United States Patent [19]

Kaalverink

[11] **3,908,707**

[45] **Sept. 30, 1975**

[54] **DEVICE FOR THE DELIVERY OF PREDETERMINED WEFT LENGTHS IN A SHUTTLELESS WEAVING MACHINE**

[75] Inventor: **Gerardus Hendrikus Kaalverink,** Asten, Netherlands

[73] Assignee: **Ruti-Te Strake B.V.,** Deurne, Netherlands

[22] Filed: **Dec. 20, 1973**

[21] Appl. No.: **426,557**

[30] **Foreign Application Priority Data**

Dec. 22, 1972 Netherlands 7217617

[52] **U.S. Cl.** ..... **139/122 H;** 226/97

[51] **Int. Cl.²** **D03D 47/36**

[58] **Field of Search** ..... 139/122 R, 122 H, 127 P; 226/97, 118, 195

[56] **References Cited**

UNITED STATES PATENTS

3,580,444	5/1971	Mullekom	226/97
3,669,328	6/1972	Castelli	139/122 H

FOREIGN PATENTS OR APPLICATIONS

1,510,153	12/1967	France	139/122 H

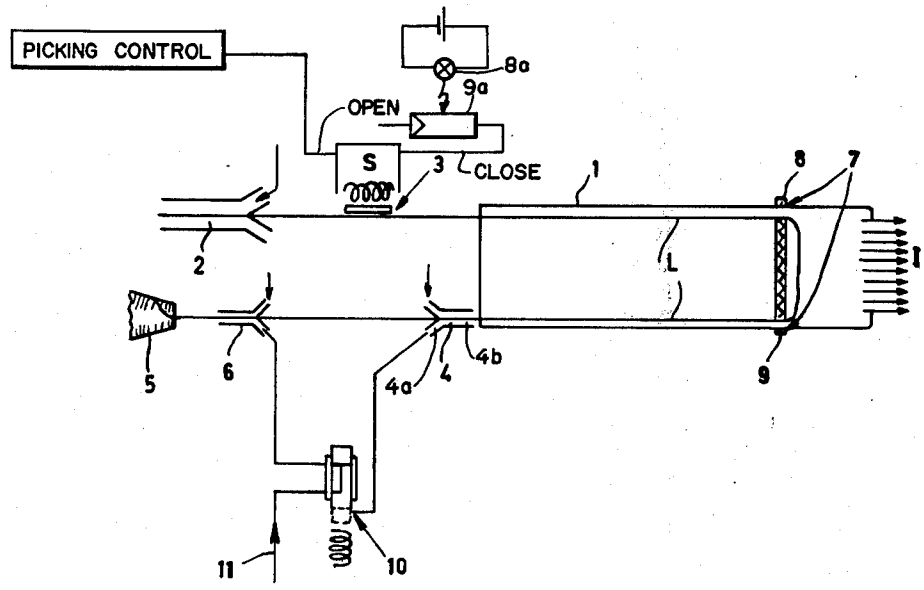
Primary Examiner—Henry S. Jaudon

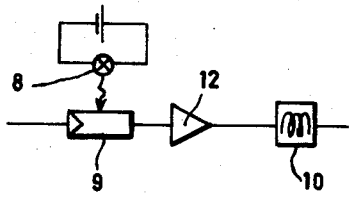
Attorney, Agent, or Firm—Marshall & Yeasting

[57] **ABSTRACT**

A device for the delivery of predetermined weft lengths through the weft conveyor of a shuttleless weaving machine, provided with means for drawing the weft yarn from a yarn cop and supplying it to an air operated buffer reservoir of the type which is adapted to form a reserve loop out of the yarn supplied, a thread clamp being provided between the buffer reservoir and the weft conveyor in the path of the reserve loop leg extending from the buffer reservoir to the weft conveyor, wherein the buffer reservoir cooperates with at least one thread detector controlling the yarn drawing means.

