UNITED STATES PATENT OFFICE

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ELECTRICALLY HEATED TOOL FOR UNITING SHEET MATERIAL

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2 Claims. (CI. 219—19)

1. This invention relates to the uniting of sheet material, and relates more particularly to apparatus for uniting a plurality of sheets of material.

2. An important object of this invention is the provision of a novel device for effectively and quickly uniting sheet material which will be simple in construction and easy to use.

3. Other objects of this invention, together with certain details of construction and combinations of parts of my novel device, will appear from the following detailed description and drawing.

4. In the drawing wherein a preferred embodiment of my invention is shown:

5. Figure 1 is a plan view of the novel device of my invention, partly broken away to show the means for holding the brush in position against the disc contact member on the roller.

6. Figure 2 is a side elevation view of the novel device of my invention, and

7. Figure 3 is a cross-sectional view through a portion of the roller.

8. Like reference numerals indicate like parts throughout the several views of the drawing.

9. In accordance with my invention, I have constructed a device which will rapidly and effectively join together two or more sheets of material, at least one of which is made of or contains a thermoplastic compound, in such a manner that the bond is resistant to stresses. In general, my device comprises a roller journaled in a suitable handle, which roller has means thereon for applying heat at spaced points along the sheets as the roller is moved along the surface of the sheet with which the device is in immediate contact.

10. Referring to the drawing for a detailed description of my novel device, reference numeral 1 indicates a handle which may be of any suitable material and construction but is here shown as comprising spaced metal members integrally connected at one end and flared at the opposite end to form a U-shaped bracket the purpose of which will hereinafter be described.

11. An electric cord 2 leading from a suitable source of electricity passes through the handle. A switch 3 is provided on the handle to control the electric current passing through the cord, the switch having a control lever or button 4 extending through one member of the handle for turning the current on or off. The control switch may be attached to the handle by means of screws 5. A fiber bushing 6 may be provided on the handle for passing the wires therethrough out of contact with the metal of the handle.

12. In the arms 7 of the bracket formed by the free ends of handle 1 are bearings 8 which may be integral with said arms 7 or the bearings may be inserted in holes at these points. In the bearings 8 is mounted a shaft 9 that carries a roller 11 of ceramic material or of other suitable non-conductor of electricity. Preferably the roller is formed of a plurality of ceramic plates 12 bound together by nuts 13 threaded upon a threaded portion 14 of the shaft 9. Attached by screws 15 to the end plates 12 are metal, preferably brass, brush or contact discs 16. After the plates 12 with the discs 16 secured thereto are pinched together by the nuts 13 a spiral groove 17 is turned in the periphery of the roller. This groove 17 is provided to accommodate a Nichrome wire coil 18 and is substantially the width of the coil and about half that in depth. One end of the coil 18 is attached to a disc 16 at one end of the roller 14 and the coil laid in the groove 17 with its other end attached to the disc 16 at the opposite end of the roller. The coil 18 may be attached to the discs 16 by screws or brazed thereto as indicated at 19.

20. The convolutions of the half-buried coil 18 project from the surface of the roller as wire loops or wire loop teeth 21 as shown in Figure 2. In place of running the coil 18 as a spiral from one end of the roller 14 to the other, the coil 18 may be wound in a ring in a plane normal to the axis of the roller and then carried below the surface of the roller, say, the width of one or two plates 12 to emerge and be wound into another ring, thus forming a roller having rings of loop teeth parallel to each other. Depending upon the use to which the device is to be put, there may be employed either the spiral or ring form of coil having one, two, three or more rows of loop teeth. In place of the wire coil other shapes or types of heating elements may be employed.

22. The shaft 9 is machined as indicated at 22 into a hub for registry with the bearing 8. The shaft 9, after insertion in the arms 7, is clamped in place by nuts 23 threaded on the portions 14 of the shaft 9 and by nuts 24 threaded on portions 25 of the shaft 9. The portions 25 of the shaft 9 are preferably of a diameter less than the hub 22 such that it may easily be passed through the bearing 8.

25. Also mounted in each of the arms 7 is a motor brush arrangement, generally indicated at 25, of any suitable make. Each brush is contained in a housing 27 held in place partly by a screw 28 and a collar 29 that extends through arm 7. A brush 31 is held by the collar 29 which is urged outwardly by a spring 32 seated in the housing.
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The brush 31 is connected to one lead in the electric cord 2 through bushing 33 and the whole assembly is adjustable relative to disc 15 by means of the nut 34. Through the brush electric current is supplied to the wire coil 19, regardless of whether the roller 14 is stationary or rotating. The nichrome wire is connected to a low voltage electric current.

When two sheets or webs of material, at least one of which is fusible, are to be joined, they are placed together in the proper juxtaposition by overlapping for a length equal to the width of the roller, with the section overlapping slightly in excess. The nichrome wire coil, which has been previously heated by means of the electric current, is rolled over the overlapped fabric with slight applied pressure. The hot coil spot welds the sheets or webs together. When the coil is, say, 1/8 inch outside diameter and 3/8 inch pitch, the hot coil spot welds the sheets together in rows of parallel slots which make a strong joint, which is resistant to stress.

