

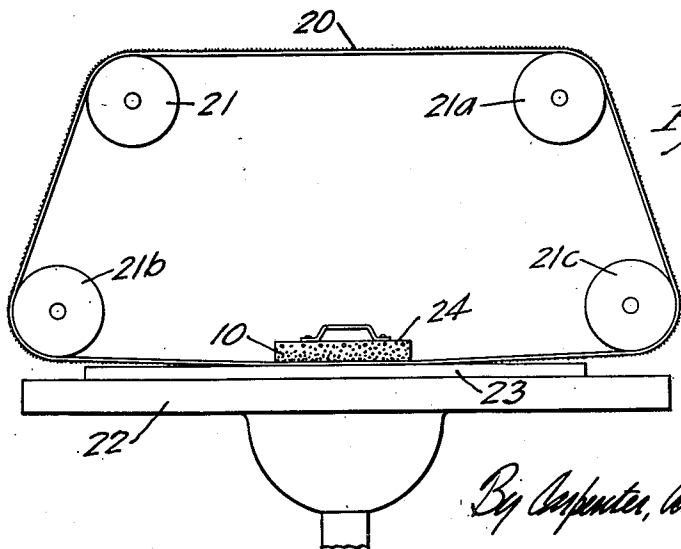
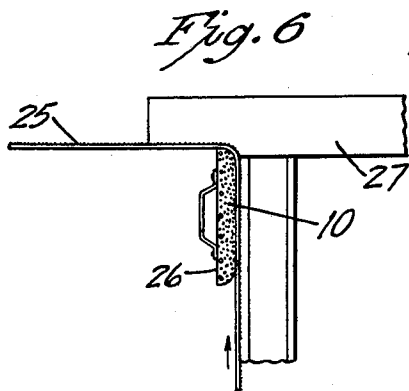
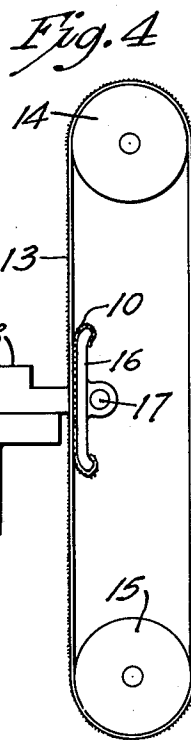
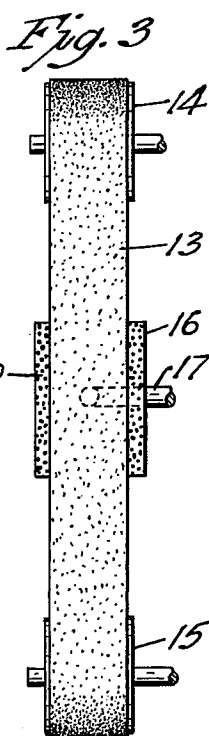
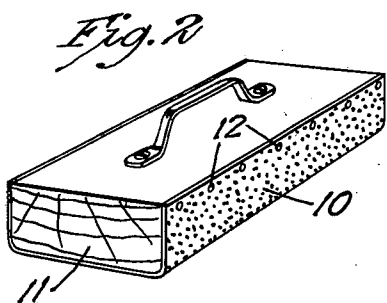
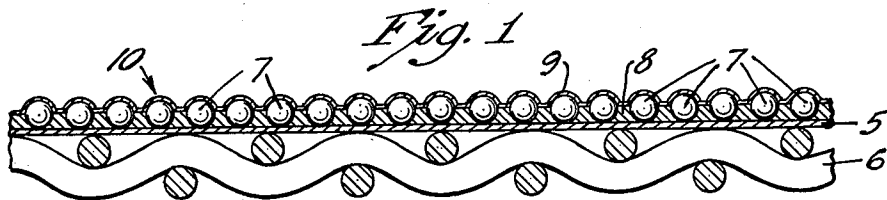
April 7, 1953

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2,633,679

FACING SHEET FOR MACHINE SANDING WITH COATED ABRASIVES

Filed Nov. 17, 1949



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UNITED STATES PATENT OFFICE

2,633,679

FACING SHEET FOR MACHINE SANDING
WITH COATED ABRASIVES

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Application November 17, 1949, Serial No. 127,838

5 Claims. (Cl. 51-141)

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This invention relates to an accessory for use in machine sanding with surface-coated abrasive belts, and particularly to a composite sheet for covering a platen or block used for support of, or pressing action against, a coated abrasive belt at the point where a workpiece is brought into contact with the abrading side of the abrasive belt.

