Feb. 28, 1956 C. FUCHS 2,736,341

SHUTTLE REPLACING MEANS FOR LOOMS

Filed Dec. 28, 1951 7 Sheets-Sheet 1

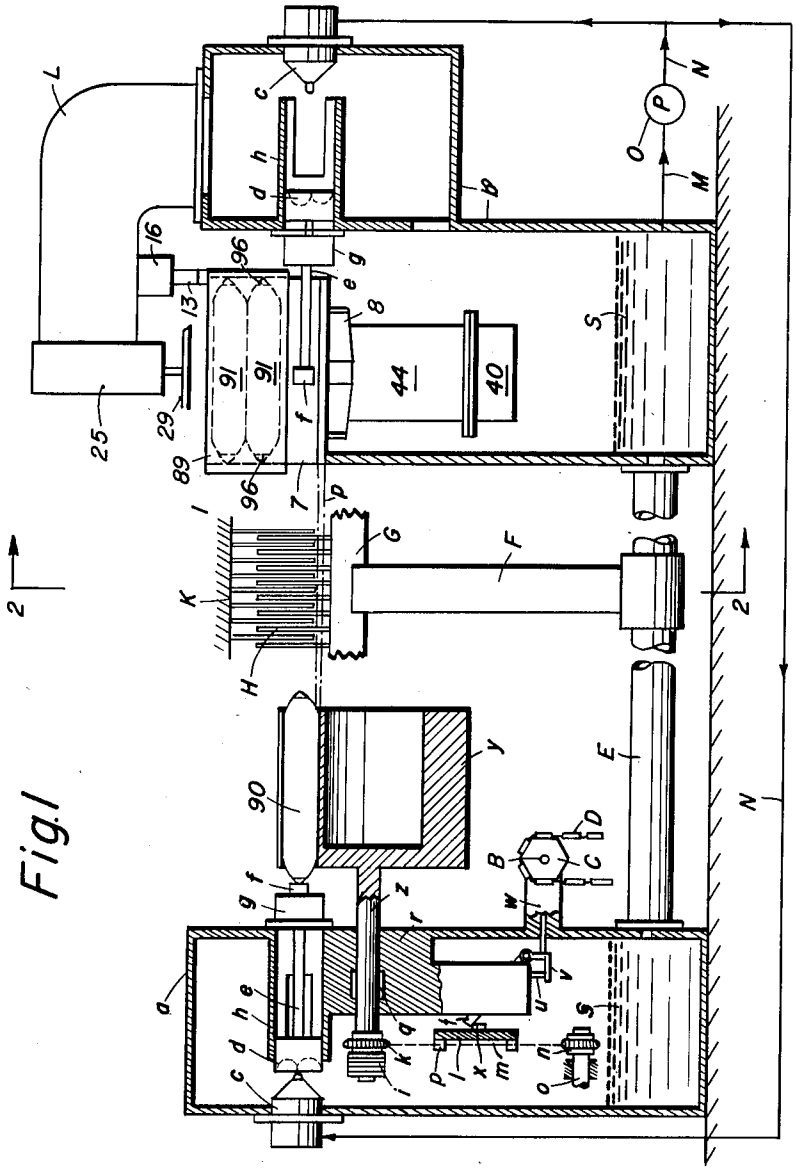

Fig. 1

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SHUTTLE REPLACING MEANS FOR LOOMS

