Nov. 26, 1968 K. W. WUEGER 3,412,763

PNEUMATIC LOOM

Filed June 7, 1966 2 Sheets-Sheet 1

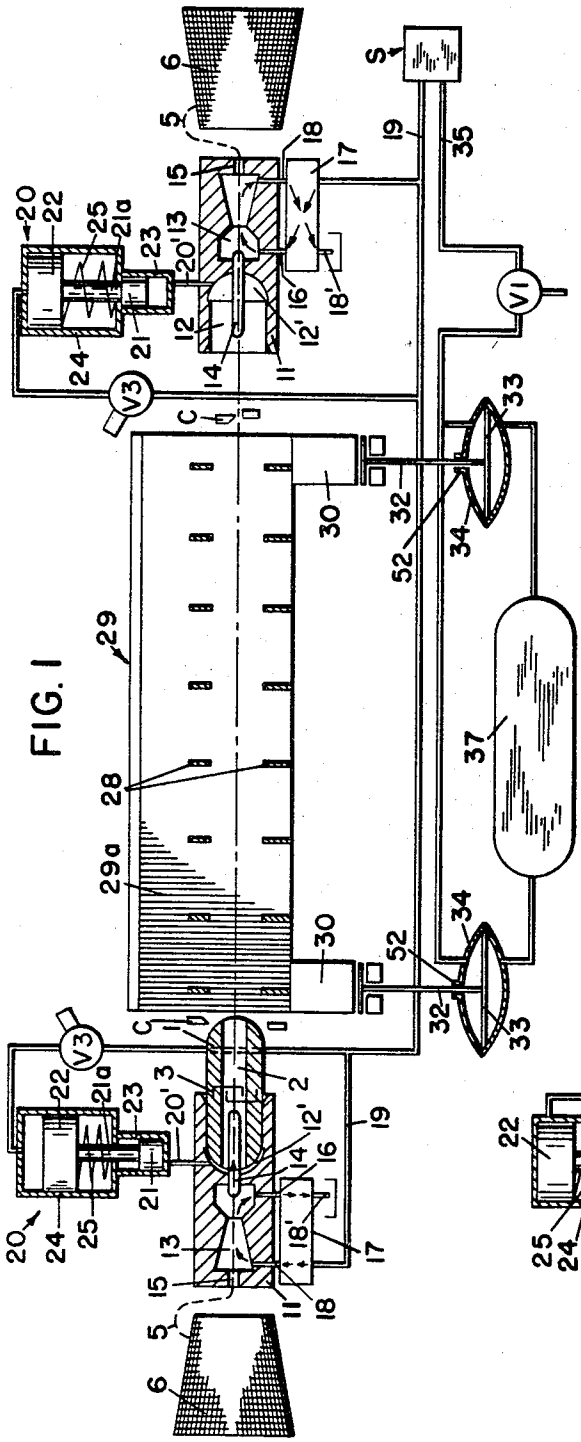


FIG. 1

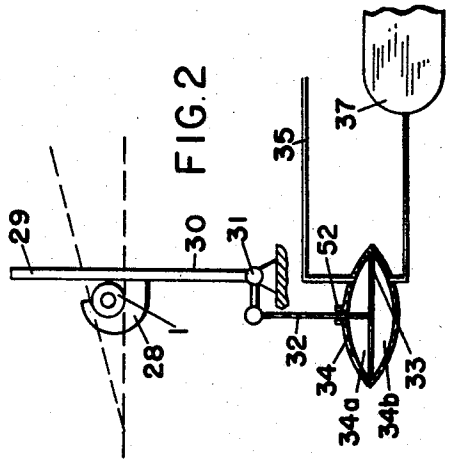


FIG. 2

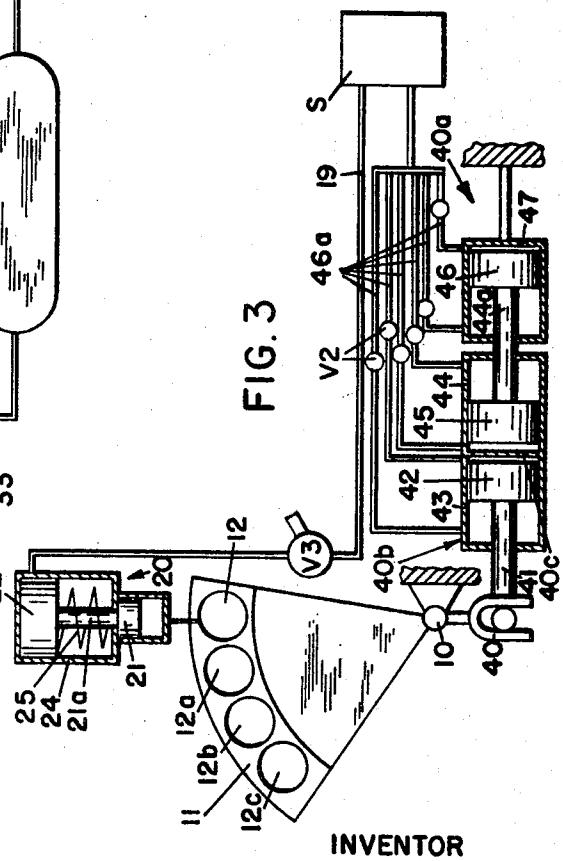


FIG. 3

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Nov. 26, 1968 K. W. WUEGER 3,412,763

PNEUMATIC LOOM

Filed June 7, 1966 2 Sheets-Sheet 2

FIG. 6

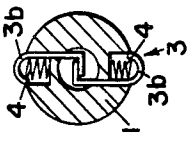


FIG. 5

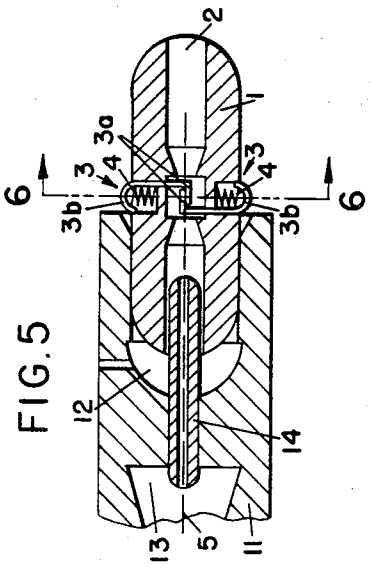


FIG. 7

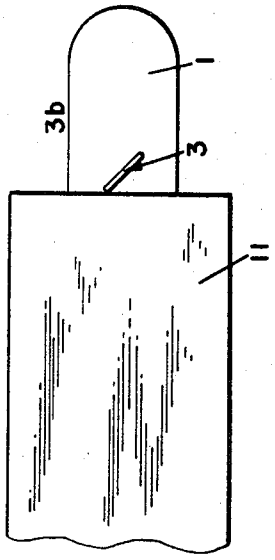
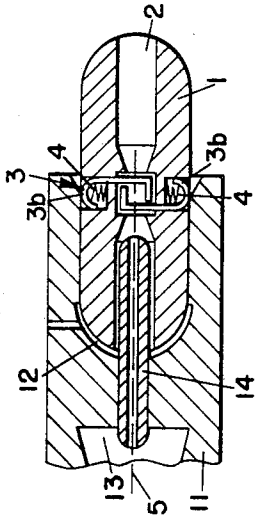


FIG. 4



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PNEUMATIC LOOM

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Filed June 7, 1966, Ser. No. 555,895
8 Claims. (Cl. 139—126)

ABSTRACT OF THE DISCLOSURE

A loom in which filling is inserted alternately from each side of the loom from outside filling supply packages by shuttles which have grippers located centrally in a longitudinal bore. The shuttles are pneumatically threaded and launched to and from launching and receiving chambers located on both sides of the loom.

The present invention relates to a loom which is pneumatically operated and more particularly to a loom wherein filling is inserted alternately from both sides of the loom from outside filling supply packages.

There are various types of outside filling supply looms which utilize a gripper shuttle for alternately laying filling from each side of the loom. In some cases, the filling is inserted from only one side, the shuttle being returned by a conveyor. The use of a gripper shuttle eliminates many motions associated with conventional looms, such as bobbin replenishing, weft detecting and box motions. Other problems associated with conventional looms remain, however, such as wear and impact associated with picking and checking.

Some looms have been produced which represented an attempt to eliminate most of the remaining problems by utilizing air or water jets to insert filling.