An abrasive belt sanding machine usually comprises an endless abrasive belt mounted on two or more rollers or pulleys, one of which is powered to provide means for driving the belt. In one form of machine there may be a stationary platen adjacent the back side of the abrasive belt at a span thereof between two rollers. It is this platen which backs up or supports the moving abrasive belt when the workpiece being abraded is pressed against the front or abrasive side of the belt. In another form of machine, a stationary platen is not used, but in its stead the operator presses a trowel-like block against the back side of a belt passing over the workpiece. In this latter form of machine the operator can move the block to press the moving belt against any portion of the workpiece where particular abrading action is desired.

In both of the above-described ways for bringing the abrading face of an abrasive belt into action on the workpiece, serious problems have been involved by reason of surface friction between the block or platen and the back side of the moving abrasive belt in pressure contact therewith. The belt may be moving anywhere from 2500 to 5000 feet per minute and the heat produced by the drag between the belt and the stationary platen, or the block held by the operator, is very considerable; in some cases being sufficient to soften the adhesive by which the abrasive grains are secured to the belt, permitting them to be tipped from their oriented position or dislodged from the sheet. Furthermore, where a hand block is used, the friction between it and the belt makes it difficult for the operator to hold the block in proper position, particularly when it is necessary for him to apply a considerable amount of pressure thereon. It is desirable to reduce the friction between the block and the back side of the belt so that the operator can apply more pressure to the block, thrust the abrasive grains into the workpiece, and thus get increased cutting action by the belt.

A number of expedients have been adopted to provide a covering material for platens and/or hand blocks to reduce the amount of friction between said pressing members and the belt. For instance, a piece of canvas, floor carpeting or the

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like, has been coated with shellac, and, while the shellac coat is still tacky, then sprinkled with powdered graphite. Three or four succeeding coats of shellac and powdered graphite have been applied. The resultant product is then wrapped around a pressing block for application to the belt by the operator. This form of covering material has not been successful, for the reason that it does not for very long present a fully planar pressing surface to the belt and must soon be replaced. The frictional heat of the traveling belt against such a cover wears the surface unevenly, being likely to cause more wear on the edges of the block and leave a high spot in the central portion thereof. As a result, if the operator applies considerable pressure to the block, the uneven profile thereof is sanded into the workpiece. If less pressure is applied, only a small portion of the abrasive belt is brought into pressure contact with the workpiece, since in such case the pressure comes only at the high spots on the block.

An object of our invention is to overcome the difficulties which arose through use of prior art coverings, such as those above described. A further object of our invention is to reduce materially the frictional drag between the pressing member and the belt. Our improved facing sheet also has the very important advantage of what may be termed individual "point" contact between the pressing surface of the sheet and the belt, as will be hereinafter described.

Briefly, the subject of our invention is a flexible facing sheet, to which a layer, comprising a multitude of hard, smooth and minute globular bodies of substantially equal diameter, has been bonded. Said bodies are adhered to the sheet so that an approximately equal spheroidal portion of each protrudes from the adhesive coat. The bodies are distributed over the surface of the sheet so that the broadest cross sections of adjacent bodies are substantially contiguous. The bodies being globular in shape, protruding portions thereof, along the surface of the sheet, recede from each other to form a multitude of individual and separate rounded tips, with interstices between. These tips, in the aggregate, form the actual pressing surface of the material. Because of the very close proximity of the tips, positive pressing action is obtained over the entire surface area of the sheet. Yet, because of the interstices between the tips, the area of contact between the pressing surface of the sheet, and the belt is much less than it would be in a pressing sheet having a truly continuous surface, i. e. not having the sur-

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face interstices of our sheet. Because of this reduced area of contact, heat-producing friction, so troublesome in prior art covering materials, has been eliminated as a serious problem where our sheet is used. Furthermore, the individual pressing "points" formed by the protruding tips, give a positive thrust to the abrasive belt so that the cutting action thereof is materially increased.

In order to fulfill their function as a friction-reducing medium, the globular bodies adhered to the sheet should be smooth surfaced and made of material which will not soften under the amount of heat generated by the drag between them and the belt. They also must have sufficient hardness so that they will not be deformed (and thus lose their function as individual contact points) under the amount of pressure to which they are subject in operation. They must also have surface characteristics which will permit them to be securely bonded to the backing.

