Nov. 17, 1942. R. H. REECE ET AL 2,302,379

BELT END SWAGING MACHINE

Filed Nov. 15, 1940 3 Sheets-Sheet 1

Fig. 1

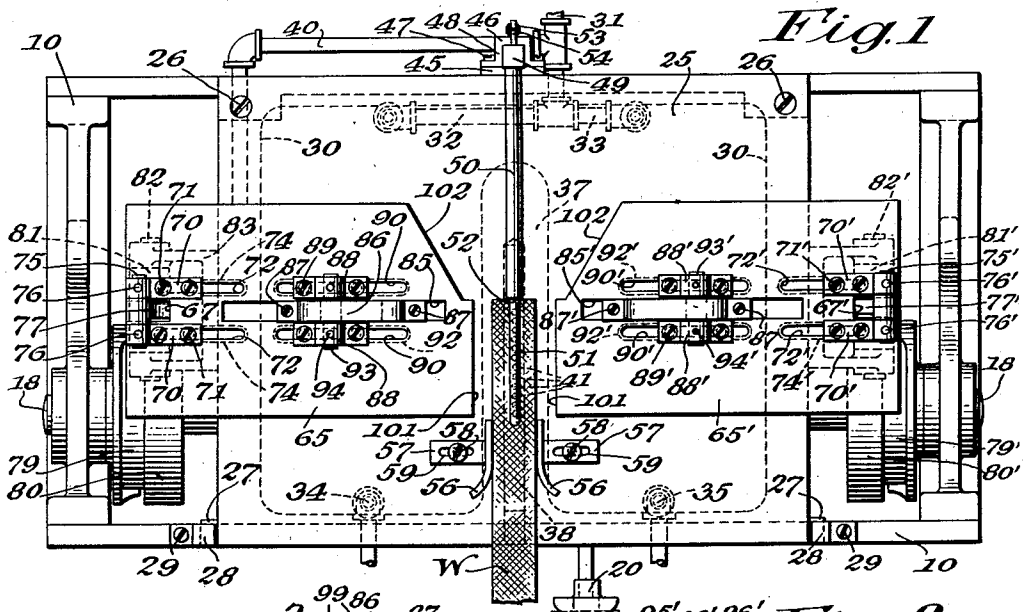


Fig. 2

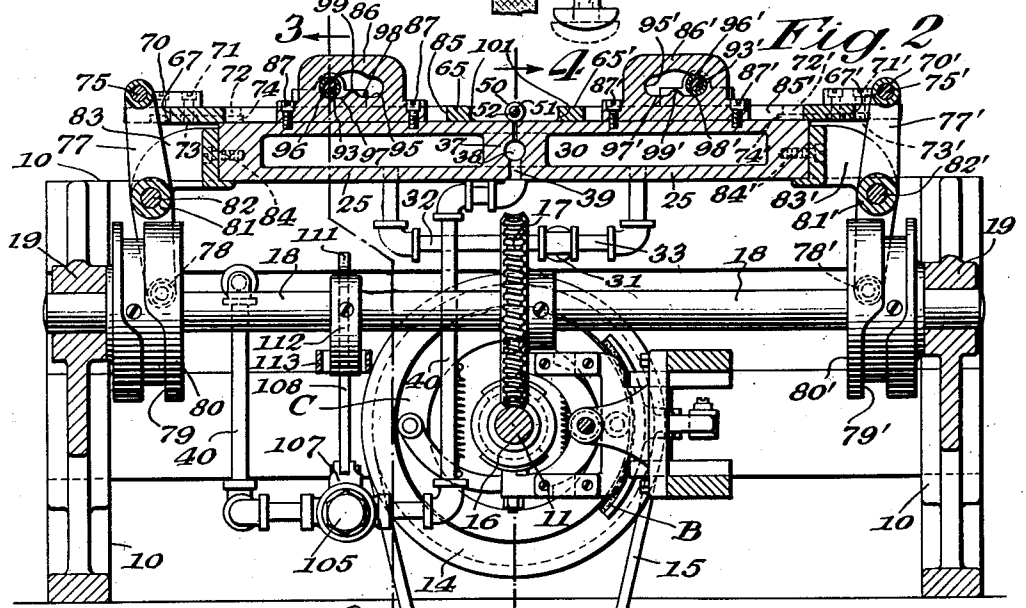
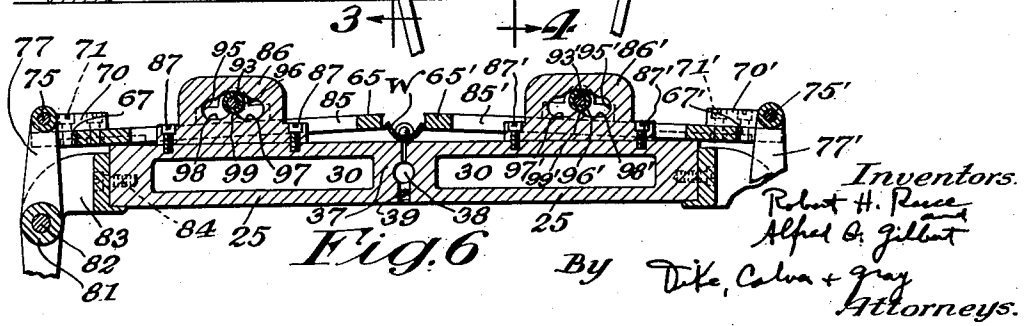


