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(11) **EP 1 357 212 A2**

(12) **EUROPEAN PATENT APPLICATION**

(43) Date of publication:
29.10.2003 Bulletin 2003/44

(51) Int Cl.7: **D03D 47/30**, D03D 47/34,
D03D 51/08

(21) Application number: **03007248.2**

(22) Date of filing: **31.03.2003**

(84) Designated Contracting States:
**AT BE BG CH CY CZ DE DK EE ES FI FR GB GR
HU IE IT LI LU MC NL PT RO SE SI SK TR**
Designated Extension States:
AL LT LV MK

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(30) Priority: **26.04.2002 JP 2002125634**

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(54) **Method and apparatus for removing defective yarn in a loom**

(57) A technique to remove a defective yarn (22) is characterized by having an air or machine-operated weft end retaining device (20, 62, 72 or 82) retain the

non-supply side end portion of one or more beaten wefts (16 or 22) by suction at least at the initial removal operation of the defective yarn.

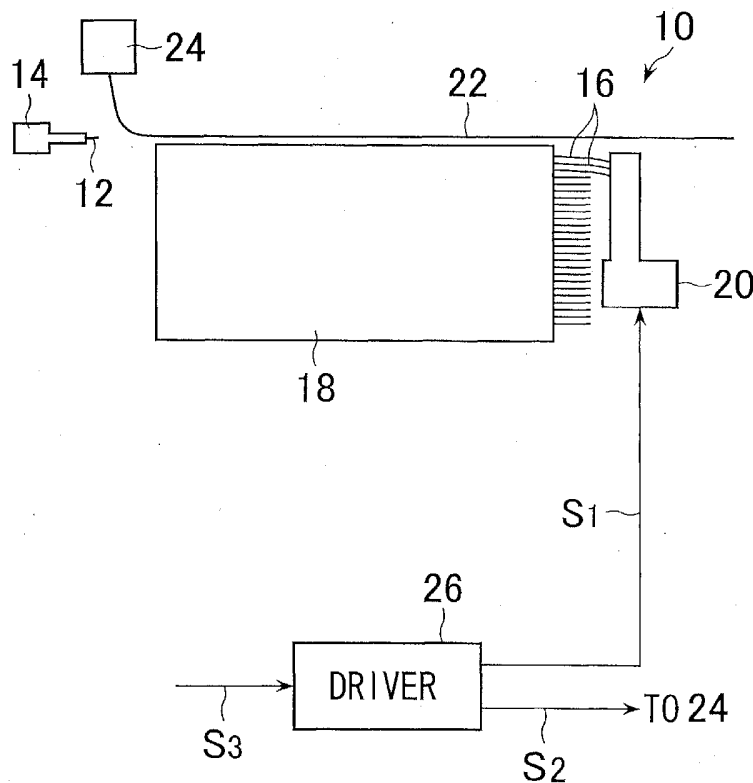


FIG. 1

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Description

BACKGROUND OF THE INVENTION

Field of the Invention

[0001] The present invention relates to a method and an apparatus for removing a defective yarn in a loom such as a jet loom.

Description of Prior Art

[0002] One of shuttleless looms such as a jet loom disclosed in Japanese Patent Appln. Public Disclosure (KOKAI) No. 9-78404 and No. 2000-328399 beats the weft while retaining an end portion (front end portion) on the non-supply side of the inserted weft by means of a suction-type weft retaining device. In this loom, a weft which failed to be inserted, that is, a defective yarn, is removed with the loom stopped.

[0003] In this loom, however, suction of the weft by the weft retaining device also stops when the loom is stopped, so that, if the defective yarn is to be taken out from inside a warp shedding toward a weft supply side, the non-supply side of the weft end normally inserted and woven into a cloth is retracted into the warp shedding, accompanied by friction of yarns against the non-supply side end portion of the defective yarn, which results in defective weaving.

[0004] There is another shuttleless loom provided with a weft remover which reverses the loom as well as a holder (weft holding device) after the loom stopped and releases the holding of a defective yarn woven into lastly (Japanese Patent Appln. Public Disclosure (KOKAI) No. 10-204758).

[0005] With the above-mentioned weft remover, however, there is a fear that even a normal weft may be off the holder when the holder is reversed, failing to surely retain the normal weft when the defective yarn is removed.

SUMMARY OF THE INVENTION

[0006] An object of the present invention lies in preventing retraction of the non-supply side end portion of the normal weft into a warp shedding with the drawing of the defective yarn.

[0007] The method of removing defective yarn according to the present invention comprises a step of actuating an air-operated weft end retaining device for retaining the non-supply side end portions of one or more beaten wefts by suction at the time of at least the initial removal operation of a defective yarn (long pick, cut pick) whose front end reached nearer the non-supply side than a normal arrival position of weft insertion as well as a defective yarn (short pick) not reaching nearer the non-supply side than the above-mentioned arrival position of weft insertion (hereinafter, those yarns are

generally called "defective yarns").

[0008] The apparatus for removing defective yarn according to the present invention comprises: an air-operated weft end retainer for retaining the non-supply side end portions of one or more beaten wefts by suction; and a driver for actuating the weft end retainer at the time of at least the initial removal operation of the defective yarn.

[0009] According to the above-mentioned removing method and apparatus, the defective yarn can be pulled out with at least the normal weft inserted immediately before the defective yarn surely retained, because the defective yarn is pulled toward the weft supply side with the non-supply side end portion of at least the normal weft inserted immediately before the defective yarn retained by an air flow.

[0010] Another method of removing defective yarn according to the present invention comprises a step of pulling out the defective yarn while having the non-supply side end portions of a plurality of wefts including the defective yarn are held by a machine-operated weft end retaining device at the time of at least the initial removal operation of the defective yarn so as to enable the traction of at least the non-supply side end portions of one or more beaten wefts.

[0011] Another apparatus for removing defective yarn according to the present invention comprises: a machine-operated weft end retainer for retaining so as to enable the traction of the end portions on the non-supply side end portion of one or more beaten wefts; and a driver for actuating the weft end retainer so as to enable the traction of the end portions on the non-supply side of a plurality of wefts including the defective yarn at the time of at least the initial removal operation of the defective yarn.

