METHOD AND APPARATUS FOR UNITING SHEETS OF RESILIENT MATERIAL

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This invention relates to uniting sheets of resilient material and more particularly to an improved method and apparatus for continuously and automatically joining the adjacent edges of two sheets of sponge rubber carpet cushion in firm abutting relationship.

The carpet cushion commonly used today as rug underlay is usually made in the form of sheets of sponge rubber. One type of cushion is made by the "controlled blow" process and another by the "free blow" process, both of which are conventional. The first type of cushion is usually formed in flat sheets, while the second type is usually formed in sheets having various projections and indentations in their surfaces to present a "waffle iron" pattern. The first type has high tensile strength while the second type has a relatively low tensile strength. Thickerly, it is usually necessary to reinforce the second type with a loosely woven fibrous backing such as "Tantex," which is preferably bonded to the rubber. In either case, the cured sheets are normally produced in standard 4½ foot widths.

Because of the increasing customer demand for 9 foot widths of this cushion, such as underlay for 9 x 12 rugs, it has become necessary to permanently join two of the 4½ foot widths at the place of manufacture. Hereunto, this was done by hand. Typically, the adjacent ends of the rolled up sheets were sprayed with an adhesive, such as latex, and then the sheets were unrolled to lay flat, side by side, on the floor; after which the adjacent edges of the sheets were joined in abutting relationship by hand. When sheets with backing were joined, it was also necessary to manually apply a reinforcing tape to the back layer overlying the abutting edges, in order to prevent the sponge from tearing at these edges, because of its low tensile strength. Finally the united sheets were rolled up again by hand for shipment. As will be apparent, this procedure not only required a great deal of manual labor, but also a large floor area, and was unduly time consuming.

Accordingly, the primary object of this invention is to minimize the manual labor, floor area and amount of time required to join two such sheets of sponge rubber carpet cushion.

Another object of the invention is to provide an improved method and apparatus for continuously and automatically uniting the sheets to be united, positioning the sheets side by side with the edges to be joined adjacent each other, butt-joining the adjacent edges tightly and evenly together, and rolling up the united sheets into a smooth roll for shipment.

Another object of the invention is to provide an improved method and apparatus which are adapted not only to unite such sheets, but also to continuously and automatically apply reinforcement to said sheets overlying the edges being joined.

Another object of the invention is to provide an improved method and apparatus which are adapted to join and reinforce the abutting edges of such sheets, whether such sheets be provided with a backing or not.

Still further objects and advantages of the invention will become apparent upon consideration of the specification and claims when read in conjunction with the accompanying drawings wherein:

FIG. 1 is a side elevational view of an apparatus embodying the invention;
FIG. 2 is a top plan view of the aforesaid apparatus;
FIG. 3 is a sectional view taken on line 3—3 of FIG. 1;
FIG. 4 is a perspective view of one type of carpet cushion, two sheets of which are united in accordance with the teachings of this invention, and
FIG. 5 is a perspective view of another type of carpet cushion, two sheets of which are united and the abutting edges thereof reinforced in accordance with the teachings of the invention.

Referring to FIGS. 4 and 5, the two most commonly used types of sponge rubber carpet cushion are illustrated. In FIG. 4, the plain sheets 10, made by the "controlled blow" process, have relatively high tensile strength and are butt-joined along their adjacent edges 11 normally without the need of additional reinforcement. In FIG. 5, the "waffle" sheets 12, made by the "free blow" process, have a relatively low tensile strength. Accordingly, each layer of sponge 13 is preferably provided with an open weave, fibrous backing 14 such as "Tantex" bonded thereto, and the butt-joined edges 15 are reinforced by a "Tantex" tape 16 overlying the edges and bonded to the backing.

