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Nunn

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[54] **SPLICING APPARATUS**

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[52] **U.S. Cl.** **57/22**

[51] **Int. Cl.** **D01h 15/00**

[58] **Field of Search** ..... 57/1, 22, 23, 34 R, 142, 57/159; 28/1; 19/161

[56] **References Cited**

UNITED STATES PATENTS

3,273,330	9/1966	Gonsalves	57/22 X
3,339,362	9/1967	Dodson et al	57/22 X
3,345,809	10/1967	Gemeinhardt	57/22
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1,266,844	3/1972	United Kingdom	57/22

Primary Examiner—Donald E. Watkins

[57] **ABSTRACT**

An apparatus for splicing overlapped fiber tows wherein the fiber tows are clamped in a fixed position while opposed spaced jet devices are moved in unison across the width of the tow. The apparatus includes a support, upper and lower sub-assemblies cantilevered from said support defining a slot between the sub-assemblies, means for mounting the jets on either side of the slot for moving in unison toward and away from the support and a means for clamping the tows after they are inserted in the slot.

4 Claims, 6 Drawing Figures

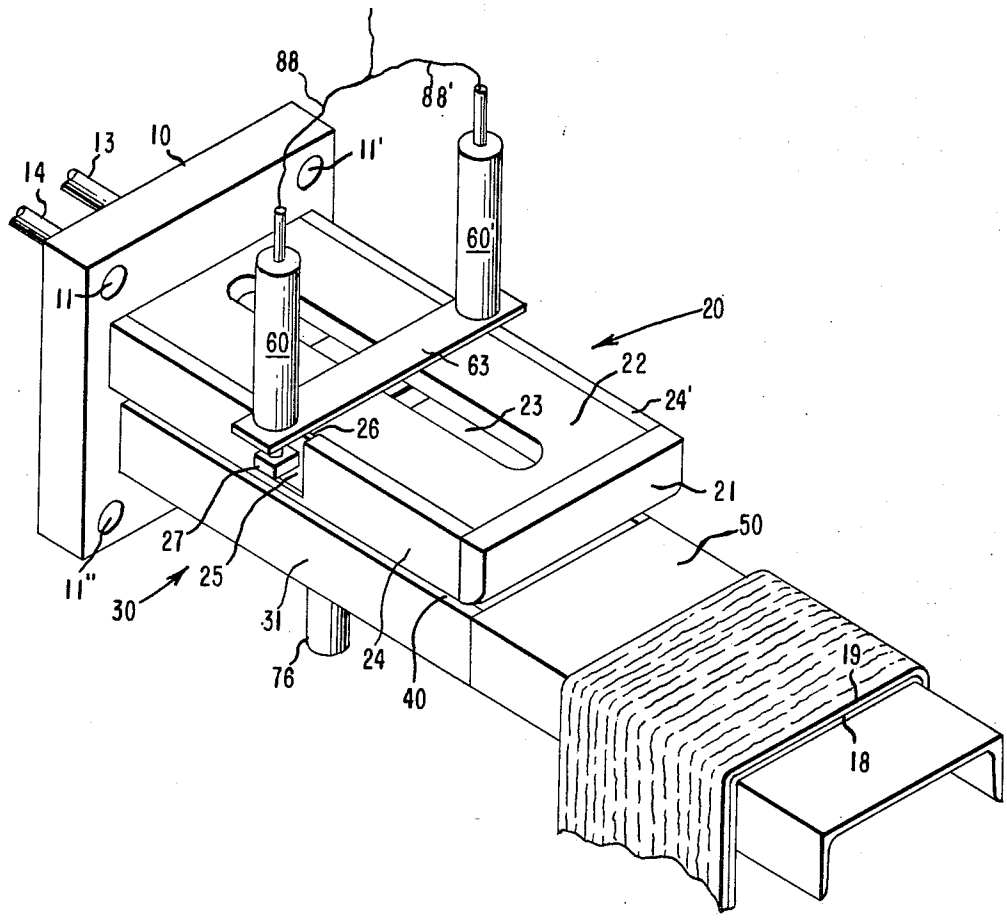


FIG. 1

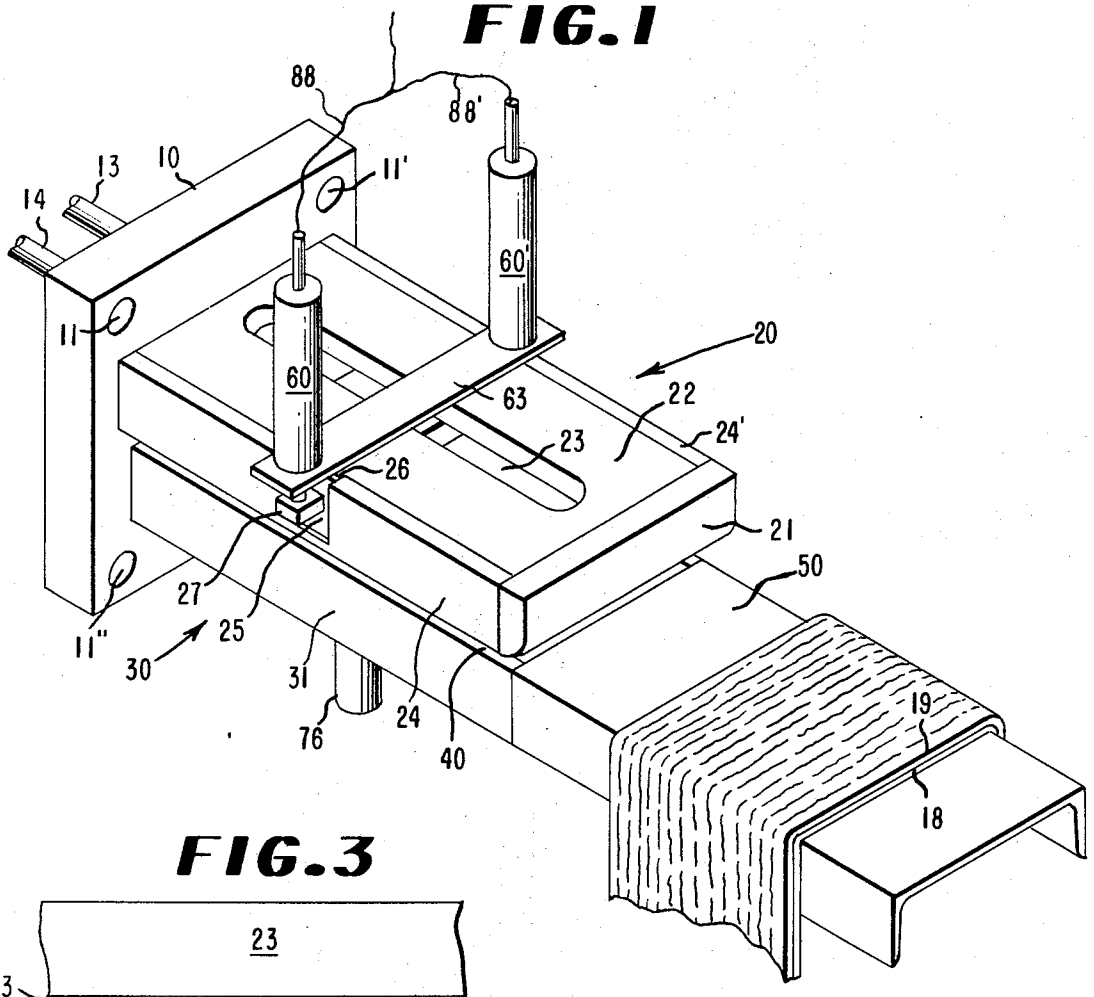


FIG. 3

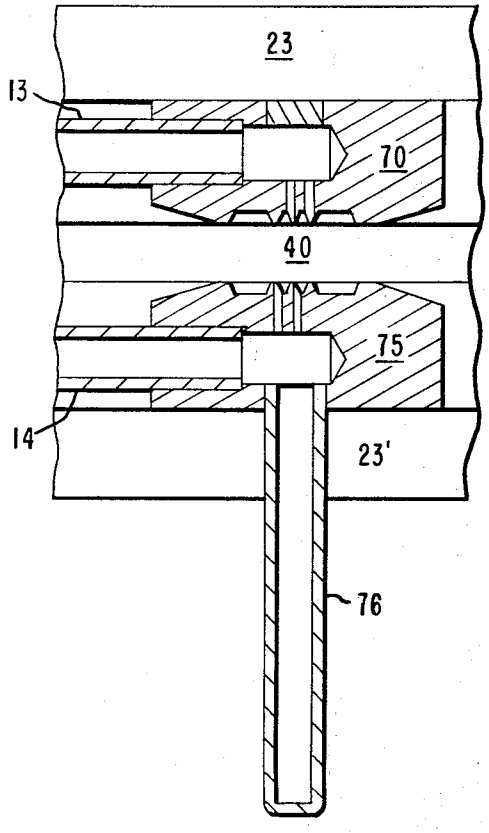


FIG. 2

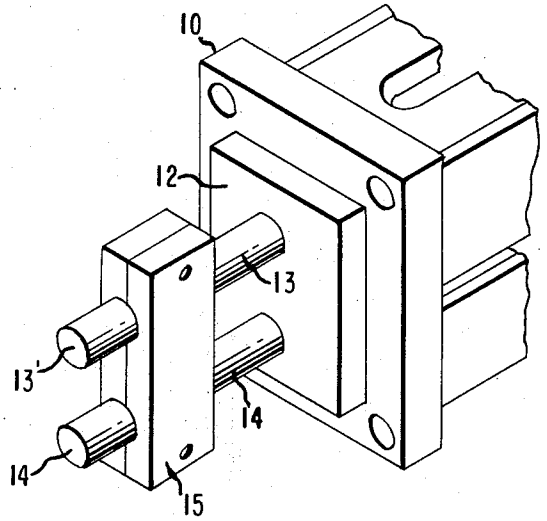


FIG. 4

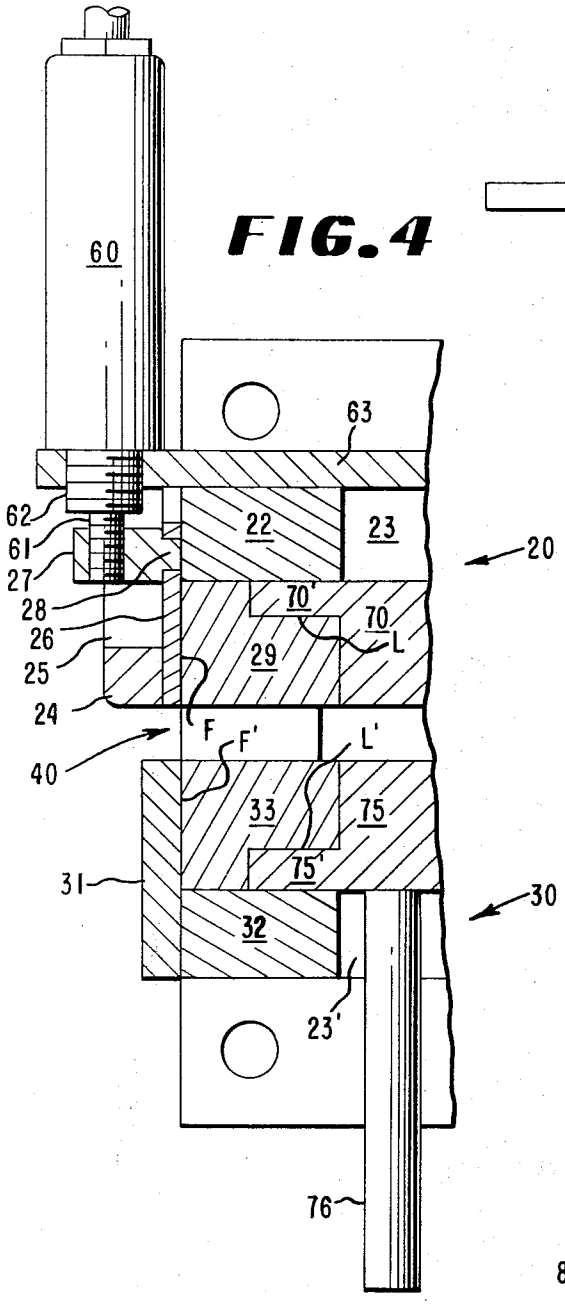


FIG. 5

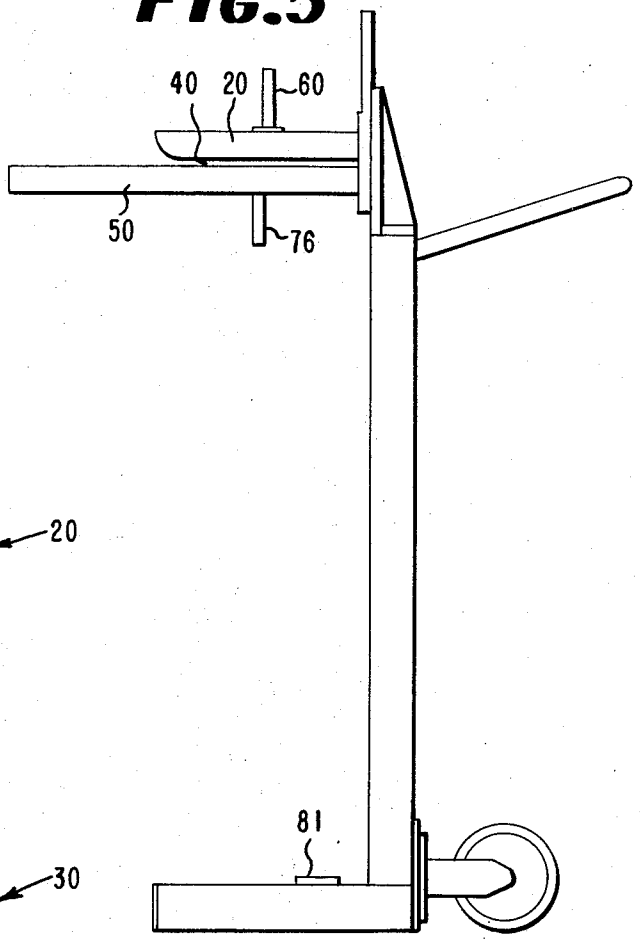
