

Nov. 11, 1969

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3,477,217

AUTOMATIC YARN SPLICER

Filed Dec. 5, 1968

3 Sheets-Sheet 1

FIG. 1.

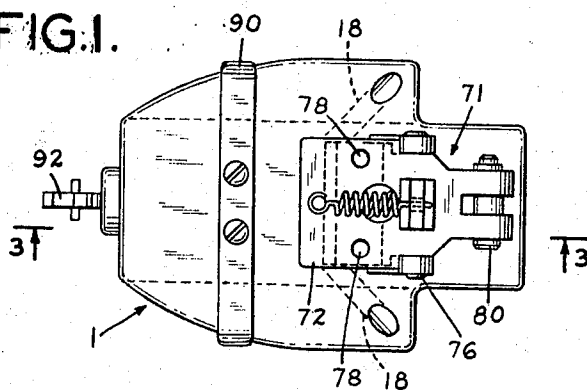
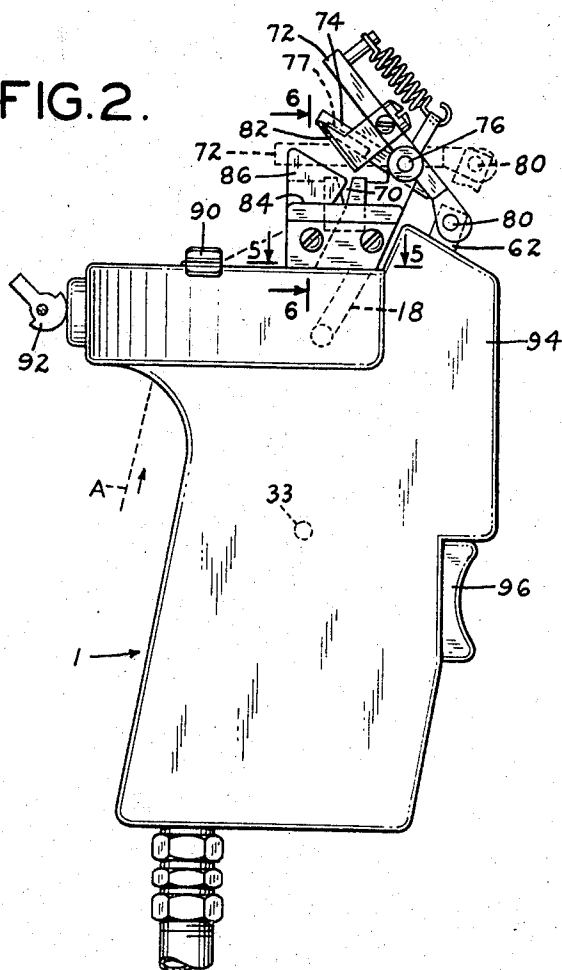


FIG. 2.