This particular size coil given above is exceptionally well-suited for uniting fabrics, at least one of which is made of or contains yarns, filaments or fibers of fusible material. In the process of tentering fabrics, it has heretofore been necessary to stop the frame at the end of each succession of pieces which have been sewn together, in order that a new batch be sewn in by hand or by machine. The sewing of the batches together at the entrance to the tenter frame required a great deal of time since it was necessary to use considerable care that the sewing exactly align the fabrics; otherwise, the finished fabric might be bowed. The sewing of the fabrics by hand or machine not only took appreciable time but also resulted in holding a section or tail end of several yards of fabric in the tentering machines which fabric often became over-processed. The device of my invention quickly joins the fabric and it is not necessary to stop the tentering operation even for a moment.

Sheets of fabric 35 of fabrics and other shapes of heating elements may be employed; for instance, a single ring of closely spaced fine gauge teeth may be employed for producing an effect such as that on the border of a handkerchief or scarf. When the material of the sheets being joined is thermoplastic and slight pressure is applied to the roller, the heated teeth pierce and melt the material to produce a series of holes or slots with sealed edges. The series of holes or slots may be arranged by selection of different rollers and teeth to produce effects similar to hemstitch or pleat. When the layers to be joined are relatively thick or one or more of the layers contain non-thermoplastic materials, the uniting of the layers may be effected with or without piercing the same by controlling the heat and pressure of my device.

Sheets containing no thermoplastic materials may be joined together by inserting between them a strip of thermoplastic sheet material or, alternatively, the non-thermoplastic sheets may be placed in abutting relationship and a strip of thermoplastic material laid over the abutting edges which strip is then spot welded to both fabrics by employing my device with a roller wide enough to span both sheets or by spot welding the thermoplastic strip to first one piece and then the other piece.

The fusible sheets or webs employed with the device of my invention may have a basis of any suitable thermoplastic compound such as, for example, cellulose acetate, cellulose propionate, cellulose aceto-propionate, cellulose aceto-butyrates, cellulose acetate-stearate, ethyl cellulose, benzyl cellulose, polymerized vinyl compounds, e.g., polymerized vinyl chloride and vinyl acetate, and synthetic linear polyamide condensation products such as polyamides derived from amino-acids or from the condensation product of diacids and or dibasic acids or of chlorinated or hydrolyzed cellulose esters.

2. The temperature of the heating element or wire coil may vary over a wide range, depending upon the type or types of sheets being joined and whether the roller is stationary or rotating. The temperature of the material to produce a tacking effect throughout the sheets or the roller may be adjusted. Obviously, the hotter the element the faster the roller may be moved across the fabric. For joining damp fabrics made of substantially all cellulose acetate fibers as said fabrics enter a tentering machine it has been found that the best temperature is at which the wire coil is a dull red to red. However, temperatures at which the wire coil is white hot may be employed. These temperatures are sufficiently high to cause the teeth to pierce the fabrics to form slots which, in traversing the edges of fused thermoplastic material. On thin fabrics such as voiles and nylons, a temperature at which the wire is heated above 200° C. but not yet red may be employed. Dry fabrics entering a fabric printing machine may be joined together with the coil at lower temperatures, while fabrics containing a lesser percentage of thermoplastic fibers or filaments may require high temperatures.

It is to be understood that the foregoing detailed description is given merely by way of illustration and that many variations may be made therein without departing from the spirit of my invention.

Having described my invention, what I desire to secure by Letters Patent is:

1. A device for uniting fabrics at least one of which contains a thermoplastic material, comprising a handle, a roller rotatably mounted on said handle, a heating element comprising a continuous wire, bent into sinuous form, wound helically about the peripheral surface of said roller, said wire having at least a part thereof projecting from said peripheral surface, and means for supplying heat to said heating element.

2. A device for uniting fabrics at least one of which contains a thermoplastic material, comprising a handle, a roller rotatably mounted on said handle, a heating element comprising a helical coil having spaced convolutions wound helically about the peripheral surface of said roller, said coil having at least a part thereof projecting from said peripheral surface, and means for supplying heat to said heating element.

FREDERICK G. DODGE.

REFERENCES CITED

The following references are of record in the file of this patent:

UNITED STATES PATENTS

<table>
<thead>
<tr>
<th>Number</th>
<th>Name</th>
<th>Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>619,519</td>
<td>Hoebenbergh</td>
<td>Feb. 14, 1899</td>
</tr>
<tr>
<td>705,768</td>
<td>McElroy</td>
<td>Apr. 30, 1903</td>
</tr>
<tr>
<td>751,327</td>
<td>Marr</td>
<td>Feb. 9, 1904</td>
</tr>
<tr>
<td>1,359,751</td>
<td>Tooby</td>
<td>May 6, 1920</td>
</tr>
<tr>
<td>2,231,132</td>
<td>Lovett</td>
<td>Nov. 11, 1941</td>
</tr>
<tr>
<td>2,253,692</td>
<td>Turke</td>
<td>Nov. 11, 1941</td>
</tr>
</tbody>
</table>