Sept. 13, 1932. C. E. MAYNARD 1,876,716

APPARATUS FOR SPLICING TUBES

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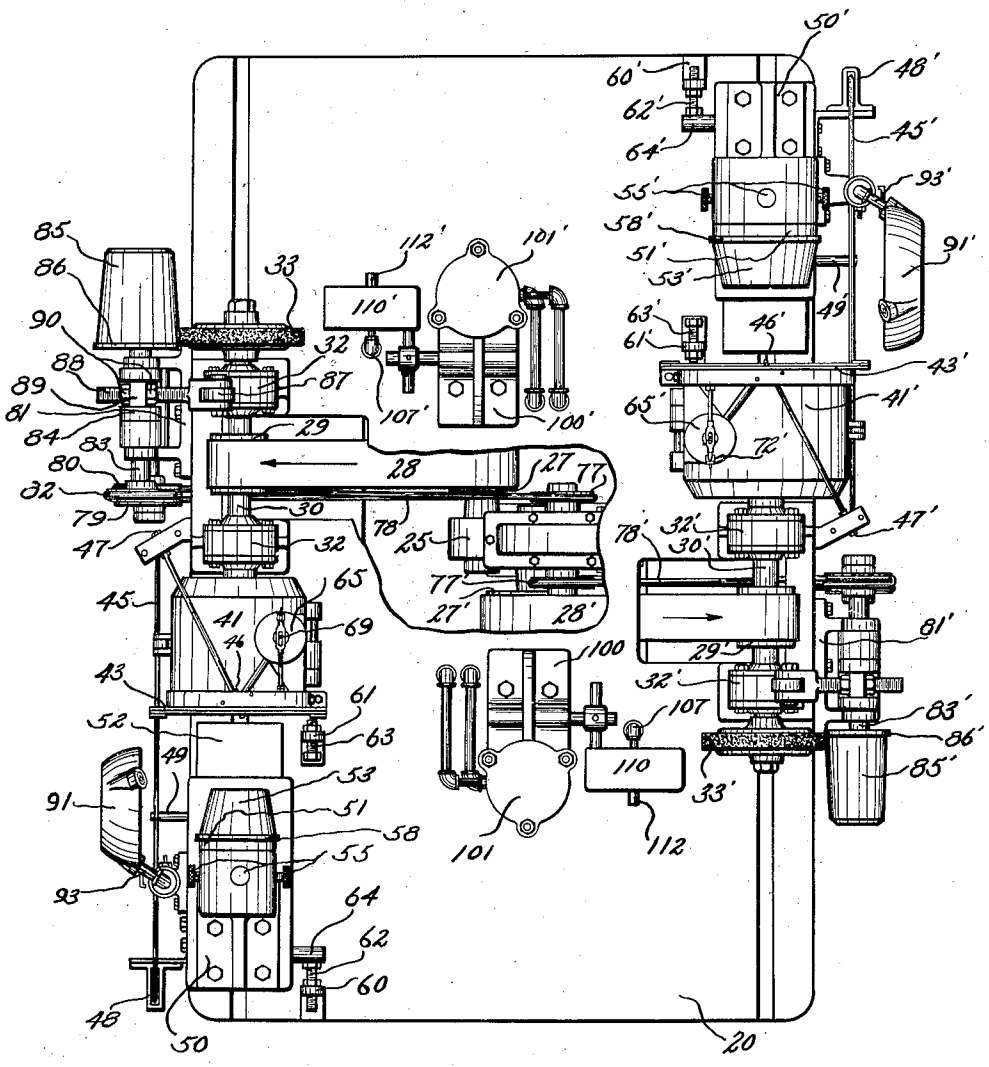