Fig. 6



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BELT END SWAGING MACHINE

Filed Nov. 15, 1940 3 Sheets-Sheet 2

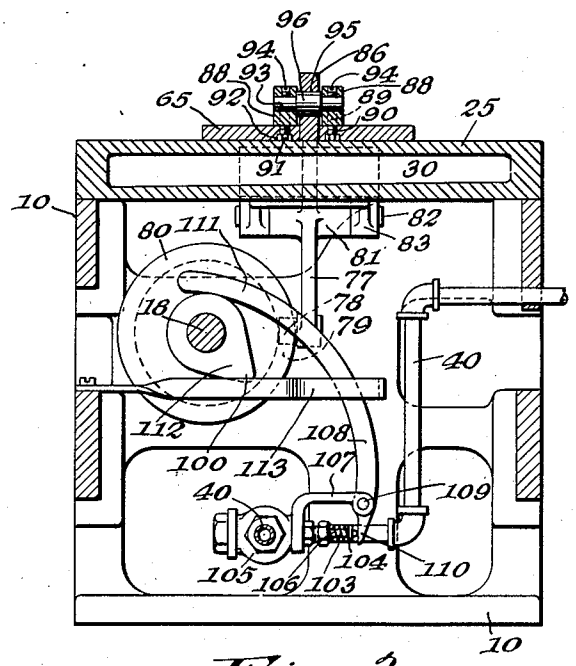


Fig. 3

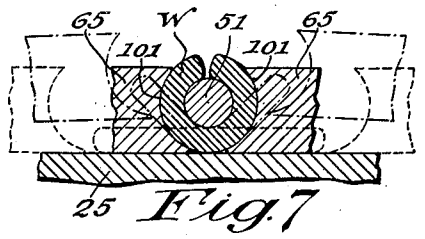


Fig. 7

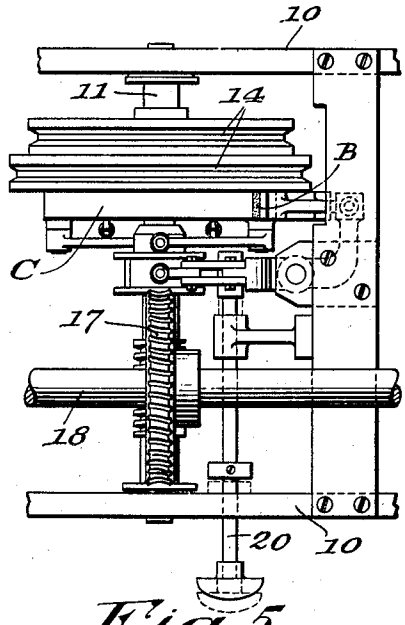


Fig. 5

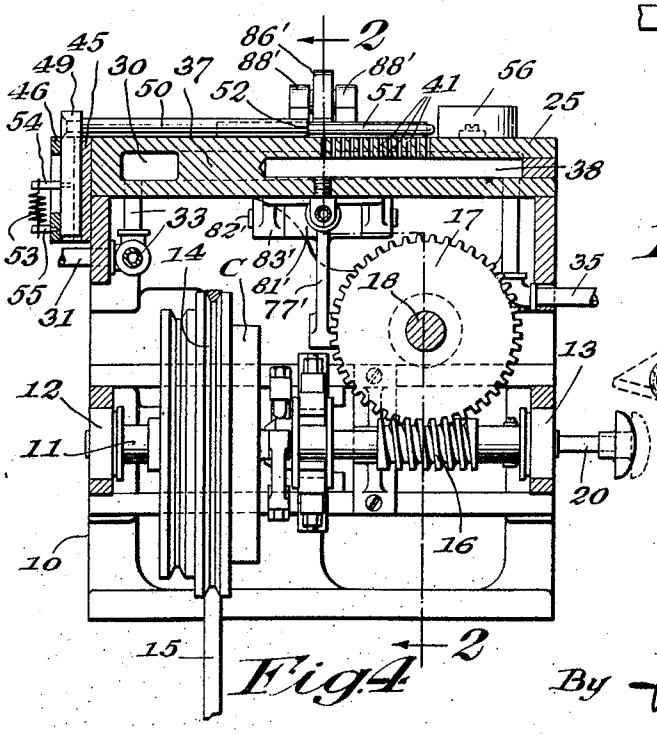


