Aug. 6, 1968 K. W. WUEGER 3,395,737

PNEUMATIC FILLING INSERTER

Filed June 7, 1966 4 Sheets-Sheet 1

FIG. 1

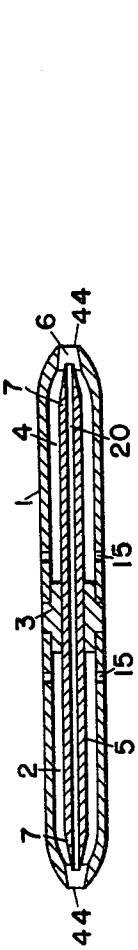
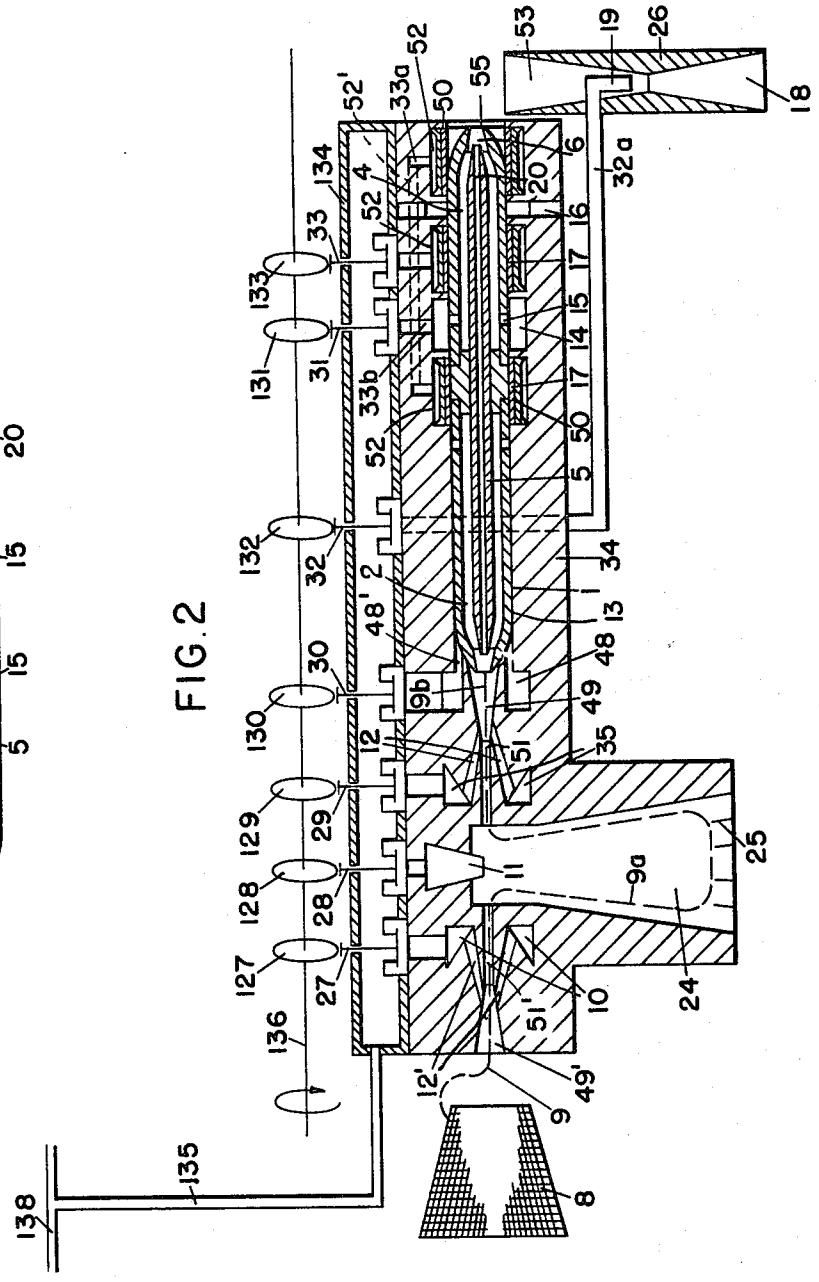


