

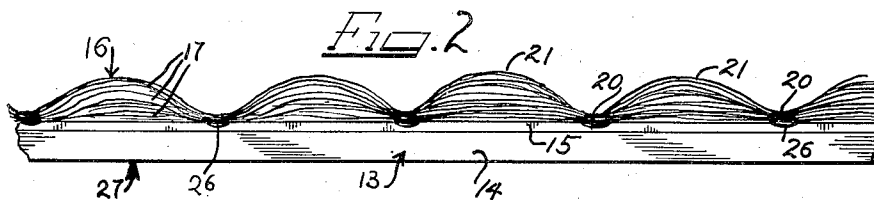
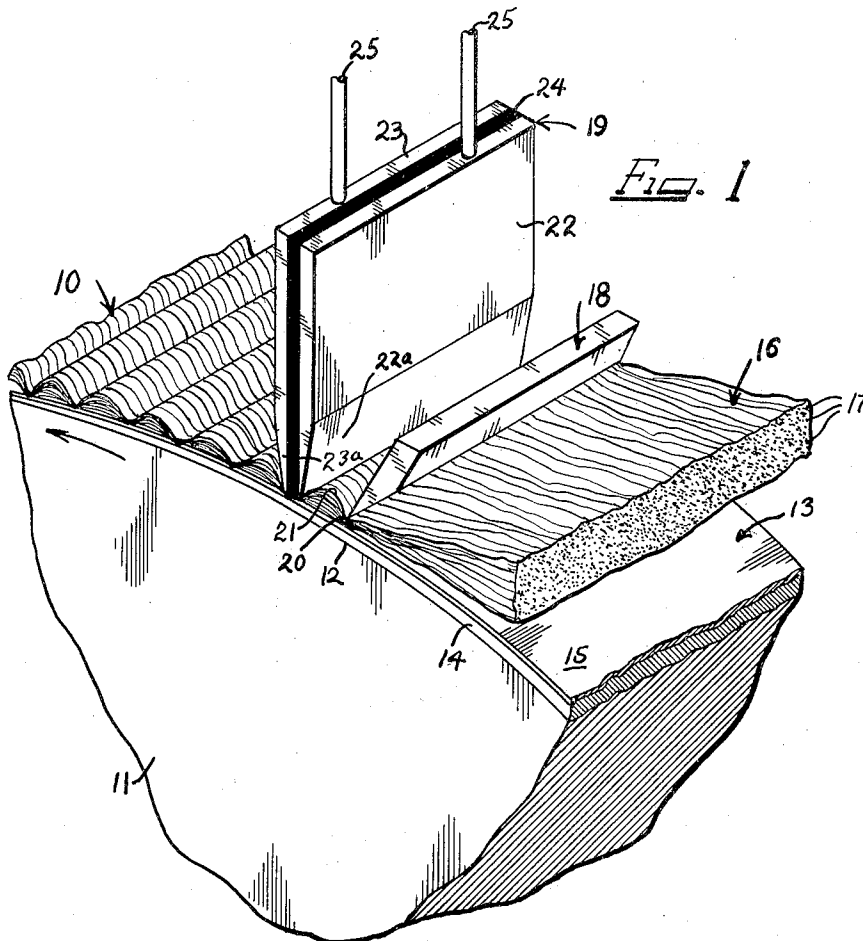
Jan. 10, 1950

C. HEPNER
METHOD AND APPARATUS FOR MAKING
BATT-COVERED SHEETS

2,493,968

Filed Oct. 17, 1946

3 Sheets-Sheet 1



INVENTOR.

BY CHARLES HEPNER

The Firm of Charles H. Hill
ATTYS.