Fig. 4

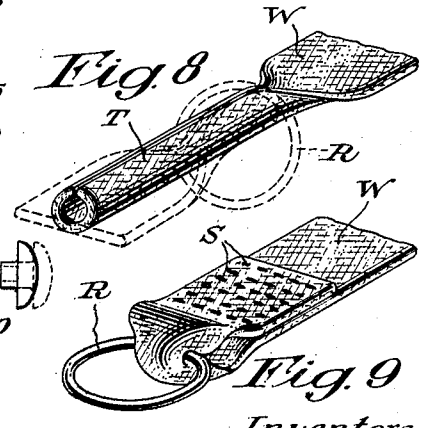


Fig. 8

Fig. 9

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BELT END SWAGING MACHINE

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Fig. 10

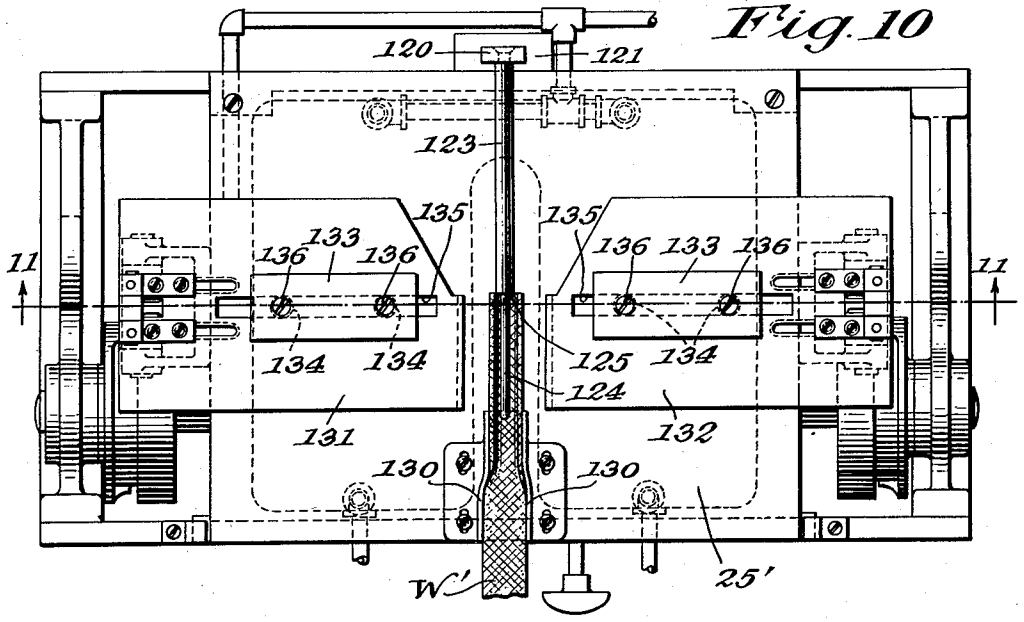
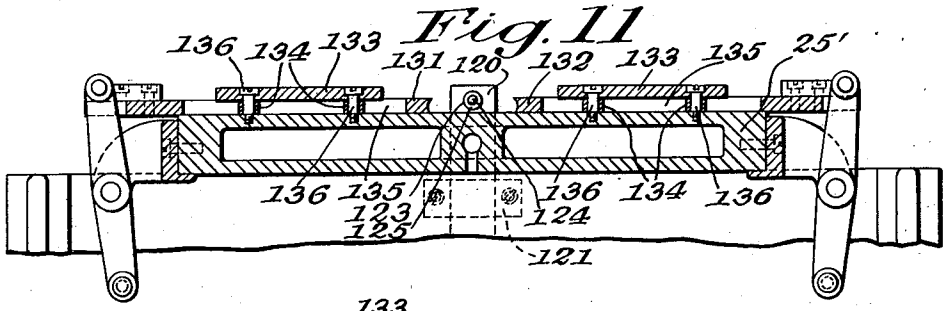