FIG. 2



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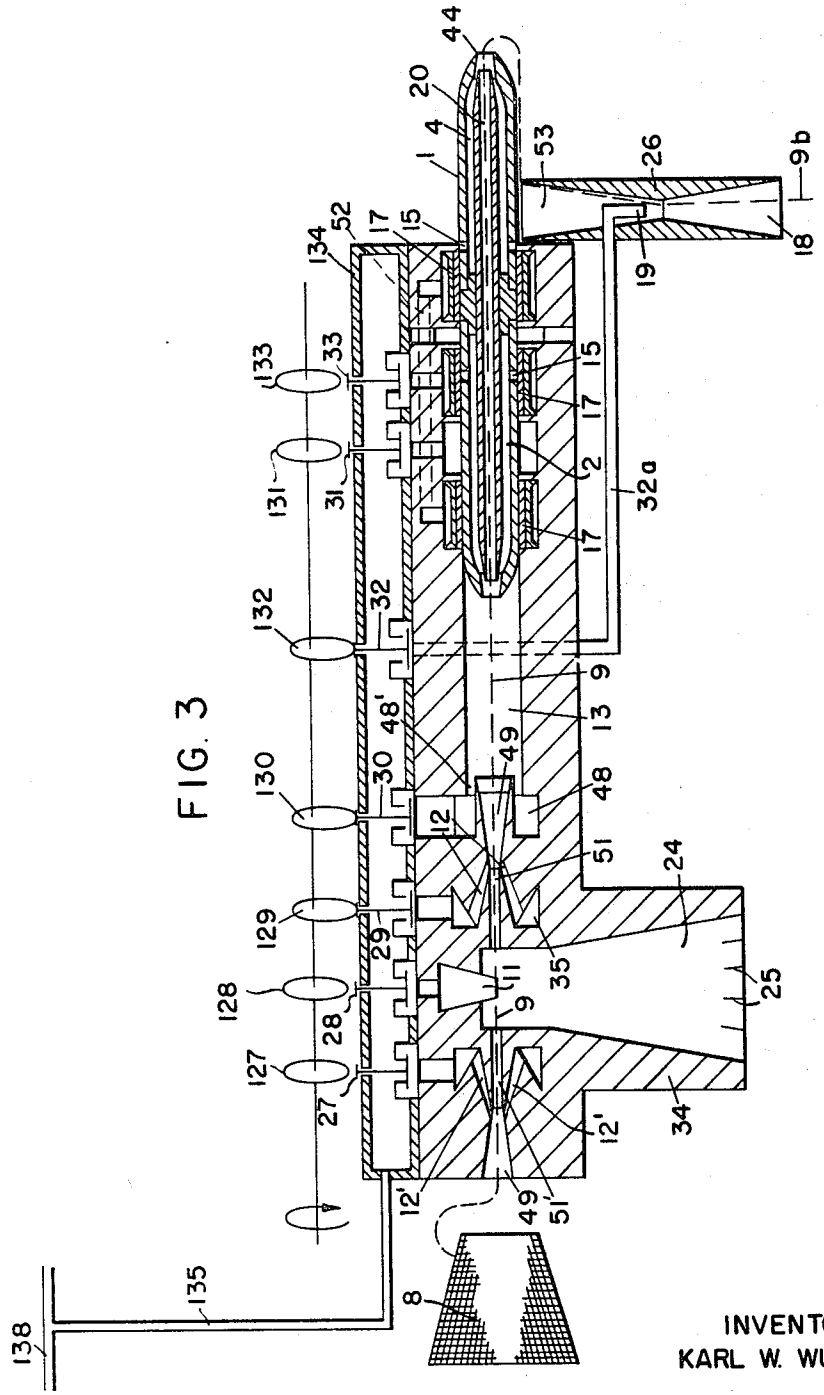
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PNEUMATIC FILLING INSERTER

