

[72] Inventor **Elisha Winthrop Hall, Jr., 89 Neal Gate, Scituate, Mass.**  
 [21] Appl. No. **51,444**  
 [22] Filed **July 1, 1970**  
 [45] Patented **Aug. 10, 1971**  
 Continuation-in-part of application Ser. No. 676,902, Oct. 20, 1967, now abandoned.

[56]

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Primary Examiner—Harold D. Whitehead

Attorney—John Noel Williams

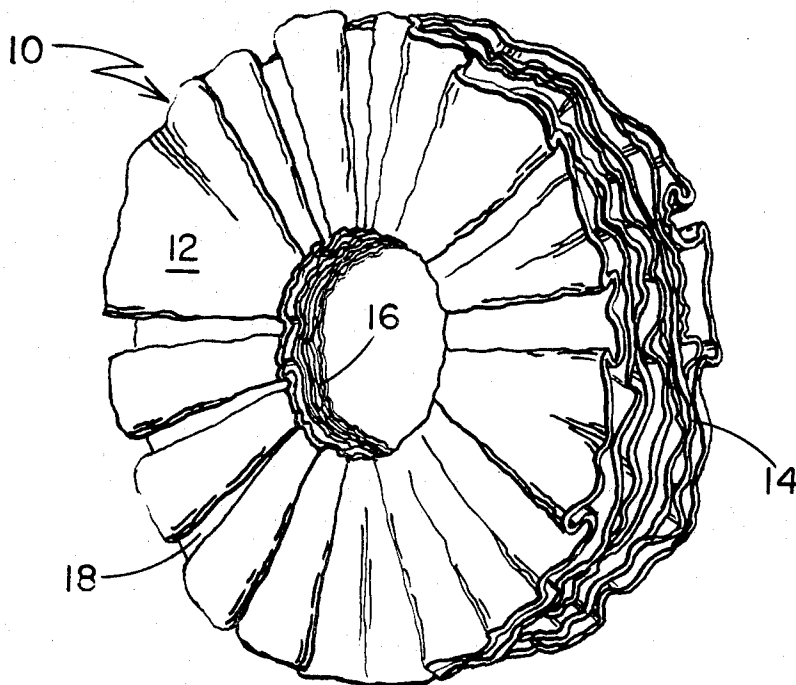
[54] **RESILIENT ABRASION**  
 10 Claims, 7 Drawing Figs.

[52] U.S. Cl..... **51/395,**  
 51/400, 51/295

[51] Int. Cl..... **B24d 11/00**

[50] Field of Search..... 51/295,  
 298, 334, 358, 394, 395, 400, 402

**ABSTRACT:** A buffing member comprising a multiplicity of thin, flexible elements secured for rotation about an axis and adapted to wipe across a workpiece wherein each element comprises a substrate in the form of a sheet member of a fibrous mesh, synthetic resinous elastomeric substance comprising elastomeric foam permanently bonded in and to the mesh, and a distribution of abrasive substance permanently bonded to the foam.