Fig. 11



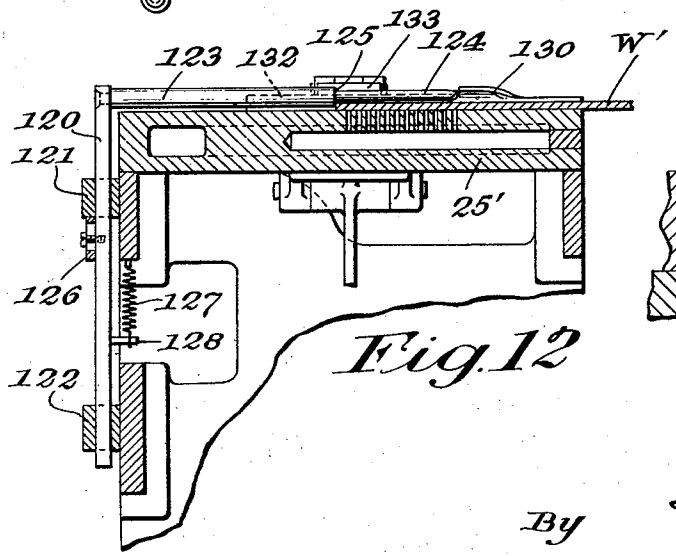


Fig. 12

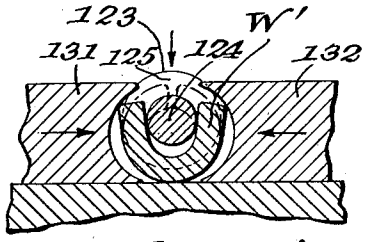


Fig. 13

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UNITED STATES PATENT OFFICE

2,302,379

BELT END SWAGING MACHINE

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Application November 15, 1940, Serial No. 365,782

6 Claims. (Cl. 18—1)

This invention relates to the preparation of belts or straps of heavy canvas, leather or the like, especially of the military type, for receiving and securing thereto a ring or buckle or the like.

The invention contemplates the provision of a machine for shaping the end of a strap or belt of heavy canvas or the like to substantially tubular form and to prepare it for the subsequent operation of attaching a ring or buckle so as to provide a good bearing therebetween. In this subsequent operation, the tubular portion of the strap is inserted in the ring and the end portion of the tube is flattened and folded upon the main body of the strap and secured thereto as by stitching. Thus, a tubular portion of the strap engages the ring and provides a good bearing for the latter having great strength and good appearance.

The ring or buckle usually has an inner diameter less than the width of the strap. But even if the width of the strap is less, a good bearing is not provided and any load placed upon the strap is transmitted between the strap and ring principally through the edge portions of the strap. It has been attempted to overcome this difficulty by forming the strap with a tapered end portion, but this only partly overcomes the difficulty and the connection between the strap and ring is relatively weak. Furthermore, the cost of production of straps or belts formed with a tapered end portion is considerably greater than those of substantially uniform width. The machine of the invention performs the shaping operation at such a rapid rate that the cost is very low and the end of the strap retains its tubular shape permanently unless intentionally disturbed.

The invention will be more clearly understood from the following description in conjunction with the accompanying drawings, in which:

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

Fig. 2 is a front sectional elevational view taken substantially upon the line 2—2 of Fig. 4;

Figs. 3 and 4 are side sectional elevational views taken upon the lines 3—3 and 4—4 of Fig. 2;

Fig. 5 is a detail plan view of a portion of the machine;

Figs. 6 and 7 are fragmentary sectional front elevational views similar to Fig. 2 showing the parts in different positions;

Fig. 8 is a perspective view showing the end of a strip of sheet material, such as heavy canvas, folded by the machine in the invention;

Fig. 9 is a perspective view showing the end of the strip looped with a ring inserted in the loop;

Fig. 10 is a plan view of a machine of modified construction;

Fig. 11 is a fragmentary sectional elevational view taken substantially along the line 11—11 of Fig. 10;

Fig. 12 is a fragmentary side sectional elevational view of the modified machine; and

Fig. 13 is an enlarged fragmentary front sectional elevational view of the modified machine.

Before explaining in detail the present invention, it is to be understood that the invention is not limited in its application to the details of construction and arrangement of parts illustrated in the accompanying drawings, since the invention is capable of other embodiments and of being practiced or carried out in various ways. Also it is to be understood that the phraseology or terminology employed herein is for the purpose of description and not of limitation, and it is not intended to limit the invention claimed herein beyond the requirements of the prior art.