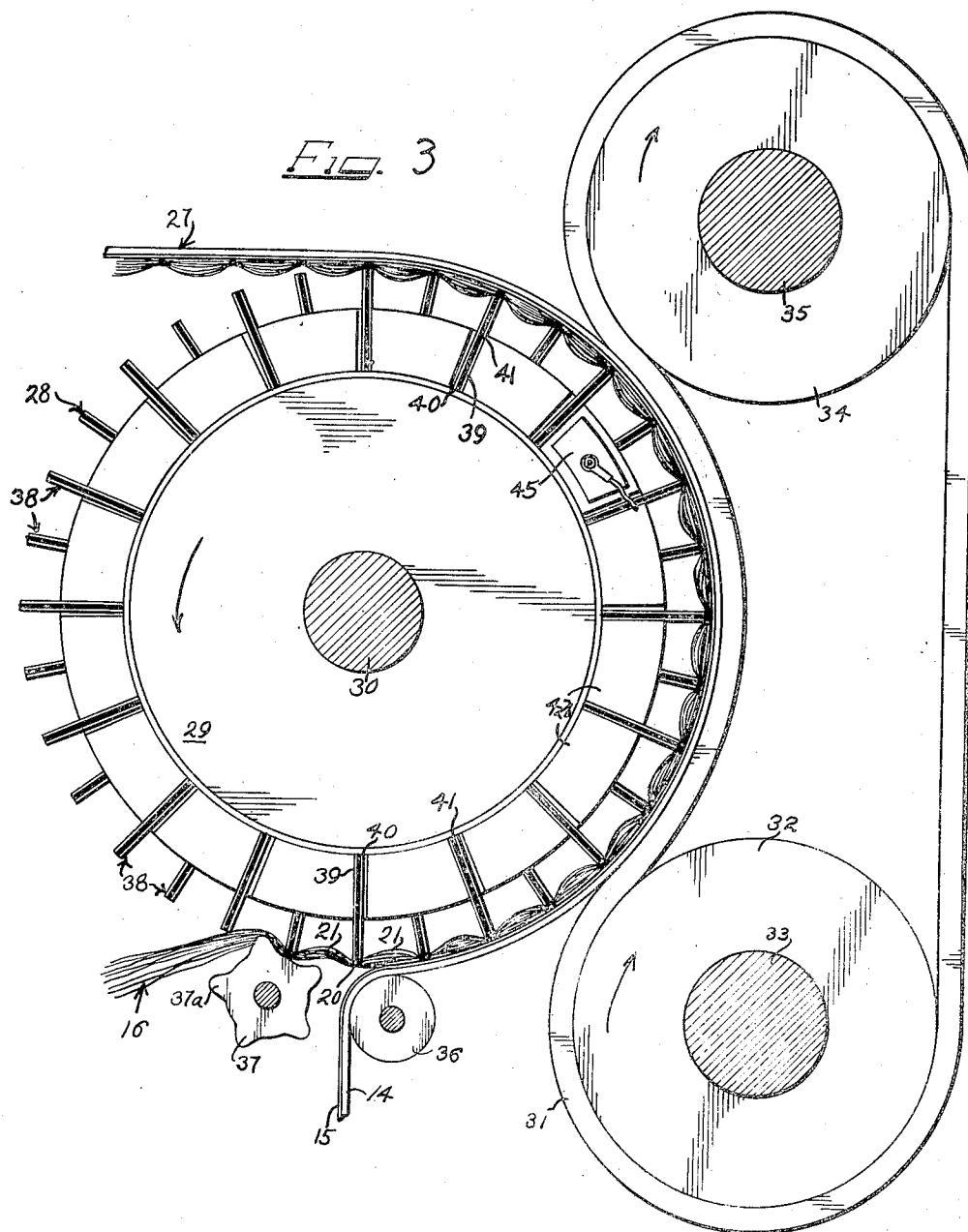
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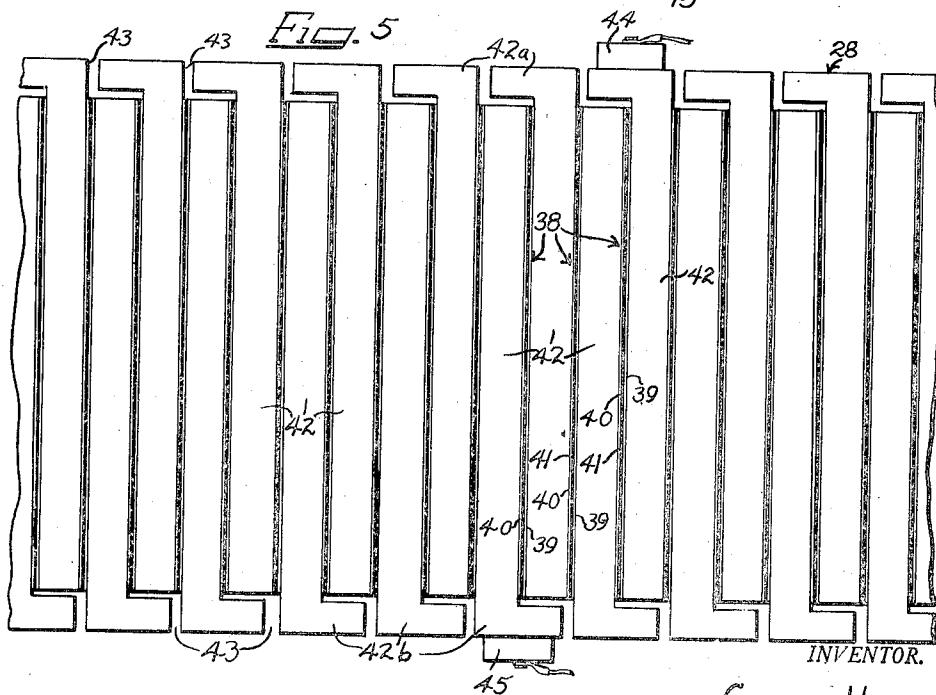