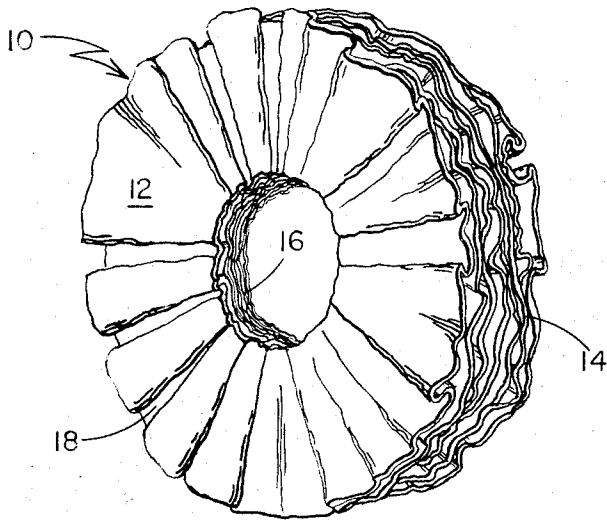


FIG. 1

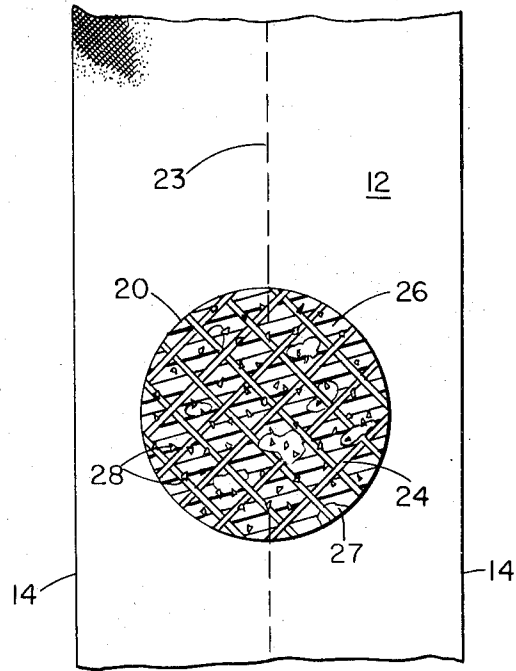


FIG. 2

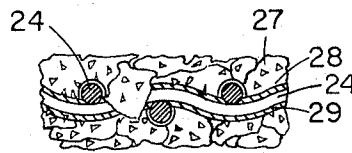


FIG. 4

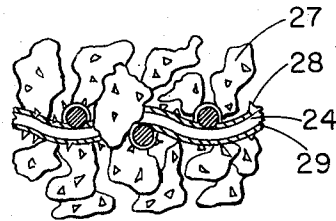


FIG. 3

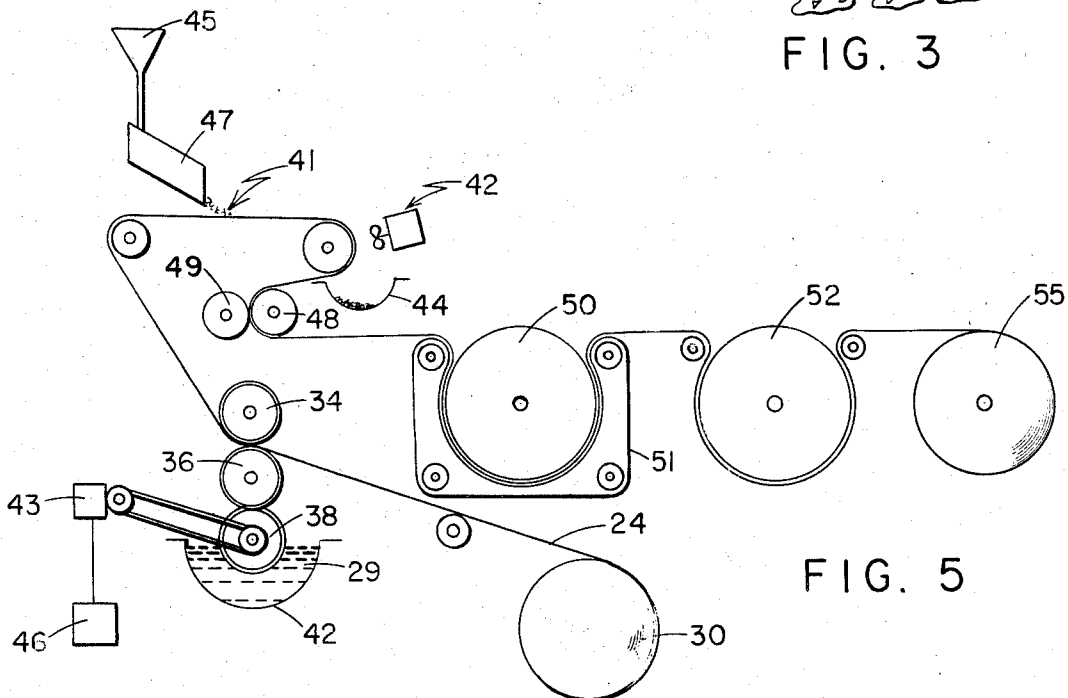