Fig. 1

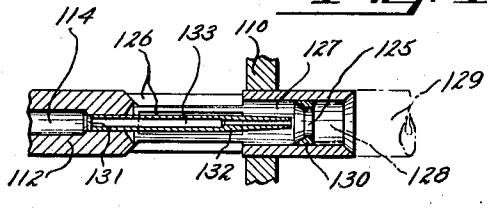


Fig. 4

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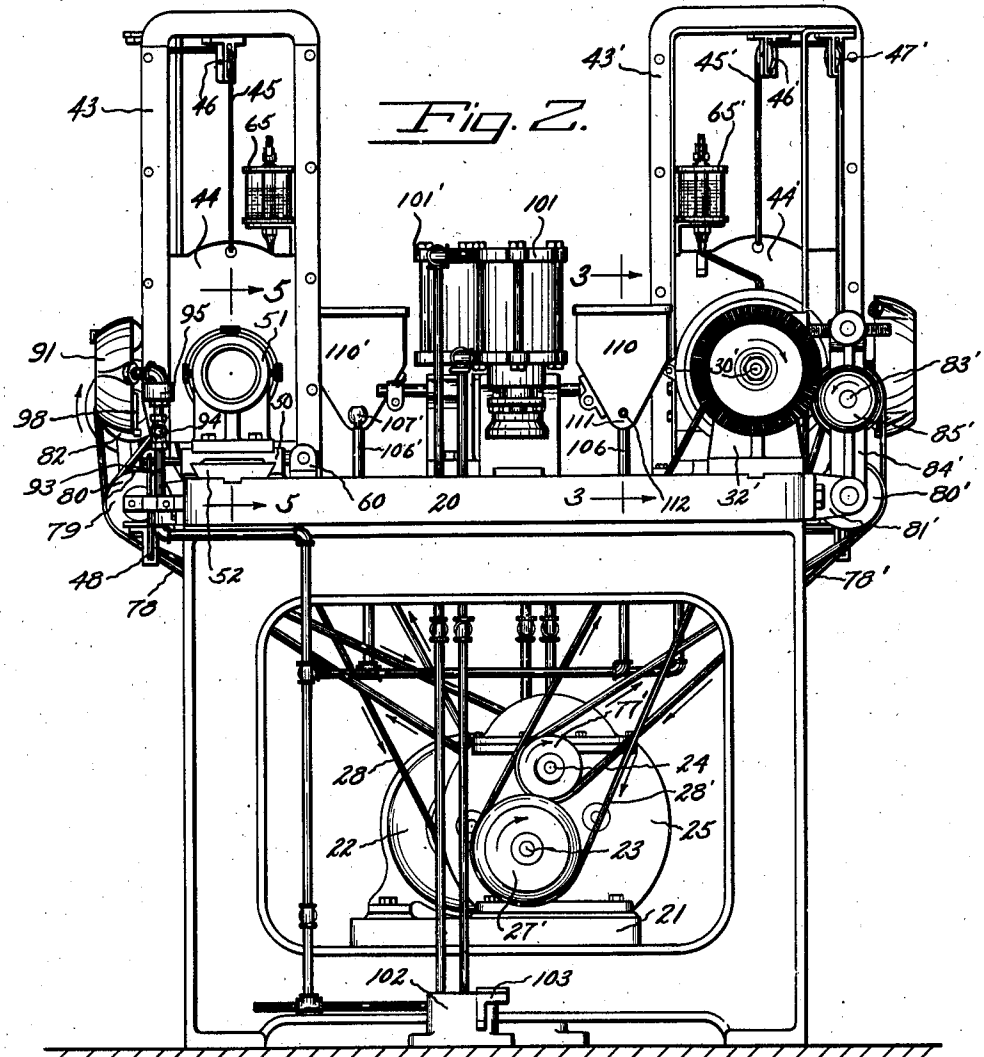
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Fig. 2.



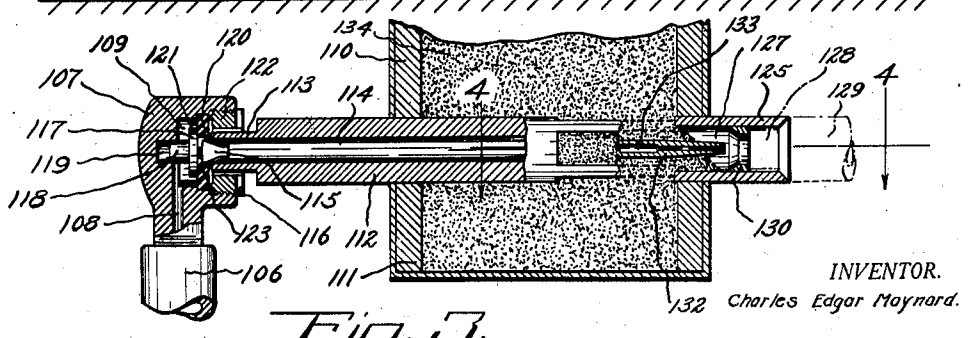


Fig. 3.