Referring now to FIGS. 1, 2 and 3, an apparatus embodying the invention comprises a frame 17 having uprights 18, 19 and 20 welded to longitudinal member 21, 22 and transverse members 23, 24, 25 and 26. Welded to the upper uprights 18 are beams 27, 28 having U-shaped bearings 29 and 30 at the top. The uprights 18 are provided with bearings 31 for rotatably supporting an idler guide roller 32. Uprights 18 and 19 are provided with flanges 33 and 34, respectively, on which is mounted a platform 35 sloping downwardly at approximately a 45° angle from roller 32. The platform 35 is provided with rectangular channels 36 in which are journaled two vertically spaced pairs of idler, crowding rollers 37. These rollers 37 are preferably positioned to make an acute angle of 82° with the longitudinal center line of the platform, the outer ends of the rollers 37 being located below and in advance of their inner ends. The rollers 37 also protrude slightly above the upper surface of the platform 35. Positioned between each pair of rollers 37 is a substantially flat seld or plate 38 which is mounted on the platform by means of a wire 39 and peg 40. Riding on the lower pair of rollers 37 and extending transversely of platform 35 is an idler guide roller 41 rotatably mounted on arms 42 which are pivotally attached to lugs 43 protruding from platform 35.

At the lower end of the platform 35, the frame 17 is provided at each side with corner braces 44 welded to longitudinal members 22 and uprights 19. Each brace 44 is provided with a bearing 45 on which is rotatably mounted a drive roll 46 by means of shaft 46a, which roll extends transversely of the frame 17. Welded to and extending upwardly from each brace 44 is a support 47 having upper and lower struts 48 and 49. Pivotally mounted on each strut 48 is a toggle lever 50 which is pivotally connected to a respective shaft 51 by a toggle link 52. The shafts 51 pass freely through struts 49 and are attached to a long bar 53 having end flanges 53a in which a squeeze roll 54, having a central sleeve 54a, is rotatably mounted. As will be apparent from FIG. 2, roll 54 extends transversely of frame 17 above an axial parallelism with roll 46. By moving toggle levers 50 at each side of frame 17, the squeeze roll 54 can be readily adjusted towards and away from drive roll 46.

Extending substantially horizontally from rolls 46 and 54 is a table 55 having rollers 56, the table being re-
ciprocable on longitudinal members 22 and engageable with stops 57 and 58 thereon, for limiting the extent of its reciprocable movement. Welded to longitudinal members 22 and cross piece 23 adjacent track 55 are two pairs of bearing supports 59, and rotatably mounted in each such pair is an idler, spreader roller 60. The rollers 60 are preferably so positioned that they make an acute angle of 87° with the longitudinal center line of the frame 17, with the inner ends of the rollers 60 being in advance of the outer ends thereof. Mounted on cross piece 23 is an air line 61 having an air jet 62 positioned in advance of and between the inner ends of rollers 60 for a purpose to be described below.

Longitudinal members 22 of frame 17 are provided with spaced pairs of bearings 63, in which are rotatably mounted wind up rolls 64 by means of shafts 64a. The power operated means for driving the drive roll 46 and wind up rolls 63 is preferably an electric motor 65 rigidly mounted on longitudinal member 21 of frame 17. Motor 65 is provided with a drive shaft 65a on which are mounted the sprockets 68 and 69, respectively; sprockets 66 and 68 being connected by a chain 70 and sprockets 67 and 69 being connected by a similar chain 71. As will be apparent from FIG. 1, upon counterclockwise rotation of motor drive shaft 65a, drive roll 46 and wind up rolls 64 will be driven in the same direction and in synchronization.

For present purposes, the various sprockets are so proportioned that rolls 46 and 64 are driven at the same speed; however, by simply varying this proportion, their speed may be varied as desired.