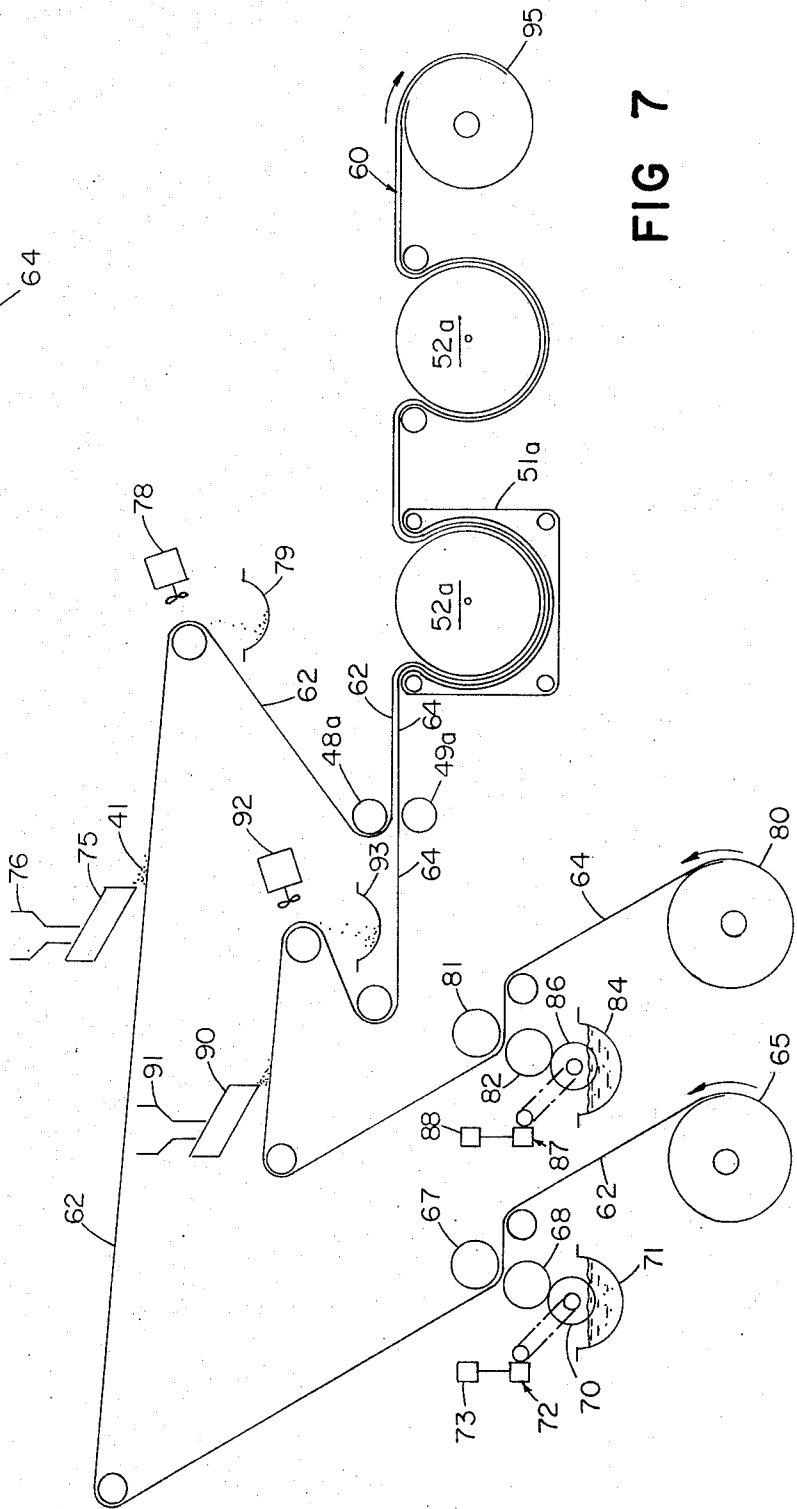
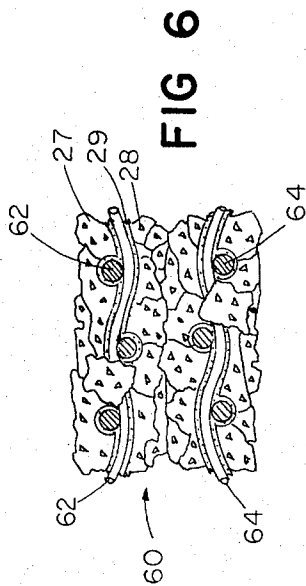


FIG. 5



## RESILIENT ABRASION

This application in a continuation-in-part of application Ser. No. 676,902, filed Oct. 20, 1967, and now abandoned.