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Fig. 2

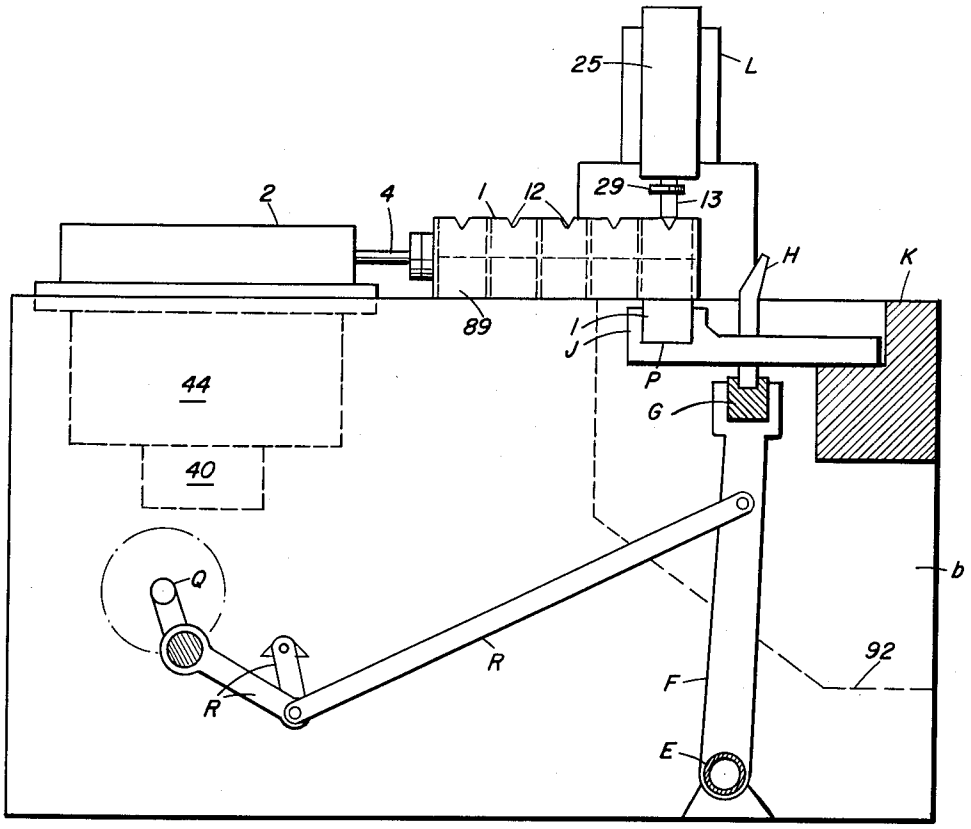

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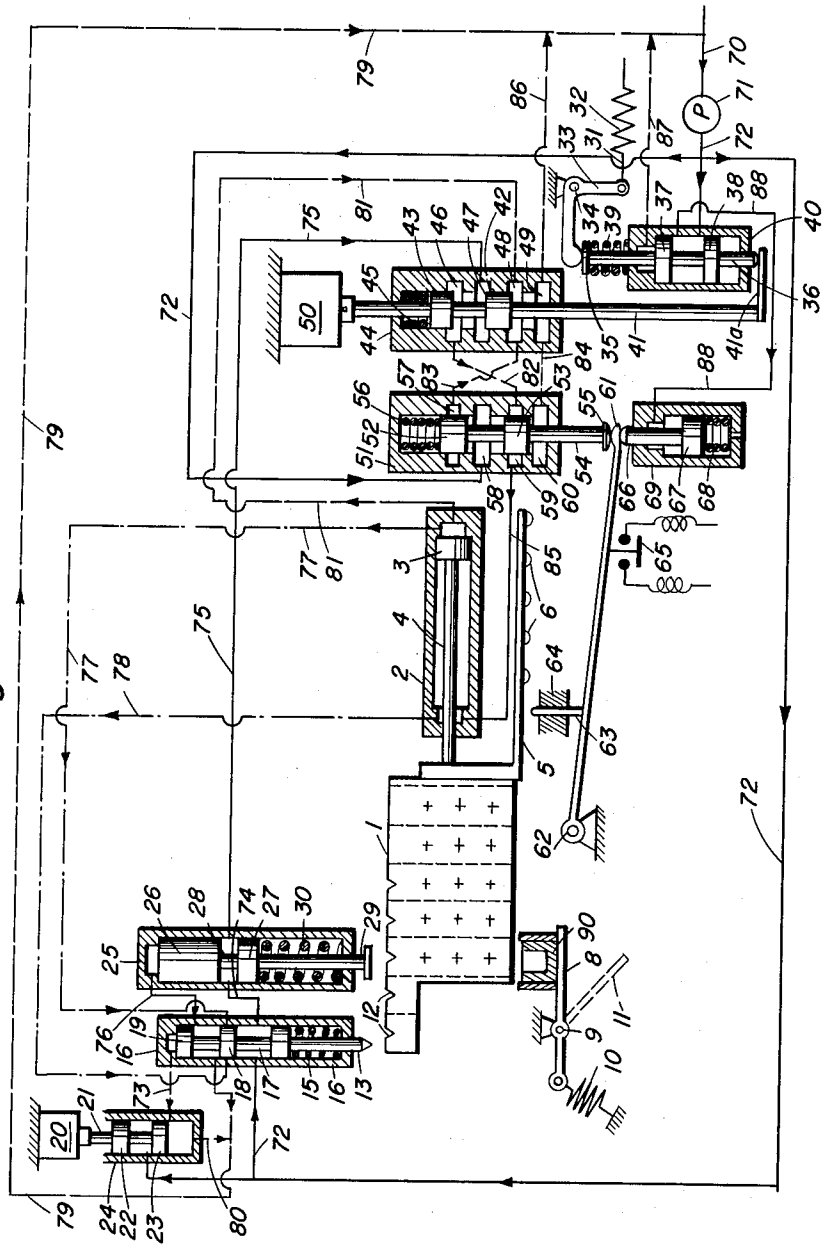
Fig. 3



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SHUTTLE REPLACING MEANS FOR LOOMS

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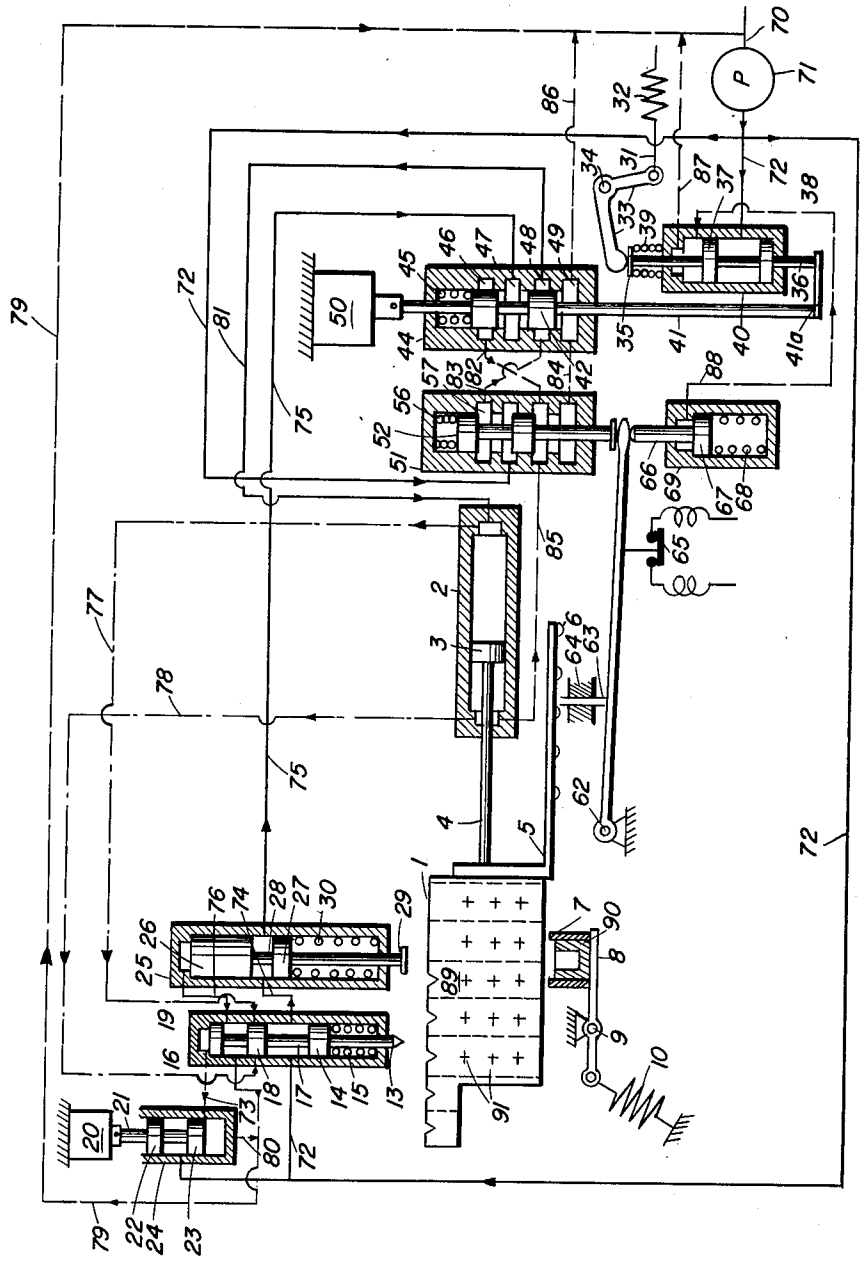
Fig. 4



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SHUTTLE REPLACING MEANS FOR LOOMS