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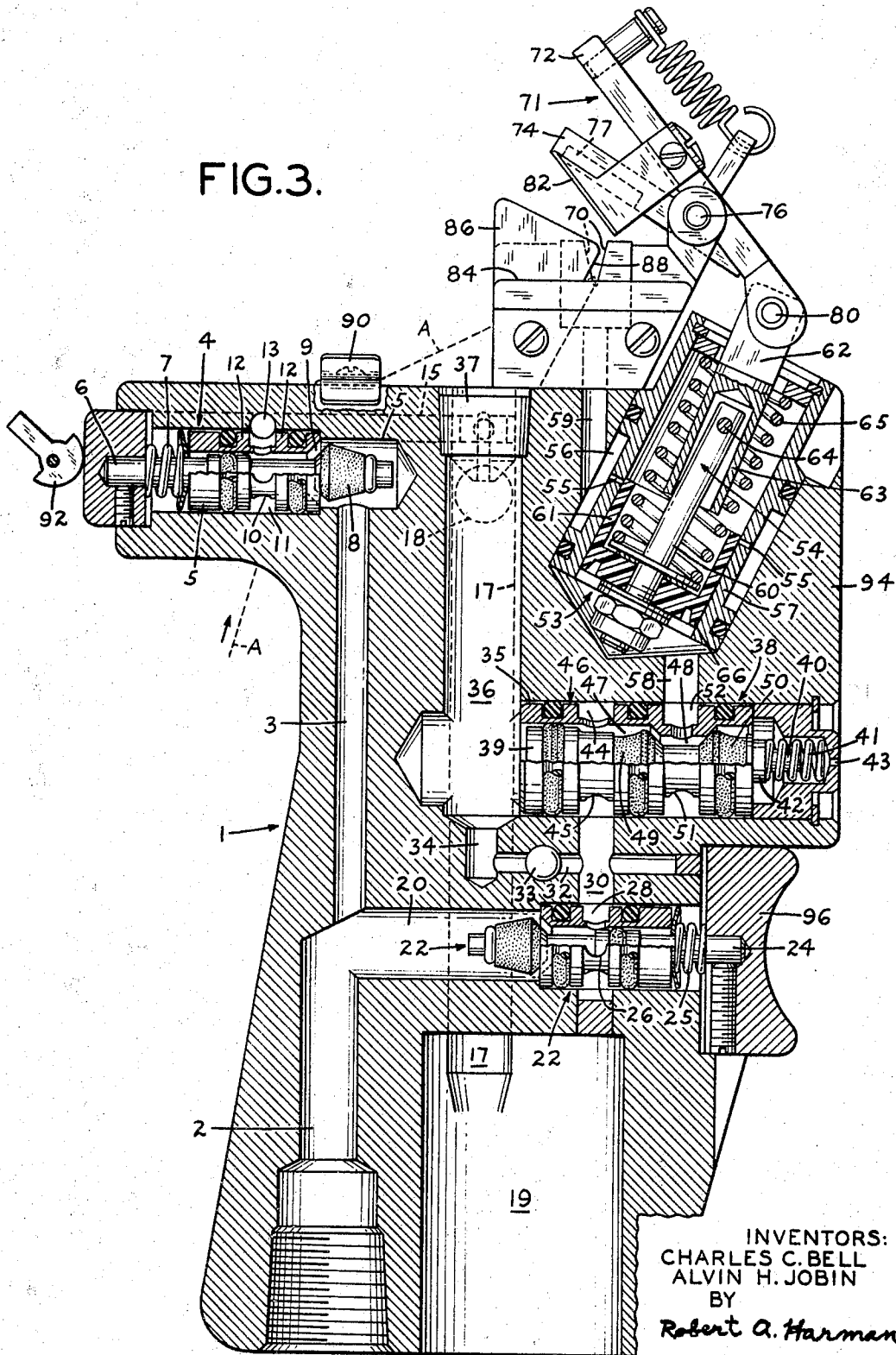
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FIG.3.



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FIG. 5.

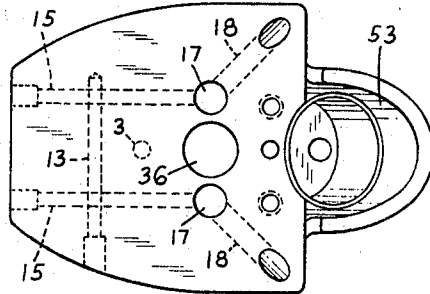


FIG. 4.