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FIG. 3



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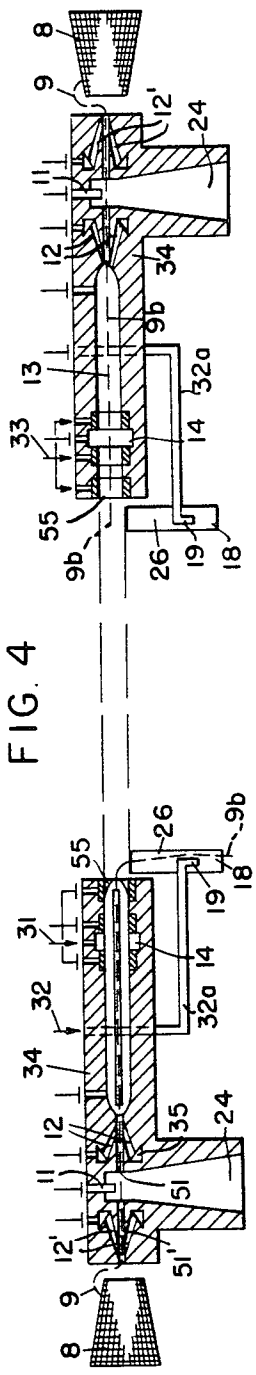