The machine illustrated in the accompanying drawings comprises a main frame 10 having a main drive shaft 11 (Figs. 2 and 4) mounted for rotation in bearings 12 and 13 provided in the rear and front portions of the frame. A set of integral pulleys 14 are rotatably mounted upon the shaft 11 and are rotated continuously from any suitable source of power as by a belt 15. A worm 16 is formed on the shaft 11 and engages a worm wheel 17 fixed upon a shaft 18 (Figs. 2, 3 and 4) which is mounted for rotation in bearings 19 at opposite sides of the frame 10. A clutch C (Fig. 5) of any conventional type is provided for connecting the set of pulleys 14 in driving relation with the shaft 11. The clutch C is actuated to move it between its engaged and disengaged positions by a rod 20 slidably mounted in suitable bearings formed in the frame 10. If desired, a brake B may be provided and arranged to stop rotation of the shaft 11 when the clutch is moved to its disengaged position.

A plate 25, serving as a work support, rests upon the top of the frame 10 and is secured near its rear edges to the frame by screws 26 (Fig. 1). A flange 27 is formed upon each of the side edges of the plate 25 near its front edge and each is adapted to be engaged by a clip 28 secured to the frame 10 by screws 29. The plate 25 is provided with a chamber 30 to which steam is supplied from a main supply pipe 31 through branch pipes 32 and 33 entering the bottom of the chamber near the rear thereof. Exhaust pipes 34 and 35 are connected to the chamber 30 near the front of the plate 25 for the exhaust of steam. The plate 25 is provided with a web 37 projecting into the chamber 30 from the front of the plate to near the rear thereof. The web 37 is provided with a longitudinally extending pas-

sage 38 which is connected by a passage 39 to one end of a pipe 40, the other end of which is connected to the steam supply pipe 31. A plurality of small holes 41 extend from the top of the plate 25 to the passage 38 and provide steam spray nozzles.

A plate 45 (Figs. 1 and 4) and a housing 46 are secured to the rear edge of the plate 25 by screws 47 and provide a vertical guideway 48 for a slide 49. One end of a rod 50 is secured to the slide 49 near its upper end. The other end of the rod 50 is provided with a portion of reduced cross section forming a mandrel 51 positioned directly above the holes 41. The shoulder 52 on the rod 50 at the rear end of the mandrel 51 serves as a stop for the work piece when positioned in the mechine as hereinafter described. The rod 50 normally is held in engagement with the top surface of the plate 25 by a spring 53 connecting a pin 54 fixed to the slide 49 and a pin 55 fixed to the housing 46. The mandrel 51 normally is spaced from the top surface of the plate 25 a distance corresponding to the minimum thickness of the work piece to be shaped. The yieldable mounting of the mandrel permits thicker work pieces to be inserted. A pair of spaced guides 56 (Fig. 1) are positioned upon the top surface of the plate 25 adjacent the forward end of the mandrel 51. The guides 56 are each carried by a plate 57 which is secured to the plate 25 by a screw 58 passing through a slot 59 in the plate 57 and engaging the plate 25.

A pair of plates 65 and 65' (Figs. 1, 2 and 3), which serve as pressure members, normally rest upon the top surface of the plate 25 so as to extend laterally beyond the side edges thereof. These plates are movable toward and away from the mandrel 51 by mechanism described hereinafter. The inner edges of the plates 65 and 65' are each provided with a substantially cylindrical concave surface 101. The remaining portions of the adjacent edges of the plates 65 and 65' are flared away as indicated at 102 so as to provide ample clearance with the rod 50. The outer edges of the plates 65 and 65' are formed with slots 67 and 67', respectively. Spaced bearings 70 are secured to the plate 65 adjacent opposite edgs of the slot 67 by screws 71 passing through a slot 72 and engaging a nut 73 positioned in a groove 74 in the bottom surface of the plate 65. A stud shaft 75 extends between the bearings 70 and is fixed thereto by pins 76. A lever 77 is pivotally connected at one end to the shaft 75 and carries at its other end a roll or cam follower 78 adapted to engage the peripheral groove 79 in a cam 80 fixed upon the shaft 18. The lever 77 is provided with a hub 81 intermediate its ends which rotatably engages a shaft 82 carried by a U-shaped bracket 83 secured to the edge of the plate 25 by screws 84.