[0012] According to the foregoing another removing method and apparatus, since the defective yarn is pulled toward the supply side with the non-supply side end portion of both the defective yarn and at least the normal weft inserted immediately before the defective yarn mechanically retained so as to be pulled out, the defective yarn can be pulled out, the defective yarn can be pulled with the normal weft immediately before surely retained.

[0013] Still another method of removing defective yarn according to the present invention comprises a step of actuating, at least at the initial removal operation of defective yarn, a machine-operated weft end retaining device whose range of retaining is preset so as to retain at least the non-supply side end portion of the weft immediately before except the weft exposed at a pick finding by reversing the loom.

[0014] Still another apparatus for removing defective yarn according to the present invention comprises: a machine-operated weft end retaining device whose retention range is preset so as to retain the end portion on the non-supply side of at least the weft immediately before except the weft exposed at a pick finding; and a driver for actuating the weft end retaining device at least

at the initial removal operation of the defective yarn.

[0015] According to still another removing method and apparatus, the defective yarn is pulled to the weft supply side in a state that the non-supply side end portion of the normal weft inserted immediately before the defective yarn is retained by actuating a machine-operated holding device whose holding range is predetermined so as not to hold the defective yarn. Therefore, the defective yarn can be pulled with the normal weft immediately before surely retained.

[0016] All the above apparatus further comprise a defective yarn pulling device, and wherein the driver can be made to actuate the defective yarn pulling device for pulling the defective yarn to the weft supply side when removing the defective yarn.

[0017] The time for the above-mentioned initial removal operation can be set as up to the time the defective yarn leaves the cloth fell.

BRIEF DESCRIPTION OF THE DRAWINGS

[0018]

Fig. 1 is a diagram showing the first embodiment of the defective yarn removing apparatus according to the present invention.

Fig. 2 is a diagram showing an embodiment of the weft end retaining device to be used in the defective yarn removing apparatus shown in Fig. 1.

Fig. 3 is a diagram showing the second embodiment of the defective yarn removing apparatus according to the present invention.

Fig. 4 is a diagram showing an embodiment of the weft end retaining device to be used in the defective yarn removing apparatus shown in Fig. 3.

Fig. 5 is a diagram showing another embodiment of the weft end retaining device to be used in the defective yarn removing apparatus shown in Fig. 3.

Fig. 6 is a diagram showing a state of retaining of the weft by the weft end retaining device to be used in the defective yarn removing apparatus shown in Fig. 3.

Fig. 7 is a diagram showing another state of retaining of the weft by the weft end retaining device to be used in the defective yarn removing apparatus shown in Fig. 3.

Fig. 8 is a diagram showing the third embodiment of the defective yarn removing apparatus according to the present invention.

PREFERRED EMBODIMENT OF THE INVENTION

[0019] Referring to Fig. 1, the defective yarn removing apparatus 10 is applied to a jet loom for weaving a cloth 18 by inserting the weft 12 into a warp shedding together with a fluid for weft insertion by means of a weft insert nozzle 14 and beating with a reed the normally inserted weft 16 against a cloth fell. The rear portion of the weft

16 is cut off from the cloth 18 at a proper timing with a cutter not shown.

[0020] The defective yarn removing apparatus 10 comprises: an air-operated weft end retaining device 20 for retaining by suction the non-supply side weft end portions of a plurality of beaten wefts 16; a defective yarn pulling device 24 for pulling and removing a defective yarn 22 to the weft supply side; and a driver 26 for driving the weft end retaining device 20 as well as the defective yarn pulling device 24.

[0021] The weft end retaining device 20 is an existing device which applies negative pressure to a suction retainer such as a suction nozzle disposed nearer the weft non-supply side than the cloth 18 by suction means and sucks into the suction retainer the non-supply side end portion of the defective yarn 22 as well as the plurality of the wefts 16 including the weft 16 normally inserted immediately before the defective yarn 22 and beaten, thereby pulling and retaining the wefts 16 and 22.

[0022] The defective yarn pulling device 24 is an existing device which applies negative pressure to a traction nozzle by traction means to pull the defective yarn 22 toward the weft supply side by the traction nozzle and remove.

[0023] A driver 26 supplies a drive signal S1 to the weft end retaining device 20 while the loom is normally operating, but does not supply the drive signal S1 to the weft end retaining device 20 while the loom is stopped except during the removal operation of the defective yarn 22, and stops the weft end retaining device 20.

[0024] Also, the driver 26 supplies the drive signal S1 to the weft end retaining device 20 at least during the initial removal operation of the defective yarn 22 and further supplies a drive signal S2 to the pulling device 24 during the removal operation of the defective yarn 22 to actuate the pulling device 24.

[0025] The driver 26, independent from the controller of the loom, is supplied with a loom stop signal from the controller of the loom when the loom fails in weft insertion. The driver 26, however, may be in common with the controller of the loom.

[0026] When a long pick or failure in weft insertion is caused by a broken yarn or the like, the loom stops. Prior to starting of the removal operation of the defective yarn 22, the warp shedding opens to the maximum, and the reed is retreated to a predetermined position.

[0027] The removal operation of the defective yarn 22 is started by pushing down an inching button of the loom. When the inching button is pushed down, the loom inches to open the warp shedding to the maximum, and a removal starting instruction signal S3 is supplied to the driver 26. The removal starting instruction signal S3 is generated by pushing down the inching button or a removal start button.

[0028] If the removal starting instruction signal S3 is inputted from the controller of the loom to the driver 26 due to a failure in weft insertion, the driver 26 acts as mentioned above so as to make the weft end retaining

device 20 and the defective yarn pulling device 24 perform the removal operation.

[0029] The weft end retaining device 20, upon receipt of the drive signal S1, is actuated by the driver 26 at least during the initial removal operation until, for example, the defective yarn 22 leaves the cloth fell. Thereby, a plurality of the wefts 16 including the weft immediately before the defective yarn 22 are retained in the weft end retaining device 20 so as to be pulled out.

[0030] Also, the defective yarn pulling device 24, upon receipt of the drive signal S2, starts pulling the defective yarn 22. Thereby, the defective yarn 22 is pulled out toward the weft supply side to be removed.