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APPARATUS FOR SPLICING TUBES

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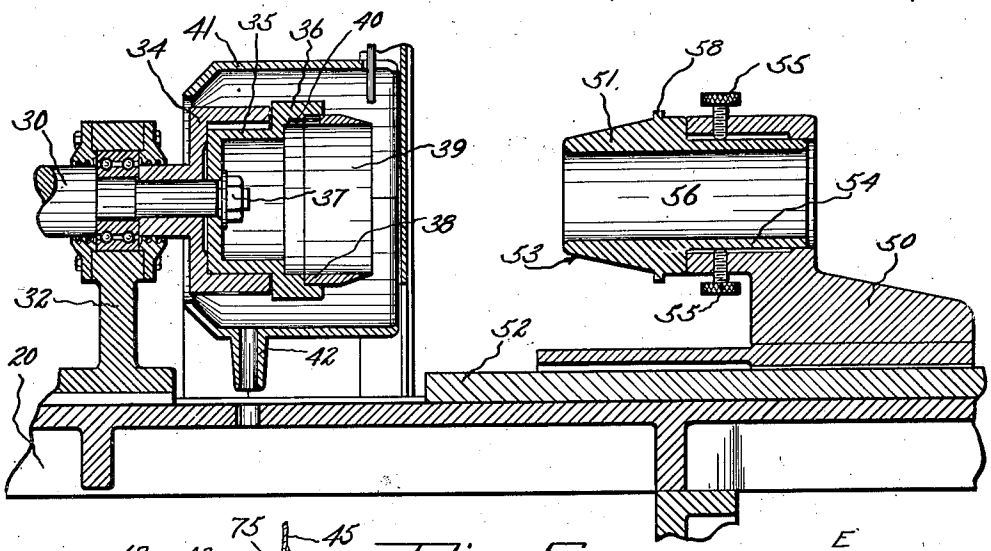
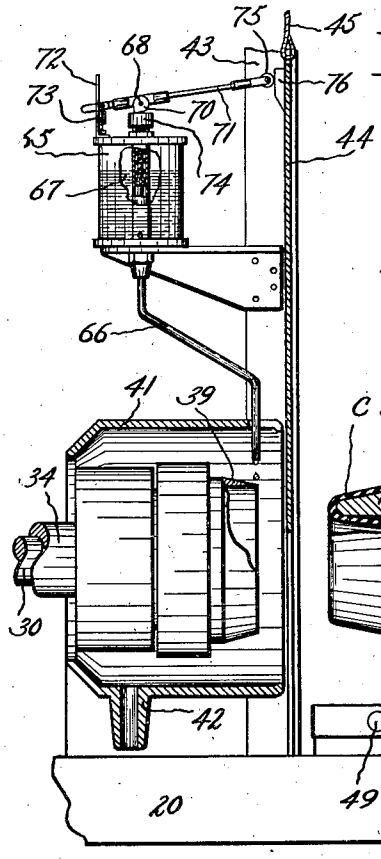


Fig. 5.



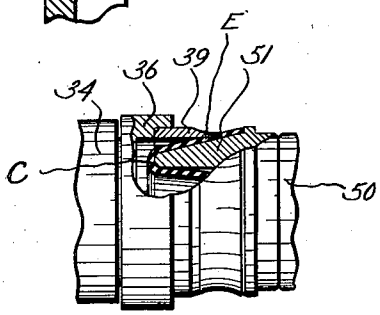


Fig. 7.