The plate 65 also is provided with a slot 85. A block 86 is secured by screws 87 to the top surface of the plate 25 and projects upwardly through the slot 85. Spaced bearings 88 are secured to the plate 65 adjacent opposite edges of the slot 85 by screws 89 passing through a slot 90 and engaging a nut 91 positioned in a groove 92 in the bottom surface of the plate 65. A stud shaft 93 extends between the spaced bearings 88 and is secured to each by a pin 94. The stud shaft 93 passes through an elongated slot 95 formed in the block 86 and carries a roll 96 adapted to engage the cam surface formed upon the lower edge of the slot 95 and comprising spaced cam surfaces 97 and 98 separated by a small sharply raised cam surface 99.

Spaced bearings 70' are secured to the plate 65' adjacent opposite edges of the slot 67' by screws 71' passing through a slot 72' and engaging a nut 73' positioned in a groove 74' in the bottom surface of the plate 65'. A stud shaft 75' extends between the bearings 70' and is fixed thereto by pins 76'. A lever 77' is pivotally connected at one end to the shaft 75' and carries at its other end a roll or cam follower 78' adapted to engage the peripheral groove 79' in a cam 80' fixed upon the shaft 18. The lever 77' is provided with a hub 81' intermediate its ends which rotatably engages a shaft 82' carried by a U-shaped bracket 83' secured to the edge of the plate 25 by screws 84'.

The plate 65' also is provided with a slot 85'. A block 86' is secured by screws 87' to the top surface of the plate 25 and projects upwardly through the slot 85'. Spaced bearings 88' are secured to the plate 65' adjacent opposite edges of the slot 85' by screws 89' passing through a slot 90' and engaging a nut 91' positioned in a groove 92' in the bottom surface of the plate 65'. A stud shaft 93' extends between the spaced bearings 88' and is secured to each by a pin 94'. The stud shaft 93' passes through an elongated slot 95' formed in the block 86' and carries a roll 96' adapted to engage the cam surface formed upon the lower edge of the slot 95' and comprising spaced cam surfaces 97' and 98' separated by a small sharply raised cam surface 99'.

A valve 105 (Figs. 2 and 3) is interposed in the pipe 40 and is normally closed by a valve member having a valve stem 106 projecting outside of the valve casing. A coil spring 103 surrounding the valve stem 106 and interposed between the valve casing and a collar 104 on the valve stem normally maintains the valve closed. A cam 112 having a high portion 100 is fixed upon the shaft 18. A bracket 107 is secured to the casing of the valve 105. A lever 108 is pivotally connected intermediate its ends in a bearing 109 at the free end of the bracket 107 so that one arm 110 of the lever engages the end of the valve stem 106 and the other arm 111 of the lever engages the cam 112. A U-shaped bracket 113, which is secured to the frame 10, embraces the arm 111 and serves as a guide preventing lateral displacement of the arm 111 from the cam 112.

To start the machine, the rod 20 is pushed from the dotted line position shown in Figs. 4 and 5 to the full line position to engage the clutch C. This causes rotation of the shaft 18 carrying the grooved cams 80 and 80'. Steam is supplied from the main supply pipe 31 through the pipes 32 and 33 to the chamber 30 and discharges through the pipes 34 and 35. Thus, the plate 25 is maintained hot and radiates heat to the presser members or plates 65 and 65' to maintain the latter hot. A work piece W, which may be in the form of a strip of heavy canvas, such as is used in making heavy canvas belts, is inserted endwise between the guides 56 and between the mandrel 51 and the top surface of the plate 25 until the work piece abuts the shoulder 52.

As the shaft 18 rotates, the high portion 100 of the cam 112 swings the arm 111 of the lever 108 causing the other arm 110 of the lever to move the valve stem 106 and open the valve 105. As the high portion 100 of the cam moves out of engagement with the arm 111, the spring 103 closes the valve. This permits steam to pass from the

pipe 40 into the passage 38 and thence through the nozzle openings 41 and strike against the work W in the form of a spray momentarily to soften the work to facilitate its shaping about the mandrel 51. At the same time, the cams 80 and 80' cause the levers 77 and 77' to swing and move the plates 65 and 65' first toward and then away from one another. As the plates move toward the mandrel 51 the lower edges of the concave surfaces 101 at the inner edges of the plates 65 and 65' are fed under the edges of the work W as shown in dotted lines in Fig. 7. The rolls 96 and 96' then engage the cam surfaces 99 and 99' respectively and cause the inner edges of the plates 65 and 65' to be raised to the dot and dash line positions shown in Fig. 7. In thus being raised the edges of the plates 65 and 65' carry the edges of the work W to the dot and dash line position shown in Fig. 7. Upon further inward movement of the plates 65 and 65', the rolls 96 and 96' move from the cam surfaces 99 and 99' to the cam surfaces 98 and 98' thus causing the plates 65 and 65' to be lowered into engagement with the top surface of the plate 25. As the plates 65 and 65' continue their movement toward the mandrel 51, the work W is folded around and pressed against the mandrel 51 as shown in full lines in Fig. 7 and the heat from the plates 65 and 65' sets the shaped work. The plates then are returned to their initial position and the operator of the machine manually pulls the work W off the mandrel. This operation of the machine shapes the end portion of the work to the substantially tubular form T as shown in Fig. 8. The operator then inserts another work piece in the machine as previously described and the machine again performs its cycle of operations as above described. Preferably, the machine is arranged to perform about fifteen complete cycles per minute.