[0031] Since the non-supply side end portions of the plurality of wefts 16 including the weft immediately before it is retained in the weft end retaining device 20 by suction when the defective yarn 22 is pulled out, there is no fear that the non-supply side end portions of those wefts 16 are pulled into the warp shedding with the traction of the defective yarn 22.

[0032] Referring to Fig. 2, the weft end retaining device 20 includes: a suction retainer 30 such as a suction nozzle sucking the non-supply side end portions of a plurality of wefts 16 and the defective yarn 22; an ejector 32 connected to the suction retainer 30; an air supplier 34 for supplying the compressed air to the ejector 32; and an exhaust pipe 36 for exhausting the air blown out from the ejector 32 together with the weft ends.

[0033] In this weft retaining device 20, the compressed air is supplied to the ejector 32 by a pipe 38 and exhausted from the ejector 32 to a refuse bin through an exhaust pipe 36. Thereby, the suction retainer 30 is applied the negative pressure, and the end portions respectively of a plurality of wefts 16 and the defective yarn 22 are sucked into the suction retainer 30.

[0034] The air supplier 34, in the illustration, receives the compressed air from a compressed air source such as a compression pump in a manifold 40 and supplies the compressed air received in the manifold 40 to the pipe 38 through two air supply paths 42, 44.

[0035] There are disposed in the air supply paths 42 and 44, respectively, a pressure regulators 46 and 48 for regulating the pressure of the compressed air to different values and solenoid valves 50 and 52 for selectively supplying the regulated compressed air to the pipe 38. The pressure regulator 46 regulates the compressed air to a higher pressure than that of the pressure regulator 48.

[0036] When the loom is normally operating, the solenoid valve 50 is opened, and the high pressure compressed air is supplied to the ejector 32. Thereby, the wefts 16 are surely sucked in the suction retainer 30 and surely retained.

When the defective yarn 22 is removed, the solenoid valve 52 is opened, and the low pressure compressed air is supplied to the ejector 32. Thereby, the wefts 16 are surely sucked in the suction retainer 30 and surely retained.

[0037] It is possible to stop the supply of the compressed air to the ejector 32 with both solenoid valves 50, 52 closed from after the loom stopped until the inching button or the removal start button is pushed down, and to start with the solenoid valve 52 opened after the inching button or the removal start button is pushed down. Also, during the period for the compressed air to be supplied to the ejector 32, the solenoid valve 52 may be turned on and off intermittently. In any of the cases, consumption of the compressed air can be controlled.

[0038] However, the compressed air of the same pressure may be supplied to the ejector 32 without providing two supply routes of the compressed air to the ejector 32. In such a case, it is possible to change the pressure of the compressed air to the ejector 32 at the normal operation time and at the time of the stoppage or the defective yarn removal operation, thereby controlling the consumption of the compressed air.

[0039] The wefts 16 beaten and retained in the suction retainer 30 are cut off in the cloth 18 at a proper timing with a cutter 54.

[0040] Referring to Fig. 3, the defective yarn removing apparatus 60 uses an existing weft end retaining device 62 which employs a machine-operated retainer which mechanically retains the non-supply side end portion of the wefts 16.

[0041] The machine-operated retainer of the weft end retaining device 62 is, for example, as shown in Fig. 4, includes: a table 64 disposed nearer the non-supply side of the wefts than the cloth 18 so as to receive the non-supply side end portion of the wefts 16; an electric actuator 66 such as a solenoid or a motor; and a stick-like retaining member 68 to be rotated angularly about an axis extending in the running direction of the wefts by the electric actuator 66.

[0042] The retaining member 68 is assembled into the rotary shaft of the electric actuator 66 at the downstream-side end portion in the moving direction of the warp 70 in a state of extending on the table 64 in the moving direction of the warp 70, and is angularly rotated at a first position largely away from the table 64 so as to receive the end portions of the wefts 16 between the table 64 and the retaining member 68 and at a second position for retaining the end portions of the wefts 16 in cooperation with the table 64.

[0043] In this weft end retaining device 62, the retaining member 68 is displaced between a proper timing at the first and the second positions during the normal operation of the loom, so as to alternately receive and retain the end portions of the wefts 16 at a proper timing, with the electric actuator 66 driven by the driver 26. Thereby, the wefts 16 including the weft immediately before the defective yarn 22 are received and retained with their end portions received between the table 64 and the retaining member 68. The defective yarn 22 is also received its end portion in the underside of the retaining member 68.

[0044] At the time of removal operation of the defec-

tive yarn 22, the retaining member 68 is displaced to the first position at least until the time of the initial removal operation to surely retain the end portions of the wefts 16 between the table 64 and the retaining member 68, but does not retain the end portion of the defective yarn 22 received in the underside. The end portion of the defective yarn 22, however, being positioned in the underside of the retaining member 68, is retained so as to be pulled out.

[0045] When removing the defective yarn 22, the defective yarn pulling device 24 is driven by the driver 26 to start traction of the defective yarn 22. Thereby, the defective yarn 22 is pulled out toward the weft supply side and removed.

[0046] When the defective yarn is pulled out, since the non-supply side end portions of the wefts 16 including the weft immediately before the defective yarn, is retained a weft end retaining device 62 so as to be pulled out there is no fear that the non-supply side end portions of the wefts 16 may be pulled into the warp shedding by the traction of the defective yarn 22.

[0047] In place of the machine-operated retainer shown in Fig. 4, a machine-operated retainer such as a weft end retaining device 72 shown in Fig. 5 may be used.

[0048] The machine-operated retainer shown in Fig. 5 employs, in place of the stick-like retaining member 68, a roller 76 as the retaining member supported by one or more arms 74 rotatably about an axis extending in the running direction of the weft 16. The arm 74 is assembled into the rotation axis of the electric actuator 66 at the downstream-side end portion in the moving direction of the warp 70 in a state of extending in the moving direction of the warp 70, and supports a roller 76 at the upstream-side end portion.

[0049] In the weft retaining device 72, the roller 76 is actuated similarly to the retaining member 68 in the embodiment shown in Fig. 4.