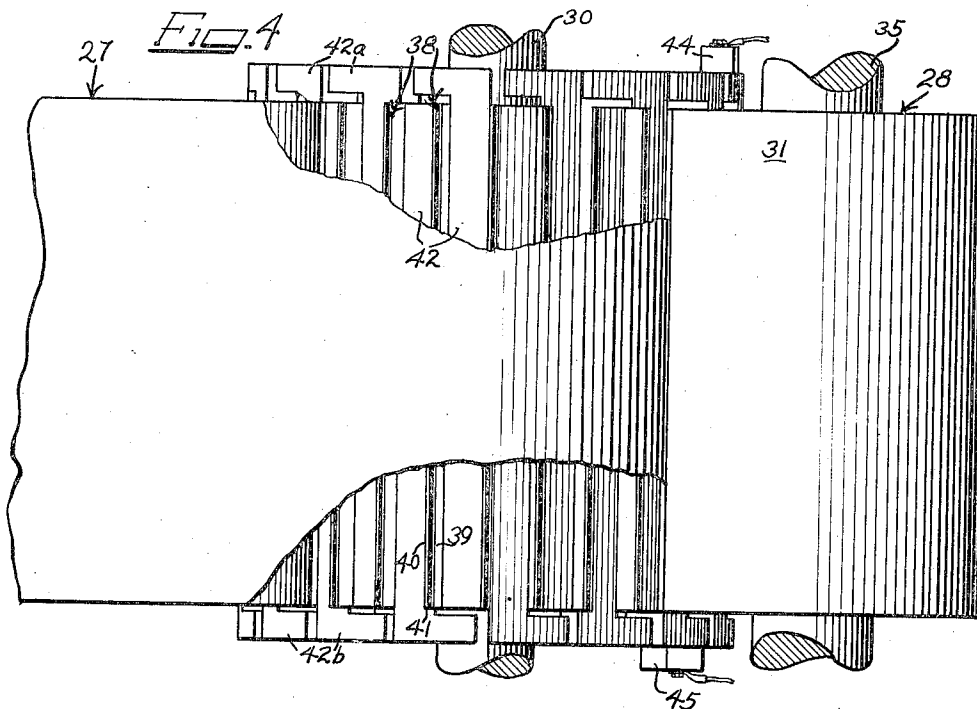
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UNITED STATES PATENT OFFICE