This invention relates to buffing wheels and the like.

One object of this invention is to provide a buffing wheel that has a durable, flexible, self-renewing peripheral working surface and edge which may be employed without application of auxiliary compounds.

Other objects are to provide a buffing or polishing member composed of improved sheet form members which are capable of withstanding severe folding and pleating and easily condensable from a drum-shaped roll.

Another object is to provide a method of making sheet form members for buffing or abrasive members which is easy, rapid, economical, and substantially continuous.

The invention features a buffing member comprising a multiplicity of thin, flexible elements secured for rotation about an axis, e.g., a shaft, and adapted to wipe across a workpiece; each of the elements comprises a substrate in the form of a sheet member of a fibrous mesh, a synthetic resinous elastomeric substance comprising elastomeric foam permanently bonded in and to the mesh, and a distribution of abrasive substance permanently bonded to the foam.

In specific embodiments the major portion by weight of each element, apart from abrasive, is comprised of the synthetic resinous elastomeric substance; the synthetic resinous elastomeric substance comprises a mixture of preformed elastomeric foam particles and unfoamed elastomeric bonding agent, the foam particles being bonded to the fibrous mesh in a compressed state; at least a substantial portion of the synthetic resinous elastomeric substance is a polyurethane resin; and the fibrous mesh is formed of flexible fibers.

In one particular embodiment the elements comprise annular discs of the sheet material held in a drawn together state at a radius smaller than the radius of the sheet material in its unassembled state; the annular sheet form elements thereby present a pleated self-renewing peripheral working edge comprised of the fine abrasive substance and the synthetic resinous elastomeric substance.

In one embodiment, also, the buffing elements each comprise two fibrous mesh substrates, with foam bonded in and to both of the substrates and sandwiched and bonded therebetween to bond the substrates together.

The invention also features a method for forming a limp sheet member having substantially permanent buffing or abrasive qualities, comprising coating at least one surface of a fibrous mesh with an elastomeric bonding agent, spreading on the mesh an abrasive layer comprising foam and abrasive grains, removing so much of the abrasive layer as remains free of the bonding agent, introducing the coated mesh and adhering material between compressing surfaces to compress the foam, and at least partially curing the adhering material after compression.

Other objects, features and advantages will appear from the following description of a preferred embodiment of the invention, taken together with the attached drawings in which:

FIG. 1 is a buffing wheel of the preferred construction;

FIG. 2 is a plan view of a preferred sheet form element with the encircled section shown in exaggerated diagrammatic form;

FIGS. 3 and 4 are magnified diagrammatic cross sections of the elements before and after compression, respectively;

FIG. 5 is a preferred production line, partially diagrammatic, for making the preferred sheet elements;

FIG. 6 is a magnified cross section of another sheet form element; and,

FIG. 7 is a preferred production line for making the elements of FIG. 6.

In FIG. 1 buffing wheel 10 is of conventional overall form comprising a multiplicity of limp radial elements 12 having

peripheral working edge portions 14, folded and drawn together at annular opening 16, and having pleats 18 extending substantially from opening 16 to working edge portion 14. Radial elements 12 are substantially free from one another and hence are capable of relative radial and circumferential shifting movements. The radius of annular opening 16 is substantially smaller than the radius of the sheet material in its pregathered and prefolded state.

In FIG. 2 the exaggerated diagrammatic magnification 20 of sheet form element 12 shows a reinforcing open mesh substrate 24 formed of flexible fibers (e.g., fiber glass mesh) and synthetic resinous elastomeric substance 26, carrying abrasive grains 28, and interlocked firmly in and about web 24. Preferably, as shown more clearly in FIGS. 3 and 4, the synthetic resinous elastomeric substance 26 comprises a mixture of a large number of preformed elastomeric foam members 27 (preferably a urethane foam) bonded together and to abrasive grains 28 by an elastomeric bonding agent 29.

