordance with the weft pattern, a series of levers, represented diagrammatically at $e'$—$e^4$ in Fig. 1, corresponding to the number of movable shuttle boxes, and means are provided whereby such levers are moved pivotally as the shuttle boxes associated therewith are selected to become active.

A stand or bracket *g*, parallel and adjacent to the inner side of the magazine *b* supports a series of electromagnets or solenoids *h*, one for each magazine compartment and each provided, as shown in Figure 11, with a vertically arranged magnet coil *h'* and a plunger or core $h^2$ passing through same. Each plunger is acted upon by a confined spring $h^3$ to hold it normally in the raised position shewn, and excitation of the magnet draws down the plunger, against the action of the spring, to the position indicated in dotted lines.

Arranged longitudinally beneath the magnets *h* is a rock shaft *i*, supported in bearings in suitable brackets and adapted to receive a constant oscillatory or rocking motion through lever *i'*, link $i^2$, lever $i^3$, rock shaft $i^4$, lever $i^5$ and rod $i^6$, from a convenient part of the loom mechanism.

Loosely mounted upon the rock shaft *i*, one below each solenoid or magnet, are a series of angle levers *j*. An arm *j'* of each lever extends towards its respective magazine compartment and is slotted to receive one arm *k'* of a bell crank lever pivotally mounted on the magazine frame and having its other arm $k^2$ slotted to receive a pin or stud *l* connected with the corresponding rocking cradle.

Each rocking cradle comprises a rod *l'* pivotally supported at its ends in the end frames of the magazine. Loosely mounted on the rod *l'* is a member $l^2$ having a part $l^3$ extending into the magazine compartment and adapted, as shewn most clearly in Fig. 4, to form when in normal position a support to the head of the lowest bobbin B in that compartment. A tip support $l^4$ secured on the rod *l'* adjacent its opposite end is adapted to extend under and support the tip end of the bobbin. Loosely mounted upon the rod *l* near its centre part is a member $l^5$ which is acted upon by a coil spring $l^6$ to cause a projection $l^7$ thereon to be held normally against a part $l^8$ of the member $l^2$. Each member $l^2$ has a projecting pin $l^9$ and the pins of adjacent pairs of cradles are connected, as shewn in Fig. 2, by springs *m* which act to hold the rocking cradles with the head and tip supports $l^3$ and $l^4$ thereof in supporting position beneath the respective lowest bobbins.

It will be apparent that if, by suitable rocking motion imparted to a cradle by its bell crank lever, the head and tip supports are removed from supporting position beneath the lowest bobbin in a compartment, such lowest bobbin will be permitted to fall, as indicated in Fig. 5, and to pass by gravity into the transferring position indicated in Fig. 2. The rocking of the cradle to release the lowest bobbin causes the member $l^5$ to be brought yieldingly into contact with the weft mass of the next lowest bobbin B' in the compartment, so that such bobbin and any remaining bobbins there may be, are supported. On return of a cradle to normal position after having released a bobbin, the member $l^5$ moves away from the bobbin with which it has been in engagement, and

such bobbin, now the lowest in the compartment, drops down on to the head and tip supports of the cradle ready to be released when required.

Each of the angle levers $j$ has pivoted to it a catch lever $j^2$, disposed immediately below or in the path of movement of the lower end of the plunger or core of its respective solenoid. Each catch lever has a projection $j^3$ on its underside adapted, when the lever is depressed, to be engaged by the hook $n'$ of the corresponding one of a series of hooked members $n$ fast on the rock shaft $i$. Each catch lever is acted upon by a spring $o$ to cause its projection $j^3$ to be normally clear of the path of oscillation of its hook member $n$.

Excitation of a solenoid causes its core to bear upon the catch lever beneath it and to depress said catch lever sufficiently to cause it to be engaged by the hook member as it oscillates, such engagement causing the angle lever to be moved pivotally about the rock shaft $i$. This pivotal movement of an angle lever causes, through the respective bell crank lever, the rocking cradle concerned to be operated to release the lowest bobbin of its compartment as before described.

Above each magnet $h$ there is pivotally mounted an indicator lever $p$ having its lower end adapted to be engaged by a spring catch $q$ associated with and adapted to be moved by the core of the corresponding magnet.

