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FOLDING MACHINE

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This invention relates to machines for folding the margins of pieces of sheet material such, for example, as parts of the uppers of boots and shoes to which there has been attached, as by stitching, a strip of binding material commonly called French binding.

In finishing the edges of uppers, particularly of women's shoes, it is quite common to use French binding and, when this is well applied, it makes an attractive finish. In all instances in which the binding material is a true French binding, as distinguished from the so-called Galloon, a strip of binding is first sewed on the grain side of the upper and then is folded over the edge of the upper and stuck down to the flesh side. For this last step, two methods are in common use. In one, the binding strip is stretched or straightened to a position in which it stands out from the edge of the upper and here it is coated. Then, after the coating has dried, the folding takes place. According to the other system, an adhesive is applied to the binding before it is sewed to the upper. This adhesive is thermoplastic and, consequently, can be applied and then dried to a non-tacky condition to permit handling, as during the sewing operation. It is subsequently activated by the application of heat. Various devices have been proposed for activating the adhesive just before the binding is folded. The problem is to apply the heat to the binding in just the amount desired at a point closely adjacent to and before the binding reaches the folding instrumentalities so that the binding is very promptly pressed into place after the adhesive has been activated. It is also desired to apply the heat in the desired locality and in such a manner that it will cause no annoyance to the operator of the folding machine or detriment to the successful operation of the machine itself. This problem was successfully solved by the invention set forth in Letters Patent of the United States No. 1,850,979, granted March 22, 1932, upon the application of George E. Williamson, where the heat is supplied to the work by means of a heated presser foot or creaser with which there cooperates the oscillating finger of a folding mechanism.

It is an object of this invention to provide a still further improved organization for applying heat to the thermoplastic coating upon the work which, while retaining the advantages of the prior construction referred to, is so constructed and arranged as to facilitate the application of heat to the work and to minimize the energy required to produce the degree of heat necessary to fully

activate the thermoplastic coating upon the work.

To this end, a feature of the invention consists in the provision in a folding machine of a heated finger closely adjacent to the presser foot. Preferably and as illustrated, this finger is located just inside the upturned binding strip where it also contacts with the edge of the work and serves as an edge gage to guide the work to the folding devices.

In accordance with another feature of the invention, the finger by means of which the thermoplastic coating is activated is in the form of a loop of electrically conductive material through at least a portion of which there is conducted an electric current, this current being utilized to heat the finger. Advantageously, the loop is supported by engagement with its spaced legs in such a way that angular and vertical adjustments are allowed.

These and other features of the invention will be described in the following specification taken in connection with the accompanying drawing, in which

Fig. 1 is a perspective view of a part of a folding machine embodying the invention;

Fig. 2 is a side elevation of these same parts upon a somewhat larger scale and showing a piece of work in process of being treated, as it moves away from the observer;

Fig. 3 is a fragmentary angular view of the operating parts of the machine taken from a different viewpoint so that the work is advancing toward the observer;

Fig. 4 is an exploded view of the parts by means of which the edge gage finger is supported;

Fig. 5 is a detail view partly in horizontal section through the stud which supports the edge gage, while

Figs. 6, 7 and 8 show the binding strip before and in successive stages of its application to the work.

The invention as herein shown is applied to a folding machine of the type shown in Letters Patent of the United States No. 1,702,598, granted February 19, 1929, on an application of P. R. Glass. In this machine, a work support 10 is mounted in the outer end of a horizontal arm 12 which is positioned just above the bench upon which the machine is supported. Overhanging this is another arm 14 and upon these two arms are supported the folding instrumentalities. The work to be treated by this machine comprises a piece of sheet material, such as the upper leather 100 shown in Figs. 7 and 8 with the flesh side uppermost. Associated with this is a binding