The air and water jet looms, however, have inherent problems of their own. The width of cloth which can be woven on these looms is limited due to turbulence in the case of air, and dispersion in the case of water. The type of filling which can be used is also limited. The filling has to be smooth because of air turbulence and in the case of water jet looms, filling with a low absorption rate has to be used. Filling tension and filling control in air and water jet looms are very difficult to maintain, making it very difficult to produce a good selvage.

It is, therefore, an object of the present invention to provide pneumatically operated weft inserting means in which the filling will be positively controlled and which overcomes all of the disadvantages noted above.

Another object of the invention is to provide pneumatically controlled means to insert multi-color filling.

A further object of the invention is to provide pneumatic means to reciprocate the lay. These and other objects of the invention are accomplished by the provision of one or more gripper shuttles which are reciprocated by one or more pneumatic launching and receiving devices on each side of the loom.

The shuttle has a central bore and a gripping means located centrally of the bore so that it can be pneumatically threaded from each side of the loom. The launching devices at each side of the loom are mounted in a segment which is pneumatically controlled to selectively place any one of the launching and receiving devices into shuttle launching and receiving position.

The lay is pneumatically operated by one or more devices, each of which is divided into two chambers by a diaphragm. One chamber is connected to a source of compressed air and the other chamber is sealed and filled with air at superatmospheric pressure but at less pressure than the source of compressed air. The diaphragm is connected to the lay by linkage and is caused to reciprocate between chambers which, in turn, causes the lay to reciprocate.

The invention will be made clear from the following description and claims taken with the accompanying drawings in which:

FIGURE 1 is a front elevation of the loom with parts in section;

FIGURE 2 is a schematic end view of the lay drive, parts being in section and broken away;

FIGURE 3 is a diagrammatic illustration of the multicolor segment and color selecting mechanism;

FIGURE 4 is an enlarged longitudinal cross section of the shuttle positioned in one of the launching devices;

FIGURE 5 is a view similar to FIGURE 4, but showing the shuttle just prior to being fully positioned in the launching device; and

FIGURE 6 is a vertical section of the shuttle along line 6—6 in FIGURE 5 and looking in the direction of the arrows.

FIGURE 7 is an enlarged top view of the shuttle positioned in one of the launching devices similar to FIGURE 5.

Referring to the drawings, a shuttle **1**, with a central bore **2** is substantially cylindrical with tapered ends. The center of the shuttle contains a thread gripping device which comprises, see FIGURES 4 to 7, of a pair of grippers **3** having complementary gripping jaws **3***a* which overlap within the bore **2** of the shuttle and looped ends **3***b*. Springs **4** normally urge jaws **3***a* into gripping relation and at the same time cause looped ends **3***b* to extend outside of the shuttle body as shown in FIGURE 5. If the shuttle is pushed into a tight path, the extending looped ends **3***b* are squeezed and push gripping jaws open as shown in FIGURE 4.

The above description shows clearly that the shuttle does not carry a bobbin but is only a filling inserter for filling **5** taken from stationary cones **6** mounted outside of the loom.

The shuttle is reciprocated across the loom to and from pneumatic launching devices located on both sides of the loom. The subject loom is adapted for weaving with multicolor filling supply, wherein several shuttles **1** and their mating launching devices are used. There are two launching devices per shuttle and each color, one on each side of the loom. The launching devices are mounted in a segment **11** which is pivoted at **10**. Each launching device contains a launching chamber, jet **13** and a guide tube **14**. The interior of each chamber **12** has an enlarged portion **12'** which forms an air space when the shuttle is in the chamber as shown in the left-hand side of FIGURE 1. This space will be charged with air to launch the shuttle **1** by means to be described. Upon entry of the shuttle into chamber **12**, looped ends **3***b* of grippers **3** are pushed towards the center of the shuttle and the gripping jaws **3***a* are opened. The jet **13** of each launching device is arranged coaxial behind the chamber **12** and is pneumatically connected to it by the filling guide tube **14** which is mounted between the jet **13** and chamber **12**. Guide tube **14** extends into the groove of shuttle **1** when the shuttle is in chamber **12**. Each launching device has a relatively small opening **15** which forms a thread guide for a filling **5** to enter jet **13** from one of the cones **6**.

The jet **13** is of the Venturi design and is connected to two air lines **16** and **18**. Line **16** opens into the inner end of the jet **13** and line **18** opens into the outer end of the jet. Lines **16** and **18** are, in turn, connected to a normally closed reversible valve **17** which can be opened to connect either line **16** or **18** to main air line **19** which is, in turn, connected to an air supply generally indicated at S and containing air at superatmospheric pressure. When the valve **17** connects line **16** to the main air line

19, it simultaneously connects line 18 to a vent 18' going out into the atmosphere. The reversible valve 17 makes it possible to reverse the air stream in jet 13.