4 Claims, 4 Drawing Figures





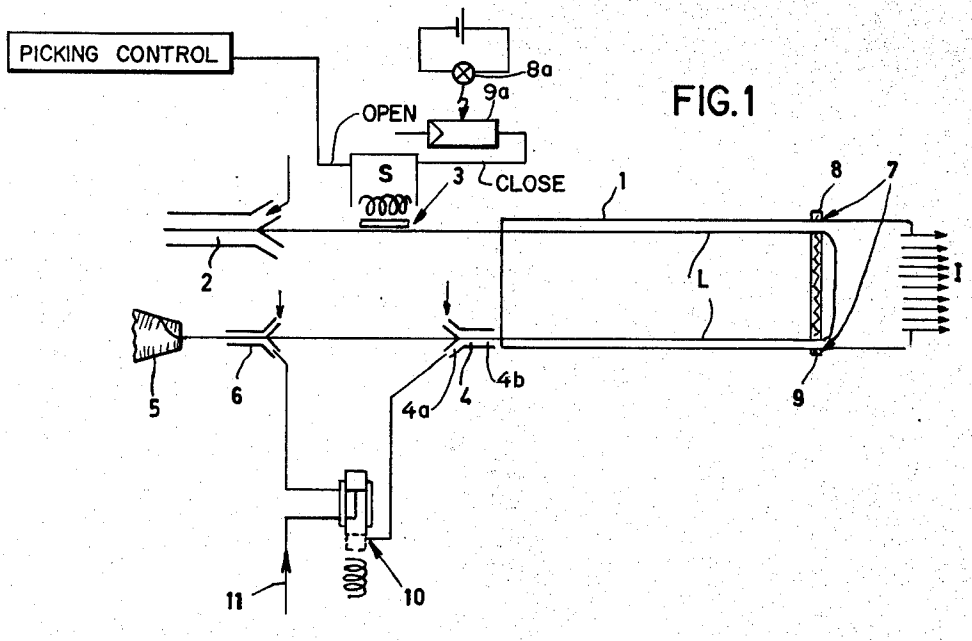

PICKING CONTROL
8a
9a
OPEN
S
3
CLOSE
1
8
7
2
L
I
5
6
4a
4
4b
9
11
10

FIG.1

FIG. 2

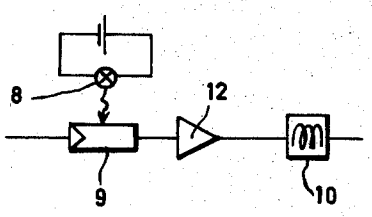
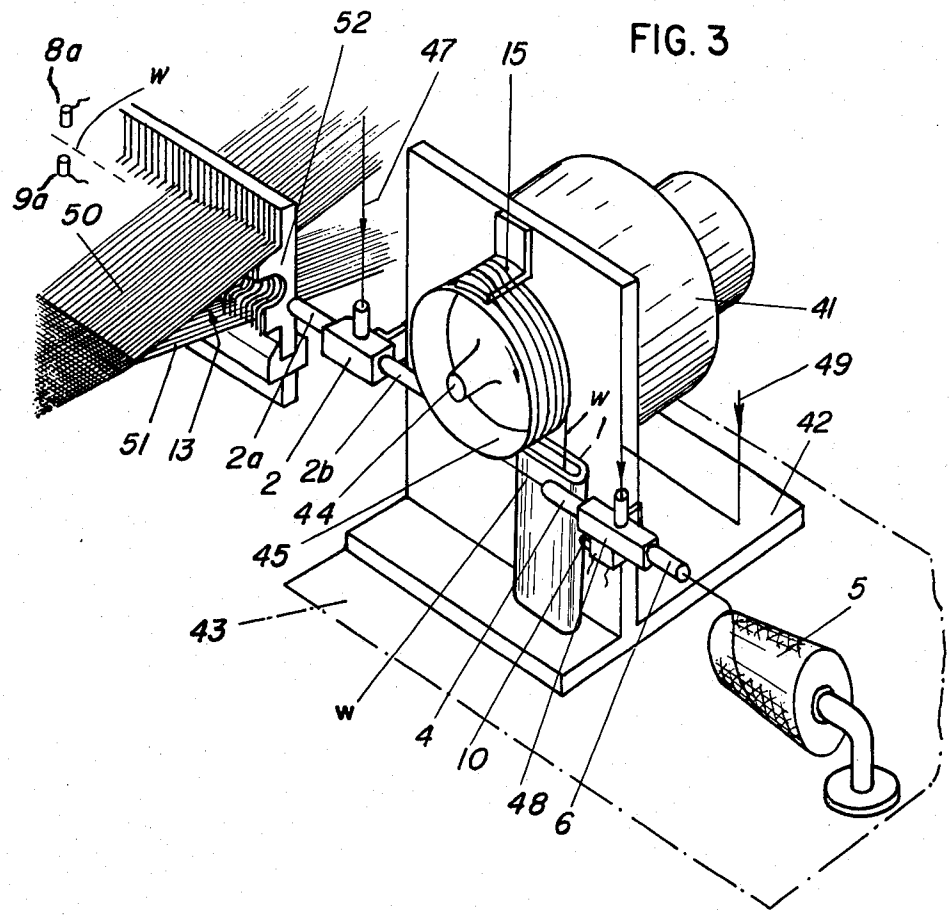