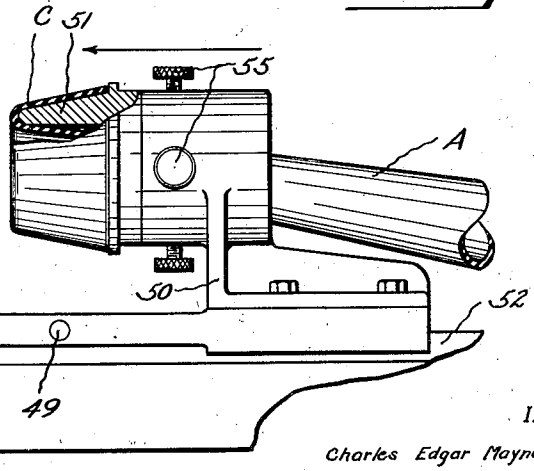


Fig. 6.

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APPARATUS FOR SPLICING TUBES

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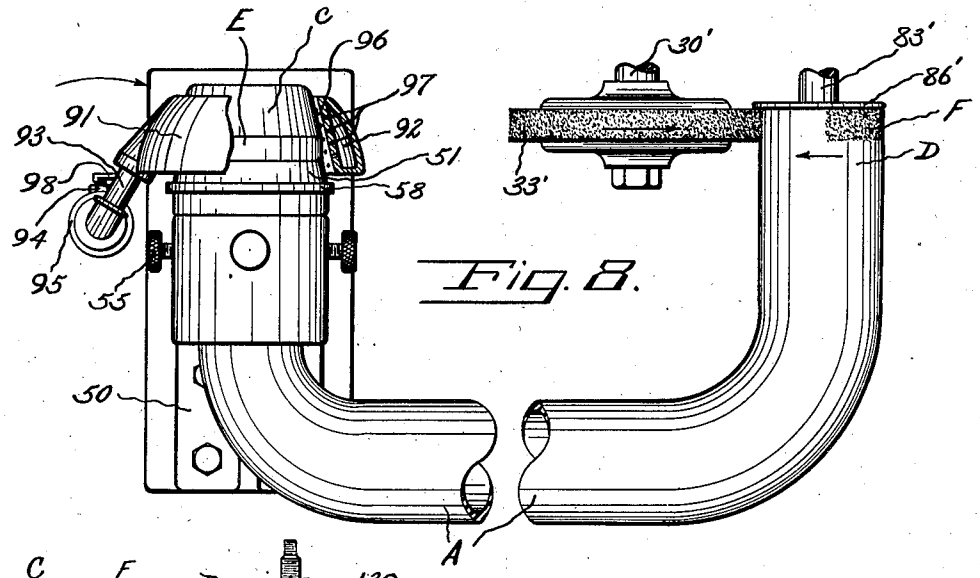


Fig. 8.

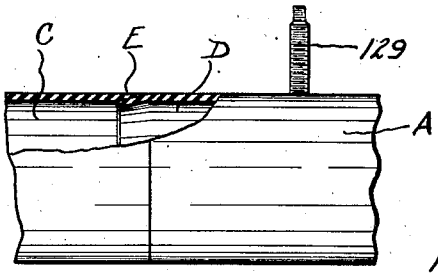


Fig. 10.

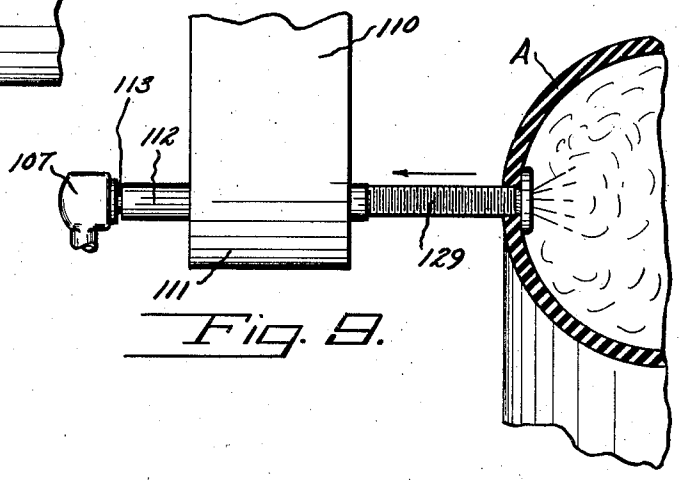


Fig. 9.