Whenever, it is necessary to reinforce the edges of the sheets to be joined, such as those in FIG. 5, the following additional device is employed. Referring to FIGS. 1 and 3, this device comprises an adhesive supply tank 72, an adhesive coating chamber 73 and a reinforcing tape supply reel 74. The supply tank 72 is welded to an L-shaped cross piece 75 which is, in turn, welded to uprights 18, and tank 72 is connected to chamber 73 by means of a gravity feed pipe 76 having a conventional shut off valve 77. The chamber 73 is welded to L-shaped cross pieces 78, which are welded to longitudinal members 22, and the chamber is provided with a pair of struts 79 in which the supply reel 74 is rotatably mounted. Depending downwardly from one end of chamber 73 are flanges 80 on which is rotatably mounted an idler guide roller 81 and extending outwardly from this end of the chamber is another idler guide roller 82. An applicator roll 83 is rotatably mounted within chamber 73 and is partially submerged in the adhesive therein, while above roll 83 there is rotatably mounted another idler guide roller 84. An additional idler guide roller 85 extends outwardly from the other end of the chamber 73, which is also provided with upwardly extending flanges 86 rotatably supporting another idler, guide roller 87.

In practicing the invention, two sheets, such as 10 or 12, after being cured, are rolled up into 4½ foot width rolls 88 on shafts 89 (FIG. 1). Preferably, one end of each roll 88 is sprayed with an adhesive such as latex which is permitted to dry for a few minutes in order to present a tacky surface to bond the sheets together securely enough so that they will not separate during the joining and wind up phases of the process. These rolls are placed on the frame 17 with their adhesively coated ends adjacent each other, the shafts 89 being supported in hooks 29 and 30. The rolls 88 are preferably offset vertically so that the adjacent ends of the rolls may be positioned as close together as feasible to reduce the amount of sidewise movement necessary to join the edges 11 or 15 of the sheets 10 or 12 as they pass through the machine. Once the rolls 88 are positioned on frame 17 and the sheets 10 or 12 have passed over roll 32 and onto platform 35, the table 55 is moved against stops 58 to permit the operator to pull the sheets down the platform 35, over crowding rollers 37, and under sled or plate 38 and idler roller 41. As this is done, the edges 11 or 15 are joined and the united sheets are then passed over drive roll 46, at which point the operator pushes the toggle levers 50 down to lock squeeze roll 54 in pressure transmitting relationship with the sheets 10 or 12 and drive roll 46. If it is desired to reinforce the abutting edges 11 or 15 of sheets 10 or 12 with tape such as 16, the operator feeds the tape from reel 74 over rollers 81 and 82, through chamber 73 where the tape is coated with suitable adhesive by applicator roll 83 under guide roll 84 and around rollers 85 and 87 to drive roll 46, before clamping squeeze roll 54 down onto the sheets.

The operator moves table 55 back against stops 57 and momentarily actuates motor 65 by means of a switch (not shown) to drive the drive roll 46 until a sufficient length of the united sheets 10 or 12 passes over table 55 and spreader rolls 60 be initially wrapped around shaft 90 into a roll 91. If reinforcing tape such as 16 is being applied to the sheets, the operator turns on the air jet 62 by means of a valve (not shown) to apply air pressure to the tape and firmly bond the sheets 10 or 12 thereto.

At this point, all the conditions necessary for automatically and continuously practicing the invention are satisfied, whereupon the operator once again starts motor 65. Drive roll 46 drives squeeze roll 54, idler crowding rollers 37, idler rollers 41 and 31, and rolls 88, through sheets 10 or 12. Thus, the sheets are continuously moved side by side with their adhesively coated edges 11 or 15 adjacent each other, down the platform 35 in a direction substantially parallel to the sheets and their adjacent edges. As the sheets 10 or 12 are continuously unwound from rolls 88 and passed over crowding rollers 37, they are continuously moved towards each other transversely of the aforesaid direction to crowd the sheets together. This latter movement butt-joins the adhesively coated edges 11 or 15 in firm adhering relationship. In order to prevent misalignment of the edges 11 or 15, commonly called "step offs," the sheets 10 or 12 are passed under the floating sled or plate 38, which continuously applies pressure thereto as they are joined. However, the plate is very light and smooth to keep friction to the minimum and as it is also distributed over a substantial area of contact with the sheets, there is no concentrated friction on the sheets and thus no interference with their movement down the platform 35 nor their movement towards each other. In passing under idler roller 41, the sheets are kept in frictional contact with the crowding roller 37, to insure their proper action.