8
12
9
10

FIG. 3


8a
w
9a
50
52
47
15
41
49
42
51
13
2a
2
2b
44
45
43
w
1
5
4
10
48
6

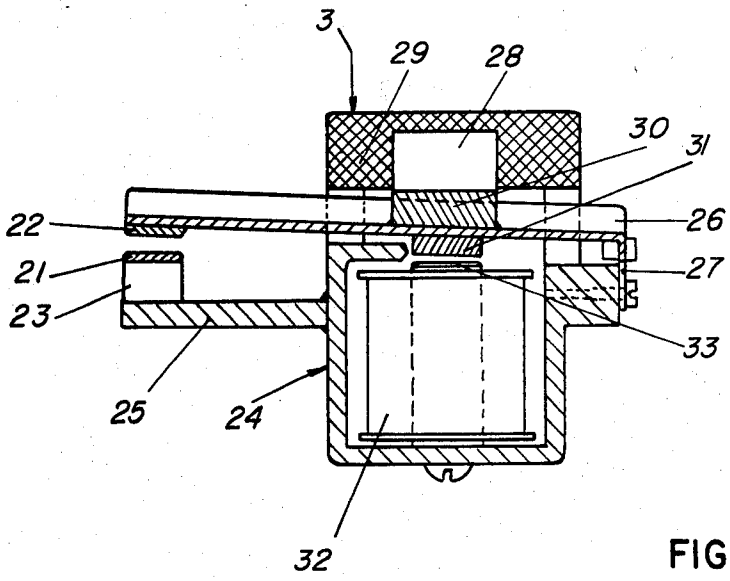

3
29
28
30
31
22
26
21
27
23
33
25
24
32

FIG. 4

DEVICE FOR THE DELIVERY OF PREDETERMINED WEFT LENGTHS IN A SHUTTLELESS WEAVING MACHINE

BACKGROUND OF THE INVENTION

The invention relates to a device for the delivery of predetermined weft lengths, through the weft conveyor of a shuttleless weaving machine, provided with means for drawing the weft yarn from a yarn cop and supplying it to an air operated buffer reservoir of the type which is adapted to form a reserve loop out of the yarn supplied, a thread clamp being provided between the buffer reservoir and the weft conveyor in the path of the reserve loop leg extending from the buffer reservoir to the weft conveyor.

Yarn preparation devices of this type are known. The yarn drawing device is generally formed therein by a pair of cooperating measuring rollers for continuously drawing the yarn from the yarn cop and supplying it to the buffer reservoir. The yarn loop, which is formed in the buffer reservoir, is then intermittently processed, namely during the weft inserting phase of a weaving cycle, by the weft conveyor, and a thread clamp is provided which is opened at the start of the weft inserting phase and again closed at the end thereof.

SUMMARY OF THE INVENTION

The device according to the invention is characterized in that the buffer reservoir cooperates with at least one thread detector controlling the yarn drawing means.

This implies that in the device according to the invention the yarn drawing means are not continuously operating, but are only energized after the loop length, present in the buffer reservoir, has decreased to less than the maximum loop length corresponding with the position of the thread detector, and remain operative until the loop length in the buffer reservoir has again increased to the length determined by the position of the thread detector. A decrease in the loop length present in the buffer reservoir is effected each time when the thread clamp opens and the weft conveyor is permitted to draw yarn from the buffer reservoir. Since the drawing of the yarn occurs according to the momentary speed, the weft conveyance and therefore the opening and closing of the thread clamp may take place according to any desired program. The device according to the invention is therefore also particularly suitable for application to weaving with different colors. Then for each color to be woven a device of the just discussed type is applied. The thread clamps of these devices may then be controlled corresponding to the desired color pattern, the opening being e.g., carried out by a control assembly programmed corresponding to the desired weft pattern, and the reclosing occurring under the control of a weft detector positioned in the weaving shed.