The work pieces thus shaped upon the machine of the invention are then ready for a subsequent operation. Thus the tubular portion T of the work, Fig. 8, is inserted in a ring R, and the end of the tubular portion T is opened and flattened as shown in dotted lines in Fig. 8 and then is folded upon the main body of the strip and secured by lines of stitching S as shown in Fig. 9.

The machine of modified construction illustrated in Figs. 10 to 13, inclusive, is in large measure identical in construction with that previously described. In the modified construction the yieldable mounting for the mandrel is different, although its principle of functioning is the same. The means for guiding the sheet material as it is inserted in the machine to position it for shaping is modified so as to cause the opposite edges of the sheet material to be turned in the direction of the mandrel and partially shaped therearound. This change makes desirable a modification of the means for guiding the movement of the presser members toward the mandrel. In other respects the modified machine is identical to that previously described.

In the modified construction, a slide 120 is mounted for movement vertically in spaced guides 121 and 122 fixed upon the rear wall of the frame. One end of a rod 123 is secured to the slide 120 near its upper end. The other end of the rod 123 is provided with a portion of reduced cross section forming a mandrel 124 located in a position corresponding to the position of the mandrel 51 of the previously described construction. The shoulder 125 on the rod 123 at the rear end of the mandrel 124 serves as a stop for the work piece when positioned in the machine. The mandrel 124 normally is held in a position spaced slightly above the top surface of the frame by a stop 126 fixed upon the slide 120 and engaging the bottom of the guide 121. The mandrel 124 is normally held in such a position by a spring 127 secured at one end to the frame of the machine and at its other end to a pin 128 fixed upon the slide 120.

A pair of spaced guides 130 are positioned upon the plate 25' adjacent the forward end of the mandrel and are adjustably secured to the plate in a manner similar to the guides 56 of the machine previously described. The guides 130 are so shaped and arranged as to turn the opposite edges of the sheet material W' upwardly in the direction of the mandrel as the work is inserted in the machine and moved toward the shoulder 125.

Presser members 131 and 132, which correspond to the presser members 65 and 65' of the previously described construction, may be mounted to slide upon the top surface of the plate 25'. A separate guide plate 133 is mounted in spaced relation to the top surface of the plate 25' and in approximate engagement with the top surface of each of the presser members 131 and 132. The guide plates 133 are supported upon spacer members 134 resting upon the top surface of the plate 25' and projecting upwardly into an elongated slot 135 formed in each of the presser members 131 and 132. The guide plates 133 are secured in position by screws 136 passing through the spacer members 134 and engaging the frame of the machine. It will be noted that the mandrel normally is positioned slightly above and approximately in line with the path of movement of the presser members 131 and 132 to permit easy insertion of the work beneath the mandrel.

As the work W' is positioned in the machine by inserting it between the guides 130 and beneath the mandrel 124, the opposite edges of the work are turned upward as illustrated in Fig. 10. As the presser members 131 and 132 are moved toward the mandrel they slide along the top surface of the frame and engage the partially shaped work W' as illustrated in Fig. 13. Upon further movement of the presser members 131 and 132 toward the mandrel 124, the work is pressed against the mandrel and this pressure centers the mandrel by moving it from its full line position to its dotted line position shown in Fig. 13. Finally, the work is pressed around the mandrel as shown in dotted lines in Fig. 13.

If desired, the springs 53 or 127 may be eliminated and the mandrels 51 or 124 may be mounted so as to be raised by the action of a cam and lowered by gravity as controlled by such cam, the cam being secured upon the driven shaft 18 so as to operate in proper timed relation to the other moving parts. In such case, the effective weight of the mandrel should be dependent upon the character of the work, being greater for heavy weight and stiff work than for light weight and easily foldable material.