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METHOD AND APPARATUS FOR MAKING
BATT-COVERED SHEETS

Charles Hepner, Chicago, Ill.

Application October 17, 1946, Serial No. 703,912

19 Claims. (Cl. 154-29)

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This invention relates to the manufacture of fibrous batt-covered sheet material such as metal wool-covered paper, and specifically deals with the production of ribbed steel wool pads.

In my Patent No. 2,287,801, granted June 30, 1942, I have described and claimed a scouring pad composed of a backing with a batt of steel wool adhesively united thereto along trough areas thereof to provide a ribbed surface, the crests of which project from the backing and the troughs of which form pockets adapted to receive shavings or chips.

The present invention now deals with methods and apparatus for commercially producing pads such as are described and claimed in my Patent No. 2,287,801. The present invention also deals with the utilization of a thermoplastic coating on backing material such as paper to adhesively unite the fibrous batt to the backing. This thermoplastic material is preferably non-tacky at room temperatures, but becomes tacky when heated to elevated temperatures for receiving the fibers of the batt embedded therein. Upon cooling, the adhesive resumes its hardened, non-tacky condition to fixedly retain the fibers embedded therein. Synthetic thermoplastic resins of the vinyl, alkyl, coumarone-indene, acrylic, and cellulosic types are suitable. Vinyl acetate, for example, has an excellent bond relationship with paper and a good bond relationship with metal.

According to this invention, a sheet of thermoplastic-coated paper, cloth, or the like is advanced on a traveling bed and a batt of grained fibrous material, such as steel wool, is successively fed onto the coated face of the paper or cloth. The fibers in the batt run generally lengthwise of the paper or cloth. A crimping mechanism forms corrugations in the batt extending crosswise of the paper or cloth. The troughs of the corrugations are then engaged by closely spaced parallel blades extending transversely across the grain of the batt. These blades are insulated from each other and an electric current is passed from one blade to the adjacent blade through the narrow band area of the trough engaged by the blades. The flow of electric current across this narrow band area heats the fibers in the area to a temperature sufficiently high for softening the thermoplastic coating. The pressure of the blade then embeds the trough into the coating for adhesively uniting the batt to the backing. Current flow between the closely spaced blades is then stopped and the softened thermoplastic is allowed to cool for permanently bonding the trough areas

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of the batt to the backing. As a result, a ribbed batt on a paper or cloth backing is formed with the trough areas of the ribs being bonded to the backing and with the crest areas of the ribs being resilient and free for abrasive action.

It is, then, an object of this invention to provide commercial methods and apparatus for making scouring and abrading appliances as disclosed in my Patent No. 2,287,801.

Another object of the invention is to provide a method of adhesively uniting fibrous batts to backing material for forming a ribbed pad.

Another object of the invention is to provide an apparatus which will quickly crimp resilient metal batts, such as steel wool pads, on an adhesive coated sheet material and quickly unite trough areas of the crimped batts to the backing.

A still further object of the invention is to provide a method of making metal wool-covered sheet material by locally pressing narrow transverse bands of the batt crosswise of its grain against an adhesive coating on a sheet and immediately thereafter passing an electric current across the pressed band area to heat the wool locally in the band area for softening the adhesive coating to embed the band area in the coating and thereby retain the wool on the backing.

A further object of the invention is to provide electrical apparatus for quickly uniting metal wool batts to a backing material such as cloth, paper, or the like.

Other and further objects of the invention will be apparent to those skilled in the art from the following detailed description of the annexed sheets of drawings which, by way of preferred examples, illustrate several embodiments of the invention.

On the drawings:

Figure 1 is a fragmentary isometric view of one form of apparatus, according to this invention, for producing ribbed fibrous batt-covered sheets according to one method of this invention.

Figure 2 is a side elevational view of a portion of a batt-covered pad produced according to the method of this invention on the apparatus of this invention.

Figure 3 is a side elevational view, with parts in vertical cross section, of another form of apparatus for forming ribbed fibrous batt-covered sheets according to another method of this invention.

Figure 4 is a top plan view of the apparatus of Figure 3 with a portion of the fibrous batt-covered pad broken away to show underlying structure.

Figure 5 is a fragmentary developed plan view

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of the drum of the apparatus of Figures 3 and 4.

As shown on the drawings:

In Figure 1 the reference numeral 10 designates generally one form of apparatus for carrying out one method of producing ribbed or corrugated batt-covered pads according to this invention. The apparatus 10 includes a cylindrical drum 11 providing a traveling bed 12 on its peripheral surface. The bed 12 moves in the direction of the arrow. Backing material 13 composed of a fibrous web 14, such as paper or cloth, and a thermoplastic adhesive coating 15, is fed by the drum 11 under a batt 16 of steel wool or the like fibrous material composed of fibers 17 extending lengthwise of the backing 13. The coating 15 is exposed on the drum surface and receives the bottom broad face of the batt 16 thereon. A reciprocating blade 18 coacts with a heating blade assembly 19 to corrugate the batt 16 transversely of the grain or direction of the fibers 17. The blade 18 crimps the batt to form transversely extending trough portions 20 at spaced parallel intervals leaving crests 21 between the troughs 20. The blade 18 acts at an angle relative to the blade 19 for tucking the batt toward the blade 19, thereby accentuating the crest 21.