Contrary to the situation prevailing in a device with continuous drawing of the yarn, of the known type described above, the length of the weft, which is inserted into the weaving shed, is herein determined by the thread clamp between the buffer reservoir and the weft conveyor. In order to permit adjusting the yarn supply to the weft conveyor as economically as possible and thereby to keep the loss of weft yarn, due to the cutting off of the ends thereof projecting beyond both cloth edges, as small as possible, it is of course important that the thread clamp respond very accurately and to a large extent reproducably to the signal emitted by the weft detector. For this purpose it is advantageous to use a yarn clamp of the type described in Dutch patent application 7217620, corresponding to U.S. patent application Ser. No. 426,798, filed Dec. 20, 1973.

Yarn drawing means of different types may be used in the device according to the invention. It is advantageous to use a yarn drawing device of the type described in U.S. Pat. No. 3,853,153 namely by directing that yarn drawing device with its output side towards the entrance of the buffer reservoir. Thereby the steep starting characteristic of the electromotor of the quick response type, used in this yarn drawing device, is made use of, whereby the yarn length taken from the buffer reservoir in a weft inserting phase is very quickly supplemented to the desired length corresponding to the position of the thread detector in the buffer reservoir, so that high weft speeds are permitted.

A simple and at the same time easily controllable device is obtained if a blowing nozzle is used as the yarn drawing means, the air supply of this nozzle being controlled by the thread detector.

Preferably the yarn draw-blowing nozzle cooperates with a yarn brake such that this yarn brake is inoperative when the blowing nozzle is energized and becomes operative when the energization of the blowing nozzle is interrupted.

In a practical embodiment the yarn brake is likewise constituted by a blowing nozzle, the blowing direction thereof being opposite to that of the yarn draw-blowing nozzle.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a schematic view of the device according to the invention.

FIG. 2 is the wiring diagram thereof.

FIG. 3 is a perspective view of a preferred form of device according to the invention.

FIG. 4 is a sectional view of a preferred form of yarn clamp for use in a device according to the invention.

In the drawing reference number 1 indicates a buffer reservoir, e.g. in the form of a suction tube, whereas reference number 2 indicates a weft inserting jet or yarn conveyor in the form of a blowing nozzle and reference number 3 a thread clamp positioned between this blowing nozzle and the buffer reservoir 1. The thread clamp 3 may be of any conventional construction, and the specific structure of the thread clamp 3 is not a part of the present invention. In FIG. 1, the thread clamp 3 is shown diagrammatically as a solenoid which actuates a clamping plate to grip the thread. As stated hereinbefore, the thread clamp 3 preferably is constructed as shown in detail in Dutch patent application No. 7217620, corresponding to U.S. patent application Ser. No. 426,798.

That yarn clamp is shown in cross section in FIG. 4, and comprises a stationary and a movable clamping jaw 21 and 22 respectively. The stationary clamping jaw 21 is secured through a rubber block 23 to a projecting part 25 of a housing 24 to be mounted stationary, e.g., on the frame of a weaving machine.

The movable clamping jaw 22 is secured to the one end of a lever 26, preferably made from a light material, such as aluminum, which is pivotally connected at its other end to the housing 24. The pivot connection is constituted by a leaf spring 27 which is somewhat bi-

ased, namely so that the spring tends to rotate the lever clockwise as seen in the drawing.

An electric coil, indicated with the reference number **28,** is preferably coiled to the shape of a flat spiral and is received in a bridge piece **29,** preferably made of plastic, extending over the housing **24** and secured thereto. The lever **26** extends below the bridge piece **29** and comprises at the position of the coil **28** a disc **30,** e.g., of aluminum, which is suitable for induction therein of eddy currents when a current pulse is sent through the coil **28.** In the open position of the yarn clamp, shown in the drawing, the lever **26** with the disc **30** is kept by the biased spring **27** against the coil **28.**

At its lower side the lever **26** supports a second disc or block **31** of ferromagnetic material, which cooperates with the armature **33** of an electromagnet **32** mounted in the housing **24.**

The described thread clamp operates as follows:

A current pulse supplied to the coil **28** results in that a large downwardly directed acceleration force is imparted to the disc **30,** which force moves the lever **26** very quickly to the closing position. If now simultaneously with energizing the coil **28** the electromagnet **32** is energized, the lever **26** is thereafter kept in its closed position during the energization time interval of the electromagnet in that the ferromagnetic disc **31** is attracted by the electromagnet armature **33.**