strip 200 attached with its edge flush with the edge of the upper by means of a single seam 300. A portion of this binding strip 200 is provided with a coating of thermoplastic adhesive 400 which is dry and non-tacky when it is brought to the folding machine but which may be activated by the application of heat. The binding strip in Fig. 6 is inverted in Fig. 7 so that its coated side is down. As a result, when the binding is folded over the edge to bring it into the condition illustrated in Fig. 8, the coating 400 contacts with the uppermost or flesh surface of the piece of work 100. The downwardly facing surface of the work shown in Fig. 8 is, then, the grain surface or that which is exposed in the finished work. In general, the folding operation is accomplished by folding instrumentalities including a creaser or presser foot 16 which has a roll 18 to facilitate its passage over portions of the work. The upwardly turned binding strip 200 is heated by means of a finger 20 and then bent over the creaser 16 by an oscillating folding finger 22 (Figs. 2 and 3) after which it is pressed down upon the work by means of a hammer 24 cooperating with the inclined face of an anvil 26. The hammer 24 and the anvil 26 cooperate to press the fold and have a movement together to feed the work. When these feeding parts are returning to take a fresh grip, the work is clamped between the presser foot 16 and an intermittently lifted block 28. A plate 30 over which the curled edge of the binding passes is grooved at 32 to receive this curled edge, as shown in Fig. 2. As in the Glass patent above mentioned, the folding finger 22 is carried upon a lever 34 which is pivoted on a stud 36. Here this stud is eccentrically mounted in a block 38 attached to the end of the arm 12. An arm 40 attached to this pivot stud may be adjusted and held in adjusted position thereby to bring the path of movement of the folding finger 22 nearer to or farther away from the creaser or presser foot 16.

The presser foot 16 and the heated finger 20 are supported on levers 110 and 48 respectively (Fig. 5) which are pivotally supported upon a pin 44 extending into a depending portion 46 (Fig. 2) of a bracket 42 which is adjustably clamped in position at the outer end of the arm 14. The lever 48 has a finger piece 50 at one end and is held by a spring 52 against an adjustable stop 54. At its outer end this lever is perforated to receive a hollow stud 56 (Figs. 4 and 5) which is enlarged at 58 to abut one surface of the lever. The finger 20 is in the form of a loop and the enlarged portion 58 has parallel flat surfaces 60 upon which are attached holders for the legs 62 of the finger. The heating of the finger is accomplished by passing an electric current through the loop. It is, consequently, necessary to insulate the legs 62 from one another and from the supporting mechanism. To this end, pieces of insulation 64, such as mica, are positioned against the flat surfaces 60 and upon these are positioned the flat holders 66 which are grooved at 68 to receive the legs 62 of the finger. These holders 66 are secured to the enlarged portion 58 of the hollow stud 56 by means of screws 70, which are centered within recesses in the holders and are insulated from the holders, by means of mica washers 72. Current is supplied to these holders by flexible leads 74 which are soldered to terminal lugs 76 which are attached by means of screws to the holders. The legs of the finger 20 are clamped in the grooves 68 of the holders by being pressed laterally into the grooves by a clamping

mechanism comprising an insulating mica washer 78, a metal washer 80 and a screw 82, this screw having a crosspin 84 which is received in a groove 86 at the end of the hollow stud 56. The screw 82 is clamped in the hollow stud by means of a nut 90 and the hollow stud is clamped in position upon the lever 48 by means of a finger nut 92 bearing against a washer 94 interposed between the nut and the lever. It will be seen that this construction greatly facilitates the removal and replacement of the finger 20 and that the finger may be adjusted either angularly about the axis of the screw 82, or vertically, or both. Angular adjustment is provided by loosening the nut 90 and swinging the stud 56 in the lever 48. Vertical adjustment is provided by loosening the nut 92 and sliding the legs 62 of the finger in the grooves 68 of the holders. Preferably, means are provided for controlling the amount of current supplied through the loop of the finger 20 and this may take the form of a transformer 102 illustrated diagrammatically in Fig. 3 as provided with secondary taps and with a sliding contact to allow ready change of the connection to the taps. Since the resistance provided by the finger 20 remains substantially constant, after it has become heated, a change of the secondary voltage supplied by the transformer 102 provides a quick and easy way of changing the amount of current supplied to the loop of the heated finger 20. This enables the operator to adjust the temperature of the finger to just the desired amount.