The portion 12' of each chamber 12 is connected through a line 20' to a pressure increaser generally indicated at 20 which comprises of two pistons, 21 and 22. These pistons are of different diameters and are connected to each other by a rod 21*a*. The smaller piston 21 moves up and down in cylinder 23 which is connected to the chamber 12. The larger piston 22 moves up and down in cylinder 24 and is connected to the main air line 19. A spring 25 normally keeps pistons 21 and 22 in their end position as shown in the right-hand side of FIGURE 1.

All of the shuttles 1 and matching launching devices are the same as described above; however, it is possible to have either on the left or the right hand side of the loom one common pressure increaser 20 which connects only the chamber 12 of the launching device that is ready for a shuttle launching. Mechanism for moving the segment 11 will be described hereinbelow.

Both segments 11 on either loom side are pneumatically adjustable for filling selection. Each segment 11 has a rigid lever 40 which makes a joint together with a connecting rod 41 connected to a chamber selecting device generally indicated at 40*a* and comprising a moveable cylinder member 40*b* and a fixed cylinder member 47. Member 40*b* has two cylindrical portions, 43 and 44 separated by a partition 40*c*. Connecting rod 41 is connected to a piston 42 which moves in cylinder 43. A second piston 45 moveable in cylinder 44 is connected by a connecting rod 44*a* to a third piston 46 which is moveable in stationary cylinder 47. The pistons 42, 45 and 46 with their mating cylinders 43, 44 and 47 are connected in series so the piston travel adds up. Each cylinder 43, 44 and 47 is connected with two of a plurality of air lines 46*a* which are connected to individual valve and vent means V2. Valve and vent means 40' are connected to the air supply S and are controlled by a paper pattern card, not shown. The pattern card by selectively controlling the opening and closing of valves 40', controls the air flow through each individual air line 46*a*. One method of using a pattern card to control air flow can be found in U.S. Patent 572,246. The two air lines for each cylinder are connected on opposite sides of the cylinder. If compressed air is allowed to flow through an air line on one side of the corresponding piston it will move to the other side of the cylinder. If the pattern card allows compressed air to flow in cylinder 47 in the right part of piston 46, FIGURE 3, pistons 46 and 45, as well as moveable cylinder member 40*b*, will move towards the left. The segment 11 moves a certain amount and a new chamber 12*a*, including a jet 13 and different color filling, is ready for launching.

If compressed air is allowed to enter cylinder 44 to the left of piston 45, FIGURE 3, cylinder member 40*b* will then be pushed to the left and segments 11 will then pivot a certain additional amount and a third chamber 12*b* with a third filling becomes ready for launching.

If compressed air is allowed into cylinder 42 to the right of piston 42, FIGURE 3, piston 42 will move to the left relative to member 40*b* and again, the segment 11 will move a certain amount to bring a fourth launching member 12*c* and its jet 13 with a different color filling into operation. It is quite possible to move the segment from the first position to the third or fourth by simultaneously charging any combination of two or all three of the cylinders 43, 44 and 47.

The resetting of the segments 11 is also done by introducing compressed air to the cylinders to the opposite side of the piston. Pistons 42, 45 and 46, cylinders 43, 44 and 47 are charged with air and the corresponding chambers are vented. Even the resetting can be done in various sequences.

The operation of the various pneumatic valves which control the operation of the loom in the sequences described above, may be controlled and timed by cams as illustrated in my co-pending U.S. application, Ser. No. 555,896, filed June 7, 1966. The operation of air valves in timed relation with the lay can be seen for example in U.S. Patents 781,632, 921,658, 1,945,238, 2,528,150, 2,538,530, and 2,858,856.