In FIG. 3 preformed elastomeric foam particles 27 are shown in an uncompressed state, at least partially filling the interstices of the fibrous mesh substrate 24, and also disposed on both sides thereof. Elastomeric bonding agent 29 is shown, in FIG. 3, as primarily covering the fibers of mesh 24, and thereby securing foam members 27 and grains 28 to the fibers. In FIG. 4 after compression the foam particles 27 have been reduced in size and both particles 27 and grains 28 have become intimately commingled with bonding agent 29 and with mesh 24 to form an integral abrasive sheet.

The abrasive grains are preferably of substantially smaller average size than the preformed resilient foam members in their uncompressed state. Because abrasive grains are substantially uniformly dispersed throughout the synthetic resinous elastomeric substance, and hence throughout mesh 24, an operable buffing surface will be continually regenerated despite wearing away of the original working edge portion 14.

Other foam materials include vinyl foams and "Ionomer" foams (available from the Gilman Brothers Company, Gilman, Connecticut, reported to be manufactured from duPont trademark "Surlyn" resin). Among the bonding agents 29 which may be used with polyurethane foams, (and also generally with vinyl and Ionomer foams) for foam-abrasive, foam-foam, and foam-substrate adhesion are the urethane adhesives such as "Vultabond" 15-S-9 (an uncured bonding agent of flexible urethane, available from General Latex and Chemical Corp.), polyamide adhesives such as "Versamid 125" (available from General Mills Corp., and which is an amine-terminated polyamide resin being the reaction of polymeric fat acids and aliphatic polyamines, with a viscosity of about 50,000 cp. at 70° F. and an amine value of 305 grams of resin per amine equivalent); the relatively rigid epoxy resins, such as Shell "Epon-828" (the reaction product of bisphenol-A and epichlorohydrin, having an epoxy number of 190 grams per epoxide equivalent and a hydroxy number of 80 grams per hydroxy equivalent), and "Epitex 101" (an alkyl-modified epoxy available from Jones Dabney Co.); and the softer rubbery adhesives such as butadiene-acrylonitrile copolymers (e.g., a 60:40 butadiene acrylonitrile ratio, available in the B. F. Goodrich "Hycar" series).

The fibrous web may be, e.g., fiber glass. Preferably, on the average per unit area, the synthetic resinous elastomeric substances will have a greater weight than the web 24.

In FIG. 5 fibrous mesh 24 is fed from roll 30 between rollers 34, 36. Roller 36 receives elastomeric bonding agent 29 from roller 38, which rotates through bonding agent reservoir 40, the amount of bonding agent removed by roller 38 depending on its rate of revolution, which in turn is controlled by variable speed element 43, through suitable drive means 46. Shaker 47 communicates with hopper 45 and deposits abrasive substance 41, preferably comprising discrete preformed resilient foam members with abrasive grains substantially uniformly bonded thereto (e.g., by premixing with a suitable bonding agent 29), onto moving coated substrate mesh 24. Blower 42

forces so much of abrasive substance 41 as remains free of unfoamed bonding agent 29 into excess abrasive collector 44. Fibrous mesh 24 and the abrasive mixture 41 are squeezed by roller members 48, 49 and pass between compressing belt 51 and heated drum 50, where they are compressed and cured. Second heated drum 52 may be supplied to assure complete curing of the elastomeric adherents. The cured sheet form member is then rolled onto takeup drum 55 whereon it may be stored until needed.

FIG. 6 shows cross section of a portion of a sheet form member 60 differing from members 12 only in having two open mesh substrates 62, 64, instead of one substrate 24. Each substrate 62, 64 is formed of flexible fibers (e.g., fiber glass mesh). Sandwiched between the substrates and interlocked firmly in and to the fibers of each substrate is an abrasive mixture comprising a large number of preformed elastomeric foam members 27 (preferably a urethane foam) bonded together and to abrasive grains 28 by an elastomeric bonding agent 29. The particles 27 are in a compressed state, reduced in size, and the particles 27 and grains 28 are intimately comingled with bonding agent 29 and mesh substrates 62, 64 to form a unitary abrasive sheet.

The use of two, rather than one mesh substrate, increases wear life by providing a better reinforced abrasive sheet, and also by allowing the sheets to be made in greater thicknesses (since a substantial amount of abrasive mixture may be sandwiched between the two mesh substrates), without any sacrifice to flexibility. These members 60 may be used in forming buffing wheels such as shown in FIG. 1.