At the entrance of the buffer reservoir **1** a yarn drawing device **4,** in the form of a blowing nozzle, is indicated, which is adapted to draw the weft yarn from the yarn cop **5** when supplied with blowing air, in order to supply this yarn to the buffer reservoir **1** in which the yarn "nestles" in the shape of a loop L under the influence of the air flow I generated in the reservoir. The blowing nozzle **4** is of conventional construction, and consists of a converging annular passageway **4***a* into which compressed air is introduced so as to inject a converging jet of air into an outlet **4***b*. The thread, which extends freely through the blowing nozzle **4,** coincides with the axis of the nozzle, and is propelled along the axis of the nozzle by the action of the jet of air. In the embodiment shown a yarn brake **6,** likewise in the form of a blowing nozzle, constructed in the same manner as the blowing nozzle **4,** is indicated between the yarn draw-blowing nozzle **4** and the yarn cop **5,** the purpose and the operation of which will be explained hereunder in detail.

The buffer reservoir **1** cooperates with a thread detector **7** comprising a light source **8,** e.g., a Ga-As diode, and a light sensitive element, e.g., a light sensitive resistance or photodiode **9.** The thread detector **7** is so positioned longitudinally of the buffer reservoir **1,** that a length of the loop L, corresponding with this position, provides the yarn length which it is desired to have ready in the buffer reservoir at the moment at which the weft conveyor **2** has to start carrying out a weft inserting phase.

In the situation shown in the drawing the thread clamp **3,** e.g., a yarn clamp of the type according to the patent application mentioned above, is closed, whereas the end of the yarn loop L is just to the right of the thread detector **7.** This means that the light beam, emitted by the light source **8,** is intercepted by the legs of the yarn loop L, so that the light sensitive element **9** receives a reduced amount of light. This situation corresponds to the position, as indicated in the drawing, of the air valve **10,** e.g., in the form of a solenoid valve, provided in the common air supply conduit **11** for the blowing nozzles **4** and **6.** The air valve **10** is a conventional two-way solenoid-operated air distributing valve. In the situation shown in FIG. **1,** the light sensitive element **9** is receiving a reduced amount of light, and the amplifier **12** is designed in the conventional manner so that under such conditions it does not supply a sufficient amount of current to energize the solenoid of the valve **10.** In the position shown of the air valve **10** the air supply to the yarn draw nozzle **4** has been interrupted whereas the supply to the blowing nozzle **6** is open. The yarn loop L is at rest in this situation, in that the blowing nozzle **6** supplies sufficient resistance to prevent the air flow I from drawing yarn from the yarn cop **5,** although the blowing nozzle **6** does not have sufficient power to draw the yarn backward out of the reservoir **1.** Thus the legs of said loop are kept taut by the operation of the air flow I and of the blowing nozzle **6** acting as a yarn brake or yarn clamp. This yarn loop is ready to be taken up by the weft conveyor, as soon as a weft inserting phase is desired, from the buffer reservoir **1** and to be conveyed through the weaving shed. The signal for this weft inserting phase is e.g., given by an electrical picking control which has been programmed according to the desired weft pattern, which signal opens the thread clamp **3.** The start of the operation of the weft conveyor **2** results in that the end of the yarn loop L arrives to the left of the thread detector **7,** whereby the light sensitive element **9** receives the undiminished light beam emitted by the light source **8** and (see the diagram according to FIG. **2**) issues a signal which is supplied to the solenoid **10** via an amplifier **12,** whereby said solenoid receives a sufficient amount of current so that it moves the two-way valve from the position shown in full lines in FIG. **1** to the position shown in broken lines, in which position the blowing air supply to the blowing nozzle **6** is interrupted and that to the yarn draw nozzle **4** is opened. From this moment on the blowing nozzle **4** draws yarn from the yarn cop **5** and supplies it to the buffer reservoir **1** until the end of the yarn loop L again arrives to the right of the thread detector **7,** at which moment the drawing of the yarn is again interrupted. This will generally be the case a moment after the weft inserting phase has been completed and the thread clamp **3** has been closed again. This closing occurs e.g., under the control of a weft detector positioned at the end of the weaving shed remote from the blowing nozzle **2,** which detector delivers a signal to the thread clamp **3** upon detecting the inserted weft.

FIG. **3** shows a weft detector, positioned at the end of the weaving shed, which like the thread detector **7** consists of a light source **8***a* and a light sensitive element **9***a*.