In order to guide the shuttle across the loom, a number of guide blocks 28 mounted on the lay 29 at spaced intervals which are less than the shuttle length. The lay comprises a reed 29, the guides 28 and two supports 30. The lay is driven pneumatically in the following manner: The supports 30 are angle levers pivoted at 31 and driven through a connecting rod 32. The diaphragm 33 divides a container 34 into two chambers, 34*a* and 34*b*. Chamber 34*a* is connected to a line 35 through a shutoff valve and vent V1 to the air supply S. The lower chamber of container 34 is pneumatically connected to a pressure tank 37 containing air at superatmospheric pressure but at lower pressure than said air supply S. Valve and vent means V1 alternately allows air to enter chamber 34*a* from air supply S and vent the air from the chamber. When air is supplied to chamber 34*a*, it overcomes the pressure in tank 37 and forces the diaphragm into chamber 34*b*. When the air in chamber 34*a* is vented, the pressure in tank 37 forces the diaphragm into chamber 34*a*. This alternate filling and venting of air in chamber 34*a* by valve and vent means V1 reciprocates the connecting rods 32 up and down through seals S2. The motion of rods 32 in turn causes the reed 29 to reciprocate between back and front positions.

To explain how the subject loom operates, a single filling insertion will be explained as follows: Each launching device contains filling from one of the cones 6 which normally extends through the jet 13 and the guide tube 14 within reach of the cutter C. The cutter C can be of any type as shown, for instance, in FIGURE 3 of U.S. Patent 2,637,349.

According to FIGURE 1, the shuttle 1 is located in chamber 12 of one of the launching devices on the left side of the loom. The looped ends 3*b* of the thread grippers 3 are pushed towards the inside by the surface of chamber 12 forcing the gripping jaws 3*a* open. The opened thread gripper is located next to the thread guide tube 14 when the shuttle is fully in the chamber, as shown in FIGURE 4.

The first step in a weft inserting sequence is the opening of the reversible valve to release compressed air, into the line 19. Referring to the lefthand side of the loom in FIGURE 1, the reversible valve 17 allows air to flow through jet 13 from left to right which blows the filling 5, causing it to be drawn off cone 6 and to travel towards the right. The filling 5 is introduced between the gripping jaws 3*a* of grippers 3. At this time, valve and vent means V3 is opened and air is allowed to flow into the cylinder 24 of the pressure increase 20. This air piston 22 down against the spring 25 which, in turn, forces the piston 21 down to compress the air in cylinder 23 and force it into the chamber 12 with a much higher pressure than that of the air supply. This shoots the shuttle 1 towards the right, out of the chamber. As soon as the looped ends 3*b* leave the chamber 12, they are effectively released and the springs 4 push the gripping jaws 3*a* together thus holding the thread 5 firmly. The shuttle 1 flies through the opened shed along the reed 29*a* and is guided by the guide blocks 28 thereby inserting the filling through the shed. The shuttle does not carry the full filling load but only the front end of filling 5 since the jets 13 continues to blow the filling. When the shuttle is about one inch from the right hand chamber 12 the reversible valve 17 is operated to cut the flow off of air through lines 18 and allow it to flow into line 16. This reverses the air stream in jet 13 momentarily to stop the filling. While the shuttle 1 enters chamber 12 on the right loom side,

the filling is slightly stretched and under tension which causes the thread to slide out of the gripping jaws 3*a*. At this moment, air valve V3 is operated to shut off the air supply to the left pressure increaser **20** and allow cylinder **24** to vent through the valve V3. This allows pistons **21** and **22** to go back in their upper positions. The shuttle **1** enters chamber **12** on the right and is decelerated by the air cushion in front of it. The looped ends 3*b* are pushed toward the inside by the chamber **12** wall and the gripping jaws 3*a* are opened. In order to keep the shuttle in position, the air which forms the cushion is vented through the bore in the shuttle.

During the above described shuttle motion the lay **29** remained in its back center position. As soon as the shuttle **1** enters the chamber **12** on the right the valve in line **35** opens to allow compressed air into the upper part of the container **34**. The diaphragm **33** moves downwards because of the relatively lower air pressure in tank **37**. The connecting rod **32** and the lay levers **30** and **31** move the reed **29***a* towards the front to beat the filling into the weave. The air is then vented out of the upper part of the container **34** and the trapped air in the tank **37** pushes the diaphragm **33** back in its end position, causing the lay to go to the back center position.

Because the grippers are opened when the shuttle enters the chamber **1**, there is a certain amount of filling which extends over the edge of the fabric. If desired this filling can be used to make a reinforced selvedge by any conventional means such as that shown in U.S. Patent 2,267,287.

An additional filling thread **5** can now be inserted from right to left in the same manner as described above.

With the subject loom all kinds of yarn can be used and every weave can be made which is woven on other type looms.