Each lever $p$ has a laterally extending arm carrying a contact member $p'$, and the contact members of the several indicator levers extend between two horizontally disposed contact bars $r$ and $s$ spaced a convenient distance apart and insulated by ebonite or like blocks $t$ from one another and from their supporting members $t'$.

When a magnet is not excited, the spring catch $q$ associated with its core is arranged to hold the corresponding indicator lever $p$ in such a position that the contact arm $p'$ of the lever makes contact with the lower contact bar $r$. Excitation of the magnet causes the indicator lever to be released by the spring catch and permits a coiled spring $u$ to swing said lever pivotally so that the contact arm breaks contact with the lower bar $r$ and moves into contact with the upper bar $s$.

Each indicator lever has at its upper end a projection $p^2$ adapted to be engaged by a cam member $v$ associated with the respective angle lever. The cam members $v$ are pivotally supported on a fixed rod $v'$ and are each connected by a rod $v^2$ with the respective angle lever. The function of these cam members $v$ is to reset the indicator levers or return them to normal position after the bobbins, the demand for which they have indicated, have been released to transferring position in the magazine.

Having thus described the mechanisms I employ, it remains to describe the electrical connections, and the manner in which the mechanisms operate.

The electric connections will first be described with the aid of the diagram, Figure 1.

Current is led to insulated contacts on the loom, and rendered available preferably by the use of an adaptor plug indicated by $w$. From this plug a wire $w'$ runs to a common feeder $w^2$ for the pivoted levers $e'$—$e^4$ associated with the shuttle box selecting mechanism. From contacts adjacent the respective levers and adapted to be respectively closed when the corresponding shuttle boxes are called upon to become active, wires $w^3$ are led to the corresponding solenoids $h$. The other wire $x'$ from the plug $w$ is led through a switch $y$ to one contact of the feeler $a$. The other feeler contact is connected to the lower contact bar $r$. The magnet $c'$ controlling the operation of the transfer hammer $c$ is connected to the upper contact bar $s$ and the switch $y$ by wires $w^4$.

There are thus provided an electric circuit comprising a series of feeler circuits and a series of transfer magnet circuits comprising common branches with means constituted by the indicator levers for switching over from a feeler circuit to the corresponding transfer magnet circuit.

Referring now to Figs. 12, 13 and 14 the levers $e'$—$e^4$, shewn diagrammatically in Fig. 1 are loosely mounted upon a spindle supported in insulating bearing blocks 3, 3 in a casing 4, and forming the common feeder $w^2$ for the levers as indicated in Fig. 1. A terminal 5 is provided on the spindle $w^2$ to receive the lead wire $w'$.

Each pivoted lever carries a spring contact 6 adapted, as shewn in the case of the lever marked "1" in Figs. 12 and 13, to engage the corresponding one of a series of contacts 7 to which the wires $w^3$ are connected.

Each pivoted lever is acted upon by a spring 8 tending to rock it into the open contact position, and each lever carries an insulated abutment 9 for a longitudinally movable rod or needle 10 associated with the box selecting mechanism. When a particular shuttle box is brought to the level of the race-way for the shuttle therein to become active, the corresponding rod or needle 10 is moved inwardly and rocks the corresponding lever $e'$—$e^4$ to cause it to close its contact. In so rocking the lever, its upper end is caused to elevate and ride under a spring actuated retaining bar 11 which holds the lever in contact until another shuttle is called upon to become ac-

tive, whereupon the elevation of the retaining bar by the rocking of the new lever releases the one which has been in contact and permits its spring 8 to return it to the open contact position. The contacts 7 are located in openings in an insulating block 12, and the front of the casing is closed by a hinged lid 13 provided with a glass 14 through which the position of the levers $e'$—$e^4$ may be observed.

The action of the mechanism is as follows:—When through the action of the shuttle box selecting mechanism a particular shuttle box is brought into line with the race-way, the corresponding lever $e'$—$e^4$ associated with that box is caused to move pivotally and thereby to close its contact. A circuit is thus set up including the source of supply, the lever $e'$—$e^4$ concerned, the corresponding solenoid $h$, the corresponding indicator lever $p$, the lower contact bar $r$, and the feeler $a$. If, on arrival of the active shuttle at the replenishing end of the loom the feeler detects substantial exhaustion of weft therein this circuit becomes closed by contact of the feeler with the exposed metal contact ring of the bobbin.