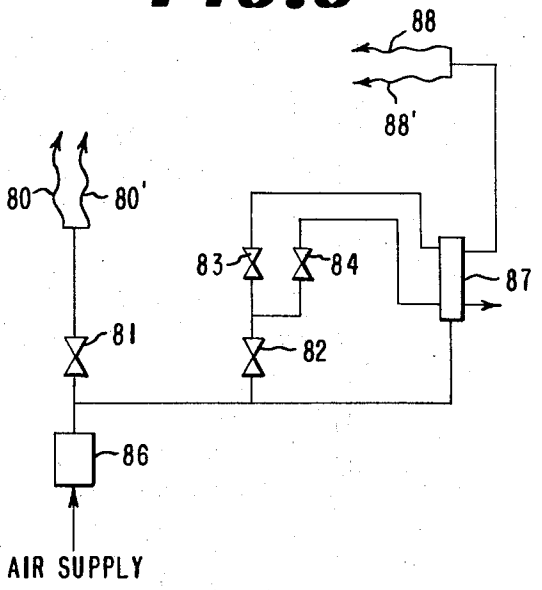


FIG. 6



SPLICING APPARATUS

BACKGROUND OF THE INVENTION

This invention relates to pneumatic jet treatment for joining lengths of textile tow to provide continuous strands. More specifically, the invention concerns improved novel and useful auxiliary apparatus for holding tow sections tightly and manipulating the jet to provide for narrow splices extending along a narrow straight line across the full width of a spread tow.