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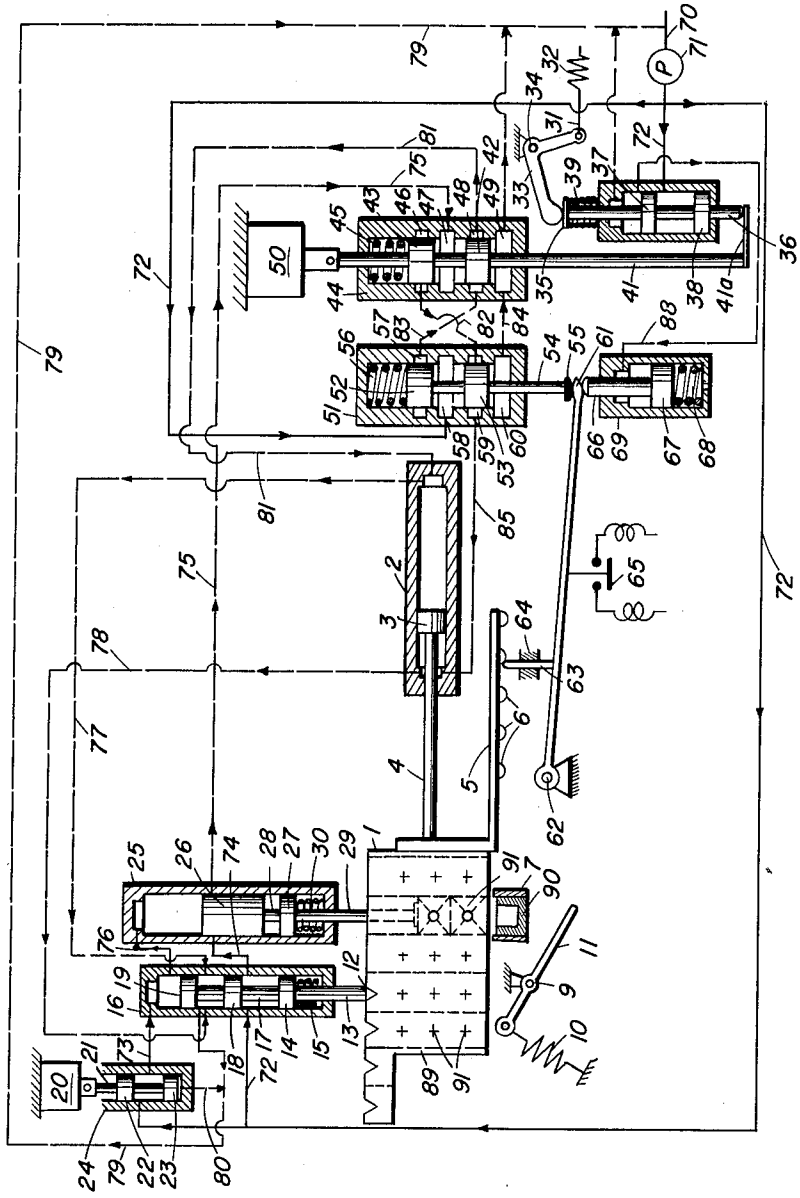
Fig. 5



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SHUTTLE REPLACING MEANS FOR LOOMS

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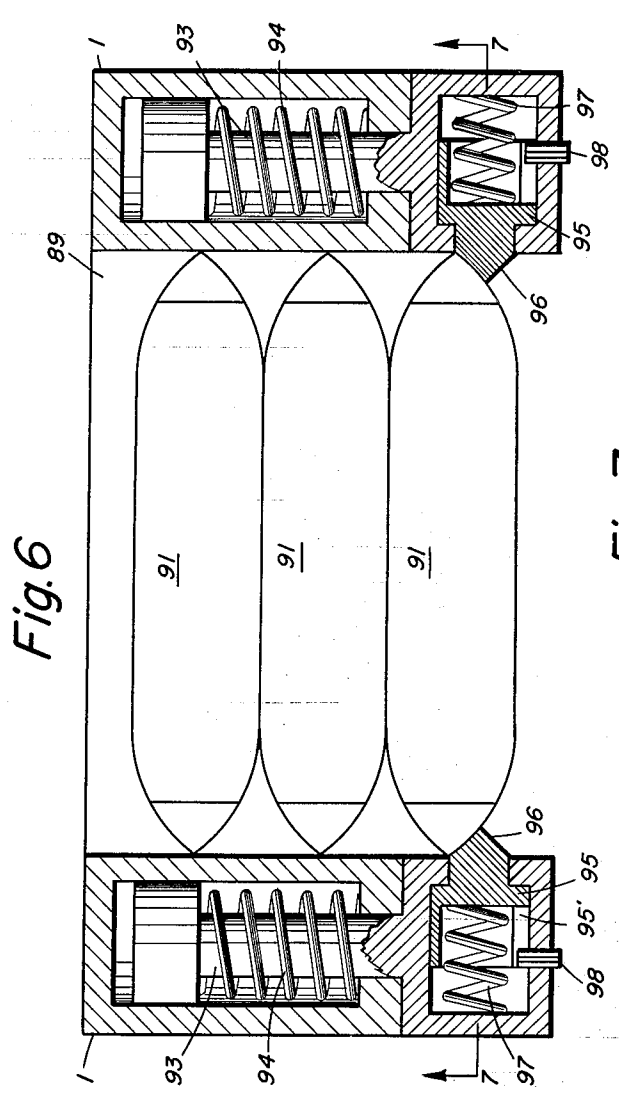