As stated hereinbefore it is advantageous to use a yarn drawing device of the type described in U.S. Pat. No. 3,853,153, by directing the yarn output of that device toward the entrance of the buffer reservoir **1.** A yarn drawing device of that type is shown in FIG. **3,** in which an electromotor **41** of the quick response type, e.g., a motor having a bell-shaped or disc-shaped armature, is mounted to one side of a motor support **42** secured to the frame **43** of a weaving machine.

On the motor shaft **44** extending at the other side of the motor support **42** a disc **45** is mounted, which is preferably made of a light metal, e.g., aluminum.

The motor support **42** also supports the weft inserting device **2** which is constituted by a blowing nozzle sup-

plied with air through a conduit schematically indicated at **47.** The weft blowing nozzle **2** has a tubular discharge section *2a* facing the opening of the weaving shed **13** delimited by the upper and lower warp threads **50** and **51** respectively and by the retracted reed **52.**

A pneumatic yarn control assembly **48,** likewise carried by the motor support **42,** is supplied with air through the schematically indicated conduit **49.** Preferably this control assembly comprises a yarn-take-off injector and a braking injector known per se. When the solenoid valve **10** is energized as hereinbefore described, the valve **10** will cause the supplied air to be bypassed to the left through the tubular injector **4,** as a result of which suction is generated at the injector **4** to draw weft yarn from the cop **5.** Upon deenergization of the solenoid valve **10,** the supplied air will flow out through the braking injector **6** and thereby exert a braking force directed to the right on the weft yarn.

The weft yarn *w* extending from the left end of the yarn control assembly **48** in tangential relationship to the disc **45** is wound several times around the circumferential surface of this disc and then is directed toward the entrance of the buffer reservoir **1** as hereinbefore described. A guide element **15** cooperating with the disc **45** keeps the yarn coils mutually separated.

The weft yarn leaving the buffer reservoir **1** in FIG. **3** extends through a thread clamp (which is hidden in FIG. **3**) to the tubular inlet *2b* of the weft inserting nozzle **2.**

The operation of the apparatus shown in FIG. **3** is as described in connection with FIG. **1,** the motor **1** being controlled by the same signals as the solenoid valve **10,** so that the motor **1** is energized at the same time as the solenoid valve **10.**

As stated hereinbefore, each time the thread clamp opens, the weft conveyor is permitted to draw weft yarn from the buffer reservoir.

For the sake of simplicity, the weft inserting conveyor **2** has been considered to be supplied continuously with compressed air, as described in patent No. 3,853,153, so that the starting and stopping of the weft insertion is controlled entirely by the opening and closing of the yarn clamp **3.** In order to conserve energy, however, the conventional practice of supplying air to the weft inserting nozzle **2** only during the weft inserting operation may be followed, using the signals which maintain the yarn clamp **3** open to simultaneously maintain the supply of compressed air to the weft inserting nozzle **2.**

I claim:

1. A device for supplying weft yarn to a weft conveyor of a shuttleless weaving machine, comprising

a. intermittently operable means for drawing weft yarn from a yarn cop,

b. an elongated buffer reservoir having at one end a mouth to which weft yarn is fed by said yarn-drawing means and in which a length of the yarn is stored in the form of a loop having one leg extending from the buffer reservoir to the weft conveyor,

c. a yarn clamp arranged to engage said leg between the buffer reservoir and the weft conveyor,

d. means for intermittently opening the yarn clamp to permit the weft conveyor to convey yarn drawn from the buffer reservoir,

e. a yarn detector arranged to detect the end of said loop in the buffer reservoir at a point remote from the mouth thereof, and

f. a control which is actuated by the yarn detector and which renders the yarn-drawing means inoperative when yarn is detected and operative when yarn is not detected, in order to cause the length of yarn in the buffer reservoir to be restored after yarn has been withdrawn from the buffer reservoir.

2. A device according to claim **1,** wherein the yarn-drawing means comprises a blowing nozzle the air supply of which is turned on by said control when yarn is not detected by the yarn detector.

3. A device according to claim **2,** characterized in that the yarn draw-blowing nozzle is preceded by a yarn brake, and the control actuated by the yarn detector renders said brake operative when yarn is detected and inoperative when yarn is not detected.

4. A device according to claim **3,** characterized in that the yarn brake is likewise constituted by a blowing nozzle, the blowing direction thereof being opposite to that of the yarn draw-blowing nozzle.

* * * * *