Once the sheets are united, they continue to move down platform 35 between squeeze roll 54 and drive roll 46, whereupon squeeze roll 54 continuously applies pressure to sheets 10 or 12, to squeeze the cemented edges 11 or 15 tightly and evenly together, as well as to assist drive roll 46 in motivating the sheets. Roll 54 may be provided with a short sleeve 54a to increase the pressure on the sheets adjacent the joined edges, if desired.

When it is necessary to apply reinforcement to the sheets 10 or 12 overlying the edges 11 or 15, tape such as 16 is fed into the bite between rolls 46 and 54 under the sheets. Thus, drive roll 46 drives the reel 74, applicator roll 83 and guide rollers 81, 82, 84, 85 and 87 through the tape to adhesively coat and supply the same, while roll 54 impresses the tape on the sheets.

From the drive roll 46, the united sheets 10 or 12 move across table 55 over spreader rolls 60 and up wind roll 64, whereby the sheets are continuously pulled into a smooth, 9 foot wide roll 91 for shipment.

The wind up rolls 64 continuously move the united sheets in the same direction as they are moved by drive roll 46, and also drive the spreader rolls 60 through the united sheets 10 or 12, for continuously spreading the united sheets transversely of the aforesaid direction, to relieve the crowding thereof caused by the rolls 37.
an open weave, reinforcing tape such as 16 is applied to sheets 10 or 12. It is preferred that the tape be subjected to air pressure by means of the backing 13, and is applied to sheets 10 or 12 and tape firmly together. This is especially helpful when the "waffle" type sheets 12, provided with the open weave backing 13, are reinforced with the open weave tape 16, because the air pressure forces the adhesive, which is preferably latex, up into the interstices of the backing 13 and speeds up the drying of the latex into a tacky state to securely bond the backing together.

It will now be apparent that the above described invention represents a substantial improvement over the prior art practice. Previously, it took two men one hour to butt-join two 60 foot lengths of such 4½ foot wide carpet cushion, not considering the additional time and labor involved in applying a reinforcing tape thereto.

By following the teachings of the invention, the same two men can easily perform the same operation, as well as reinforce the sheets, in approximately one quarter of an hour. Thus, production is increased by approximately 400%.

While the preferred forms of this invention have been described more or less in detail herein, it is to be understood that various changes may be made therein without departing from the spirit of the invention, and it is intended to cover such changes in the appended claims.

The embodiments of the invention in which the exclusive property or privilege is claimed are defined as follows:

1. Apparatus for uniting sheets of resilient material having adhesively coated edges to be butt-joined comprising a frame having a substantially horizontal table and a platform sloping downwardly from one end of said frame towards said table, a drive roll rotatably mounted on said frame between said platform and said table and a pair of wind up rolls rotatably mounted on the other end of said frame adjacent said table for continuously moving said sheets side by side with said edges adjacent each other down said platform and over said table in a direction substantially parallel with said sheets and said edges, a plurality of idler, crowing rollers rotatably mounted on said platform in advance of and driven by said drive roll through said sheets for continuously moving said sheets towards each other in a direction generally parallel to said edges with said surfaces facing but spaced from each other, means for continuously moving said sheets laterally thereof and towards each other transversely of said direction to crowd said surfaces together in contact with each other in firm adhering relationship, and means for continuously relieving the crowding thereon by spreading the thus united sheets laterally thereof and transversely of said direction.