The consequent excitation of the solenoid concerned causes its core to be attracted. The downward movement of the core or plunger causes the spring catch associated therewith to release the indicator lever, and the coiled spring acting on the latter causes it to move out of contact with the lower bar $r$ and into contact with the upper bar $s$. The attraction of the solenoid core also causes the catch lever beneath same to be depressed as indicated in Fig. 7, but since the excitation of the solenoid has been only momentary, and the rock shaft $i$ is at this time making an idle movement, that is to say in a direction to carry the hook member away from the catch lever, no further action occurs at this time. It will be noted from Fig. 1 that the swinging over of the indicator lever from the lower to the upper contact bar causes the magnet $c'$ controlling the transfer hammer to be put in series with a circuit including the source of supply, the shuttle box selector lever, the solenoid, the indicator lever, and the upper contact bar.

On return to the shifting shuttle box end of the loom of the active shuttle, exhaustion of the weft in which has been detected and indicated, this shuttle may either remain active, or may go out of action.

If the same shuttle remains active the box selector lever $e'$—$e^4$ maintains its contact closed so that the circuit which has been described remains completed. The core of the solenoid concerned thus remains attracted with the result that as the hook member oscillates the angle lever concerned is moved as shewn in Fig. 9, and the rocking cradle of the magazine compartment concerned is operated to release the lowest bobbin in that compartment and permit it to drop to transfer position. Meanwhile the excitation of the magnet $c'$ controlling the transfer hammer has initiated operation of the latter, so that when the shuttle arrives back at the replenishing end of the loom, the new bobbin is transferred to the shuttle and the empty bobbin is knocked out.

If, instead of the weft pattern calling for the substantially exhausted bobbin to remain active upon its return to the change box end of the loom consequent upon detection of the substantial exhaustion, the pattern calls for that shuttle to go out of action, the corresponding box selector lever $e'$—$e^4$ breaks its contact and the new circuit which was formed upon detection of exhaustion remains open. The indicator lever however, remains in its position of indication as shewn in Fig. 8, and the first time the box selecting mechanism calls the shuttle into action again replenishment is effected just as if the shuttle had remained active following upon the detection of weft exhaustion.

It will be seen that the mechanisms employed, and the electrical arrangements whereby such mechanisms are caused to function, are very simple, the amount of wiring necessary is reduced to a minimum, and the general arrangement and construction are such that the parts are easily accessible and easily maintained in working order.

The details of construction of the different parts employed in carrying out the invention and their exact disposition on the loom will necessarily vary according to the particular make or type of loom to which they are being applied.

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

1. Automatic electrically operable weft replenishing mechanism for shifting shuttle box looms comprising a transfer circuit and a feeler circuit having in common branches provided with means for controlling the delivery to the transferrer of selected weft carriers corresponding to those of the respective shuttles, means operable by the box-selecting mechanism to complete a selected branch, means operable by the momentary completion of the feeler circuit, upon detection of exhaustion of filling in the active shuttle, to complete the transfer circuit and to break the feeler circuit and means successively operable by the transfer circuit when completed respectively, to cause the delivery of a selected weft carrier and to actuate the transferrer upon the

next return of the same shuttle to the filling replenishing end of the loom.

2. Automatic electrically operable weft replenishing mechanism for shifting shuttle box looms as in claim 1, characterized by the provision of means operable by the shuttle box selecting mechanism upon selection of a different shuttle to become active to break the previously selected branch circuit of the weft carrier delivering means.

3. Automatic electrically operable weft replenishing mechanism for shifting shuttle box looms having a magazine provided with a plurality of compartments comprising a transfer circuit and a feeler circuit having in common normally open branches including solenoids associated with the respective compartments and provided with indicator switches normally positioned to complete the feeler circuit, means operable by the shuttle box selecting mechanism to complete a selected branch, means operable by the solenoid of the selected branch when energized by momentary completion of the feeler circuit upon detection of substantial exhaustion of filling in the active shuttle to cause said indicator switch to break the feeler circuit and thereupon to complete the transfer circuit through said branch, means operable by the energized solenoid to release a weft carrier from its associated compartment and means operable by the completed transfer circuit to actuate the transferrer upon the next return of the same shuttle to the filling replenishing end of the loom.