FIG. 4

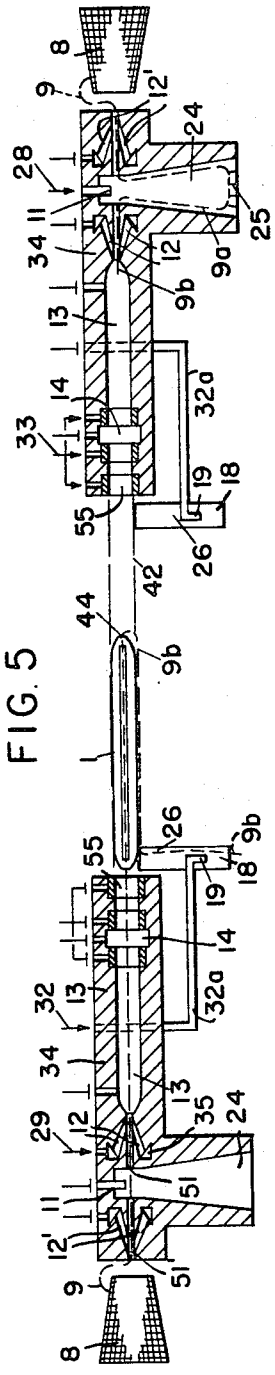


FIG. 5

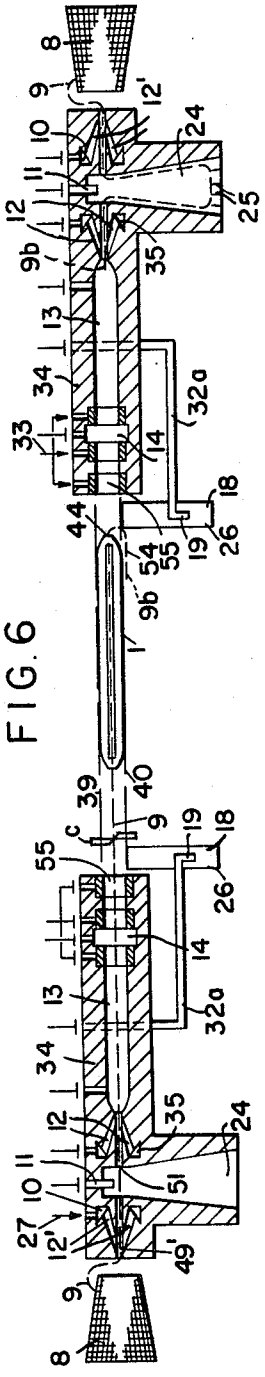


FIG. 6

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FIG. 8

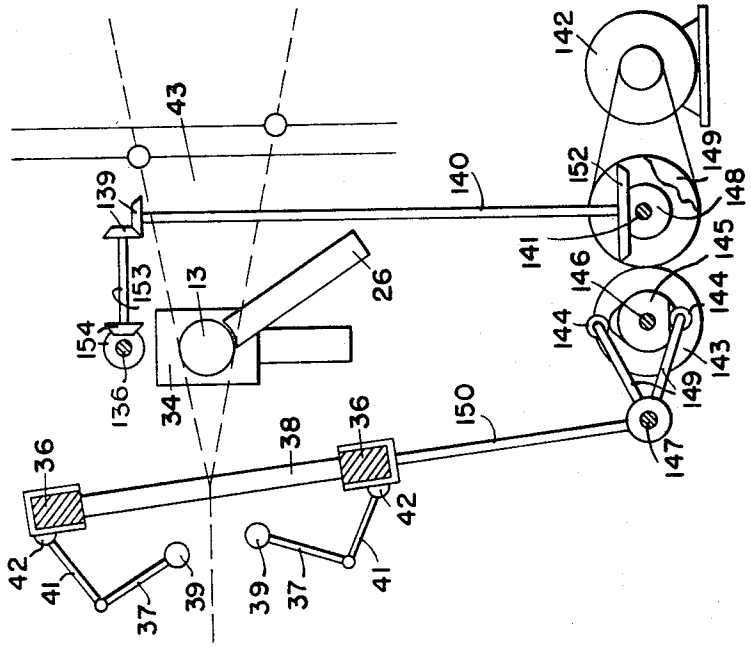
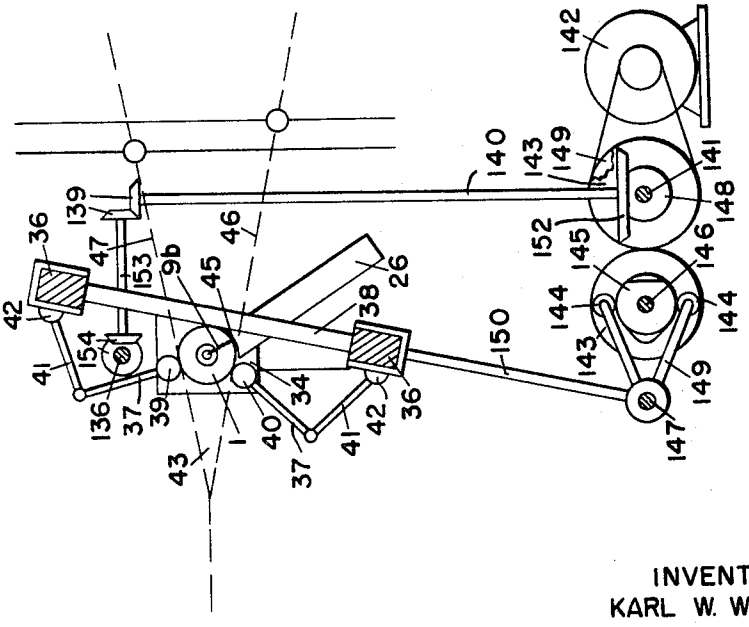


FIG. 7



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United States Patent Office 3,395,737
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3,395,737

PNEUMATIC FILLING INSERTER

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Filed June 7, 1966, Ser. No. 555,896
10 Claims. (Cl. 139—126)

ABSTRACT OF THE DISCLOSURE

A pneumatic loom in which filling from outside supply package is alternately inserted from each side of the loom with the aid of a shuttle having a longitudinal bore and which is reciprocated between pneumatic launching and receiving devices on each side of the loom. A free end of the filling is blown through the bore of the shuttle before it is launched and filling is blown across the loom behind the shuttle after it is launched so that the end of the filling is guided across the loom by the shuttle.

This invention relates to pneumatic filling insertion in a loom operating with outside filling supply.

In shuttleless looms where the filling is inserted by air or water, without clamping, there have been certain disadvantages. One disadvantage is that the width of cloth which can be woven is limited due to turbulence in the case of air and dispersion in the case of water. This same air turbulence is likely to untwist the filling so that only smooth filling can be used. In the case of water jet looms, only a filling which has a low absorption rate can be used.

Another disadvantage of air or water jet looms is that filling tension is very difficult to maintain. The only force exerted on the thread is that of the air or water. It is therefore very difficult to make a good selvage because of the difficulty of handling the filling. In order to increase the width of the loom or to increase tension on the yarn, a great deal of power is needed proportional to any added gains.

It is therefore an object of the present invention to provide pneumatic weft inserting mechanism which will overcome the above disadvantages.