2. Apparatus in accordance with claim 1 including means for continuously applying along the seam formed by said contacting surfaces a reinforcing strip to said sheets extending across said seam and overlapping said edges.

3. Apparatus in accordance with claim 1 including means for applying a slight sliding pressure continuously to said sheets at said edges in advance of and while said surfaces are brought into contact, means for continuously applying pressure to said sheets after they are contacted to squeeze said adhering surfaces tightly and evenly together.

4. Apparatus in accordance with claim 1 including means for continuously applying along the seam formed by said contacting surfaces a reinforcing strip to said sheets extending across said seam and overlapping said edges.

5. Apparatus in accordance with claim 1 including means for applying a slight sliding pressure continuously to said sheets at said edges in advance of and while said surfaces are brought into contact, means for continuously applying pressure to said sheets after they are contacted to squeeze said adhering surfaces tightly and evenly together.

6. Apparatus in accordance with claim 1 including means for continuously applying along the seam formed by said contacting surfaces a reinforcing strip to said sheets extending across said seam and overlapping said edges.

7. Apparatus in accordance with claim 1 including means for applying a slight sliding pressure continuously to said sheets at said edges in advance of and while said surfaces are brought into contact, means for continuously applying pressure to said sheets after they are contacted to squeeze said adhering surfaces tightly and evenly together.

8. Apparatus in accordance with claim 1 including means for continuously applying along the seam formed by said contacting surfaces a reinforcing strip to said sheets extending across said seam and overlapping said edges.

9. Apparatus for butt-joining sheets of resilient material at least one of which has an adhesive coating on a surface at an edge thereof that is to contact a surface at an edge of the other sheet in butt-joined relation comprising, power driven means for continuously moving said sheets for continuously moving said sheets towards each other in a direction of said direction to crowd said sheets together and thereby join said edges in firm, adhering relationship, means mounted on said platform between said crowding rolls and engageable with said sheets for continuously applying pressure thereto to prevent misalignment of said edges as they are joined, means mounted on said frame for continuously coating a reinforcing tape with an adhesive and driven by said drive roll through said tape for continuously supplying said tape to one side of said sheets over said adhering edges, a squeeze roll adjustable and rotatably mounted on said frame above and in axial parallelism with said drive roll and driven thereby through said sheets and tape for continuously applying pressure to the same after they are united to squeeze said edges tightly and evenly together and to impress said tape on said sheets, a plurality of idler, spreader rollers rotatably mounted on said frame between said table and said wind up rolls and driven by said wind up rolls through said sheets for continuously supplying the united sheets transversely of said direction to relieve the crowding thereof, means mounted on said platform between said spreader rollers and driven wind up rolls for continuously applying air pressure to said tape to firmly bond said sheets thereto, and power operated means mounted on said frame and interconnected with said drive roll and said wind up rolls for positively driving the same in synchronization.

10. Apparatus for butt-joining sheets of resilient material at least one of which has an adhesive coating on a surface at an edge thereof that is to contact a surface at an edge of the other sheet in butt-joined relation comprising, power driven means for continuously moving said sheets for continuously moving said sheets towards each other in a direction of said direction to crowd said sheets together and thereby join said edges in firm, adhering relationship, means mounted on said platform between said crowding rolls and engageable with said sheets for continuously applying pressure thereto to prevent misalignment of said edges as they are joined, means mounted on said frame for continuously coating a reinforcing tape with an adhesive and driven by said drive roll through said tape for continuously supplying said tape to one side of said sheets over said adhering edges, a squeeze roll adjustable and rotatably mounted on said frame above and in axial parallelism with said drive roll and driven thereby through said sheets and tape for continuously applying pressure to the same after they are united to squeeze said edges tightly and evenly together and to impress said tape on said sheets, a plurality of idler, spreader rollers rotatably mounted on said frame between said table and said wind up rolls and driven by said wind up rolls through said sheets for continuously supplying the united sheets transversely of said direction to relieve the crowding thereof, means mounted on said platform between said spreader rollers and driven wind up rolls for continuously applying air pressure to said tape to firmly bond said sheets thereto, and power operated means mounted on said frame and interconnected with said drive roll and said wind up rolls for positively driving the same in synchronization.