4. Automatic electrically operable weft replenishing mechanism for shifting shuttle box looms as in claim 3, characterized in that the indicator switches are spring actuated and are held against the action of their springs in position to complete the feeler circuit by catches which are released by the movement of the core of the energized solenoid.

5. Automatic electrically operable weft replenishing mechanism for shifting shuttle box looms as in claim 3, characterized in that the feeler circuit and transfer circuit are provided with contact bars extending in parallelism and in that the indicator switches of the respective branches are pivotally mounted and normally held in position against the action of their springs to engage the contact bar of the feeler circuit by means which are released respectively by the movement of the core of the energized solenoid.

6. Automatic electrically operable weft replenishing mechanism for shifting shuttle box looms as in claim 3, characterized in that the feeler circuit and transfer circuit are provided with contact bars extending in parallelism and in that the indicators are provided with springs tending normally to hold them in engagement with the contact bar of the transfer circuit, but are normally held in engagement with the contact bar of the feeler circuit by catches which are released by the movement of the core of the energized solenoid.

7. Automatic electrically operable weft replenishing mechanism for shifting shuttle box looms as in claim 3, characterized in that the means for releasing the weft carriers from their respective compartments comprises a regularly oscillating rock shaft having hooked members, rocking cradles for supporting the weft carriers in the respective compartments, means for actuating said rocking cradles including spring supported catch levers positioned respectively to be depressed into engagement with a hook member of said rock shaft by the movement of the core of the energized solenoid.

8. Automatic electrically operable weft replenishing mechanism for shifting shuttle box looms as in claim 3, characterized in that the indicator switches are spring actuated and are held against the action of their springs in position to complete the feeler circuit by catches which are released by the movement of the core of the energized solenoid, and in that the means for releasing the weft carriers from the respective compartments include a regularly oscillating rock shaft having hooked members, rocking cradles for supporting the weft carriers and means for actuating the rocking cradles including spring supported catch levers positioned respectively to be depressed into engagement with a hook member of said rock shaft by the movement of the core of the energized solenoid and means operable by the movement of the weft carrier releasing means to restore the indicators to engagement with the solenoid controlling catch whereby said indicator when restored will complete its branch of the feeler circuit.

9. Automatic electrically operable weft replenishing mechanism for shifting shuttle box looms as in claim 3, characterized in that the indicator switches are spring actuated and are held against the action of their springs in position to complete the feeler circuit by catches which are released by the movement of the core of the energized solenoid, and in that the means for releasing the weft carriers from the respective compartments include a regularly oscillating rock shaft having hooked members, rocking cradles for supporting the weft carriers in the respective compartments, means for actuating said rocking cradles including a series of angle levers pivotally mounted on said rock shaft, spring supported catch levers pivotally mounted upon said angle levers and positioned to be engaged respectively by the cores of the sole-

noids and to be depressed by the core of the energized solenoid into engagement with a hook member of the oscillating rock shaft whereby upon engagement with the hook member the rocking cradle will be actuated to release the selected filling carrier.

10. Automatic electrically operable weft replenishing mechanism for shifting shuttle box looms as in claim 3, characterized in that the indicator switches are spring actuated and are held against the action of their springs in position to complete the feeler circuit by catches which are released by the movement of the core of the energized solenoid, and in that the means for releasing the weft carriers from the respective compartments include a regularly oscillating rock shaft having hooked members, rocking cradles for supporting the weft carriers in the respective compartments, means for actuating said rocking cradles including a series of angle levers pivotally mounted on said rock shaft, spring supported catch levers pivotally mounted upon said angle levers and positioned to be engaged respectively by the cores of the solenoids and to be depressed by the core of the energized solenoid into engagement with a hook member of the oscillating rock shaft whereby upon engagement with the hook member the rocking cradle will be actuated to release the selected filling carrier and a cam operable by the movement of the angle lever when actuated to restore said indicator switch to normal position and thereby complete the feeler circuit.

In testimony whereof I affix my signature.

D. M. HOLLINS.