It will be seen from an inspection of Figs. 2 and 3 that the thin vertical lower end 104 (Fig. 4) of the finger 20 is so positioned with respect to the folding instrumentalities that it serves as an edge gage abutting the edge of the leather work piece 100 at a point substantially opposite to the point of contact of the roll 18 in the presser foot and as close as possible to the folding finger 22. By reason of this location, the edge gage finger 20 does not interfere with the turning of the work on inside curves. At the same time, the binding 200 is kept constantly in close engagement with the inner face of the finger 20 by reason of the action of the folding finger 22 in holding the approaching portion of the binding turned up and, therefore, the heat is applied to the adhesive coating 400 upon the binding material at a point where it is most effective. Further, the heat is localized in the finger and this means that the amount of electric power necessary to activate the binding is greatly reduced, that adjacent parts of the machine are not heated to a point where they are an annoyance to the operator, and that the activation of the adhesive coating is very effective. Inasmuch as the heat is applied just prior to the folding operation, it is not necessary to heat the binding any more than is required to soften the adhesive and loss of heat during the passage of the binding through the machine is negligible so that no allowance need be made therefor.

The presser foot 16 is slidably supported in the outer end of a lever 110 which, as noted above, is also carried upon the stud 44. The lever 110 has a finger piece 112 which is overlapped by a lug 114 upon the finger piece 50 so that the two may be depressed together. This presser foot lever is urged to a position determined by an adjustable stop screw 116 by means of a spring (not shown), the compression of which is determined by an adjusting screw 118. The presser foot itself is slidably supported in the outer end of the lever 110, being urged toward the work by a spring

120 and held against complete expulsion by a stop screw 122.

It is common experience that joints between overlapping ends, folds at sharp corners and the like may require to be folded by hand and, in order that the adhesive at these portions may be activated conveniently, the machine is provided with an auxiliary electrical heating unit supported by a bracket 130. This unit 133, which is contained within hollow sleeves 132, is supplied through a flexible conduit 134 and associated with it is a forwardly extending member 136 having an enlarged head 138 at its outer end. The member 136 is mounted upon one of the sleeves 132. This head 138 will become hot and is exposed so that the small portions of the binding which are to be activated manually may be pressed against it and quickly heated thereby. All other portions of the heating unit and the member 136 are covered to conserve the heat and to avoid any danger of burning the operator's fingers. To this end, there has been provided a rigid cover 140 of ceramic material or the like to the outer surface of which there is secured a felt cover 142.

Under some climatic conditions or with some grades of work, it may be desirable to warm the leather work piece 100 slightly so that the activated adhesive 400 upon the binding will not be too quickly cooled before adhesion thereto has been effected. Accordingly, provision is made for transferring a small amount of heat to the presser foot 16 through a depending arm 150, the upper end 152 of which is clamped to one of the hollow sleeves 132. The lower end of this arm has a vertical flange 154 in sliding contact with a plate 156 secured to the end of the lever 110 in which the presser foot is slidably supported. It should be understood, however, that this heating of the work by the presser foot is auxiliary to and entirely separate from the principal activation of the thermoplastic adhesive by means of the heated finger 20.

The machine having been set up with the parts in the desired adjustment, its operation is substantially as already described, it being only necessary for the operator to depress the finger piece 50 in order to insert the work beneath the presser foot 16 and the finger 20. In so doing, the operator will bring the edge of the leather work piece 100 into contact with the edge gage finger 20 and will curl up the leading end of the binding so that it is pushed up by the finger 22 and then forced down into firm engagement with the flesh surface by the hammer 24. The work will be fed forward by the coaction of the hammer 24 with the anvil 26 and, as the binding is dragged over the heated edge gage finger 20, the thermoplastic adhesive 400 thereon will be activated so that the binding will immediately stick firmly in place upon the flesh surface of the leather 100.