[0050] For this reason, the roller 76 is displaced to the first and the second positions at a proper timing, as the electric actuator 66 is driven by the driver 26, so as to alternately receive and retain the end portions of the wefts 16 during the normal operation of the loom. Thereby, the wefts 16 including the weft immediately before the defective yarn 22 are retained with their end portions received between the table 64 and the roller 76. The defective yarn 22 is also received its end portion in the underside of the roller 76.

[0051] At the time of removal operation of the defective yarn 22, the roller 76 is displaced to the first position at least until the initial removal operation and surely retains the end portions of the wefts 16 between the table 64 and the roller 76. However the end portion of the defective yarn 22 is retained and positioned in the underside of the roller 76 so as to be pulled out, but is not retained by the roller 76.

[0052] When removing the defective yarn, the defective yarn pulling device 24 is driven by the driver 26 and

starts traction of the defective yarn 22. Thereby, the defective yarn 22 is pulled out and removed.

[0053] Also in the weft end retaining device 72, when the defective yarn is pulled out, the non-supply side end portions of the wefts 16 including the weft immediately before the defective yarn 22 is retained by the weft end retaining device 72 so as to be pulled out, so that there is no fear for the non-supply side end portions of those wefts 16 to be drawn into the warp shedding by the traction of the defective yarn 22.

[0054] In the case of the weft end retaining devices 62 and 72 employing a machine-operated retainer, it is possible to adjust beforehand a position in the moving direction of the warp such that, as shown in Fig. 6, the table 64 and retaining members 68 or 76 surely retain the normal wefts 16 but retain the defective yarn 22 so as to be pulled out. In this case, except the defective yarn made pick finding by reversal of the loom, one or more wefts 16 are retained by the retaining members 68, 76 at least during the initial removal operation.

[0055] As shown in Fig. 7, however, the table 64 and the retaining member 68 or 72 may be adjusted beforehand a position in the moving direction of the warp such that the defective yarn 22 is retained together with one or more normal wefts 16. In this case, the defective yarn 22 is retained so as to be pulled out.

[0056] While all the above embodiments utilize the existing weft end retaining devices 20, 62, 72 in the defective yarn removing apparatus 10, 60, it is possible, such as the a defective yarn removing apparatus 80 shown in Fig. 8, to retain the defective yarn 22 together with one or more normal wefts 16 when removing the defective yarn 22 by using a weft end retaining device 82 other than the existing weft end retaining device 20 (or 60).

[0057] In the defective yarn removing apparatus 80, the weft end retaining device 82 is disposed between the weft end retaining device 20 (or 60) and the cloth 18 during weaving. Also, the existing weft end retaining device 20 (or 60) is actuated at the time of the normal operation of the loom, while the weft end retaining device 82 is actuated at least at the time of initial removal operation of the defective yarn 22.

[0058] All the above embodiments remove the defective yarn 22 by the pulling device 24, but it is possible to remove the defective yarn 22 by hand.

[0059] The starting time of operation of all the above-mentioned weft end retaining devices for the removal operation of the defective yarn 22 can be determined, for example, as follows.

[0060] The inching button is pushed down to start the operation .

[0061] The inching button is pushed down to retreat the reed, and the retention is started when the reed is retreated to a predetermined angle.

[0062] The operation button for the weft end retaining device is pushed down to start the retention.

[0063] The inching button and a button other than the operation button for the weft end retaining device are

pushed down to start the retention.

[0064] The retention is started by the sensing output of the sensitivity of a sensor which senses that an operator approached the loom.

[0065] The retention is started by the sensor's output sensing that the defective yarn 22 has approached. This sensor is on the running path of the wefts and is disposed nearer the downstream side in the weft running direction than the position reaching the normal weft inserting position.

[0066] The retention is started simultaneously with the stoppage of the loom.

[0067] The termination time of operation of the weft end retaining device for the removal operation of the defective yarn 22 can be determined, for example, as follows.

[0068] Simultaneously with the starting of the retaining motion, the measurement of the time is started with the start of the retaining action by a timer or the like, and the retaining motion is terminated with a lapse of a predetermined time.

[0069] The retaining motion is terminated by pushing down the release button for the weft retaining device.

[0070] The retaining motion is terminated by pushing down the inching button and a button other than the operation button for the weft end retaining device.

[0071] The retaining motion is terminated when the sensor for sensing that an operator approached the loom has no longer sensed the operator.

[0072] The retaining motion is terminated when the sensor for sensing the normally inserted weft has no longer sensed the weft.

[0073] The retaining motion is terminated simultaneously with restarting of the operation of the loom.

[0074] As apparent from the above, while it is sufficient that the weft end retaining device is actuated at least at the time of the initial removal operation, it is also possible to actuate not only at the initial removal operation but also during the removal operation of a long pick or a cut pick, during the removal operation of the defective yarns of all kinds, during the stoppage due to failure in insertion, or during every stoppage regardless of causes of stopping.

[0075] The present invention can be variously modified without being limited to the above embodiments and unless departing from its purport.

Claims

1. A method of removing a defective yarn (22) in a loom, comprising a step of actuating an air-operated weft end retaining device (20) for retaining the non-supply side end portions of one or more beaten wefts (16, 22) by suction at least at the initial removal operation of said defective yarn.

2. A method of removing a defective yarn (22) in a

loom, comprising a step of pulling out said defective yarn while having a machine-operated weft end retaining device (62, 72 or 82) retain the non-supply side end portions of a plurality of wefts (16, 22) including said defective yarn (22) so as to pull out the non-supply side end portions of one or more beaten wefts at least at the initial removal operation of said defective yarn.

3. A method of removing a defective yarn (22) in a loom, comprising a step of actuating a machine-operated weft end retaining device (62, 72 or 82) whose retaining range is preset at least at the initial removal operation so as to retain at least the non-supply side end portion of the weft (16) immediately before except the weft (22) exposed at a pick finding.

4. An apparatus for removing a defective yarn (22) in a loom, comprising: an air-operated weft end retaining device (20) for retaining the non-supply side end portions of one or more beaten wefts (16, 22) by suction; and a driver (26) for actuating said weft end retaining device at least at the initial removal operation of said defective yarn.