A more specific object is to provide a weft inserting mechanism which will enable the weft to be guided across the loom.

These and other objects of the invention as will be noted herein are accomplished by the provision of a pneumatic launching and receiving device at each end of the loom which reciprocates a guide shuttle therebetween. The shuttle has a central longitudinal bore through which a weft thread is blown when the shuttle is in one of said launching devices. A valve which is connected to a source of compressed air allows the weft from an outside supply package to be blown through the bore in the shuttle until it extends slightly beyond. Another valve connected to said source of compressed air allows air to launch the shuttle from the launching device while a third valve connects a jet to the compressed air to blow the weft across the loom. While the shuttle is in flight, the portion of weft which extends beyond the end thereof loops around the end of the shuttle. The shuttle therefore acts as a guide for the weft while it is being blown across the loom. By guiding the weft, it can be blown straighter and for a greater distance. The end of the weft is also controlled to enable the formation of a selvage.

Other features and details will become clear from the following description and claims taken with the accompanying drawings in which:

FIGURE 1 is a longitudinal cross section of the novel guide shuttle;

FIGURE 2 is a longitudinal cross section of one of the launching devices with the shuttle in launching position;

FIGURE 3 is a view similar to FIGURE 2 and showing the shuttle just as it is being launched;

FIGURE 4 is a diagrammatic view of both launching devices in cross section, showing the shuttle in the left-hand launching device ready for launching;

FIGURE 5 is a view similar to FIGURE 4 and showing the shuttle in flight;

FIGURE 6 is a view similar to FIGURE 4 and showing the shuttle just as it is about to enter the right-hand launching device;

FIGURE 7 illustrates the lay in back center position and the fixed left-hand launching device as well as the synchronized drive for the launching controls taken from the lay drive; and

FIGURE 8 is a view similar to FIGURE 7 and showing the lay in the front center position.

Referring to the drawings and particularly to FIGURE 1, the shuttle **1** is a symmetrical cylindrical body with tapered ends. The shuttle has a cylindrical bore **20** extending through its longitudinal center line. Located between the wall **5** forming the bore **20** and the outer wall **5'** of the shuttle are two circumferential pressure chambers, **2** and **4**, separated by a partition **3** in the center of the shuttle. Each chamber extends from the partition **3** and tapers toward its respective end of the shuttle where it forms an opening **6** to the outside of the shuttle. Wall **5**, which forms the bore **20**, is tapered at **7** toward each end of the shuttle and terminates before reaching the openings **6**. The combination of the tapers **7** and openings **6** form Venturi jets when air is blown into chambers **2** and **4** through openings **15** in the outer wall **5** of the shuttle as will be explained hereinbelow.

The above description shows clearly that the thread carrier has no bobbin, no filling gripper or other means for towing the yarn. Shuttle **1** has nothing but a thread guiding function whereby the filling is supplied by cones **8** according to FIGURES 4–6, these are mounted outside of the loom, next to the picking devices.

In order to accelerate thread **9** and shuttle **1** both loom sides are equipped with pneumatic launching checking and receiving devices **34**. Each launching device **34** has a launching chamber **13** from which the shuttle **1** is launched and received through a launching chamber exit **55**. Chamber **13** has an enlarged portion **14** which forms a circumferential space around the shuttle, this space being aligned with openings **15** when the shuttle is in the chamber **13**.

The front part of the launching chamber has in between the seals **17** several exhaust openings **16** which lead the air during launching into a muffler, not shown. This muffles the escaping sound during launching.

There are a series of brake rings **17** lining the inner part of the chamber. Each brake ring separates chamber **13** from a circumferential braking chamber **52**. Chambers **52** are interconnected through a common air line **52'**. There is also a seal between each ring chamber **52** and each brake ring **17**. Located coaxially behind the outer end of chamber **13** is an annular filling feed chamber **35** which is connected to a diffusion chamber **49** through jet passageways **12**. Chamber **49** has a frustra-conical shape with the larger end opening into chamber **13**. Passageways **12** are so placed with respect to chamber **49** that air blown through the passageways from chamber **35** meets at a certain point on the center line of the chamber **49**. An annular propulsion chamber **48** is separated from and circles chamber **49**. Chamber **48** is connected

to launching chamber 13 through a narrowed annular passageway 48'.