Fig. 6

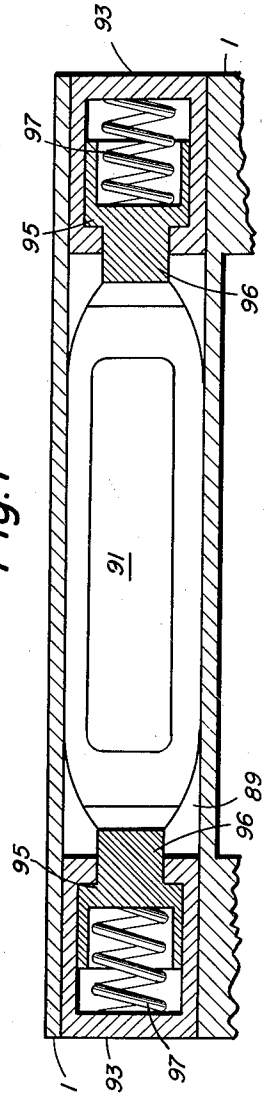

Fig. 7

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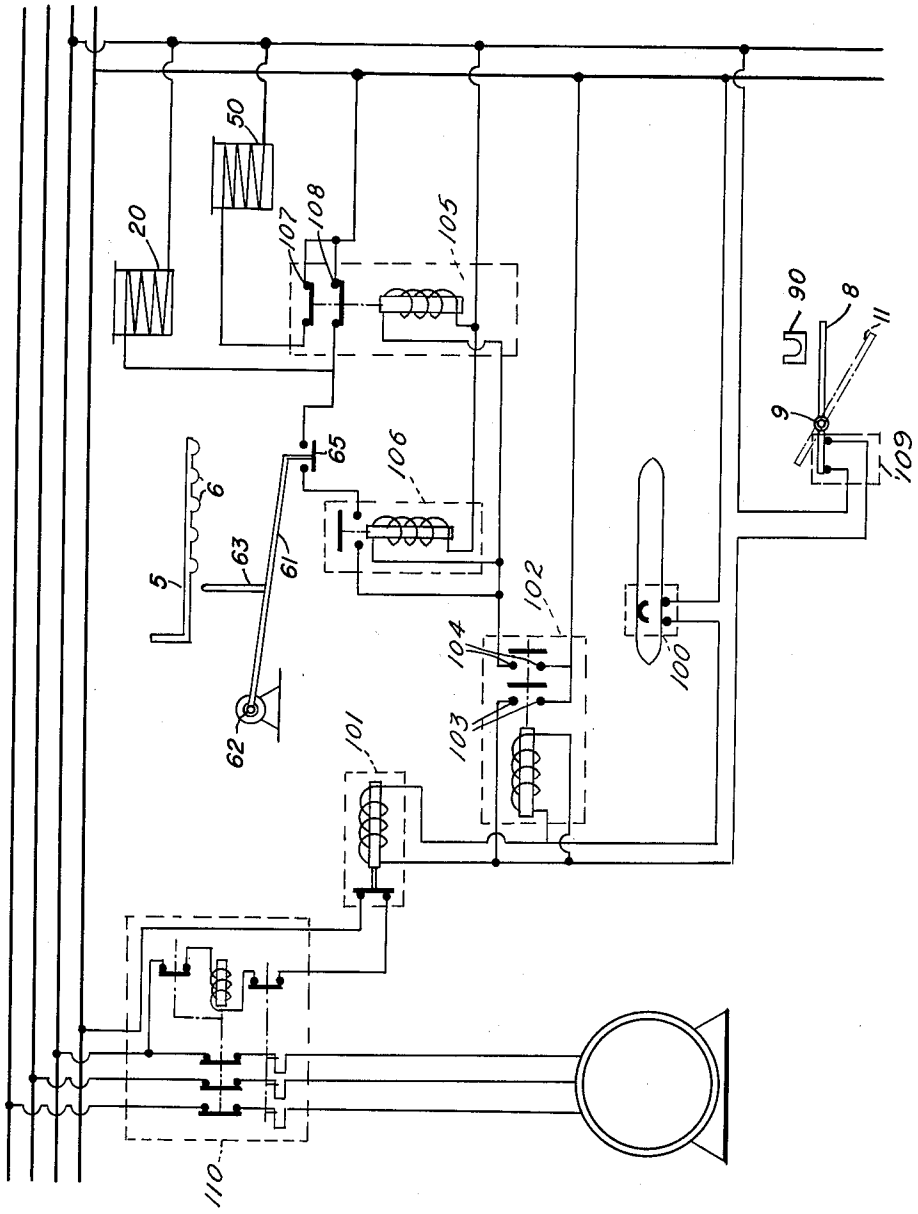
Fig. 8



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United States Patent Office 2,736,341 Patented Feb. 28, 1956

2,736,341

SHUTTLE REPLACING MEANS FOR LOOMS

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Application December 28, 1951, Serial No. 263,904

Claims priority, application Germany December 28, 1950

19 Claims. (Cl. 139—232)

This invention relates to a method of and means for automatically changing bodies of the same size on machines, more especially for automatically replacing empty shuttles by full shuttles on looms.

In various techniques there frequently occurs the necessity of quickly and automatically replacing a body by another of the same dimensions. This occurs, for example, in packing machines, in which a filled box or container is to be replaced by an empty one. This requirement is particularly important in connection with looms in which, in a comparatively rapid sequence, a spent weft spool has to be replaced by a fresh one of a similar nature, for example, by changing the whole shuttle.

The method and the means which constitute the subject of this invention are concerned with such interchanging operations, the changing of the shuttles on a loom being described and illustrated as a typical example.

Even today, on looms of relatively old construction, the empty shuttles are still manually replaced by full shuttles after the loom has been automatically stopped. The looms of the most modern construction as known at the present time may be equipped with automatic shuttle-changing mechanisms, but the shuttle-changing can be effected at the most with two colours. In heavy looms having large capacity shuttles and tubular cop spools, no multi-colour automatic shuttle-changing mechanisms are known.

The method proposed and described herein and the mechanism which is illustrated present the essential advantage that the change-over can take place automatically without any appreciable loss of time. An important technical advantage consists in that it is also possible to interchange as many shuttles as desired with yarn spools of different colours or different qualities.

It is a characteristic feature of the present invention that a multi-cell shuttle magazine which has a supply of shuttles of the same or different yarn colour or quality, is brought into the position necessary at any time by means of a hydraulic drive, and that this position is then accurately adjusted and fixed hydraulically, whereupon the changing of the shuttles, i. e. the ejection of the empty shuttle and the introduction of the full shuttle which is required is again effected hydraulically. The operating fluid for all the operating parts is supplied by a common pressure pump, whereby the space requirements are restricted to a minimum and the operation takes place silently. The arrangement comes into operation when a shuttle has become empty and this is effected by an electrically actuated contact. By this means, the driving motor of the loom is stopped and the automatic shuttle-changing operation is initiated. Upon completion of this shuttle-changing operation, the driving motor of the loom is then set in operation again automatically by means of an electrical contact, for example, by the empty shuttle falling out.

In order to illustrate the procedure and to explain

the method of operation, reference is made to the accompanying drawings, wherein:

Figure 1 is a general view of the most important parts of the loom.

Figure 2 is a section on the line II—II of Figure 1.

Figure 3 is a circuit diagram of the changing arrangements in the rest position, that is to say, with the loom running.

Figure 4 shows the arrangements at the instant when the loom has just been stopped and the reserve shuttle magazine slides into the operative position.

Figure 5 shows the reserve shuttle magazine in the operative position and adjusted during the ejection operation, that is to say, while the loom is still stopped.

Figure 6 shows the mounting of several shuttles in a box of the reserve shuttle magazine.

Figure 7 is a section on the line VII—VII of Figure 6.

Figure 8 shows the wiring of the electric system for operating the shuttle replacing means according to the invention.

The drawings show the assembly of the automatic changing mechanism only in a diagrammatic simplified manner. The letters indicate those parts of the loom which are necessary for a complete understanding of the operational process while the loom is working but which are not directly connected with the actual subject of the invention. The numerals, on the other hand, represent those parts which are essential to the present invention.

In the drawings:

a is the container for operating liquid (left side of the machine);
b is the container for operating liquid (right side of the machine);
c is the jet device for driving the shuttle **90** which is in use;
d is the jet deflector (jet bowl);
e is the deflector stem;
f is the picker;
g is the guide flange for the deflector stem *e*;
h are guide-ways for the jet deflector *d*;
i are cams which are rigidly connected with the drum shaft *z* as the means for automatically indicating the shuttle colour;
k is the upper chain wheel rigidly connected with the drum shaft *z*;
l is the return slide;
m is the linked chain;
n is the bottom chain wheel mounted on the fixed spindle *o*;
o is the fixed spindle for the bottom chain wheel *n*;
p are end securing means for the linked chain *m* on the return slide *l*;
q is the rotary piston for the rotary servo-motor rigidly connected with the drum shaft *z*;
r is the fixed housing for the servo-motor;
s is the control arrangement for the drum magazine *y*;
t is the return lever for the return mechanism *k* to *p*;
u is the feeler lever for the control mechanism *s*;
v is the pivoted lever for the control mechanism *s*;
w is the feeler pin for the perforated card D;
x is a cam adjustably secured to the return slide *l*;
y is the drum magazine rigidly connected with the drum shaft *z*;
z is the drum shaft by which the drum magazine *y* is supported;
B is the shaft for the perforated card drum C;
C is the perforated card drum;
D is the perforated card which controls the shuttle selection;