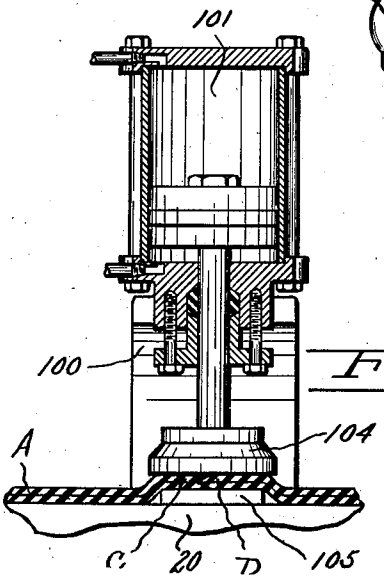


Fig. 11.

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Patented Sept. 13, 1932 1,876,716

UNITED STATES PATENT OFFICE

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APPARATUS FOR SPLICING TUBES

Application filed February 17, 1930. Serial No. 428,955.

My invention relates to apparatus for use in splicing sections of rubber tubing to form annular tubes, such as the inner tubes used in pneumatic tire casings.

It has for its object an improvement in the uniformity and quality of the splice together with an improvement in the efficiency with which the operation may be performed. Other and further objects will be apparent from the following specification and claims:

In the accompanying drawings which illustrate one embodiment of my invention,

Fig. 1 is a plan view of the machine illustrating my invention;

Fig. 2 is a front elevation of the machine shown in Fig. 1;

Fig. 3 is an enlarged view shown partly in section and taken on line 3—3 of Fig. 2;

Fig. 4 is a sectional view taken on line 4—4 of Fig. 3;

Fig. 5 is an enlarged view shown partly in section and taken on line 5—5 of Fig. 2;

Fig. 6 is an enlarged view, partly in section, illustrating the cutter lubricating operation;

Fig. 7 is an enlarged fragmentary side elevation illustrating the skiving operation;

Fig. 8 is a fragmentary plan view illustrating the buffing and drying operations;

Fig. 9 is a view, partly in section, illustrating the operation of forcing a powdered lubricant into the tube;

Fig. 10 is a fragmentary view of an inner tube, partly in section, showing the ends of the inner tube inserted, one within the other, preparatory to the pressing of splice; and

Fig. 11 is a sectional view of the splicing press illustrating the splicing of the tube.

Referring to the drawings, a table 20 supports a pair of spaced parallel shafts 30 and 30′ journaled respectively in roller bearings carried in supporting brackets 32 and 32′ attached to the top of the table, skiving cutters 39 and 39′, operating respectively in guards 41 and 41′, and buffing wheels 33 and 33′ (both hereafter more specifically described) being respectively secured to diagonally opposite ends of the shafts 30 and 30′. The shafts 30 and 30′ are continuously rotated from a motor 22 which is mounted on a shelf 21 below the top of the table 20. As shown in Fig. 1 the shaft 30 is driven by a belt 28 passing around a pulley 27 mounted directly on the motor shaft, while the shaft 30′ is driven by a belt 28′ from a pulley 27′ secured to a shaft 23 driven by suitable gearing from the motor 22, the gear ratio and the respective diameters of pulleys 27 and 27′ being such that shafts 30 and 30′ are driven at the same speed. The diagonal arrangement of the skiving cutters and buffing wheels and the fact that the shafts 30 and 30′ are continuously driven at the same speed, together with the arrangement of tube supporting means later described, makes possible a double unit in which both sets of operating mechanisms are "right-handed." Duplicate parts are shown by primed character numbers and where the parts are duplicated a description of one will serve equally for the other. The skiving cutters comprise a holder support 34 (see Fig. 5) pressed onto the end of shaft 30 to which support is keyed a cylindrical hub 35 containing cutter holder 36, a flanged nut 37 preventing lateral movement of the support 34 and hub 35 on the shaft 30. The rear portion 38 of skiving cutter 39 is pressed into a stepped-off bore in the holder 36 and is held against rotative movement with relation to the holder by a dowel pin 40.