A thread hold back chamber 24 is located near the outer end of the launching device. A jet 11 opens into the top of the chamber 24 for a purpose to be described. The bottom of the chamber 24 has filling supporting reeds 25. Chamber 24 is connected to diffusion chamber 49 through a connecting bore 51 and is connected to a filling entry port 49' by a connecting bore 51'. Filling entry port 49' has a frusto-conical shape with the larger end opening to the outer end of the launching chamber adjacent one of the filling packages 8.

In order to give the filling thread the proper feed length, each launching device has a yarn checking device located between entry port 49' and chamber 24. This device includes an annular chamber 10 which is connected to port 49' through a jet passageway 12'. Jets 12' are arranged so that air blown into chamber 10 flows through the jets and into the entry port and meets at the center line of the port.

According to FIGURES 2–8, located below launching chamber exit 55 is an injection thread guide tube 26 which is divided in two parts, a diffusion part 18 and a suction chamber 53. An air jet 19 connected to an air line 32*a* is located in chamber 53 and is directed into part 18. Each launching device contains a common air supply chamber 134 which is connected by an air line 135 to a main supply line 138 containing air at superatmospheric pressure. Chamber 134 therefore is constantly supplied with air at superatmospheric pressure and is used to supply air to all of the chambers and jets in the launching device described above. Situated in the chamber 134 are a series of valves which can be individually opened or closed to individually control the air flow to each of their respective chambers. Referring more particularly to FIGURE 2, the valves and their functions as viewed from left to right are as follows: Valve 27 controls the flow of air into chamber 10 and jets 12'. Valve 28 controls the flow of air into chamber 24 through jet 11. Valve 29 controls the flow of air into chamber 35. Valve 30 controls the air flow into chamber 48. Valve 32 controls the flow of compressed air to jet 19 through line 32*a* and valves 31 and 33 control the flow of compressed air into chambers 14 and 52 respectively.

The opening and closing of the valves 27–33 is controlled by a series of cams 127–133 respectively. Cams 127–133 are mounted on a camshaft 136 located above each launching device. Referring to FIGURES 7 and 8. shafts 136 are driven through appropriate bevel gears and drive shafts from the lay drive. The lay drive includes a motor 142 which drives a shaft 141 through a pulley 149. Shaft 141 drives a shaft 146 through equal gears 143. A cam 145 fixed to shaft 146 operates a pair of followers 144 of a two-pronged lever 149. Lever 149 is fixed to a shaft 147 which supports the lay 36 through a laysword 150. Cam 145 makes one rotation every pick and oscillates lever 149 to rock the lay 36 between front and back center positions.

The camshaft 136 on the right-hand side of the loom, as shown in FIGURE 7, is driven by shaft 141 in the following manner: A bevel gear 148 fixed to shaft 141 drives a larger bevel gear 152 which is fixed to an upright shaft 140. Gear 152 has a two-to-one ratio to gear 148 so that shaft 140 makes one rotation for every two rotations of shaft 141. Shaft 140 drives a horizontal shaft 153 through equal bevel gears 139. Shaft 153 drives shaft 136 through equal bevel gears 154. From this description, it can be seen that shaft 136 makes one rotation for every two rotations of shaft 141 and therefore one rotation for every two reciprocations of the lay or beat reed 36. Shaft 141 extends across the loom and drives the cam shaft 136 on the left-hand side of the loom through a similar arrangement of gears as that described and shown in FIGURE 7.

A series of upper and lower guide rolls 39 and 40 respectively are mounted on levers 37 which are adjustably pivoted on levers 41. Levers 41 are, in turn, adjustably supported on lay 36, at 42. Rolls 39 and 40 are arranged across the loom and the upper rolls can be adjusted with respect to the lower rolls and both with respect to the reed 38 and the lay 36. The guiding arrangement provides a three-point contact for the shuttle 1 as it is propelled across the loom.

The timing of the valves 27–33 and the pneumatic devices which they control will be understood best by the following description of a picking sequence.