E is the flow pipe conveying operating liquid from one side of the loom to the other;
F is the reed vibrator;
G is the reed beam;
H are the reed blades;
J are track blades secured to the breast beam K;
K is the breast beam;
L is the housing for the adjusting mechanism 13 to 19 and the ejector mechanism 25—30;
M is the suction pipe for the hydraulic jet drive;
N is the pressure pipe for the hydraulic jet drive;
O is the fluid pump;
P is the shuttle path;
Q is the crankshaft;
R is the reed linkage;
S is the liquid bath in the bottom part of the containers *a* and *b*;
1 is the reserve shuttle magazine;
2 is the cylinder of the displacement servo-motor 3 and 4;
3 is the piston of the servo-motor;
4 is the piston rod of the servo-motor;
5 is the return slide rigidly connected with the piston rod 4;
6 is the cam on the return slide 5;
7 is the shuttle-changing cell;
8 is the bottom flap of the shuttle changing cell 7; pivotable about the pin 9;
9 is the pin for the bottom flap 8;
10 is the tension spring for the bottom flap 8;
11 shows the bottom flap 8 in the open position;
12 are adjustment grooves on the reserve shuttle magazine 1;
13 is the adjustment pin which, by engaging in the grooves 12, locks the reserve shuttle magazine 1 in the operative position;
14 is the piston rigidly connected with the adjustment pin 13 and the pistons 18 and 19 by the piston rod 17;
15 is the compression spring for forcing the piston 14 upwardly;
16 is the cylinder of the adjustment mechanism 13 to 19;
17 is the piston rod rigidly connected with the relieved pair of pistons 18 and 19;
18 and 19 are pistons rigidly connected with the piston rod 17;
20 is a lifting magnet which serves to control the regulating slide valve mechanism 21 to 23. Its winding is connected to two circuits, one of which always supplies voltage while the loom is operating. The second circuit of the field winding is controlled by the electric contact switch 65.
21 is the connecting rod constituting the regulating slide valve mechanism with the two pistons 22 and 23;
22 is the bottom piston of the regulating slide valve mechanism;
23 is the top piston of the regulating slide valve mechanism;
24 is the cylinder for the regulating slide valve mechanism 21 to 23;
25 is the cylinder for the pistons 26 and 27;
26 is an ejector piston rigidly connected with the control piston 27 by an intermediate member 28;
27 is the control piston;
28 is the cylindrical intermediate member;
29 is the piston rod with ejector plate;
30 is the compression spring urging the ejector mechanism 26 to 29 in an upward direction;
31 are cables which are kept under tension and moved in time with the control movements by the cam *i* (Figure 1) from the left side of the loom. The number of cables corresponds to the number of shuttle boxes 89, for example, 5 being shown;
32 are compensating tension springs for the cable 31 (e. g. 5);
33 are bell-crank levers for transmitting the movement of the cable 31 to the head 35 (e. g. 5);

34 are the pivots of the bell-crank levers 33 (e. g. 5);
35 are the heads rigidly connected with the piston rods 36 (e. g. 5);
36 are the piston rods rigidly connected with the pistons 37 and 38 (e. g. 5);
37 and 38 are relieved pistons sliding in the cylinder 40 (e. g. 5);
39 are compression springs urging the heads 35 in an upward direction (e. g. 5);
40 are cylinders for the pistons 37 and 38 (e. g. 5);
41 is a piston rod rigidly connected with the pistons 42 and 43 and coupled at its upper end with the lifting magnet 50. The piston rod is made at its bottom end in the form of a yoke to act as a locking bridge so that all the regulating slide valves 35 to 38 are supported thereon by the piston rod 36 forming an extension of the piston 38;
41*a* is the locking bridge rigidly connected with the piston rod 41;
42 and 43 are pistons sliding in the cylinder 44;
44 is the cylinder of the pistons 42 and 43;
45 is the compression spring urging the piston 43 downwardly;
46 to 49 are annular chambers in the cylinder 44;
50 is the lifting magnet which is energized while the loom is operating and thereby lifts the control slide valves 41 to 43, with which it is coupled, against the force of the compression spring 45;
51 is the cylinder for the pistons 52 and 53;
52 and 53 are pistons sliding in the cylinder 51;
54 is the piston rod rigidly connected with the pistons 52 and 53 and the transverse yoke 55;
55 is the transverse yoke rigidly connected with the piston rod 54 and acting as a common transmission member between all the pivoted levers 61 (e. g. five of them) and the single slide valve consisting of the parts 52 to 54;
56 is the compression spring urging the piston 52 in a downward direction;
57 to 60 are annular chambers in the cylinder 51;
61 are pivoted levers positively guided between the transverse yoke 55 and the lifting plunger 66 (e. g. five of them);
62 is the pivot for the pivoted lever 61;
63 is a push rod movable in a vertical direction in the guide-way 64 (e. g. five of them);
64 is the guide-way for the push rod 63;
65 is the electric contact switch for controlling the second circuit of the lifting magnet 20;
66 is the lifting plunger rigidly connected with piston 67 (e. g. five of them);
67 are pistons (e. g. five of them);
68 is a compression spring urging the piston 67 in an upward direction;
69 is the cylinder of the piston 67;
70 is the intake pipe for the pressure pump 71;
71 is the pressure pump;
72 is the pressure pipe for the operating liquid;
73 to 88 are pipes for operating liquid;
89 are the shuttle boxes (e. g. five of them);
90 are operating shuttles;
91 are reserve shuttles in the reserve shuttle magazine 1;
92 is a collecting channel for ejected empty shuttles;
93 is a locking cam guide in the reserve shuttle magazine 1 (Figures 6 and 7);
94 are retaining springs which urge the locking cam guide 93 and thus the locking cams 95 with their pointed ends 96 in an upward direction;
95 are the locking cams sliding in the guide 93;
96 shows the tapered point of the locking cam 95; the reserve shuttles 91 in the individual shuttle boxes 89 are supported on said points;
97 are locking springs for the locking cams 95;
98 is a pin extending into slot 95′ of member 95 for preventing rotation thereof.

100 is a shuttle contact built in the shuttle;
101 and 102 are relays;
103 and 104 are contactor pairs for relays 102;
105 and 106 are two further relays;
107 and 108 are contactor pairs in relays 105;
109 is a drop contact switch;
110 is the safety switch for the motor.

This arrangement illustrated in Figures 3 to 8 operates as follows:

During the running of the loom, all the parts are in the position shown in Figure 3, in which the reserve shuttle magazine 1 is hydraulically secured in its right hand end position and is disposed with its front end wall above the shuttle changing cell 7.

The reserve shuttle magazine 1 is secured in this end position, since the left side of the piston 3 of the displacement servo-motor 2 to 4 receives pressure liquid from the pump 71 through the pipe 72, the annular space between the pistons 14 and 18, the pipes 74, the annular space between the pistons 26 and 27, the pipes 75, the annular spaces 47 and 46, the pipe 82, the annular space 59 and the pipe 85. At the same time, the piston 67 is supplied with pressure liquid from above through the pipe 72, the annular space between the pistons 37 and 38 and the pipe 88, and is retained in its lowermost position against the action of the spring 68.

Due to the position of the two control slide valves, formed by the pistons 42 and 43, and 52 and 53, respectively, the cylinder space is relieved to the right of the piston 3 of the displacement servo-motor 2 to 4 through the pipe 81, the annular spaces 48 and 49 and the pipes 86, 79 and 70. At the same time, the pressure liquid conducted through the pipe 72 into the annular space 58 is shut off by the pistons 52 and 53 with respect to the annular spaces 57 and 59. Moreover, in this condition, the lifting magnet 20, which is connected into the main control circuit of the loom is energized and has attracted the control slide valve 21 to 23.