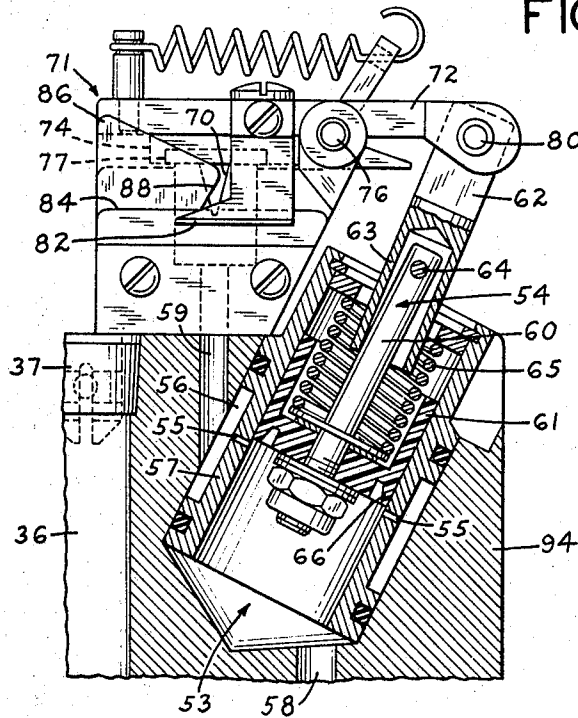
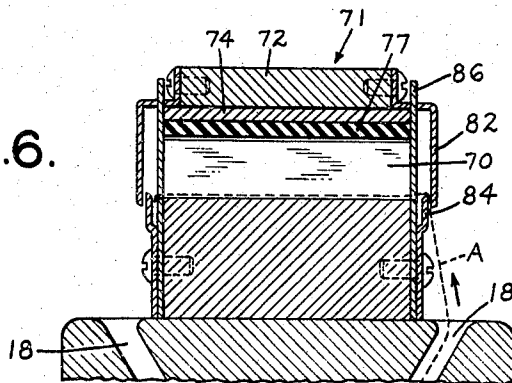


FIG. 6.



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3,477,217

AUTOMATIC YARN SPLICER

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Int. Cl. D01h 17/00, 13/26

U.S. Cl. 57—22

6 Claims

ABSTRACT OF THE DISCLOSURE

A hand held yarn splicer operated by a timed jet of air. The start of the jet is timed by the rise of a control piston actuated by compressed air, and the jet is cut off by the shift of a valve actuated when a precise pressure is reached in a pressure chamber. The rate of build up of pressure in the pressure chamber is adjustable. The same control piston automatically closes the cover of the splicing chamber and operates cutters to trim the yarn ends off close to the zone in the yarn where the splice will be made, all before any splicing action begins.

This invention relates to yarn splicing apparatus operated by an air jet. It relates particularly to a mechanism for adjustably setting the duration of such air jet. The invention is particularly applicable as an improvement upon U.S. Patent No. 3,306,020, of Feb. 28, 1967, to N. Rosenstein.

Further advantages provided by the invention are the automatic operation of cutters for trimming the yarn ends off close to the splicing zone, and the automatic closing of the splicing chamber cover, all coordinated by that same timing mechanism which also times delivery of compressed air to the splicing chamber. Overtravel of the cover closing means assures proper closing before any splicing action begins.

Other advantageous features include aspirators which exert the proper tension for cutting the yarn ends and clear away the cut ends. The convenient shape and compact size of the device add to its utility.

SUMMARY OF THE INVENTION

The splicer of the invention consists of two principal portions, a body portion and a head portion.

The body portion houses aspirator ducts for the yarn ends to be spliced, and ducts to carry compressed air for delivery to the splicing chamber in the head. Control valves for turning on and off the air supply to the aforesaid ducts are included.

The body further contains a combination piston and valve actuated by air pressure first to operate as a piston, closing the sealing cover and then working a set of cutting blades to trim the yarn ends; then to operate as a valve, admitting the compressed air flow to the splicing chamber. The motion of the piston accurately controls all these operations.

Also included is an automatic cut-off system comprising a pressure chamber; an adjustable valve for controlling the flow of compressed air into the chamber; and a cut-off valve actuated when the pressure in the chamber reaches a precise value, whereby after an adjustable time interval for pressure build-up in the pressure chamber, the flow of air to the splicing chamber is automatically cut off.

The invention is particularly applicable in conjunction with a yarn splicing head comprising an elongated, V cross section chamber open at both ends and having at least one slot for admitting air, longitudinally disposed along the junction of walls forming the V. A cover for

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the chamber is also provided. Such head is constructed generally as described and illustrated in U.S. Patent No. 3,306,020 of Feb. 28, 1967 to N. Rosenstein.