In the past, tow specimens have been joined by many techniques including the use of a fluid jet as taught by Dodson et al. in U.S. Pat. No. 3,339,362. The splices produced by that technology have been satisfactory for many applications but the procedure has been known to be too time-consuming and the splice is not consistently strong enough nor small enough for some uses such as continuous cutting to staple by passage through a staple cutter.

SUMMARY OF THE INVENTION

In an apparatus for splicing overlapped fiber tows wherein said overlapped tows are passed between opposed fluid jet streams issuing from spaced jets facing each other, the improvement comprising: a support; upper and lower sub-assemblies cantilevered from said support defining a uniform slot there between; means for slidably mounting said spaced jets in said upper and lower sub-assemblies on either side of said slot for movement in unison toward and away from said support; and means adjacent each edge of the slot for releasably clamping the overlapping tows after they are inserted and extended beyond each edge of the slot.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** is an isometric sketch of the assembled apparatus showing the front portion;

FIG. **2** is an isometric sketch showing the rear portion of the apparatus;

FIG. **3** is a side elevation, sectioned in a vertical plane parallel to the long axis of the apparatus and extending through the center of the opposed jetting devices, other portions of the assembly broken away;

FIG. **4** is an end elevation half in section and partly broken away, the section taken in a vertical plane through the center of the apparatus;

FIG. **5** is an elevational view of a carriage to which the apparatus of the invention is attached; and

FIG. **6** is a schematic piping diagram for a pneumatic circuit applicable to this invention.

DESCRIPTION OF THE PREFERRED EMBODIMENT

Turning first to FIGS. **1** and **4**, the invention is seen to comprise a support plate **10** having suitable holes **11**, **11'**, **11''**, etc., for fixing this plate rigidly to a frame or to a movable carriage. Fixed to the front surface of this mounting plate is an upper cantilevered sub-assembly **20** and a lower cantilevered sub-assembly **30**, defining a uniformly thick slot **40** between the two sub-assemblies. In the preferred embodiment, this slot was made approximately 11 mm. in thickness, but this thickness dimension is not critical to the invention and may be selected to suit the thickness of the material to be spliced. An apron **50** extends longitudinally out from lower sub-assembly **30** to provide a place for assembling the tows **18**, **19** to be spliced in preparation for inserting them in the slot **40**.

Sub-assembly **20** comprises first an elongated upper base plate **22**, having a viewing window **23** therethrough which extends over a major portion of the length of plate **22**. Fastened to the long edges of plate **22** are two identical clamp retainer plates **24**, **24'**, each having a central cut-out **25** extending part way down from the top of these plates. Inside each retainer plate **24**, **24'**, there is mounted a slidable clamping plate such as **26**. A lug **27** is constructed with a boss **28** to fit into an appropriate hole in clamping plate **26**. A threaded bore is provided near the other end of lug **27** to receive the piston rod **61** of air cylinder **60**. Cylinder **60** is threaded to a mounting block **63** which extends across the sub-assembly **20** and is fastened to base plate **22**. The structures of air cylinder **60**, lug **27**, and clamping plate **26** are duplicated on the other edge of sub-assembly **20**. An upper shoulder bar **29** is fastened to the under side of plate **22** and constructed with a vertical face F to receive the inside face of clamping plate **26**. A ledge L arranged to support one side of the upper half of the splicer head is explained later. An identical shoulder bar is mounted just inside the other edge of sub-assembly **20**. End piece **21** extends across the outer end of sub-assembly **20** and is fastened to the end of plate **22**.

Lower sub-assembly **30** comprises a clamp anvil **31** along one edge of a lower base plate **32**. Plate **32** is identical to plate **22**, even including an elongate opening **23**. A lower shoulder bar **33** is fastened to plate **32** just inside anvil **31** and has a face F' adjacent the inner face of anvil **31**. Shoulder bar **33** also has a ledge L' inverted and arranged to receive an extension of the lower part of the splicer head as discussed below. The other edge of plate **32** has another anvil and shoulder not shown but constructed and attached in a similar, symmetrical manner to **31** and **33**.