The adjusting mechanism 13 to 19 and the ejector mechanism 25 to 30 are located in their upper rest position, since they are forced upwardly by the compression springs 15 and 30, respectively, and their pistons 19 and 26, respectively, are relieved of load through the pipes 76, 73, 80, 79 and 70. The piston 23 separates the pressure pipe 72 from the pipe 73. In this condition, neither the adjusting mechanism 13 to 19 nor the ejector mechanism 25 to 30 are in engagement with the reserve shuttle magazine.

The operational shuttle 90 is disposed in the shuttle-changing cell 7 on the closed bottom flap 8. The pivoted lever 61 is located in its bottom position and the push rod 63 bearing thereon is not lifted. The circuit of the electric contact switch 65 which is connected in a second or auxiliary circuit to the winding of the lifting magnet 20 is interrupted.

If the operating shuttle 90 becomes empty, a feeler incorporated therein but not shown, responds in the shuttle changing cell 7 and thereby stops the loom: the circuit for lifting magnet 50 is thus interrupted because it is a part of the main circuit of the loom. The piston rod 41, together with the locking bridge 41*a* and the pistons 42 and 43, is moved downwardly due to the compression spring 45 and thereby releases all the regulating slide valves 35 to 38 which are blocked by the locking bridge 41*a*. However, these regulating slide valves 35 to 38 are initially held elastically on the bell crank levers 33 by the compression springs 39. The cable 31 of the shuttle 90 actually being used but now become empty is tightened by the eccentric cam *i* (Figure 1) and, through the associated bell-crank 33, forces the corresponding regulating slide valves 35 to 38 downwardly against the action of the compression spring 39. This structure is more fully shown in my co-pending application, Serial No. 263,903, now Patent No. 2,707,005. By this means,

the pipe 88 is shut off from the pressure pipe 72 and connected with the relieving pipe 87. Consequently the annular space located above the piston 67 is relieved through the pipe 88 and the lifting plunger 66 with its piston 67 is urged upwardly under the action of the compression spring 68. The piston 52 and 53 are also moved upwardly against the action of the weaker compression spring 56 and thus open the path of the pressure liquid to the right side of the piston 3 of the displacement servo-motor 2 to 4 (see Figure 4) through the pipe 72, the annular spaces 58 and 57, the pipe 83, the annular space 48 and the pipe 81. At the same time, the left side of the piston 3 is relieved through the pipe 85, the annular spaces 59 and 60, the pipe 84, the annular space 49, and the pipes 86, 79 and 70. By this means, the reserve shuttle magazine 1 is moved towards the left as far as the position determined by the return slide 5 or the cam 6 arranged thereon. With the upward movement of the control slide 52 to 55, the pivoted lever 61, which is located between the common transverse yoke 55 and the lifting plunger 66 and 67 which has just responded, has also moved upwardly and has thus lifted the push rod 63 and closed the electric contact switch 65. Consequently, the lifting magnet 20 is also energized, but through the second or auxiliary circuit therefor.

As the corresponding cam 6 of the return slide 5 slips over the push rod 63, the deflected push rod 63 and thus the pivoted lever 61 are urged downwardly again. The control slide valve 52 to 55 is again moved downwardly under the force of the associated compression spring 56, whereby the flow of pressure liquid to the servo-motor 2 to 4 is interrupted. The reserve shuttle magazine remains in the predetermined position. The electric contact switch interrupts the second circuit to the lifting magnet 20, which is thus de-energized, and the adjusting mechanism 13 to 19 and the ejector mechanism 25 to 30 commence to function. Due to the lowering of the piston 23 (Fig. 5), the liquid under pressure from the pipe 72 can now act on the piston 19 through the annular space between the pistons 22 and 23 and the pipe 73. The piston 19 is moved downwardly and, by means of the adjusting pin 13, fixes the reserve shuttle magazine 1 in one of the adjusting grooves 12 which are provided. Due to this new position of the piston 18, both sides of the piston 3 of the servo-motor 2 to 4 are relieved through the pipes 77 and 78 by way of the pipes 79 and 70. The reserve shuttle magazine 1 can therefore now assume the accurate position above the shuttle changing cell 7 as determined by the adjustment mechanism 13 to 19. After the adjustment has been carried out, the pipe 76 from the piston 19 for the supply of liquid under pressure to the ejector mechanism 25 to 30 has been opened and the piston 26 is acted upon. The ejector plunger 29 is moved against the force of the compression spring 30 in a downward direction, urges a fully loaded reserve shuttle 91 into the shuttle changing cell 7 and forces the empty operating shuttle 90 out of the shuttle changing cell 7 in a downward direction against the action of the spring 10. The stroke of the ejector mechanism 25—30 is so limited that it is always only the lowermost shuttle, that is to say, the operating shuttle 90 which has become empty, which is forced out of the reserve shuttle magazine 1 through a blocking arrangement 93 to 98, it at the same time forcing the empty shuttle 90 from the shuttle changing cell 7. The additional reserve shuttles 91 provided in the same shuttle box 89 of the reserve shuttle magazine 1 are prevented from falling through by the yieldable blocking arrangements 93 to 98.

The introduction of the new operating shuttle 90 into the shuttle changing cell 7 is effected as follows:

By the pressure of the ejector plate 29 on the top of the reserve shuttle 91 of a shuttle box 89, all the reserve shuttles 91 in said box, which shuttles are arranged one above the other and are retained by the locking cam 95 loaded with a strong locking spring 97, are forced downwardly

against the action of the two retaining springs 94. When the tension of the two retaining springs 94 has reached a definite value, the downward movement ceases and the bottom reserve shuttle 91 is forced over the locking cams 95, overcoming the locking springs 97 arranged therein. The new operational shuttle 90 is then in the shuttle changing cell 7. Since the ejector plunger 29, which is limited in its stroke, again travels out of the shuttle box 89, the retaining springs 94 can again lift the reserve shuttles 91 still located in the shuttle box 89. The direct contact between the operating shuttle 90 and the reserve shuttles 91 in thus eliminated and the reserve shuttle magazine 1 can return unhindered to its initial position.

These operations, namely, the outward movement of the ejector plunger 29 from the shuttle box 89 and the return of the reserve shuttle magazine 1, are initiated by the empty shuttle 90 forced out of the shuttle changing cell 7. As it falls, it closes an elecrical contact which causes the lifting magnets 20 and 50 to be again energized and with delay starts the loom again. The pipes 73 and 76 are without pressure through the pipes 80, 79 and 70. The operation of the electric system and the wiring thereof is explained in detail hereinafter (see also Figure 8). The compression springs 15 and 30 force the parts above them in an upward direction, whereby in the end position, the connection between the pipes 74 and 75 is restored and made available for the flow of liquid under pressure to the annular chamber 47. In this way, the left side of the piston 3 in the servo-motor 2 to 4 again receives liquid under pressure from the annular space 47 through the annular space 46, the pipe 82, the annular space 59 and the pipe 85, while the right side of the piston is relieved through the pipe 81, the annular chambers 48 and 49 and the pipes 86, 79 and 70. The pipes 77 and 78 leading to both sides of the displacement servo-motor 2 to 4 have been shut off and closed again by the returned piston 18. The reserve shuttle magazine 1 now travels back to its right-hand initial position and is retained hydraulically therein until the procedure is repeated in the manner described for any desired operating shuttle 90.