It will be evident that application of the timing mechanism of the invention is not confined to any one design of jet splicing head, nor even necessarily to jets used for yarn splicing purposes.

The device suitably takes the general form of a pistol handle. When the terms "top" and "bottom," "vertical" and "horizontal" are used hereinafter, it is to be understood that these have reference to the device when positioned as in FIG. 2, with the splicing chamber uppermost and the handle generally vertical; but the device can be held and used in any attitude. "Upward" and "downward," "inward" and "outward" as hereinafter used likewise refer to directions from the center of the device, when the device is in the position illustrated in FIG. 2.

In the accompanying drawings:

FIG. 1 is a plan view with the cover shown in closed position.

FIG. 2 is a side elevation with the cover shown in open position, wherein the dashed line shows one yarn end in string-up position, the second yarn end being omitted for clarity.

FIG. 3 is a vertical section along the line 3—3 of FIG. 1 with the valves shown in quarter section and with the cover shown in open position.

FIG. 4 is a partial view similar to FIG. 3 with the cover shown in closed position.

FIG. 5 is a horizontal section along line 5—5 of FIG. 2.

FIG. 6 is a vertical section along line 6—6 of FIG. 2 with the cover shown in closed position, and with the string-up indicated.

DETAILED DESCRIPTION OF PREFERRED DEVICE

The presently preferred embodiment of this invention is more fully described below with reference to the accompanying illustrative drawings.

Aspirator system

The body generally designated 1 comprises a main air inlet duct 2 leading vertically upward to an aspirator air inlet duct 3. The duct 3 in turn leads to an aspirator air control valve generally designated 4.

Referring to FIG. 3, the principal elements of valve 4 are a sleeve member 5 within which is a piston or core 6. A spring 7 urges piston 6 toward the outward or closed position. In this closed position a plug 8 suitably of rubber or the like, mounted on piston 6, mates with and bears against the sloping wall of a seat 9 which forms the inward end of sleeve 5. Access of air from duct 3 to the interior of sleeve 5 is thus blocked in the closed position of valve 4. In the open position piston 6 is held inward against the action of spring 7 whereby a passageway is opened between the top of plug 8 and the mating wall of seat 9.

Numeral 10 designates a ring of ports in sleeve 5 giving access from the interior of sleeve 5 to annular channel 11. This annular channel 11 is defined by sleeve 5 and by flanges 12, 12. As best seen in FIG. 5, channel 11 intersects horizontal duct 13, which in turn perpendicularly meets a pair of parallel horizontal channels 15, 15. Channels 15 lead to a pair of vertical ducts 17, 17 which are the exit ducts for aspirator air. A yarn inlet passageway 18 branches from each duct 17 at an angle and leads upward to the outside of body portion 1.

Numeral 19 designates a waste collecting chamber to which air aspirator outlet ducts 17 lead.

Splicing air system

A duct 20 branches horizontally from main air inlet duct 2. The flow of compressed air in this duct 20 is con-

trolled by valve 22 which has the same construction as above described for valve 4. When piston 24 of valve 22 is pressed inwardly against the action of spring 25, valve 22 admits compressed air from duct 20 to the interior of the valve sleeve. This compressed air is then free to flow out ports 26 into annulus 28 and thence into vertical duct 30.

Branching horizontally from duct 30 is duct 32 leading via needle valve seat 33 into duct 34 which gives access to pressure chamber 36.