The sequence of the above picking device is as follows: The filling, being drawn off packages 8 on both sides, runs through all control and displacement devices within the launching station 34. At the starting position the filling lies with its outer end 9*b* in the diffusion chamber 49. According to FIGURE 2, the shuttle is situated in chamber 13 of the launching device at the left-hand side of the loom. A certain length of filling, indicated at 9*a*, occupies filling hold back chamber 24. This starting position is the beginning of the picking motion. At this time, cam 131 operates valve 31 to allow compressed air into the enlarged portion 14 of chamber 13 from supply chamber 134. The compressed air goes from portion 14 through opening 15 of shuttle 1 into the shuttle cavity 4. The air escapes into the atmosphere through the opening 6 of the shuttle. The shape of shuttle opening 6 causes the air to escape at a very high speed, thus creating a partial vacuum in bore 20 of the shuttle. This partial vacuum in bore 20 draws the filling 9 into the bore. Cam 131 is timed to close valve 31 after enough length of filling has been drawn from package 8 so that end 9*b* extends a certain length beyond the outer end of the shuttle. Upon closing of valve 31 the thread displacement stops at once.

Cam 132 opens valve 32 for a fraction of a second before the closing of valve 31 which feeds compressed air into jet 19 through line 32*a*. The flow of air through jet 19 creates a partial vacuum in chamber 53 which draws the filling end 9*b* which extends out of shuttle into part 53 and down through part 18 of guide tube 26. Guide tube 26 therefore effectively holds the filling until the shuttle is launched.

As soon as the filling tip 9*b* extends the full length of guide tube 26, cam 130 opens valve 30 to allow compressed air into propulsion chamber 48. A blast of air is thus sent against the shuttle in chamber 13 through passageway 48' to launch the shuttle into the warp shed made up of upper warp 47 and lower warp 46, see FIGURE 3.

At the instant of shuttle launching, cams 129 opens valve 29 which creates air streams through jets 12 to draw filling from the package 8 and blow it into the shed behind the shuttle. Valve 30 opens for the short time, approximately $\frac{1}{130}$ second. Valve 29 stays open until the filling has crossed the shed.

As the shuttle shoots out of the chamber 13, the filling tip is still held by tube 26 and as the shuttle moves on, the thread is layed in a sharp turn around the shuttle nose, as shown in FIGURE 5. At this moment, valve 32 closes and the end 9*b* of the filling is no longer held by tube 26.

As the shuttle proceeds across the loom, the jets 12 keep the filling 9 in suspension, feeding it behind the shuttle which causes the filling tip 9*b* to stay close to the shuttle during most of its travel. The friction between filling tip 9*b* and warp threads 46 or the reeds of lay 38 is sufficient to keep the weft tip positively against the shuttle. The friction however is not enough to draw the filling off the cones 8 and insert it into the shed, that is mainly the job of the jets 12 which draw the filling off its cone and feeds it behind the shuttle 1.

According to FIGURE 5 the shuttle 1 flies with the filling through the shed 43. At the last third of the total shed width the air stream in jet 12 is shut off by valve 29 and cam 127 opens valve 27 to allow compressed air

into chamber **10**. Opening of valve **27** causes an air flow through jets **12'** in the opposite direction from that of jets **12**. Since the filling represents little mass, it is stopped very promptly so that valve **27** has only to open for a small fraction of a second. This fact makes it possible to predetermine an exact picking length.

Filling **9** now comes to a standstill through the checking of jets **12'**, however, shuttle **1** keeps traveling. The relative motion of the shuttle and the filling tip **9***b* retracks the filling within the forward moving shuttle. When the shuttle nose **44** has reached the right hand selvage, the filling tip **9***b* extends out a small amount beyond the nose of the shuttle and will be eventually used to form a tucked-in selvage. This amount is indicated by the reference character **54** in FIGURE 6. Any of the well-known selvage tucking devices may be used such as those shown, for instance, in U.S. Patent 2,267,287.

Jets **12'** hold the filling while the shuttle continues its flight out of the shed and into the chamber **13** of the right-hand launching and receiving device and during the formation of the selvage.