The replacement of shuttles takes place with aid of the auxiliary electric control system shown in Figure 8.

If the operating shuttle is emptied, a shuttle contact 100 provided in the same reacts to charge the magnet coil of relays 101 with voltage, interrupt the control circuit of the motor safety switch 110 and interrupt the operation of the loom.

At the same time voltage is also charged to the magnet coil of relays 102. This causes the contactor pair 103 of relays 102 to be closed and to act as a locking contact in parallel to the shuttle contact 100. Voltage is also applied concurrently to the magnet coils of relays 105 and 106 by way of the simultaneously closed contactor pair 104 of relays 102.

Thereupon the contactor pair 107 of relays 105 will be opened at once, whereby current to the lifting magnet 50 is interrupted. The contactor pair 108 of relays 105 opens with a delay which is selected of sufficient duration to keep the lifting magnet 20 dead until the electric contact switch 65 is closed in consequence of the operation of the hydraulic system, whereby voltage is again applied to the lifting magnet 20 by way of relays 106. Accordingly current to the lifting magnet 20 is only interrupted in the same instant, when the reserve shuttle magazine is in operative position, and when the switch 65 is opened by the corresponding cam 6 of the return slide and intermediary members 63 and 61. Thereby the hydraulic operation of the adjusting and ejecting mechanism is started as has been described hereinbefore. During the subsequent ejection of the empty shuttle, the bottom flap 8 is swiveled into the position indicated at 11 and opens the drop contact switch 109. Therewith the shuttle replacing operation is terminated and all electric switching members return to their initial position shown in Figure 8.

In the manner described, the shuttle changing operations takes place entirely automatically with the minimum loss of time. The same operation could also be carried out by partial replacement of the hydraulic system by lever arrangements without essentially changing the mode of shuttle-changing which has been described. It is obvious that various constructional details could be formed differently without substantially affecting the method which has been described and the mechanism disclosed herein. More especially, the construction could be such that certain of the movements described are effected by compressed air or electric current.

However, the hydraulic drive just described has the advantage of being extremely compact and so long as a clean operating liquid is used, reliability in operation is completely assured. For example, if oil is used as the liquid under pressure, the mechanical wear on all moving parts is reduced to a minimum and the formation of rust is excluded. In addition, the production costs are very low, since comparatively small constructional elements are involved which mainly consist of only simple rotatable members.

I claim:

1. In a loom; a shuttle box at one side thereof for receiving the shuttle at one end of its travel across the loom, a multiple compartment reserve shuttle magazine above the shutle box releasably supporting reserve shuttles in vertically stacked relation in the compartments thereof to be transferred to the box, hydraulically operable pusher means acting downwardly from above said magazine for forcing a reserve shuttle out of said magazine into said shuttle box, said shuttle box releasably supporting the shuttle thereon for discharge thereof from the box upon the application of a downwardly acting force thereon, and hydraulic control means for moving said magazine to bring the compartments thereof into registration with said box.

2. In a loom; a shuttle box at one side thereof for receiving the shuttle of the loom at one end of its travel and open at one side, the wall of said shuttle box opposite said one side being adapted for releasing a shuttle in the box therefrom when it is pushed toward the said wall, a multiple compartment reserve shuttle magazine on the said one side of the shuttle box adapted for being moved relative to the shuttle box to register the compartment thereof with the shuttle box, the reserve shuttles therein parallel with the shuttle in said box, said magazine supporting hydraulic operable pusher means on the opposite side of said magazine from said shuttle box operable for entering the compartment of the magazine that is registered with said shuttle box to dislodge a reserve shuttle in parallelism with itself therefrom into said shuttle box, with the said wall of the shuttle box permitting the displacement from the said box of the shuttle being replaced, and hydraulic means for moving said magazine.

3. In a loom; a shuttle box at one side for receiving the shuttle of the loom at one end of its travel and being open at the top, the bottom wall of said box being yieldable so as to releasably support the said shuttle therein, a multiple compartment reserve shuttle magazine slidably mounted above said shuttle box and movable thereover hydraulic means for moving said magazine to locate the individual compartments thereof over said shuttle box, the reserve shuttles in the magazine being releasably supported therein in parallel registration with the shuttle in said box, a pusher member above the magazine in vertical registration with said shuttle box, and hydraulically operated means for moving said pusher member downwardly for dislodging the lowermost one of the reserve shuttles from the compartment of the magazine that is registered with said shuttle box into said shuttle box while simultaneously forcing the shuttle already in the box out of the bottom thereof.

4. An arrangement according to claim 3 in which the reserve shuttles are supported in the compartments of said

magazine by resilient detent means arranged in the box at the opposite ends of the lowermost shuttle in each compartment thereof, and said detent means being operable upon retraction of said pusher member to elevate the reserve shuttles remaining in the pertaining compartment of the magazine at least slightly whereby a clearance is maintained between the shuttle in the shuttle box and the lowermost shuttles in the said magazine.

5. In a loom; a shuttle box at one side of the loom for receiving the loom shuttle at one end of its travel, said shuttle box being open at the top and having its bottom wall hinged thereto and normally spring urged upwardly to close the bottom of the shutle box, a multiple compartment reserve shuttle magazine slidably mounted above the shuttle box and movable for bringing the said chambers thereof into selective vertical registration with said shuttle box, each said chamber being adapted for containing a plurality of reserve shuttles in vertically stacked parallel relation with the shuttle in the shuttle box, a pusher member above the said magazine in vertical alignment with said shuttle box, and hydraulic means for moving said pusher member downwardly to force the lowermost shuttle out of the chamber that is aligned therewith and therethrough to force the shuttle in the shuttle box out the bottom thereof.

6. An arrangement according to claim 5 in which each chamber of the magazine has a spring loaded plunger at the opposite ends thereof for engaging the ends of the lowermost shuttle in the respective chamber, said plungers having upwardly and outwardly inclined end surfaces whereby the shuttles are releasably retained in the respective chambers thereby, while retraction of said pusher member upwardly after the transfer of a shuttle to said box will permit said plungers to elevate the shuttles remaining in the chamber thereby to provide a clearance between the shuttles in the said magazine and the shuttle in said box.

7. An arrangement according to claim 2 in which hydraulic means is provided operable for engaging the magazine and locking it in its several positions of registration of the compartments thereof with said shuttle box, and means to actuate said hydraulic means prior to the operation of said pusher means for dislodging the reserve shuttles from the magazine.