The blade assembly 19 also reciprocates toward and away from the batt to successively seat in the troughs 20 as they advance from the corrugating blade 18. The blade assembly 19 is composed of a first resistance element 22 and a second resistance element 23 in closely spaced parallel relationship therewith and separated therefrom by dielectric material 24. The blades 22 and 23 have beveled active end portions 22a and 23a respectively presenting end edges of reduced area to the troughs 20 of the batt 16. These blades are connected by electrical conduits 25 with a transformer which energizes the blades to heat their end edges whenever electrical contact therebetween is established through the engaged metal fibers 17 in the troughs 20 of the batt 16. The blades are composed of material having high electrical resistance, such as stainless steel or Nichrome, and the current flow therethrough, when contact therebetween is established by the fibers 17, is sufficient to heat the blade ends and fibers to temperatures high enough to soften the thermoplastic material 15, immediately under the troughs 20. The heated fibers 17 in the troughs 20 are then pressed by the blade assembly 19 into the softened thermoplastic material for forming bonds 26. Some of the fibers 17 are embedded in the plastic material as best shown in Figure 2. The current supply to the blades 22 and 23 is then cut off, preferably while the blade is still pressing against the fibers, and the thermoplastic material is allowed to cool and harden for permanently bonding the fibers thereto.

While the blades 22 and 23 are preferably composed of resistant material which becomes heated at the blade edges 22a and 23a when current flows between the blades through the fibers 17, it should be understood that the blades could be made of copper or other good electrical-current conducting material, and heat could be generated by the resistance of the fibers 17 to electrical current flowing therethrough between the blades.

The finished pad or batt-covered sheet 27 shown in Figure 2 is thus composed of backing material 13 including a sheet 14, of paper, cloth, or the like, and a thermoplastic adhesive 15 coated on the sheet 14, together with a batt 16 covering the coating 15 and corrugated thereon to provide alternate ribs or corrugations 21 separated by

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troughs or valleys 20. The fibers 17 of the batt material extend generally lengthwise of the backing and transversely of the corrugations. The fibers in the troughs or bottoms of the valley portions 20 are at least partially embedded at 26 in the adhesive coating 15 to integrally bond the batt to the backing. It should be understood that the fibers in the crests 21 are free and resilient, to have abrasive or polishing action on surfaces rubbed thereby. The valleys or troughs 20 between the crests 21 are adapted to receive abraded dust or the like removed by the fibers on the crests to thereby prevent clogging of the securing surface.

Pads or wool-covered sheets 27 are, according to this invention, also commercially produced on apparatus 28 shown in Figures 3 to 5. This apparatus 28 includes a wheel or drum 29 on a horizontal axle 30, a feed belt 31 trained around a lower pulley 32 on a horizontal axle 33 beneath the level of the axle 30, and around a top pulley 34 on a horizontal axle 35 at a level above the axle 30, a feeding roller 36 beneath the drum 29, and a star wheel or fluted roller 37 adjacent the feeding roller 36.

The coated backing material 13, composed of the paper or cloth backing 14 and thermoplastic coating 15, is fed around the roller 36 to present the coated face 15 toward the drum 29. The wool batt 16 is fed over the star wheel 37.

The wheel or drum 29 has a plurality of equally spaced blade assemblies 38 projecting radially from the periphery thereof. The radial spacing of the outer edges of the blades 38 determines the wave length of the crest and trough since, as shown in Figure 3, the star wheel 37 has the points 37a thereof projecting successively into the spaces between the blades 38 for corrugating the batt 16 to lay the crests 21 into the spaces between the blades while causing the extremities of the blades to press against the batt and form the troughs or valleys 20 between the crests.

Each blade assembly 38 is composed of relatively thin spaced parallel blades 39 and 40 preferably composed of electrical resistance material such as stainless steel, Nichrome, or the like. The blades 39 and 40 are separated by dielectric insulation 41.