In FIG. 7, for making members 60, fibrous mesh 62 is fed from roll 65, between rollers 67, 68. Roller 68 receives bonding agent 29 from roller 70, which rotates through bonding agent reservoir 71, the amount of bonding agent removed by roller 70 depending on its rate of revolution, which in turn is controlled by variable speed element 72, through suitable drive means 73. Shaker 75 communicates with hopper 76 and deposits abrasive substance 41 (preferably, discrete preformed resilient foam members with abrasive grains uniformly bonded thereto, e.g., by premixing with a suitable bonding agent 29), onto moving coated mesh 62. Blower 78 forces so much of abrasive substance 41 as does not adhere to the bonding agent on the mesh into collector 79.

At the same time, substrate 64 is fed from roll 80, between rollers 81, 82, the latter roller 82 applying bonding agent received from reservoir 84 by roller 86. Roller 86 is driven, as was roller 70, by suitable variable speed element 87 and drive means 88. Shaker 90 deposits abrasive substance 41 from hopper 91 onto the moving coated web 64. An optional blower 92 may be used to force so much of the abrasive substance 41 as does not adhere to the bonding agent on the mesh into collector 93. Where a thicker deposit of abrasive substance is desired, the blower may be eliminated and the mesh 64 led directly to roller members 48a, 49a, where the two mesh substrates are squeezed together. The two substrates, with foam particles now sandwiched therebetween, pass, as previously described for a single substrate element, between compressing belt 51a and heated drum 50a, where they are compressed and the bonding agent cured or set. Second heated drum 52a may be added to assure complete curing. The integral sheet form member 60a is then rolled onto

takeup drum 95.

As shown in FIG. 6, the resultant member 60 has foam particles 27 bonded in and to both substrates 60, 64, in a compressed state, and also bonded to other particles 27 between the substrates so that the two substrates are bonded together through the intermediate foam particles.

Other embodiments will occur to those skilled in the art and are within the following claims.

What I claim is:

1. A buffing member comprising a multiplicity of thin, flexible elements secured for rotation about an axis, and adapted to wipe across a workpiece, each of said elements comprising a substrate in the form of a sheet member of a fibrous mesh, synthetic resinous elastomeric substance permanently bonded in and to said mesh comprising elastomeric foam, said foam bonded in and to said fibrous mesh, and a distribution of abrasive substance permanently bonded to said foam.
2. The buffing member of claim 1 wherein said foam is in a compressed state.
3. The buffing member of claim 2 wherein the major portion of the weight of said element, apart from said abrasive substance, is comprised of said synthetic resinous elastomeric substance.
4. The buffing member of claim 2 wherein abrasive substance is distributed through said mixture.
5. The buffing member of claim 2 wherein said fibrous mesh is formed of flexible fibers.
6. The buffing member of claim 2 wherein said elements comprise annular discs of said sheet material held in a drawn-together state at a radius smaller than the radius of said sheet material in the unassembled state, said annular sheet form elements thereby presenting a pleated self-renewing peripheral working edge comprised of said fine abrasive substance and said synthetic resinous elastomeric substance.
7. The buffing member of claim 2 wherein each of said elements comprises an additional substrate in the form of a sheet member of a fibrous mesh, said foam is bonded in and to said additional mesh, and said meshes are bonded to one another through foam sandwiched and bonded between said meshes.
8. A buffing member comprising a multiplicity of thin, flexible elements secured for rotation about an axis, and adapted to wipe across a workpiece, each of said elements comprising a substrate in the form of a sheet member of a fibrous mesh, synthetic resinous elastomeric substance permanently bonded in and to said mesh comprising a mixture of preformed elastomeric foam particles and elastomeric bonding agent, said foam particles bonded in and to said fibrous mesh in a compressed state, and a distribution of abrasive substance permanently bonded to said particles by said elastomeric substance.
9. The buffing member of claim 8 wherein said preformed elastomeric foam particles are formed of polyurethane.
10. The buffing member of claim 8 wherein each element includes an additional substrate in the form of a second sheet member of a fibrous mesh, and said form particles are bonded in and to said additional substrate in a compressed state and bonded to other particles between said substrates, and therethrough to particles bonded in and to the first said substrate.