8. In a loom; a shuttle box at one side of the loom for receiving the loom shuttle at one end of its travel being open at the top and having its bottom wall hinged thereto and spring urged upwardly for normally closing the bottom of the box, a multiple compartment shuttle holder at the opposite side of the loom for supporting a plurality of shuttles adapted for carrying weft threads having different characteristics, said holder being movable for selectively presenting the shuttles in the compartments thereof to the picker of the loom for determining the character of the product being woven, hydraulic means to move said holder, a reserve shuttle magazine at the said one side of the loom slidable over said shuttle box and having multiple compartments corresponding to the multiple compartments of said holder, reserve shuttles in the compartments of said magazine in vertically stacked relation parallel with the shuttle in said box and the weft threads therein respectively corresponding to the weft threads in the shuttles in the said holder, a pusher element above the magazine in vertical alignment with said box for forcing shuttles out of said magazine into the box while simultaneously forcing the shuttle from the box out the bottom wall thereof, hydraulic means for actuating said pusher element, hydraulic means for moving said magazine over said box, means sensitive to the position of said holder for halting said magazine with the compartment thereof that corresponds with the compartment of the holder that is in effective position in vertical registration with said shuttle box, and a hydraulic circuit for supplying fluid to said hydraulic means.

9. In a loom; a shuttle box at one side of the loom open at the top and having a yieldable bottom wall, a multiple compartment reserve shuttle magazine slidably mounted at the said one side of the loom and movable over hydraulic means to move said magazine, the shuttle box, the compartments of said magazine being adapted for receiving reserve shuttles vertically stacked and parallel with the shuttle in said box and releasably retained in said compartments for release through the bottom thereof into said box, a multiple compartment shuttle holder in the opposite side of the loom having shuttles in the compartments thereof adapted for carrying weft threads of different characteristics, hydraulic means for moving said holder for selectively presenting the compartments thereof to effective position to the picker at that side of the loom, means for halting said loom upon an empty shuttle being received in said shuttle box and for initiating movement of the magazine over the shuttle box, means sensitive to the position of said holder for determining the amount of movement of said magazine so that the compartment thereof which aligns with said shuttle box will correspond with the compartment of the holder that is in effective position, hydraulically operated means operable after the magazine has been positioned for forcing the shuttles in the compartment aligned with the box downwardly to dislodge the lowermost one therefrom into said box and to force the empty shuttle from the box out the yieldable lower wall thereof, and a hydraulic circuit to supply pressure fluid to said hydraulic means.

10. An arrangement according to claim 9 in which the dislodging of the empty shuttle from the shuttle box first causes retraction of the said hydraulic means, then causes retraction of the magazine, and then again initiates the operation of the loom.

11. In a loom; a shuttle box at one side of the loom having a yieldable lower wall and being open at the top, a reserve shuttle magazine having a plurality of vertical compartments open at the bottom adapted for selective registration with said box so that shuttles stacked vertically therein will be parallel with the shuttle in the box when the pertaining compartment registers therewith, a multiple compartment shuttle holder in the opposite side of the loom, hydraulic means for moving said holder for selectively presenting the shuttles carried thereby to the picker at that side of the loom, hydraulic means for moving said magazine laterally of said box for aligning the compartments thereof with the box, hydraulic circuit for supplying pressure fluid to said hydraulic means, and a control system connected with said holder to be influenced thereby operable to control the supply of pressure fluid to the hydraulic means for moving said magazine to halt the magazine with a different one of the compartments thereof registering with said box for each position of said holder.

12. An arrangement according to claim 11 in which the said control system comprises an individual control element associated with each compartment of said holder and each effective only when the pertaining compartment of the holder is in effective position, and limit means associated with the hydraulic actuating means for said magazine and arranged for being made selectively effective according to whichever one of said control elements is effective.

13. An arrangement according to claim 11 in which the magazine is provided with a separate limit means for each compartment thereof operable when effective to halt the magazine with the pertaining compartment thereof aligned with said box, a control element for each said limit means operable when actuated to make the pertaining limit means effective, and means connecting said control elements with said holder for selectively actuating the control elements as the individual compartments of the holder are moved into effective position.

14. In a loom; a shuttle box at one side of the loom open at the top and having a yieldable bottom, a re-

serve shuttle magazine having a plurality of compartments for reserve shuttles, a fluid motor connected to the magazine to reciprocate it over said box, a cam carried by the magazine for each position of alignment of a compartment thereof with the box, a member engageable by each cam in the pertaining said position of the magazines, a source of pressure fluid, means for supplying fluid from said source to said motor to move the magazine across the box, means responsive to the actuation of anyone of said members by its pertaining cam for interrupting said supply, a multiple shuttle holder on the opposite side of the loom movable for selectively presenting the shuttles therein to the picking axis of the loom, hydraulic means for moving said holder, means normally holding said members in ineffective position, and means operated by movements of said holder for releasing a different one of said members to effective position for each operative position of said holder.

15. An arrangement according to claim 14 in which a hydraulically operated pusher is positioned for pushing a shuttle from the compartment aligned with the box out the bottom of the compartment into the box while simultaneously pushing the shuttle that was in the box out the bottom thereof, and means operable upon an empty shuttle being received in said box during operation of the loom for halting the loom and initiating the supply of fluid to said motor, and means operable upon said magazine being halted by actuation of one of said members for supplying pressure fluid to said pusher.

16. An arrangement according to claim 15 in which the dislodging of the empty shuttle from the box brings about the retraction of the pusher, then retraction of the magazine, and then causes said loom to resume operation.

17. An arrangement according to claim 15 which includes a hydraulically operable clamp for clamping the magazine in its respective positions of alignment of a compartment thereof with said box, and means for operating said clamp to clamp the magazine before the pusher operates and for retracting the pusher before the clamp is retracted.

18. In a control system for a loom of the nature described in which a multiple compartment reserve shuttle magazine is movable over the shuttle box to a position corresponding to the position of a multiple shuttle holder on the opposite side of the loom; a double acting fluid motor connected with the magazine, a source of fluid under pressure, conduit means leading from the source to the motor and including valve means normally closed when the loom is in operation, means for opening the valve means and for halting the loom when an empty shuttle is delivered to said box, a control element actuatable by said magazine for each position of alignment of a compartment thereof with said box, said control element normally being in ineffective position, a connection from each control element to said holder operable for making a different one of said elements effective for each operative position of said holder, each said element comprising a movable lever, spring means urging each lever toward effective position, fluid operable means for counteracting the influence of each spring means, and a normally closed valve between said source of pressure fluid and each said fluid operable means, arranged for being actuated into open position singly in accordance with the position of said holder.

19. In a control system of a loom of the nature described having a multiple shuttle holder movable for presenting the shuttles therein selectively to the picking axis of the loom, a plurality of cam members carried by said holder, a plurality of levers, a resilient connection between each cam member and each lever whereby a different one of the levers is actuated for each operative position of the holder, a multiple compartment reserve shuttle magazine for supplying reserve shuttles to the loom and having a supply position corresponding to each position of the holder, a control element adapted for actuation by the magazine in each said position thereof, resilient means normally urging said element toward effective position, fluid operable means for each element for moving them to ineffective position, and a valve associated with each lever and hydraulically connected between said source of pressure fluid and said fluid operable means normally positioned to permit a supply of fluid to said fluid operable means, and movable upon actuation of the pertaining lever into position to exhaust the fluid operable means connected therewith.

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