Having described the invention what is now claimed is:

1. In a loom having means for forming a warp shed, pneumatic filling inserting mechanism for inserting filling from outside supply packages into said warp shed comprising:

(a) a source of compressed air;

(b) a pneumatic launching and receiving device at each end of the loom, each of said devices having a chamber;

(c) a shuttle adapted to be launched from and received into said chambers, said shuttle having a longitudinal bore and filling gripping means disposed within said bore;

(d) means for threading one end of filling into said gripping means; and

(e) launching valve means for connecting each of said launching devices to said source of compressed air, whereby said shuttle is propelled through said warp shed, thereby inserting said filling therein.

2. In a loom as described in claim **1**, wherein each of said launching devices has a filling control chamber which has an outer air port, an inner air port, and a filling entry port through which said filling extends from said package, said threading means comprising:

(a) a guide tube connecting said filling control chamber to said launching and receiving chamber, adapted to enter the bore of said shuttle as said shuttle enters said launching and receiving chamber; and

(b) valve means adapted to connect said outer air port to said source of compressed air, whereby said filling is blown through said guide tube into the bore of said shuttle into said gripping means.

3. In a loom as described in claim **2** wherein said valve means is a reversible valve which alternately connects said inner and outer ports to said source of compressed air wherein said filling is braked upon connection of said port to said source of compressed air.

4. In a loom as described in claim **2**, wherein said gripping means comprises:

(a) a pair of gripper members having complementary gripping portions extending into the bore of said shuttle, at least one of said members having an outer portion extending beyond the outer surface of said shuttle; and

(b) spring means normally urging said gripping portions into filling engaging position and maintaining said outer portion in said extended position, and adapted to allow said outer portion to be depressed in opposition to said spring means by the wall of said launching and receiving chamber, whereby said gripping portions are opened when the shuttle enters said chamber.

5. In a loom as described in claim **1**, wherein said launching valve means comprises:

(a) a pneumatic pressure increaser pneumatically connected to said launching chamber and adapted to supply said launching chamber with air at a pressure greater than that of said source of compressed air upon connection to said source; and

(b) a launching chamber valve adapted to connect said pressure increaser to said source of compressed air.

6. In a loom as set forth in claim **5**, wherein said pressure increaser comprises:

(a) a cylinder member having a first cylindrical portion pneumatically connected to said launching chamber valve and a second cylindrical portion pneumatically connected to said launching and receiving chamber and being of smaller diameter than said first cylindrical portion;

(b) a first piston moveable in said first cylindrical portion;

(c) a second piston of smaller diameter than said first piston and moveable in said second cylindrical portion;

(d) connecting means rigidily connecting said first piston to said second piston; and

(e) spring means normally urging said pistons away from pressure increasing positions in their respective cylinders.

7. In a loom as described in claim **1**, wherein there is a plurality of said launching devices mounted in a moveable support on at least one side thereof, each being supplied with filling from a separate package and selecting means connected to said support for selecting said launching devices.

8. In a loom as described in claim **7** wherein there are at least four launching devices in said moveable support said selecting means comprises:

(a) a moveable cylinder member having two compartments;

(b) a piston for each of said compartments and moveable therein;

(c) a stationary cylinder having a compartment;

(d) a piston moveable in the compartment of said stationary cylinder;

(e) a first connecting rod operatively connecting said moveable support to the piston in one of the compartments of said moveable cylinder member;

(f) a second connecting rod connecting the piston in the other of the compartments in said removable cylinder member to the piston in the compartment of said stationary cylinder;

(g) a pair of air lines for each of said compartments, one air line of a pair connecting one end of its respective cylinder to said source of compressed air and the other of the pair connecting the other end of the cylinder to said source of compressed air, whereby the individual control of air through said air lines enables said selector to move said segment to any one of four different positions; and

(h) means to selectively connect and disconnect either end of each of said compartments to said source of compressed air, whereby said moveable support will

be moved to selectively position any one of four different launching and receiving devices.

References Cited

UNITED STATES PATENTS

2,488,192	11/1949	Hindle	139—144
2,902,058	9/1959	Walton	139—126
3,224,468	12/1965	Zerbee	139—127

FOREIGN PATENTS

623,735	5/1949	Great Britain.
935,256	8/1963	Great Britain.
1,069,859	5/1967	Great Britain.
199,995	5/1965	Sweden.

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