11. Apparatus for butt-joining sheets of resilient material at least one of which has an adhesive coating on a surface at an edge thereof that is to contact a surface at an edge of the other sheet in butt-joined relation comprising, power driven means for continuously moving said sheets for continuously moving said sheets towards each other in a direction of said direction to crowd said sheets together and thereby join said edges in firm, adhering relationship, means mounted on said platform between said crowding rolls and engageable with said sheets for continuously applying pressure thereto to prevent misalignment of said edges as they are joined, means mounted on said frame for continuously coating a reinforcing tape with an adhesive and driven by said drive roll through said tape for continuously supplying said tape to one side of said sheets over said adhering edges, a squeeze roll adjustable and rotatably mounted on said frame above and in axial parallelism with said drive roll and driven thereby through said sheets and tape for continuously applying pressure to the same after they are united to squeeze said edges tightly and evenly together and to impress said tape on said sheets, a plurality of idler, spreader rollers rotatably mounted on said frame between said table and said wind up rolls and driven by said wind up rolls through said sheets for continuously supplying the united sheets transversely of said direction to relieve the crowding thereof, means mounted on said platform between said spreader rollers and driven wind up rolls for continuously applying air pressure to said tape to firmly bond said sheets thereto, and power operated means mounted on said frame and interconnected with said drive roll and said wind up rolls for positively driving the same in synchronization.
sheets in a direction generally parallel to said edges with
said surfaces facing but spaced from each other, means
acted by said sheets during movement thereof under
action of said power driven means for continuously
moving said sheets laterally thereof and towards each
other and transversely of said direction to crowd said
surfaces together in contact with each other firmly,
adhering relationship, and means actuated by the thus
united sheets during their continued movement in said
direction under the action of said power driven means
for continuously relieving the crowding thereafter by
spreading the thus united sheets laterally thereof and
transversely of said direction.

10. Apparatus in accordance with claim 9 wherein said
first mentioned means includes means for continuously
applying along the seam formed by said contacting sur-
faces a reinforcing strip to said sheets extending across
said seam and overlapping said edges.

11. Apparatus for butt-joining sheets of resilient ma-
terial at least one of which has an adhesive coating on
a surface at an edge thereof that is to contact a surface
at one edge of the other sheet in butt-joined relation
comprising, a frame, means for continuously moving said
sheets in a direction generally parallel to said edges with
said surfaces facing but spaced from each other, said
means including a driven drive roll mounted on said
frame for pulling said sheets partially through said appa-
tratus, a pair of wind up rolls, at least one of which is
driven, for pulling said sheets through the remainder of
the apparatus, said wind up rolls being mounted on said
frame in spaced relation to said drive roll, first idler roll
means for continuously moving said sheets laterally there-
of and towards each other transversely of said direction
to bring said surfaces together in contact with each other
to crowd said sheets together firmly, adhering relation-
ship, a squeeze roll mounted on said frame opposite said
drive roll and driven thereby through said sheets, said
squeeze roll and said drive roll forming a nip through
which said sheets pass to be continuously pressed to
squeeze said adhering edges tightly and evenly together,
second idler roll means mounted on said frame intermedi-
ate said drive roll and said wind up roll and driven by
the latter through said sheets for continuously spreading
the thus united sheets transversely of said direction just
sufficiently to relieve the crowding thereof, and means
mounted on said frame and operatively connected to both
said drive roll and said driven wind up roll for positively
driving the same in synchronism.

12. Apparatus in accordance with claim 11 including
means for continuously applying along the seam formed
by said contacting surfaces a reinforcing strip to said
sheet extending across said seam and overlapping said
edges.

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