We have found that the necessary characteristics above-mentioned are combined in glass beads, and, in view of the fact that such beads are inexpensive and easy to obtain, we prefer to use them. Ordinary lime glass such as is used in the manufacture of glass containers or window panes is suitable. There are, however, numerous other materials which can be used. For instance, iron, steel or other metal alloys possess suitable characteristics, as do certain hard, heat-resistant plastic materials or vitreous materials such as porcelain.

As above pointed out, the purpose of the glass beads or other globular bodies on the sheet is to provide a multitude of separate, but very closely adjacent, contact points between the pressing member and the moving abrasive belt. In view of this intended function, there are limitations upon the size of beads which may successfully be used. If the beads chosen are too small, their pressing areas will be so closely adjacent that they will fail to function as separate pressing contacts. That is, in a coating of such size beads the interstices between the protruding tips of the beads are so insignificant that the desired point contacts of pressure are lost. Furthermore, in view of the fact that the area of surface contact (and thus the friction) between the sheet and the belt is reduced by the amount of gap between the protruding tips of the beads, it is desirable that larger beads be used so that these gaps or interstices will be of significant size. On the other hand, if the beads chosen are too large, the gaps between the bead tips will be so wide that certain areas of the belt passing thereover will not be thrust into the workpiece. In other words, the bead tips will be so far apart that continuous pressing action will not be obtained, and the isolated bead tips may "groove" the workpiece.

It is necessary to achieve the proper balance between contact points and open space. If there are too few contact points (excessively large beads, or beads spaced too far apart), the belt will not be uniformly thrust into the workpiece; if there are too many contact points (excessively small beads and insufficient open space), heat producing friction will not be adequately reduced nor will individual "point" contact result.

We have found that full advantage of the unique properties of our composite sheet is not obtained if beads smaller than .008 inch in diameter or larger than .0237 inch in diameter are used, although the sheet will function with impaired efficiency when beads outside these limits

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are applied. A particularly advantageous balance, as above stated, is obtained when a Number 8 or Number 9 glass bead is used. Such beads have a diameter of from .01 to .016 of an inch, and there are from 3000 to 6000 of them upon a square inch of beaded sheet material. When such size bead is used a nice balance between open area and contact area is achieved.

The backing for the composite sheet should be a tough, tear-resistant material which will, for a long period of use, withstand the drag imposed upon it by the traveling abrasive belt without breaking or fraying at the points where it is creased over the sides of the block or platen. It should be sufficiently flexible to conform to the surface of the member to which it is affixed, and must, furthermore have a surface to which the bead-bonding coat will adhere. We have found that a fabric material adequately fulfills these requirements. For instance, a drills cloth having a 76 x 46 thread count and weighing about 17 to 18 pounds per ream is especially suitable. However, fiber material or paper which has the required toughness may be used in place of the preferred fabric backing.

In order to render the preferred fabric backing more water-resistant, to unify the fibres thereof and increase its strength and to make the bonding coat more adherent thereto, it may be saturated in a solution composed of, for example, a vinyl acetate emulsion and a maleic anhydride derivative. Such solution is extremely impervious to water and at the same time is very flexible. A saturation weighing 23 to 26 grains (dry weight) per 24 square inches of material is adequate. After saturation, the fabric may be heated to 150-160° to dry. One vinyl acetate emulsion which performs satisfactorily has the following composition:

	Parts
Water	3300
Polyvinyl alcohol	37
Sodium bicarbonate	15
Sodium lauryl sulfate	30
Vinyl acetate monomer	1953
Di 2-ethyl butyl maleate monomer	446
Ammonium persulfate	18

The water, polyvinyl alcohol, sodium bicarbonate, and sodium lauryl sulfate are mixed and heated in a suitable container to 135-140° F. The vinyl acetate monomer and ammonium persulfate are then added, and the batch is held at 138-140° F. for about 30 minutes to allow the exothermic reaction to take place. The maleate monomer is then slowly added, the temperature being held at 138-140° F. for about 30 minutes and then allowed to rise to 185° F. for the final reaction.

In order further to seal the fabric backing, to provide additional anchorage for the bonding coat, and to control the penetration of the adhesive bond into the backing, a presize coating may then be applied to the saturated backing. One such presize coating material which has been used with successful results is a polyvinyl acetate solution, the specific composition of which is hereinafter set forth.