5. An apparatus for removing a defective yarn (22) in a loom, comprising: a machine-operated weft end retaining device (62, 72 or 82) for retaining the non-supply side end portion of one or more beaten wefts (16, 22) and so as to be pulled out; and a driver (26) for actuating said weft end retaining device so as to retain the non-supply side end portions of a plurality of the wefts including said defective yarn at least at the initial removal operation of said defective yarn and so as to be pulled out.

6. An apparatus for removing a defective yarn (22) in a loom, comprising: a machine-operated weft end retaining device (62, 72 or 82) whose retaining range is preset so as to retain the non-supply side end portion of at least the weft (16) immediately before except the weft (22) exposed at a pick finding; and a driver (26) for actuating at least at the initial removal operation of said defective yarn.

7. An apparatus described in claim 4, 5 or 6, further comprising said defective yarn pulling device (24) for pulling said defective yarn toward the weft supply side, and wherein said driver actuates said defective yarn pulling device at the time of removing said defective yarn.

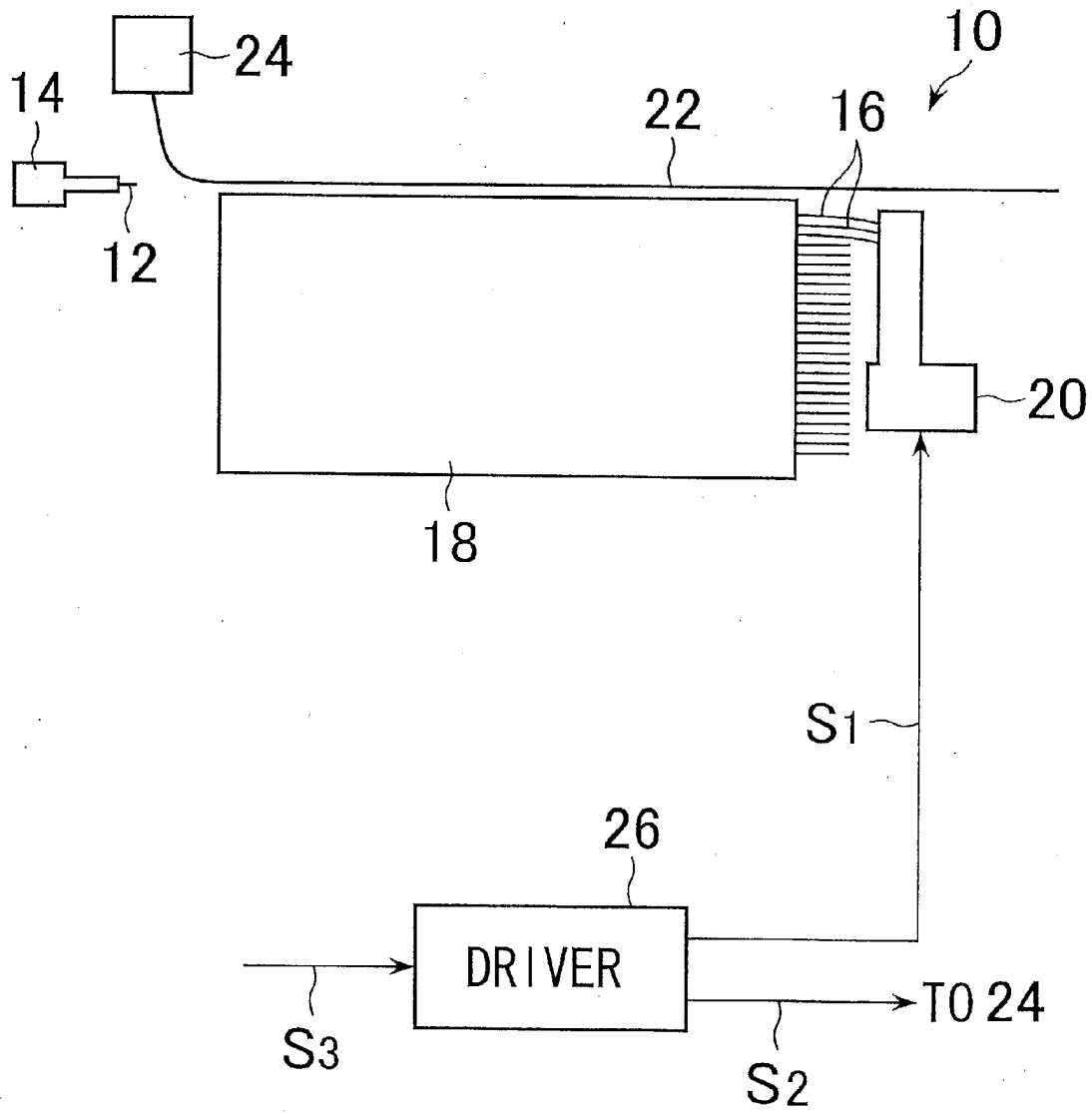


FIG. 1

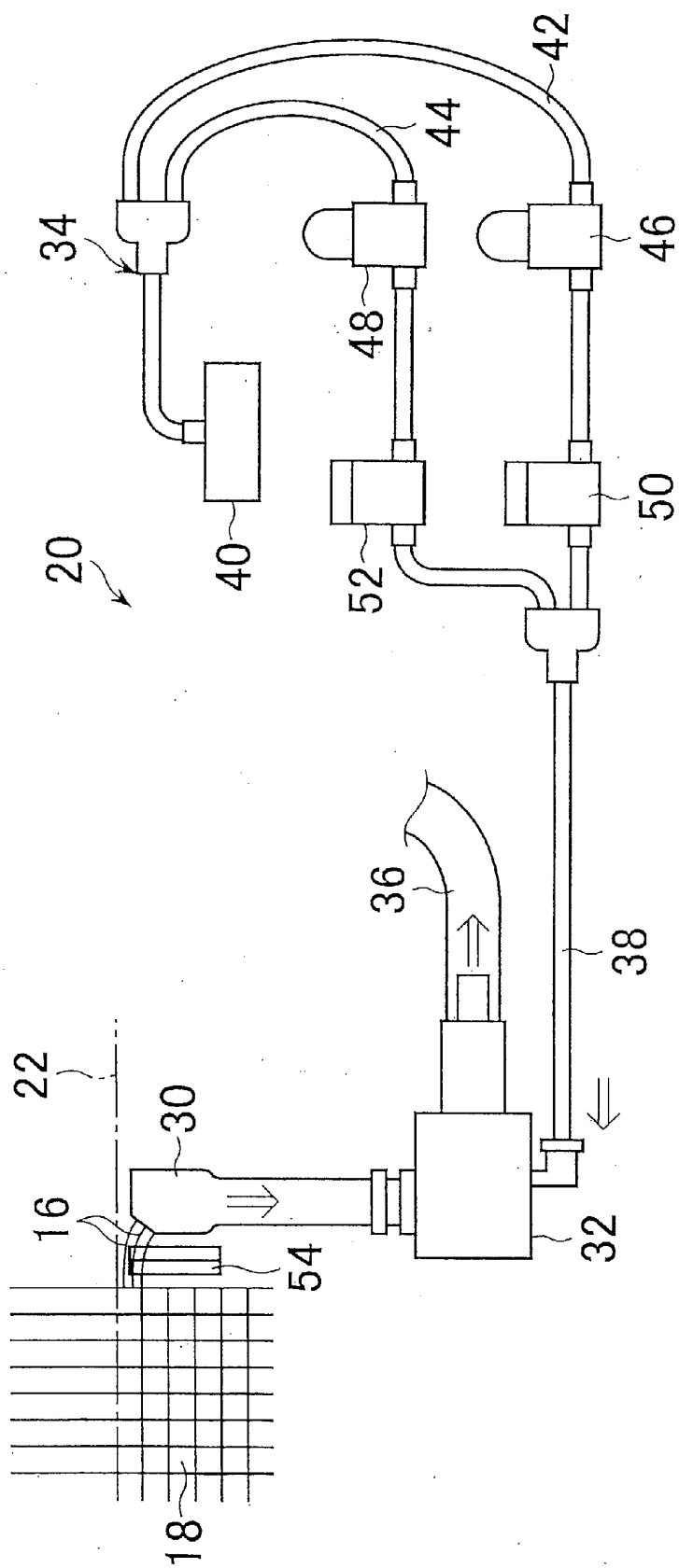


FIG. 2

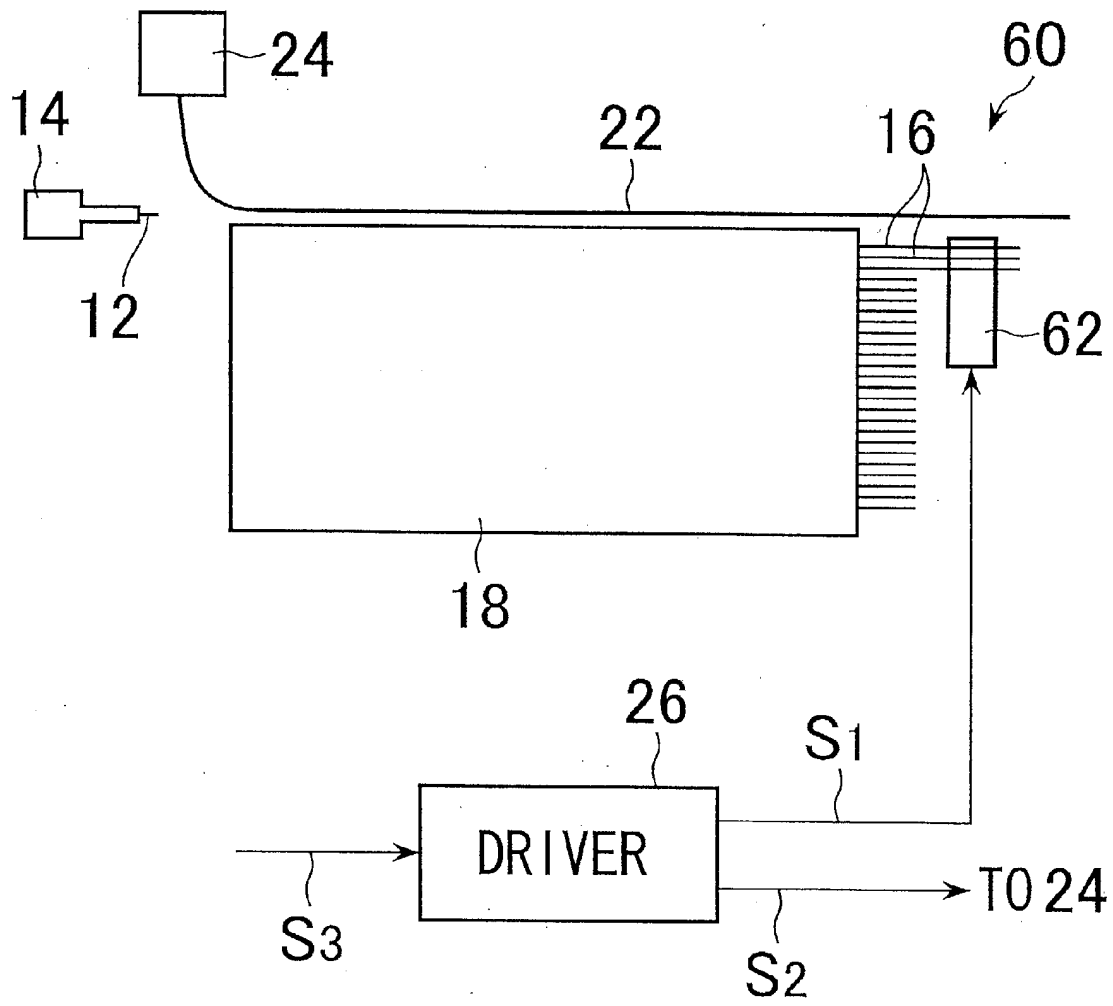


FIG. 3

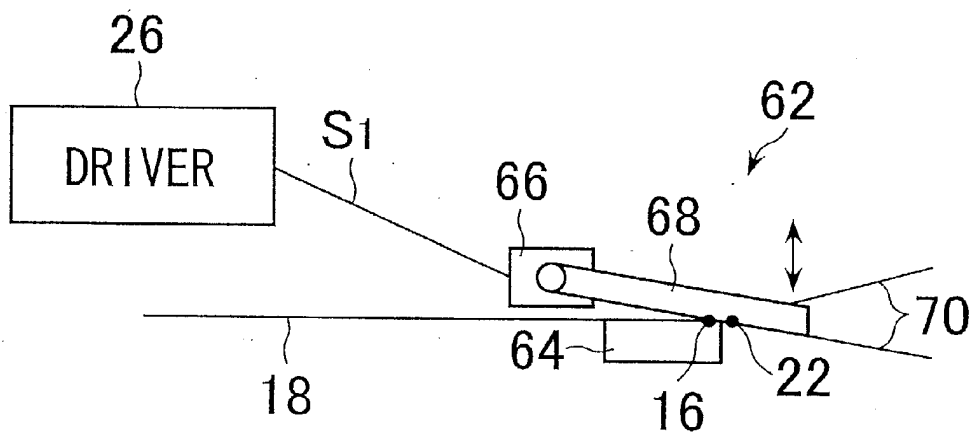


FIG. 4

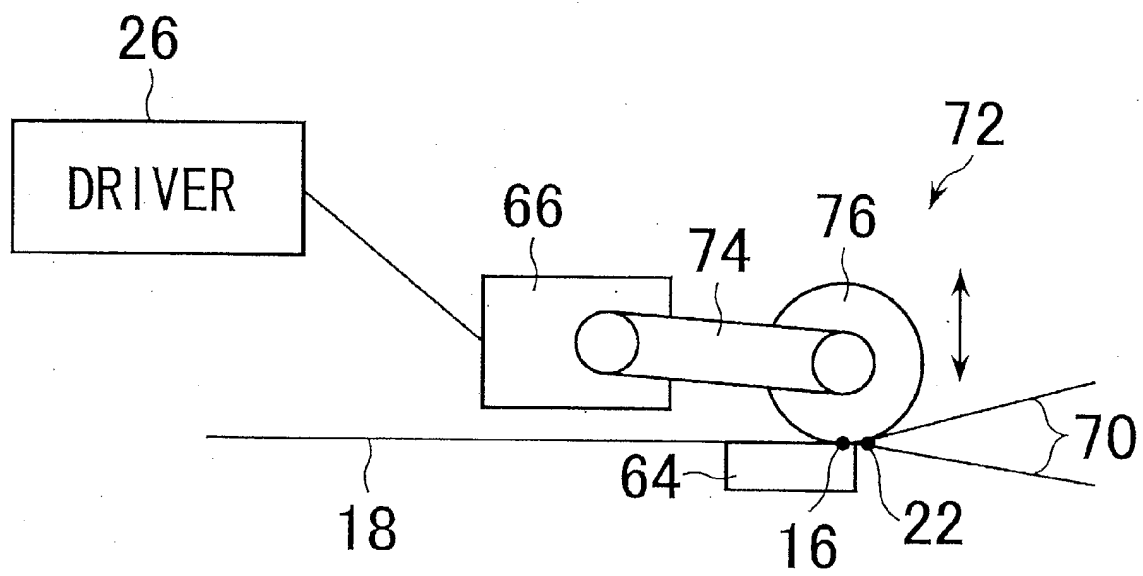


FIG. 5

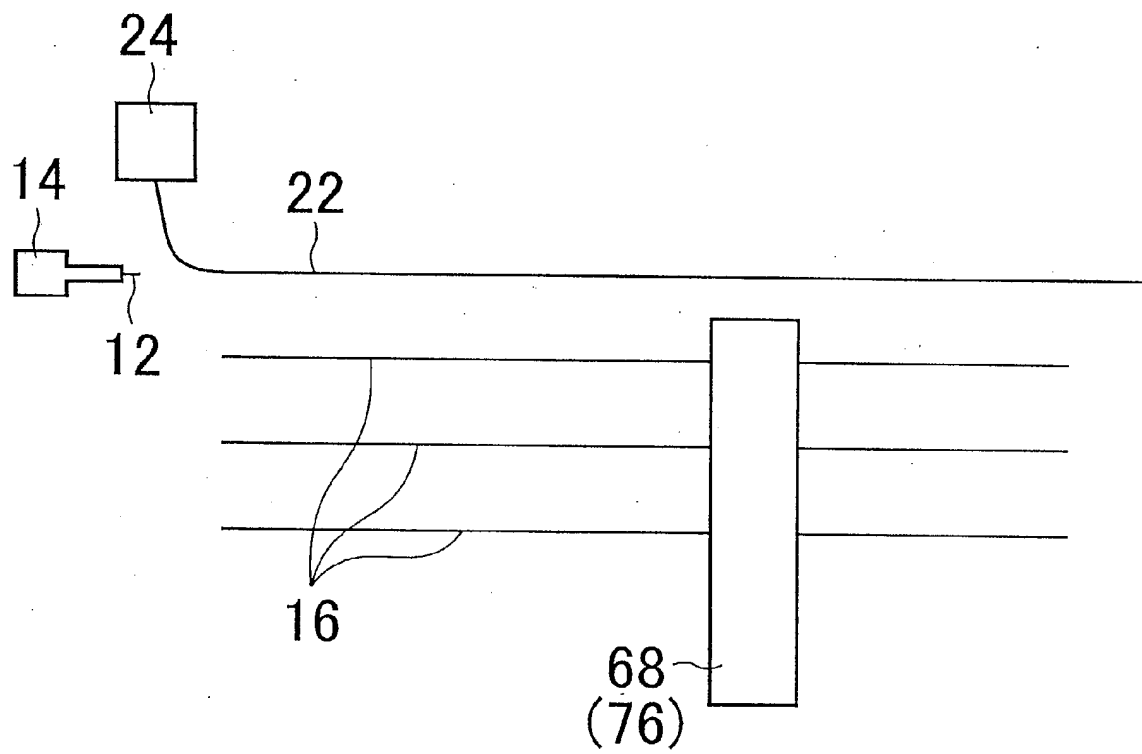


FIG. 6

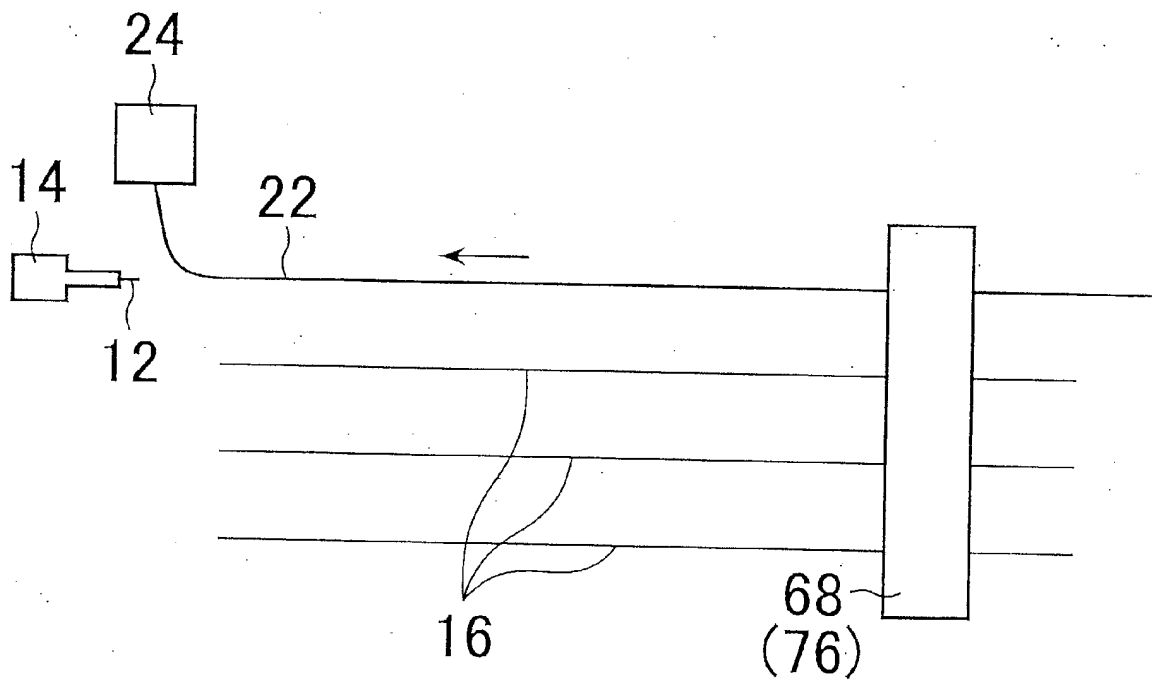


FIG. 7

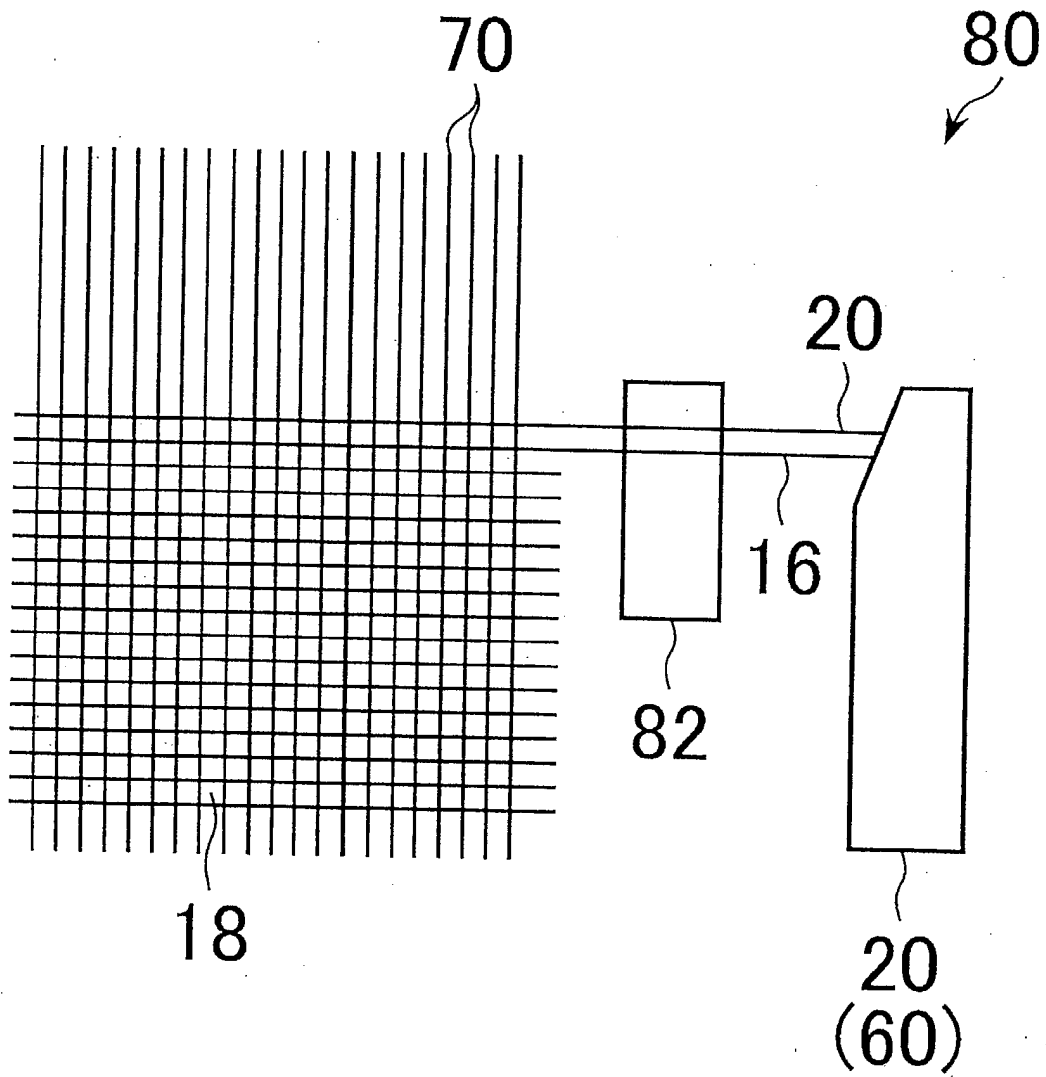


FIG. 8