Commutator segments or bars 42, of good electrical conductivity, such as copper, extend between the blade assemblies 38 and have good contact therewith along their entire lengths. Alternate bars 42 have heads 42a projecting beyond one end of the blades while the bars 42 between these alternate bars have heads 42b projecting beyond the other ends of the blades. These heads 42a and 42b form rims around the drum or wheel 29 with air gaps 43 therein. These air gaps 43 are much narrower than the spaces between the blade assemblies 38.

A first electrical contact brush 44 has sliding engagement with the heads 42a. A second electrical contact brush 45 has sliding contact with the heads 42b. The brushes 44 and 45 are offset, as shown in Figure 5, so that current flow will be established through several sets of blade assemblies 38. As illustrated, current will flow through the bar 42 engaged by the brush 44 to energize the blade 39 engaging one side thereof. If metal wool of the batt 16 bridges the insulation 41 current will flow through the metal wool to the blade 40, thence through the adjacent bar 42 to the next blade 39, thence through the wool to the adjacent blade 40, across the next bar 42 to energize the third blade 39 and thence

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through the wool to the blade 40 from which the current will flow through the adjacent bar 42 to the head 42b and to the brush 45. As illustrated, therefore, three blade assemblies 38 are thereby simultaneously energized. As the drum or wheel 29 rotates, the rims provided by the heads 42a and 42b, being in engagement with the brushes 44 and 45 during the rotation, will cause successive energization of succeeding groups of three-blade assemblies whenever these blade assemblies are covered by electrical conducting batt material 16.

As illustrated in Figure 3, the star wheel feeds the batt to the underside of the drum 29 and corrugates it into the spaces between the blade assemblies 38. The corrugated batt in engagement with the peripheries of the blade assemblies is then fed into engagement with the coated face 15 of the backing assembly 13. The backing material is fed around the roller 36. The batt covered with the backing material is then directed around the peripheries of the blade assemblies into engagement with the belt 31 which forms a traveling bed for the batt and its backing. The troughs 20 of the batt are caused to tightly engage the edges of the blades so that the fibers will establish electrical contact between the blades 39 and 40 of each assembly 38. While the backing material is still covered with the belt 31, groups of three-blade assemblies are successively energized to heat the blades and soften the thermoplastic adhesive 15 thereby embedding the troughs 20 into the softened thermoplastic. The blades are then successively de-energized and allowed to cool while still maintaining their pressure engagement with the troughs. The softened thermoplastic material thereupon hardens to retain the troughs embedded therein.

From the above description it will be understood that the apparatus 28 of Figures 3 to 5 receives the batt 16 at the underside of the wheel or drum 29 and crimps the batt by means of the star wheel 37 into engagement with the blade assemblies which project radially from the wheel. The feed roller then deposits the coated face of the backing assembly 13 onto the crimped batt and as the wheel is rotated, the batt and its backing are advanced to be covered with the traveling belt 31. While the material is still covered with the belt, the blades are heated to soften the thermoplastic material and embed the troughs of the batt into the coating 15. The blades are then allowed to cool while still in pressure engagement with the troughs so that the thermoplastic material can harden and retain the troughs embedded therein.

The above descriptions and examples illustrate methods and apparatus for commercial manufacture of ribbed batt-covered sheets and show wherein a batt of resilient fibrous material such as metal wool is crimped or corrugated transversely of its grain and then subjected to heat over narrow band areas in the trough portions of the corrugations for softening an adhesive on the backing material to become embedded and permanently bonded in the adhesive. Thermoplastic resinous materials form satisfactory adhesives, and are preferably selected so as to be non-tacky at room temperatures, and to have excellent bonding properties with both non-metallic fibrous material, such as paper, cloth, or the like, and metallic fibrous material, such as metal wool batts.

It will, of course, be understood that various

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details of construction may be varied through a wide range without departing from the principles of this invention and it is, therefore, not the purpose to limit the patent granted hereon otherwise than necessitated by the scope of the appended claims.

I claim as my invention:

1. The method of making batt-covered sheet material which comprises corrugating a grained batt of fibrous material to form corrugations therein extending crosswise of the grain thereof, depositing the corrugated batt on the thermoplastic-coated face of a fibrous sheet, pressing the troughs of the corrugations against the coating on the sheet, locally heating the pressed troughs to soften the thermoplastic material and embed the troughs therein, and allowing the thermoplastic material to cool for retaining the embedded troughs thereby fixedly connecting the batt to the fibrous material and forming a ribbed batt surface on the fibrous material.