Example 1

	Parts
Polyvinyl acetate	20
Ethyl alcohol	40
Xylol	40

These ingredients are mixed and then agitated in a suitable container until a clear solution is

attained. In the example above shown, the polyvinyl acetate used was that manufactured by the Union Carbide and Carbon Corporation, New York, N. Y., and sold by it under the trade-mark "Ayat." Other thermoplastics such as polyvinyl butyrol, ethyl cellulose, etc. can be used in the presize and/or impregnating solution, but the polyvinyl acetate is preferred because of the general availability of the solvents above shown. After application of the presize solution the coated web may be run through an oven at 150 to 160° F. to dry.

The beads must be secured to the treated backing by a tough, abrasion and heat resistant, flexible bonding coat which has high and permanent adhesion to the beads and to the backing. There are various adhesives which possess these qualities to a greater or less degree. For instance, certain compositions of the thermoplastic variety, such as polyvinyl butyrol, ethyl cellulose and the like may be used. Certain well known urea formaldehyde resins may also be used if they are first plasticized by an alkyd resin to render them less hard and brittle. However, we have found that the best combination of qualities needed in the bond coat is found in a material having a varnish base or, more specifically, an oil modified alkyd resin. One particular reason why this type of bond coat is preferred is that it has greater resistance to constant abrasive wear than an adhesive of the synthetic thermoplastic type. An example of a modified drying oil bond which has been used successfully is given hereinbelow:

Example 2

	Parts
Dehydrated castor oil.....	660
Linseed free fatty acids.....	1060
Glycerine	595
Phthalic anhydride.....	1130
Xylol	550

All of the above ingredients except the xylol are mixed together, heated to about 450° F. and held at that temperature until the proper viscosity and acid number are reached; approximately two to three hours. The resultant product is allowed to cool to about 400° F. and the xylol is then added. A bond coat as above described weighing from 8 to 12 grains (dry weight) per 24 square inches of backing is adequate.

The composition may of course be modified to vary the oil length (which in the example given above is close to 50%), and other drying oils or combinations thereof (e. g. oiticica, tung, Perilla, soyabean, etc.) may be substituted for those above shown.

Another bond coat which works well, although it is slightly less flexible and slower to cure than the composition set forth in Example 2 is as follows:

Example 3

	Parts
Tung oil.....	270
Oil-soluble phenol formaldehyde resin.....	90
Xylol	110
Mineral spirits (oleum).....	110

The tung oil and resin are mixed thoroughly, heated to 450° F. and held at that temperature until proper viscosity is obtained, i. e. about 40 to 50 minutes. The material is then allowed to cool to about 400° F. and the xylol and mineral thinner is added. In the example above the resin employed was "Bakelite BR-254" a product of the Bakelite Corporation, New York, N. Y. This

resin is commercially available and has given good results.

To illustrate exemplary embodiments of the invention and not to limit it, reference is made to the accompanying drawings in which:

Figure 1 is an enlarged diagrammatic section through a bead-coated sheet made according to our invention.

Figure 2 is a perspective view which illustrates the application of our material to a pressing block of a type commonly used.

Figure 3 is a schematic view (front) of a belt-sanding apparatus and illustrates the use of our beaded sheet as a covering for a stationary platen used to back up or support the abrasive belt against a workpiece.

Figure 4 is a side view of the belt-sanding apparatus of Figure 3, showing a workpiece being abraded.

Figure 5 is a schematic view of another type of belt-sanding apparatus and shows a manner of using a pressing block covered with our beaded sheet.

Figure 6 is a side view of the block of Figure 2 being used in a furniture abrading operation.

Referring in detail to the drawing (in the several figures of which like reference characters denote similar parts), in Figure 1 a flexible, film-forming presize coating 5 is applied to the surface of a flexible backing sheet 6, which, as hereinabove indicated, has preferably been saturated or impregnated with a sealing and waterproofing composition. (It is to be understood that one or both the sealing composition or pre-size coating may be omitted in the interest of economy, if desired.) Globular bodies 7 are secured to the presize layer 5 by means of adhesive 8. Each globular body is shown submerged within the adhesive to a depth of more than half its diameter so that it is positively confined in a strong socket wherein surface adhesion alone is not depended upon for anchorage.