Having described my invention, what I claim as new and desire to secure by Letters Patent of the United States is:

1. In a machine for folding French binding pre-coated with a thermoplastic cement and attached to a work piece, a work support, a presser foot engaging the work piece to hold it against the support, means for folding the binding and feeding the work, said machine being provided with a gage finger for contact with the edge of the work piece and with the upturned binding immediately adjacent to the presser foot, and electrical means for setting up a flow of current in said gage finger to heat it.

2. A machine for operating upon a piece of work to which there has been attached a binding strip adapted to be folded around the edge of the work, said binding strip being coated upon one face with a thermoplastic adhesive, having, in combination, a support for the work, means for progressively bending the binding strip into a position in which it may be pressed upon the face of the work and for progressively pressing the binding strip on to the work, and a heated edge gage positioned to contact with the edge of the work piece and the upturned binding strip prior to the contact of the strip with said bending means, said edge gage comprising a loop of electrically conductive material and means for passing an electric current through said loop to heat the gage.

3. A machine for operating upon a piece of work to which there has been attached a binding strip adapted to be folded around the edge of the work, said binding strip being coated upon one face with a thermoplastic adhesive, having, in combination, a support for the work, folding and feeding mechanism including a presser foot for engagement with the work piece, means for guiding the work and activating the coating of adhesive comprising an edge gage finger positioned for engagement with the edge of the work piece adjacent to the presser foot and to heat the coating of adhesive upon the upturned binding strip, said gage comprising a loop of metal the legs of which are insulated from one another, and means for conducting an electric current to the legs of said loop.

4. In a folding machine for French binding work, folding instrumentalities, an edge gage comprising a loop of electrically conductive material formed into legs and a finger for engagement with the work immediately prior to the folding operation, electrically insulated supporting means for the legs of said loop, and means for conducting an electric current through said loop.

5. A machine for operating upon a piece of work to which there has been attached a binding strip adapted to be folded around the edge of the work, said binding strip being coated upon one face with a thermoplastic adhesive, the machine having, in combination, folding and feeding mechanism, a metallic finger positioned closely adjacent to the path of movement of the binding being folded by said mechanism and close to and to the rear of the mechanism, and means for conducting an electric current through at least a portion of said finger thereby to heat the finger and to activate the thermoplastic adhesive.

6. In a folding machine for French binding work, folding instrumentalities and an edge gage comprising a loop of electrically conductive material the legs of which join to form a finger for engagement with the work immediately prior to the folding operation, a support, means for clamping the legs of said loop upon said support in insulated relation to one another, said clamping means being constructed and arranged to permit angular adjustment of said finger with respect to the folding instrumentalities, and means for conducting an electric current through said loop.

7. In a folding machine for French binding work, folding instrumentalities and an edge gage comprising a loop of electrically conductive material the legs of which join to form a finger for engagement with the work immediately prior to the folding operation, a support, means for clamping the legs of said loop upon said support in insulated relation to one another, and means for conducting an electric current through said loop.

lated relation to one another, said clamping means being constructed and arranged to permit heightwise adjustment of said finger with respect to the folding instrumentalities, and means for
5 conducting an electric current through said loop.

8. In a machine for folding French binding precoated with a thermoplastic cement and attached to a work piece, a work support, a presser foot engaging the work piece to hold it against
10 the support, means for applying heat to the margin of the work piece over which the binding is to

be folded comprising a heating unit in heat-conductive relation to said presser foot, means for folding the binding and feeding the work, said machine being provided with a metallic finger to contact with the upturned binding immediately
5 adjacent to the presser foot, and means for conducting an electric current through at least a portion of said finger thereby to heat the finger and to activate the thermoplastic adhesive.

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