Vertically above duct 30 is a cut-off valve indicated generally by numeral 38. This valve is somewhat similar in construction to valve 4 above described, but provides a double action. This valve 38 (FIG. 3) comprises piston or core 40 normally urged inward by spring 41 bearing against collar 42. An annulus 44, surrounding the inward section of valve 38, connects the valve exteriorly to duct 30; and communicates via ports 45 with a compartment 47 in the interior of the valve. A passageway, within sleeve 46, connects this first compartment 47 to a similar outward compartment 48. Mounted on core 40, in compartment 47, is a plug 49 similar to plug 8 of valve 4, adapted to close off compartment 48 from compartment 47 when core 40 is moved outward from its normal position. In the normal position of core 40, a plug 50 mounted on the core closes the outward end of compartment 48. Compartment 48 is in communication through ports 51 with annulus 52 which in turn communicates via duct 53 with air chamber 53.

Air chamber 53 contains a piston adapted for reciprocation in the chamber, generally indicated by numeral 54. This piston comprises shaft 60 and head 61. The piston is urged inward into chamber 53 by a spring 65. The upper end of shaft 60 extends into arm 62 through sleeve 63. Arm 62 is rockingly connected to shaft 60 by pivot pin 64. A stiffly flexible lip 66, surrounding the base of piston head 61, is designed to expand slightly when pressure is applied against the piston head. Air leakage past the head is thus prevented and premature air flow through ports 55 is avoided. Sealing cover 74 must shut first.

Air chamber 53 is pierced part way up its wall 57 by a ring of slots 55 which lead into annular chamber 56. Annular chamber 56 is joined to vertical duct 59, which leads to the splicing chamber.

Automatic timing system

Referring again to pressure chamber 36, this is a vertical chamber closed at the top by an adjustable venting valve 37. Automatic timing valve 38, as previously described, is located perpendicular to pressure chamber 36, in well 35 which intersects chamber 36. The inward end of core 40, designated by numeral 39, thus forms a movable barrier at one side of chamber 36, in well 35.

The rate at which compressed air enters chamber 36 is accurately adjustable by setting the position of the needle valve in seat 33. Thus an adjustable interval of time is required for the pressure to build up in chamber 36 and develop a force upon core 40, exerted against barrier 39, sufficient to overcome the counter-thrust upon core 40 due to force developed by pressure in chamber 47 and 48 acting upon the differential area between areas of barrier 39 and plug 49. Since barrier 39 exposes its full area to the pressure in chamber 36, the resultant outward force on barrier 39 will shift core 40 outward and close valve 38 when pressure in chamber 36 rises to about 60% of line pressure. Spring 41 serves to keep valve 38 in open position with no pressure in duct 30.

Splicing head

A preferred splicing head is of the general construction described and illustrated in U.S. Patent 3,306,020 of Feb. 28, 1967 to N. Rosenstein. This head comprises an open-ended splicing chamber of V cross section, indicated in the drawings generally by numeral 70. The

splicing chamber 70 will have at least one slot longitudinally disposed along the junction of the walls forming the V and can also, e.g. for use with relatively heavy yarns, have two or more such slots. Easily interchangeable chambers can be provided, differing in width of the V angle and/or in having only one vs. two longitudinal slots. The V angle can vary from say 15° to 90°, being wider for heavier yarns.

In addition to the splicing chamber proper, the splicing head includes a cover indicated in the drawings generally by the numeral 71. A preferred cover consists of upper and lower lids 72 and 74 hinged together at hinge 76 and urged apart in jaw-like fashion by a spring. The lower lid or sealing cover 74 is provided with a gasket 77 which bears against the top of splicing chamber 70 to cover the same tightly except for venting holes 78, while leaving the V shaped chamber open at both ends to allow escape of air therefrom. Venting holes 78 penetrate both the upper lid 72 and the lower lid 74, allowing escape of air through these holes from the splicing chamber.

The upper lid 72 is attached by pivot pin 80 to the upper end of arm 62. This upper lid 72 carries a pair of cutting blades 82 which meet corresponding fixed cutting blades 84 at points closely adjacent to each end of splicing chamber 70, to trim the yarn ends off close to the splicing zone. (See FIG. 6.) A pair of yarn guides 86 with slots 88 are provided at each end of splicing chamber 70 to facilitate placing yarn in chamber 70 and bringing it across one fixed cutting edge 84, through the chamber 70, and around the far end of the chamber without crossing the far cutting edge.