2. The method of making batt-covered sheets which comprises advancing a thermoplastic-coated sheet on a support, corrugating a resilient batt of fibrous material to form corrugations extending crosswise of the sheet, depositing the corrugated batt on the coated face of the sheet, pressing the troughs of the corrugations against the coating on the sheet, and locally heating the pressed troughs of the corrugations to soften the thermoplastic coating and embed some of the fibrous material of the batt therein.

3. The method of making metal-wool covered sheet material which comprises depositing a batt of metal wool onto a heat-sensitive adhesive coating on a fibrous sheet, locally pressing narrow transverse bands of the batt against the coating, passing electrical current across the bands to heat the wool locally in the band area and soften the adhesive with the heated wool, embedding the heated wool in the softened adhesive, and allowing the softened adhesive to cool for fixing the embedded wool therein.

4. The method of making metal wool-covered sheet material which comprises depositing a grained batt of metal wool onto a heat-sensitive adhesive coating on a fibrous sheet, locally pressing narrow transverse bands of the batt crosswise of its grain against the coating, passing electrical current across the bands to heat the wool locally in the band areas and soften the adhesive with the heated wool, continuing the pressing operation on the narrow transverse band areas after the adhesive has been softened to embed the band areas of the wool into the adhesive, and allowing the softened adhesive to cool and harden for fixing the embedded wool therein.

5. The method of making metal wool-covered sheet material which comprises corrugating a resilient batt of metal wool to form corrugations extending transversely of the grain of the batt, depositing the corrugated batt onto a heat-sensitive coating on a fibrous sheet, pressing a blade assembly into the trough portion of each corrugation, heating the blade assembly to heat the trough portion for softening the coating, and continuing the pressing operation to embed the trough portion into the softened coating for bonding the batt to the fibrous sheet only at the trough portions of the corrugations in the batt.

6. The method of making metal wool-covered paper backed pads which comprises crimping a

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grained batt of metal wool to form corrugations extending transversely of the grains of the batt, depositing the crimped batt onto the thermoplastic-coated face of a paper sheet, advancing the sheet and batt on a traveling bed, pressing spaced parallel blades against the trough portions of the corrugated batt, passing an electrical current between the blades through said trough portions to heat the fibers of the trough portions for softening the thermoplastic coating at said trough portions, continuing the pressing operation to partially embed the trough portions into the thermoplastic coating, and allowing the coating to cool and harden for retaining the embedded fibers therein.

7. The method of making metal wool-covered paper pads which comprises advancing a thermoplastic-coated paper web on a traveling bed with the coated face of the web exposed, feeding a metal wool batt over the traveling web, corrugating the metal wool batt transversely of the grain of the wool and across the width of the web, pressing the troughs of the corrugations against the coated face of the web, and passing an electric current through the pressed troughs for softening the thermoplastic material to adhesively unite the batt to the web.

8. The method of making metal wool-covered paper sheets which comprises corrugating a metal wool batt over radially extending blade assemblies, covering the corrugated batt on said assemblies with the coated face of a thermoplastic-coated paper web, pressing the web against the batt to squeeze the trough areas of the corrugated batt against the coated face of the web, and heating said trough areas to locally soften the coated face of the web for fixedly uniting the batt to the web.

9. Apparatus for forming batt-covered sheet material which comprises a traveling bed adapted to receive a thermoplastic adhesive material-coated sheet thereon with the coated face exposed, means for successively crimping a resilient batt to form corrugations therein extending transversely across the width of the bed and sheet material, and heating means engaging the batt in the troughs of successive corrugations and coacting with the batt to press the trough-defining portions of the batt into the thermoplastic coating on the sheet.

10. Apparatus for forming batt-covered sheets which comprises a traveling sheet support, a corrugating blade coacting with the sheet support, and a heating blade in advance of the corrugating blade and coacting therewith to press the troughs of the corrugations of the batt material against the sheet on the support.