The globular bodies shown are of substantially equal size and are submerged substantially equally deeply within the adhesive (to a depth of over one-half their area, as above indicated). Thus an approximately equal spheroidal portion of each body protrudes from the adhesive, the total number of said protrusions forming a discontinuous, planar, pressing face. The bodies are spread out uniformly, and very closely adjacent, over the surface of the sheet. This close adjacency, plus the fact that all the bodies protrude an approximately equal distance beyond the adhesive, avoids the possibility that the piece being abraded may be grooved or scratched by individual bodies.

It should of course be appreciated that Figure 1 is not a true section of our beaded sheet, but is drawn so that the true diameter of each body will be shown. In an actual sheet of the material a single section plane would not pass through the center of each bead in a series since the beads are not arranged in rows.

The glass beads or other spherical bodies may be coated upon the backing in a uniform layer by any one of the methods which are well known in the abrasive art. For instance, the adhesive-coated web may be passed (adhesive side up) horizontally under a hopper containing the spherical bodies, which hopper is designed to sprinkle an excess of such bodies over the surface of the coated sheet. The web may then be passed over a batter which jiggles it from the back side and causes the applied bodies to settle

into and be adhesively held by the viscous bond coat fluid, the bodies coming to rest against the hardened presize coating underlying the adhesive coat, with somewhat less than one-half of their area protruding from the adhesive. The web may then be moved in a vertical direction so that the excess of spheres thereon will drop off, and thence be moved horizontally between accurately spaced nip rolls which will press into the adhesive such beads as may be stuck to the surface of the other beads. The web (with the beads applied and aligned) is then passed into an oven to dry and set up the bead bonding coat. This objective is accomplished (with an adhesive of the kind hereinabove described) in about 24 hours at about 175-200° F.

After the bond coat has been set up and cured, a size coat 9 similar in composition to the bonding adhesive may be applied. Such coating increases the adhesion of the globular bodies to the surface of the sheet. If a size coat is applied, care should be exercised so that the quantity thereof does not fill the interstices between the protruding spheroidal tips and thus destroy the discontinuous pressing surface of the sheet. After the size coat has been applied, the web may then again be held in a drying oven for about 24 hours at 175-200° F. to set up said coating.

In Figure 2 bead-coated sheet 10 is shown affixed to a pressing block 11 such as is commonly used by operators of abrading machines to press against the back side of a traveling abrasive web to bring the abrading face thereof into pressure contact with the workpiece. The pressing block may conveniently be made of wood. In the figure shown, sheet 10 is secured to the block by means of tacks 12. However, it will be obvious that the sheet could be attached in a variety of other ways; for instance, by means of clamps or the like. Furthermore, although the block shown has a flat pressing face it could equally well be made otherwise. For instance, if a cylindrical object were being abraded it would be advantageous to provide a concave pressing face on the block to press the traveling belt around the periphery of the workpiece.

Figures 3 and 4 show a belt-sanding apparatus comprising an endless abrasive belt 13 mounted on rotatable pulleys 14 and 15, means, such as an electric motor (not shown) for rotating one of the pulleys so as to drive the belt, and a shoe or supporting member 16 mounted by means of shaft 17 adjacent the back of the belt at a span thereof between pulleys. The face of said shoe 16 adjacent the back side of the belt is covered with beaded sheet 10. As an object, such as workpiece 18 on the work support 19, is pressed against the moving belt 13, said belt is pressed against sheet 10 on shoe 16. As hereinabove stated, the discontinuous surface of the sheet, formed of alternate protuberances and open spaces, then presents a multitude of "point supports" for the belt, the open spaces between said point supports materially reducing the area of heat-producing friction contact between the back of the web and the sheet.

Figure 5 illustrates another type of belt-sanding apparatus wherein an abrasive belt 20 is mounted, abrasive side out, on four rotatable pulleys 21, 21A, 21B and 21C, in rectangular arrangement, one of which is driven to propel the belt and the other three of which are rotated by the pull or drag of the moving belt. Beneath a span of the belt between pulleys 21B and 21C is

work support 22 and workpiece 23. A pressing block 24 is covered with beaded sheet 10. The operator presses said covered block against the back side of the belt 20, at any point between pulleys 21B and 21C to obtain increased cutting action by the abrading face of said belt upon the workpiece.