A spring clip or button 90 is provided to hold each yarn after stringing into the chamber 70.

Operation

Numeral 92 designates a camming switch operable by the thumb to force piston 6 inward when the switch is "on" and to allow spring 7 to move piston 6 outward when the switch is "off."

With switch 92 in the "on" position whereby piston 6 is forced inward, the operation of the device will be quite evident from the foregoing description. Compressed air enters from a source not shown into duct 2 and then splits into two flow paths, one being the aspirator air entering duct 3 and the other being the splicing air entering duct 20.

With switch 92 in the "on" position, the aspirator air passes through valve 4 via duct 13 into channels 15 and thence passes down aspirator ducts 17.

The device is now ready for string up. One yarn end, which is designated A in FIG. 2, is run down aspirator yarn inlet 18 at the near side of the device. This yarn A is then slid along yarn guide 86 until it drops into the slot 88 which positions the yarn across fixed cutting edge 84 and through the V-shaped groove of splicing chamber 70. At the far end of the splicing chamber, the yarn is brought around yarn guide 86 at that end so that the yarn does not cross the cutting edge 84 just beyond that end of the splicing chamber; and the yarn is clipped down under the far side clip button 90 to hold it steady. The remaining yarn is then conveniently hand held against the handle of the splicer to keep it from getting tangled.

The like operation is then carried out starting at the other side of the splicing device with a second yarn end. Piston 24 is now pressed inward, conveniently by squeezing a button 96 with the fingers holding the splicing device.

Referring now to FIG. 3, as long as piston 24 is held in, a part of the incoming compressed air is free to flow through duct 20 and through valve 22 into vertical duct 30, splitting into a flow through horizontal branch duct 32 and a flow into compartment 47 of valve 38.

Following now the flow through valve 38 (FIG. 3), that valve is in its normal position wherein core 40 is urged inward. Accordingly the air is free to pass plug

49 and enter compartment 48 and thence pass via ports 51 into annulus 52, duct 58, and air chamber 53.

Initially piston 54 will be in the downward position and cover 71 will be open as shown in FIG. 3. The compressed air entering chamber 53 will raise piston 54 thus urging arm 62 upward. This upward motion of arm 62 causes cover 71 to pivot at axis 76 thus lowering the cover toward splicing chamber 70 and lowering the cutting edges 82 toward fixed edges 84. This rotation of cover 71 is accommodated by the rocking action of arm 62 about pivot pin 64 and the pivoting action of the cover 71 about pivot pin 80.

Lower lid 74 is positioned with reference to upper cutting edge 82 so that this lower lid will close around splicing chamber 70 before the yarn end is cut and before the compressed air enters duct 59 which leads into the splicing chamber. At this stage piston head 61 has risen almost high enough to uncover slots 55 in the wall 57 of chamber 53.

As the piston head continues to rise, it lowers upper lid 72 thereby lowering cutting edges 82 to trim the yarn ends off close to the splicing zone. A moment later the rising piston closes upper lid 72 and uncovers slots 55, thus allowing compressed air from chamber 53 to reach duct 59 and jet through the one or more slots in splicing chamber 70 when the splice is made. (See FIG. 4.)

The duration of the splicing action may be quite important in obtaining a clean, strong splice with certain yarns. The present device accurately controls, by the rise of piston 54, the start of the jet, and permits setting automatically the cut-off of the jet. Referring to FIG. 3, the needle valve is adjusted in its seat 33 to regulate the rate of air flow into duct 34 and pressure chamber 36. When the pressure has built up sufficiently in chamber 36, the force against the solid end 39 of core 40 becomes great enough to shift this core outward against the force of spring 41 plus the force developed by the pressure in chamber 47 acting against the differential areas of barrier 39 and plug 49, as previously explained. Thereby plug 49 is shifted to bear against the inward sloping wall between compartment 47 and compartment 48. This motion thus seals off compartment 47 and prevents further flow of air into air chamber 53 and duct 59 and splicing chamber 70. Generally the duration thus controlled for flow of splicing air will be a fraction of one second. At the same time this outward motion of core 40 unseats plug 50 from its position sealing compartment 48. Air pressure in compartment 48, duct 58, and air chamber 53 is quickly relieved as spring 65 drives piston 54 down into air chamber 53, and the air in the chamber and ducts below the piston is expelled and vented through valve 38 past plug 50 and out to the atmosphere through air vent 43.