Referring now to FIG. **2**, the rear surface of mounting plate **10** is seen to carry a bearing plate **12** with upper and lower bores sized and located to receive two rigid smooth-surfaced pipes **13**, **14**. A pipe spacer and clamp **15** is arranged to hold pipes **13**, **14** parallel and spaced so as to slide easily through bearing plate **12**. Clamp **15** is spaced along the pipes **13**, **14** a distance sufficient to allow back and forth motion equivalent in length to the tow width to be spliced. This clamp also enables relative alignment of upper and lower splicer heads to achieve optimum splicing performance. The inner ends of pipes **13** and **14**, as seen from FIG. **3**, are fastened respectively to the upper half **70** and the lower half **75** of the splicer head. The outer ends **13'**, **14'** of the pipes are connected to flexible hydraulic hoses, not shown, in FIG. **2** but indicated as **80**, **80'** in FIG. **6**.

The two halves **70**, **75** of the splicer head are constructed substantially as taught by Dodson et al. in U.S. Pat. No. 3,339,362. The only significant modification to this design as taught is the addition of rectangular extensions **70'**, **75'** as shown in FIG. **4** which are arranged to slide along shoulders **29**, **33**, respectively. Symmetrical extensions not shown are formed on the other side of each half of the splicer head. An operating handle **76** is attached to and extends downward from the lower half **75** of the splicer head, passing through a slot **23'** in lower base plate **32** similar to slot **23**. Thus, when handle **76** is moved back and forth in slot **23'**, it moves lower half **75** of the splicer head and, by virtue of the

mechanical connection through pipe **14**, clamp **15**, and pipe **13**, this moves the upper half **70** of the splicer head in unison. The upper and lower halves **70, 75** of the splicer head are constrained to a straight-line motion as a result of shoulder bars **29, 33** and the corresponding bars on the other side of the center line of the apparatus.

The apparatus of this invention may optionally be made movable by mounting it on a wheeled carriage **90** as shown in FIG. **5.** In some cases, it may be fixed to a carriage on an overhead monorail.

Control of the air supplies for the pneumatic splicer and the air cylinders is accomplished by means of the piping arrangement shown in FIG. **6.** Thus, air from an air supply not shown is passed through air filter **86** and then to branched pipes one of which passes through a foot operated toggle air valve **81** and thence to the two hydraulic hoses **80, 80'** which connect to pipes **13, 14** of, for example, FIG. **2.** The other branch circuit is further divided, one line of which passes through a push-button air switch **82** from which it branches to pass through two push-button air switches **83, 84** and thence to control parts of an air relay **87** (e.g., Numatrol Model RA-5-0101). The output of relay **87** goes to hydraulic hoses **88, 88'** which in turn are connected to the air-cylinders **60, 60'**, respectively. Air input is supplied to relay **87** via a branch line from filter **86.**

Procedures for operating the tow splicer of this invention will now be described. Two types of splices are commonly made, the first of which is called a "lap" splice. This type is made by first placing one end of the first tow **18** to be spliced across the apron **50** in front of the splicer with the loose end of the tow to the right as one faces the machine. The loose end should hang down about 30 to 40 cm., being sure that the tow is perfectly flat with no folds or twists on the apron surface. Next, the second tow **19** to be spliced is placed across the first tow with its loose end to the left. Again, its loose end should hang down about 30 to 40 cm., and the tow should be flat with no folds or twists. This second tow must be placed on top of the first tow with the edges corresponding to within about 30 mm. of each other. Next, the overlapping tows are grasped on each side of the apron and slid into slot **40** of the splicer. By looking down through window **23,** the edges of the tow can be observed. These should be adjusted so that they are just visible at the two ends of the window. Now, push-button switches **82, 83** are pushed simultaneously. This operates air cylinders **60, 60'**, and forces clamping bars **26** down onto the tow against anvils **31.** Since the tow samples are resting on the top surface of sub-assembly **30** at the time of clamping no sag is possible in the fibers between the clamps and none can be induced by the air-jets from the splicer head. The next step is to depress the foot valve **81** once and release it. Since **81** is a toggle valve, this action turns the air on to supply upper and lower splicer heads **70, 75** through pipes **13, 14** and hoses **80, 80'**. Next, the handle **76** is grasped underneath the splicer and moved in and out across the tow at least 6 times. Now valve **81** is depressed again which turns off the air to the splicer heads **70, 75.** Air switches **82, 84** are now pressed in order to unclamp the now-spliced tows.