In Figure 6 there is shown a fragment of an abrasive belt 25, a pressing block 26 covered with beaded sheet 10, and a fragment of a workpiece 27 (in this case an item of furniture, namely a table). The abrasive belt 25 is mounted on pulleys (not shown), one of which is driven to propel the belt. This figure illustrates the use of a pressing block covered with beaded sheet 10 to secure proper abrading contact between an abrasive belt and a curved surface such as is common in furniture construction. The edge of the pressing block is shaped, in this instance, to conform in reverse to the curved underside of the table top. The edge or pressing face of the block may, of course, be differently shaped to conform to a differently profiled workpiece.

It will be readily apparent from the foregoing description that a greatly improved covering sheet has been produced. Superior results are obtained by the use of small solid globular bodies. They provide a uniform surface supported by strong bonding materials, preferably submerging more than half the surface of each body. Thus a surface is presented which does not break down under heavy usage and in which the points of contact with the abrasive belt are retained at a uniform elevation. It is to be understood that the accompanying drawings are merely illustrative of many ways in which our beaded sheet may be used and also that other bonding materials, as well as variations in the saturation, presize, and bonding coats, within the scope of our invention, may be employed. The various details set forth may be modified without departing from the spirit of our invention as defined within the appended claims.

What we claim is:

1. In machine sanding apparatus including a pair of pulleys and an endless, abrasive-coated belt mounted on said pulleys, an accessory adapted to press said traveling, coated abrasive belt against a workpiece, comprising a platen, and a facing on said platen formed of a tear-resistant flexible backing, a flexible, abrasion-resistant adhesive coating on a face of said backing, and a layer on said coating comprising a multitude of minute, substantially equal sized, hard, smooth-surfaced globular bodies; a substantially equal area of each body in excess of 50% thereof being embedded in said adhesive coating, leaving exposed to the abrasive belt a discontinuous, planar pressing face composed of multitudinous, closely adjacent, contact areas formed by the non-embedded spheroidal portions of the globular bodies.

2. In the art of machine sanding with coated abrasives including a plurality of pulley members and an endless abrasive belt trained on said pulleys, a member for pressure contact with the uncoated surface of said abrasive belt and disposed intermediate said pulley members, said member being surfaced with a friction-reducing sheet comprising a tear-resistant flexible backing, a flexible, abrasion-resistant adhesive coated on one surface of said backing, and a multitude of separate, abrasive-belt contacting points protruding from said coating and comprising the spheroidal portions of minute, substantially equal-sized, hard, smooth-surfaced, globular bod-

ies equally deeply embedded in said adhesive coating to a depth of from 50 to 75% of their area.

3. In machine sanding apparatus including a plurality of pulleys, an abrasive-coated belt trained about said pulleys, and means for causing said abrasive-coated belt to travel about said pulleys; an accessory having a pressing face adapted to press the traveling abrasive-coated belt against a work piece, the pressing face of said accessory being provided with a friction reducing surface comprising a uniform layer of minute, substantially equal sized, hard, smooth-surfaced globular bodies, said globular bodies being deposited in an abrasion-resistant adhesive coating, a substantially equal area of each body in excess of fifty per cent thereof being embedded in said adhesive coating, leaving exposed to the abrasive belt a discontinuous pressing surface composed of multitudinous, closely adjacent, contact areas formed by the non-embedded spheroidal portions of the globular bodies.

4. In machine sanding apparatus including means for driving an endless abrasive-coated belt to present an abrading face to a work piece, an accessory for maintaining pressure contact between said abrading face and said work piece, said accessory comprising a rigid member having a pressing surface and a uniform layer of minute, substantially equal sized, hard, smooth-surfaced globular bodies adhesively bonded over said pressing surface of said rigid member, said globular bodies being within the diameter range of from .008" to .0237", and being adhesively bonded so that a substantially equal segment of each body from 50 per cent to 25 per cent thereof protrudes

from the bond, said globular bodies lying substantially contiguous to each other, each protruding segment receding from closely adjacent protruding segments to provide separate, point contacts between each segment and the moving belt.

5. In machine sanding apparatus including a plurality of pulleys, an abrasive-coated belt trained about said pulleys, and means for causing said abrasive-coated belt to travel about said pulleys; an accessory having a pressing face adapted to press the traveling abrasive-coated belt against a work piece, the pressing face of said accessory being provided with a friction-reducing surface comprising a multitude of minute, substantially equal-sized, hard, smooth surfaced spheroidal protuberances uniformly distributed over said pressing face, the total number of said spheroidal protuberances forming a discontinuous low-friction surface for contacting the back side of the traveling abrasive coated belt.

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