It can be seen, therefore, that the shuttle acts only as a guide for the filling throughout its flight to keep the filling straight and particularly at the point where the filling is stopped by the jets **12'**. The relative motion of the shuttle and filling at the end of the shuttle flight puts tension on the filling. This insures that the filling will be straight at beatup and that the end **9***b* of the filling will be guided precisely for selvage formation.

The shuttle is checked mechanically by the brake rings **17** as it enters the right-hand chamber **13**. Just as the shuttle enters the chamber **13**, cam **133** opens valve **33** and allows compressed air to enter braking chambers **52** via passageway **52'**. The compressed air pushes against the seal **50** and forces the brake rings **17** against the shuttle.

Beatup of the filling occurs after the shuttle has entered the launching chamber as shown in FIGURE 8. The shuttle is launched by one launching device and received by the other while the lay is in its back center position as shown in FIGURE 7.

After the shuttle has entered the chamber in the right-hand launching device, the filling is cut at the left-hand selvage by cutting mechanism indicated at C. Any conventional cutting mechanisms may be used as shown, for instance, in FIGURE 3 of U.S. Patent 2,637,349.

After the filling is cut, cam **128** opens valve **28** very briefly to allow compressed air into chamber **24** through jet **11**. The flow of air through jet **11** blows the length of filling extending through the launching device into chamber **24** into loop **9***a* as shown in FIGURE 2. The shuttle will be launched from the right-hand launching device in the same manner as described for the left-hand launching device.

The timing of the various cams and valves can be adjusted to vary any portion of the sequence. For example, valve **29** can be closed and valve **27** can be opened earlier or later in the cycle to weave different widths of cloth or to vary the amount of excess filling, indicated at **54** in FIGURE 6, for forming a selvage.

Having described the invention, what is now claimed and desired to be secured by Letters Patent 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 shuttle having a central longitudinal bore; and

(b) pneumatic shuttle launching, checking and receiving means located on each side of the loom comprising:

(1) pneumatic threading means for projecting a free end of said filling through and beyond said shuttle bore;

(2) means for launching said threaded shuttle across said loom through said shed; and

(3) means for blowing said filling through said shed behind the launched shuttle, whereby said shuttle guides the free end of each filling while it is blown into said shed.

2. In a loom as described in claim **1** wherein said filling inserting mechanism further comprises means for braking said filling after said shuttle is launched and said filling is blown into said shed and before said shuttle traverses said shed, whereby said filling end will pull out of said shuttle before it enters the launching and receiving means on the other side of the loom.

3. In a loom as described in claim **1**, wherein each of said launching and receiving means has a chamber from which said shuttle is launched and into which it is received and further comprises means to direct at least one jet of air into said chamber to launch said shuttle.

4. In a loom as described in claim **3** wherein said blowing means comprises:

(a) a filling guide tube which opens into said chamber; and

(b) means to direct a jet of air into said tube toward said chamber.

5. In a loom as described in claim **4** wherein said filling inserting mechanism further comprises means for braking said filling before said shuttle has completely crossed said loom, whereby said filling will pull out of said shuttle after it leaves the shed and before it enters the chamber on the other side of the loom.

6. In a loom as described in claim **5**, wherein said braking means comprises means to direct at least one jet of air into said filling guide tube, away from said chamber for braking said filling.

7. In a loom as described in claim **3** wherein each of said launching and receiving means further comprise means for checking said shuttle in said chamber.

8. In a loom as described in claim **7** wherein said launching chamber has at least one circumferential groove and said checking means comprises at least one circumferential brake band which seals said groove wherein it forms an air chamber, said brake band being effective upon pressurization of said chamber to check said shuttle.

9. In a loom as described in claim **1**, wherein said loom further comprises a pneumatic filling holding means located adjacent said launching and receiving chamber adapted to hold said free end of said filling projecting through said shuttle until said shuttle is launched.

10. In a loom as described in claim **9** wherein said filling holding means comprises:

(a) a tube open at both ends, one of said ends being adjacent the free end of filling projecting from said shuttle bore; and

(b) means for directing a jet of air in said tube towards the opening in the other end of said tube, whereby said air jet will cause said free end to be drawn into said tube and held therein.

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