In order to trim the loose ends of the splice uniformly close to the splice, the assembly is now moved to the left and the pneumatically spliced line is aligned to the left edge clamp and anvil **26, 31.** Switches **82, 83** are now again pushed so that the splice is clamped for accurate trimming of the surplus upper tow end as it is extending to the left of the apparatus. Next, the tow assembly is unclamped by pushing air switches **82, 84** and the splice assembly is now slid to the right side of the splicer and the splice line is aligned with the right hand clamp and anvil. The assembly of tows is again clamped and the top tow is folded back up over the top of the splicer leaving the free end of the bottom tow available for accurate trimming. Finally, the combined tows are unclamped as before and removed from the splicer apparatus.

A butt splice is made in somewhat similar manner except at first each tow is placed across apron **50** with loose ends hanging down 30 to 40 cm. both to the right hand side. Again both tows are aligned flat with no folds or twists in the section to be spliced. This assembly is then inserted and aligned as before in the slot **40** while viewing the assembly through window **23.** It is clamped, the air turned on to the splicer, splicer heads moved back and forth across the tows as previously described for at least about 6 full cycles. The spliced tow assembly is unclamped as before but now moved to the right with the splice line under the right hand clamp, clamped and both loose ends trimmed just beyond the splice. Protruding ends of the spliced fibers are now folded toward the inside of the spliced tow so that the splice may be transported smoothly through a cutter or other processing machinery.

A novel, improved splicing apparatus has been described wherein double clamping means are provided to enable two overlapping tow sections to be held without droop or slack. In addition, means are provided whereby pneumatic splicing jets may be traversed in a narrow controlled path across the full width of overlapping tows. Finally, the clamping arrangement enables the placement and accurate trimming of loose tow ends after the splice has been accomplished. Not only has a stronger, more compact, smoother running splice been made possible, but also the time required to complete the splicing procedure has been reduced from several minutes to as little as 1 to 2 minutes. This, of course, is particularly important in avoiding excessive stops during production.

What is claimed is:

1. In an apparatus for splicing overlapped fiber tows wherein said overlapped tows are passed between opposed jet streams issuing from spaced jets facing each other, the improvement comprising: a support; upper and lower sub-assemblies cantilevered from said support defining a uniform slot there between; means for slidably mounting said spaced jets in said upper and lower sub-assemblies on either side of said slot for movement in unison toward and away from said support; and means adjacent each edge of the slot for releasably clamping the overlapping tows after they are inserted into and extended beyond each edge of the slot.

2. The apparatus as defined in claim **1,** including an apron extending longitudinally from the lower sub-assembly beyond said upper assembly.

3. The apparatus as defined in claim **2,** said support being movable.

4. In an apparatus for splicing overlapped fiber tows wherein said overlapped tows are passed between opposed fluid jet streams issued from spaced jets facing each other, the improvement comprising: a support

having a front and rear surface; upper and lower spaced sub-assemblies cantilevered from the front surface of said support defining a uniform slot there between to accommodate said overlapped tows; a pair of rigid pipes attached to the spaced jets; a pair of bearings through said support located above and below said slot, each of said pipes being slidably supported by said pair of bearings; a clamp located beyond the rear surface of said support and connected between said pair of pipes to hold them in a fixed relationship to each other; means for slidably mounting said spaced jets in said upper and lower sub-assemblies on either side of said slot for movement in unison toward and away from said support a distance at least equal to the width of the tow; means connected to one of said spaced jets for imparting said movement; and means adjacent each edge of the slot for releasably clamping the overlapping tows after they are inserted into and extended beyond each edge of the slot.

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