We claim:

1. In an apparatus for shaping the end portion of a flat strip of sheet material to tubular form with the axis of the tube equidistant from the edges of the strip, a support, a pair of presser members movable toward and away from one another, spaced guide members on said support for

positioning the end portion of said strip with the center line in a predetermined position thereon, a mandrel, means for supporting said mandrel between said presser members for movement toward and away from said support while maintaining its axis parallel thereto and in a plane equidistant from said guide members and perpendicular to said support whereby said end portion of said strip may be positioned between said support and mandrel with its center line lying in said plane by insertion between said guide members, and means for moving said presser members.

2. In an apparatus for shaping the end portion of a flat strip of sheet material to tubular form with the axis of the tube equidistant from the edges of the strip, a support, a pair of presser members movable toward and away from one another, spaced guide members on said support for positioning the end portion of said strip with the center line in a predetermined position thereon, a mandrel, means for supporting said mandrel between said presser members for movement toward and away from said support while maintaining its axis parallel thereto and in a plane equidistant from said guide members and perpendicular to said support whereby said end portion of said strip may be positioned between said support and mandrel with its center line lying in said plane by insertion between said guide members, a stop adapted to be engaged by the end of said strip when the latter is inserted between said support and mandrel, and means for moving said presser members.

3. In an apparatus for shaping the end portion of a flat strip of sheet material to tubular form with the axis of the tube equidistant from the edges of the strip, a support, a pair of presser members movable toward and away from one another, spaced guide members on said support for positioning the end portion of said strip with the center line in a predetermined position thereon, a mandrel, means for moving said presser members, and means for supporting said mandrel between said presser members for movement toward and away from said support while maintaining its axis parallel thereto and in a plane equidistant from said guide members and perpendicular to said support whereby said end portion of said strip may be positioned between said support and mandrel with its center line lying in said plane by insertion between said guide members, said guide members having means for inturning the longitudinal edges of said end portion while maintaining its center line in said predetermined position.

4. In an apparatus for shaping the end portion of a flat strip of sheet material to tubular form with the axis of the tube equidistant from the edges of the strip, a support, a pair of presser members movable toward and away from one another, spaced guide members on said support for positioning the end portion of said strip with the center line in a predetermined position thereon, a mandrel, means for supporting said mandrel between said presser members for movement toward and away from said support while maintaining its axis parallel thereto and in a plane equidistant from said guide members and perpendicular to said support whereby said end portion of said strip may be positioned between said support and mandrel with its center line lying in said plane by insertion between said guide members, means for heating said presser members, means for spraying said strip with a normally liquid substance, and means operable in timed relation to render said spraying means operative and then inoperative and move said presser members to engage and shape said end portion around said mandrel and at a predetermined time thereafter move said presser members away from the mandrel.

5. In an apparatus for shaping the end portion of a flat strip of sheet material to tubular form with the axis of the tube equidistant from the edges of the strip, a support, a pair of presser members movable toward and away from one another, spaced guide members on said support for positioning the end portion of said strip with the center line in a predetermined position thereon, a mandrel, means for supporting said mandrel between said presser members for movement toward and away from said support while maintaining its axis parallel thereto and in a plane equidistant from said guide members and perpendicular to said support whereby said end portion of said strip may be positioned between said support and mandrel with its center line lying in said plane by insertion between said guide members, said guide members having means for inturning the longitudinal edges of said end portion while maintaining its center line in said predetermined position, means for heating said presser members, means for spraying said strip with a normally liquid substance, and means operable in timed relation to render said spraying means operative and then inoperative and move said presser members to engage and shape said end portion around said mandrel and at a predetermined time thereafter move said presser members away from the mandrel.

6. In an apparatus for shaping the end portion of a flat strip of sheet material to tubular form with the axis of the tube equidistant from the edges of the strip, a support, a pair of presser members movable toward and away from one another, spaced guide members on said support for positioning the end portion of said strip with the center line in a predetermined position thereon, a mandrel, means for supporting said mandrel between said presser members for movement toward and away from said support while maintaining its axis parallel thereto and in a plane equidistant from said guide members and perpendicular to said support whereby said end portion of said strip may be positioned between said support and mandrel with its center line lying in said plane by insertion between said guide members, means for heating said presser members, means for spraying said end portion when so positioned with a normally liquid substance, means for moving said presser members, and means operable as said presser members are moved toward one another to cause the presser members to swing and move the adjacent edges thereof out of their normal path of movement toward the mandrel to turn the opposite edges of said end portion partially around the mandrel and then return to their normal path of movement to press said end portion around the mandrel.

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