Mounted on the table 20 and surrounding and enclosing the skiving cutter 39 is a hinged guard 41 shaped to act as a catch basin for any excess liquid or lubricant that may be thrown off the cutter during the skiving operation. At the bottom of the guard 41 is an apertured boss 42 through which the excess liquid or lubricant can flow into any suitable receptacle.

Mounted in vertical guides 43 secured to the table top is a sliding cutter shield 44 that is actuated by a cable 45 passing over pulleys 46, 47 and 48 to a pin 49 fixed in a bracket member 50, which carries nozzle member or skiving bob 51 and is slidably supported on guideway 52 secured to the table top. The nozzle member 51 includes a frustoconical nose portion 53 with a cylindrical shank 54, the latter being secured in the bracket 50 by set screws 55 and provided

with an axial opening 56 for the reception of the tube A to be skived. A shoulder 58 rises abruptly from the nose portion of the bob. The shoulder 58 serves for positioning the tube end C as hereafter described. Attached to the table beside the slidable bracket 50 are stop brackets 60 and 61 carrying adjustable stop screws 62 and 63 which limit the movement of the bracket 50 toward and from the cutter 39 by means of stop pin 64 fixed in the bracket.

Mounted on one of the vertical guides 43 (see Fig. 6) is a standard type of spring valve oil cup 65 provided with a tube 66 positioned to direct the intermittent flow of lubricant 67 onto the leading edge of the skiving cutter 39. Pivoted on pin 68 of the spring pressed valve stem 69 is a lever 71 having a heart-shaped cam 70 adapted, when lever 71 is raised, to engage cap 74 and thereby raise stem 69 to open the valve. One end of the lever 71 rides in a guide 72 and a spring 73 holds the rotatable roll 75, located in the opposite end of the lever, in the path of cam block 76 secured to the cutter shield 44.

Mounted on the side of the table 20 is a tube drying device comprising an annular member 91 provided with a chamber 92 connected to an air pipe 93 having a whistle valve 94, and is swingingly mounted on the pipe 93 at 95. The inner face 96 of the member 91, provided with a series of openings 97, is substantially parallel to the tapered surface of the bob 51 when positioned as shown in Fig. 8. Secured to the swinging member 91 is a plate 98 for operating the whistle valve as later described.

Journaled in the gear box 25 is the drive shaft 24 having pulleys 77 and 77′ rigidly attached thereto. Each pulley is respectively adapted to drive through endless belts 78 and 78′, continuously rotatable tube supporting cones 85 and 85′ adjustably positioned in operative relation with their respective buffing wheels 33 and 33′. These parts being duplicates of each other, but one need be described. The belt 78 passes upwardly over idler pulleys 79 and 80, mounted in bracket 81 on the side of the table, and around pulley 82 which is secured to and drives a transversely extending shaft 83 journaled in support 84 pivotally secured to the bracket 81 on the table 20. Rigidly attached to shaft 83 is the truncated cone 85 provided with a shoulder 86 which serves for positioning the tube end D as will hereafter be described. Pivotally mounted on the boss 87 on one of the supports 32 is an adjusting screw 88 extending through an aperture in the pivotally mounted block 89 secured in the cone supporting bracket 84. On the adjusting screw are lock nuts 90 which lock the screw 88 and block 89 in their proper positions.

Brackets 100 and 100′ secured to the top of the table support splice presses, each of which comprises a double acting air cylinder 101 connected by pipes to a suitable valve 102 provided with a foot operating lever 103. Secured to the piston of the air cylinder is a platen 104 while directly beneath the cylinder platen mounted on the table is a second platen 105.