11. Apparatus for forming a ribbed wool-covered paper which comprises a drum adapted to receive a paper web thereover, a blade coacting with said drum adapted to receive a wool batt thereunder to crimp the batt toward the drum, a blade in spaced parallel relation with the corrugating blade, said blade having spaced parallel electrically conducting portions with pointed ends adapted to seat in the troughs of corrugations formed by the corrugating blade, and means for flowing electric current through the blade portions for heating the troughs of the batt.

12. Apparatus for forming wool-covered sheets which comprises a drum having radially projecting blade assemblies, each blade assembly including spaced parallel electric conducting blades and an insulator therebetween, bars between the blade assemblies having good electrical contact there-

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with, alternate bars having head portions projecting from opposite ends of the wheel, brushes engaging said head portions for energizing the bars to cause current to flow from the bars through the blades whenever electrical contact between the spaced blade portions is established, a wheel arranged to corrugate batt material over the blade assemblies, means for feeding a coated web over the corrugated batt on the blade assembly, a traveling belt for backing up said web to press the trough areas of the corrugated batt against the blade assemblies, and said brushes being arranged relative to said heads of the bars for energizing groups of blade assemblies during passage of the belt-pressed batt and web thereover.

13. Apparatus for forming wool batt-covered sheets which comprises a wheel having radially extending blade assemblies, each blade assembly including spaced parallel heat-conductive blades and a separating insulator therebetween, a belt trained to lap a portion of the blade assemblies on the wheel, means for corrugating a batt on the peripheries of the blade assemblies, means for feeding a thermoplastic-coated paper web between the corrugated batt on the blade assemblies and the belt, and means for electrically energizing groups of blade assemblies to flow current through the troughs of the corrugated batt for softening the coating on the sheet to bond the batt to the sheet.

14. Apparatus adapted for uniting metal wool batts to backing material which comprises a wheel, radially extending blade assemblies on said wheel, bars between said blade assemblies, heads on said bars, adjacent bars having the heads thereof projecting beyond opposite ends of the wheel, brushes engaging said heads to energize the bars for energizing the blades, and means for feeding a batt of wool over the blades thereby electrically connecting the blade sections to be energized by said brushes.

15. Apparatus adapted for forming metal wool-covered backing material which comprises a traveling bed adapted to receive backing material thereon, a corrugating device adapted to corrugate metal wool, blade means adapted to engage the troughs of the corrugations produced by said device and coact with said bed to press the troughs against the backing material, and means for energizing the blade means to unite the troughs to the backing material.

16. In the method of making metal wool-covered sheet material by securing a corrugated batt of metal wool to a thermoplastic adhesive coated backing sheet, the steps which comprise pressing the troughs of said batt into surface engagement with the adhesive layer on said backing sheet, passing an electric heating current through that portion of said troughs held in contact with said layer to locally soften the pressed area of the thermoplastic and embed the troughs in said adhesive coating whereby upon subsequent cooling of said batt and said backing sheet the corrugated batt is securely anchored to the backing sheet.

17. In the method of making metal wool-covered paper backed pads by securing a corrugated batt of metal wool to a paper backing having a layer of temperature-sensitive material deposited thereon, the steps which comprise pressing the troughs of said batts into surface engagement with the adhesive layer on said paper sheet, passing an electric heating current through that portion of said trough in contact with said layer, and maintaining said trough in contact with said

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layer until the adhesive cools to retain said batt in position upon the paper sheet.

18. Apparatus for forming batt-covered sheet material which comprises a continuous backing surface adapted to convey a fibrous web having a non-tacky thermoplastic adhesive coating deposited thereon, means for directing an elongated corrugated batt onto said backing surface in contact with said adhesive coating, means for engaging the batt in successive troughs to press the batt against said coating, and means for passing an electric heating current through said batt material to locally soften said coating while pressing said batt into contact therewith for embedding the troughs of said batt in said coating.

19. Apparatus for forming batt-covered sheet material which comprises a continuous backing surface adapted to convey a fibrous web having a non-tacky adhesive coating deposited thereon, means for directing an elongated corrugated batt against said backing surface in contact with said adhesive coating, a pair of electrical resistance elements extending across the width of

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said batt for engaging one surface of the corrugated batt in the troughs thereof to press the same into engagement with said coating and means for passing an electric current through said resistance elements and said trough to locally soften said coating while pressing said batt there against to embed the troughs of the batt in the coating.

CHARLES HEPNER.

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