When piston 24 is now released by releasing button 96, the air flow through valve 22 to duct 30 and chamber 36 is cut off. The pressure developed in chamber 36 is relieved in a few seconds by leakage of air past adjustable venting valve 37. When the pressure in chamber 36 has dropped sufficiently, core 40 is shifted by spring 41 inward again to its normal position; and in a few seconds the device is ready for another splicing cycle.

The ends of yarn cut off by the cutters are drawn down aspirator ducts 17 into collecting chamber 19 from which they can easily be cleaned out whenever convenient.

We claim:

1. Timing mechanism for an air jet, comprising:

- (1) A chamber for receiving a flow of compressed air;
- (2) A piston, adapted for reciprocation in the chamber, having a head closely fitting the chamber wall;
- (3) Means to urge said piston into said chamber;
- (4) In the chamber wall, a ring of slots disposed lengthwise around the perimeter, positioned to be

covered by the piston head when it is near the bottom of the chamber and to be uncovered when the bottom of the piston head rises in the chamber to the level of the slots;

- (5) A duct communicating with said slots;
 - (6) Ahead of said chamber, a valve comprising a core and a sleeve defining together two compartments which are in communication when the core is in open position and are closed off from each other when the core is in closed position; the first said compartment being in communication with an air inlet duct, and the second compartment being in communication with the chamber above cited as item (1); and when the core is in closed position only, the second compartment is in communication with the outside atmosphere; whereby when said core is in open position air flows through said valve to the chamber above cited as item (1), and when the core is in closed position said air flow is cut off and air expelled from said chamber is vented through said valve to the outside atmosphere;
 - (7) Means to urge said core to open position;
 - (8) A second chamber for receiving a flow of compressed air;
 - (9) Means for supplying compressed air to said second chamber while compressed air is being supplied to said first chamber above cited as item (1);
 - (10) Means for adjusting the rate of air pressure build-up in said second chamber;
 - (11) Means for applying the air pressure in said second chamber to the core of said valve above cited as item (6) to shift said core from its open to its closed position, thereby terminating the flow of air to said first chamber above cited as item (1) and allowing air to be expelled from said first chamber and vented through said valve to the outside atmosphere as the piston is urged into said first chamber.
2. An air jet yarn splicer wherein the air jet is timed by the mechanism of claim 1, the air jet being delivered to a splicing chamber from the first chamber of claim 1.
3. Splicer of claim 2 wherein the said piston, cited as item (2) of claim 1, is connected to a cover fitting over the splicing chamber which cover comprises a lower lid and an upper lid which are urged apart; wherein the rise of said piston closes said lower lid before uncovering the slots above cited as item (4) of claim 1, and then over-travel of the piston lowers the upper lid and uncovers said slots to deliver compressed air to said splicing chamber.
4. Splicer of claim 3 wherein said upper lid carries cutting blades which cooperate with fixed cutting blades closely adjacent to each end of said splicing chamber, positioned to meet said fixed cutting blades before the rising piston uncovers said slots delivering compressed air to the splicing chamber.
5. Splicer of claim 4 wherein a pair of aspirators is provided to tension the yarn ends before cutting and to clear away the cut ends.
6. Splicer of claim 2 wherein the splicing chamber is open ended and of V cross section, and has at least one slot longitudinally disposed along the junction of the walls forming the V.

References Cited

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JOHN PETRAKES, Primary Examiner

U.S. Cl. X.R.

57—34