Extending through an opening in the table 20 near each cylinder bracket 100 is a vertical air pipe 106 connected to a valve housing 107 provided with an air passage 108 connecting the pipe 106 and the valve chamber 109. In front of the valve housing 107 fixed on an extension of the cylinder bracket 100 is a powdered soapstone container 110 provided with a V-shape hopper portion 111. Near the bottom of the portion 111 in the soapstone 134 and positioned directly in front of the valve housing is a slidable sleeve 112 extending through both walls of the container. One end of the sleeve has a cylindrical shank 113 provided with an axial bore 114 adapted to engage an enlarged pear-shaped portion 115 on the stem 116 of an air valve 117 which has a cylindrical hub 118 slidably held in the bore 119 of the valve housing 107 by a flexible packing 120 and a cap bushing 122. One side of the packing 120 acts as a valve seat 121. The pear-shaped portion 115 of the air valve 117 projects through the opening 123 in the valve seat to engage the end of the shank 113 of slidable sleeve 112 which extends inside the cap bushing 122. The ejecting end 125 of the sleeve 112 is provided with a series of radial soapstone feed slots 126, located inside the wall of the container, and terminates in a transverse combining chamber 127 of sufficient size to permit the entrance of the inflating end 128 of an ordinary inner tube valve stem 129. Secured in the chamber 127 is a valve stem stop collar 130. Pressed into a bore 131 of the sleeve 112 is an air nozzle 132 having a transverse air passage 133 connecting the bore 114 and the combining chamber 127.

The operation of the above described apparatus is briefly as follows. With the frusto-conical skiving bob 51 in the outer retracted position shown in Figs. 1 and 5, one end of a rubber tube A is inserted through the opening 56 and folded back, as at C, over the outer wall of the bob with the margin of the tube end abutting the shoulder 58. The folded back portion of the tube is washed to remove any lubricating powder which may have been used in preparing the open ended tube. The bob 51 is then pushed forward into operative position with respect to the rotating knife 39. Upon the first advancing movements of the bob 51 the cable 45 attached to pin 49 fixed in the slidable support 50 is operated to raise the slidable guard 44, thereby causing the cam block 76 to contact with and swing the cam roll 75 and lever 71 upward to open or life the spring pressed valve of the glass body

oil cup 65 by means of the rotating movement given the heart-shaped cam 70 (see Fig. 6). As soon as the cam roll 75 of the lever has passed over the block 76 the valve closes, thereby stopping further flow of the lubricant during the actual skiving operation and thus permitting only sufficient lubricant for one complete cutting operation to flow through the pipe 66 onto the rotating skiving cutter 39.

As the plate 44 and the cam block 76 are returned to the position shown in Fig. 2 the cam roll 75 and lever 71 are carried down by the cam block 76 until the roll 75 rides over the cam block back to its normal position. The heart-shaped cam 70 is so positioned and shaped that it will not open the valve of the lubricating device during the downward movement of the cam block 76. When the tube is completely skived (see Fig. 7) the skiving bob 51 is withdrawn to its outer retracted position and the annular member 91 is swung into operative position with respect to the skived end C. As the member 91 is swung into operating position the chamber 92 is automatically connected to the air line through the whistle valve 94, being opened to the air line by means of the valve operating plate 98. The wet portion of the tube end C is then subjected to the drying action of compressed air which is directed onto the tube through the openings 97 in the chamber 91.

While the end C of the tube is being skived and dried the other end D is positioned on the pivotally mounted truncated cone 85 which has been properly set with relation to the buffing wheel 33 and locked in place by means of the lock nuts 90. Rotative movement of the tube is retarded until the margin of the tube end D abuts the shoulder 86 of the tube supporting cone 85. The tube end is allowed to rotate with the cone 85 until it has been completely buffed and has a buffed surface width at least equal to the length of the skived portion E on the opposite end of the tube. The buffing wheel 33 rotates at a different speed, preferably higher, than that of the rotating cone, resulting in a uniform buffing action and giving a control of the buffing time. When the tube end D has been completely buffed it is removed from the cone 85, and the buffed surface wiped with a rubber softening agent. A valve stem 129 is secured in the tube adjacent one end either before or after the buffing operation. The air drying chamber 91 is then returned to its inoperative position (see Fig. 2), thus closing the air line as soon as the plate 98 swings away from the spring pressed whistle valve plunger. The skived portion E of the tube is immediately wiped with the rubber softening agent before being removed from the skiving bob. The skived end of the tube is then immediately positioned in overlapped contact with the buffed portion F of the other tube end. The inflating end of the valve is now inserted into the combining chamber 127 of the slidable sleeve 112 until it contacts with the stop collar 130. Continued pressure of the valve stem against the collar 130 moves the sleeve 112 sufficiently to cause its shank 113 to act on the pear-shaped head of the valve 117 causing the valve to be disengaged from its valve seat 121, thus permitting the passage of compressed air from the pipe 106 into the bore 114 of the sleeve, and by further movement of the sleeve 112 the shank 113 presses against the flexible packing where it is held during the soapstoning operation. As the air passes from the nozzle 133, which is constantly surrounded by powdered soapstone 134, the soapstone is drawn forward and mixed with the air in the combining chamber and is impelled by the pressure of air through the inner tube valve stem 129 into the tube A. Sufficient soapstone is admitted to the tube to thoroughly coat the inside of the tube at the splice. The amount of soapstone in the combining chamber 127 remains about the same at all times for as fast as it is used the soapstone in the container moves in through the slots 126 of the sleeve 112, thus keeping the nozzle 132 surrounded substantially as shown in Fig. 3 and assuring a uniform coating of the tube walls. When sufficient soapstone is forced into the inner tube the valve stem 129 is withdrawn from the combining chamber 127. As soon as the pressure of the inner tube valve stem is removed the valve 117 and flexible valve packing 120 return to their normally closed positions shown in Fig. 3, thus stopping the flow of compressed air and at the same time moving the sleeve 112 forward into its inoperative position.

After the ends of the tube have been placed in overlapped contact with one another and the inside of the tube at the splice thoroughly soapstoned to prevent adhesion of the rubber, the splice is then immediately introduced between the two platens of the press and the platens are brought together through the admission of air to the cylinder 101 which forces the top platen downwardly against the bottom platen, the operation being controlled by valve 102 operated from the foot lever 103. After a short pressing period the platen is raised and the tube is removed from between the platens and the flattened splice rotated 90° about the longitudinal axis of the tube and the pressing operation is repeated. The portion of the splice at the edges during the first pressure may have been slightly creased although not to any permanent degree if the platen 104 is wider than the flattened splice. The second pressing operation will remove the crease and unite the portion of the tube which was not united during

the first operation. The tube is now ready to be placed in a mold, inflated and cured to the shape desired.

The speed of rotation of the skiving cutter with respect to the speed of rotation of the cone 85 is such that the preparation of the tube ends are so synchronized that actual splicing operation may follow immediately upon completion of both the skiving-drying operation and the buffing operation, assuring a uniform condition of the surfaces to be joined which minimizes the tendency of the splice to vulcanize unevenly.

The fact that I in effect control the time of buffing by the speed of the cone 85 permits the speed of the buffing wheel to conform to that of the cutter making possible the mounting of a cutter and buffing wheel on the same shaft and the duplicate arrangment of parts to form a compact double unit machine in which both units are "right handed" and in the operation of which, although the parts are continuously operated without clutch control, the two operators need not necessarily keep pace with each other.

Having thus described my invention, I claim:

1. A tube splicing device comprising a pair of spaced parallel shafts, means for continuously rotating said shaft, a skiving cutter mounted on a diagonally opposite end of each shaft, a buffing wheel mounted on the other diagonally opposite end of each shaft, a support associated with each cutter adapted to receive one end of a tube to be spliced and independently movable to and from operative relation with its associated cutter, drying mechanisms positioned in the path of movement of said supports, and a continuously rotating cone associated with each buffing wheel adapted to receive the other end of the tube being operated on by the adjacent cutter and independently adjustable with respect to its associated buffing wheel, the speed of rotation of the cones being such as to synchronize the time of the buffing operation with the combined time of the cutting and drying operations so that the preparation of the opposite ends of a tube will be completed substantially at the same time.

2. A tube splicing device comprising a pair of spaced parallel shafts, a skiving cutter mounted on a diagonally opposite end of each shaft, a buffing wheel mounted on the other diagonally opposite end of each shaft, means to continuously rotate said shafts and means to support the ends of tubes to be spliced in operative relation with the cutters and buffers.

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