

Jan. 25, 1938.

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2,106,186

ABRASIVE SLEEVE AND METHOD OF FORMING THE SAME

Filed Nov. 2, 1936

2 Sheets-Sheet 1

Fig. 1.

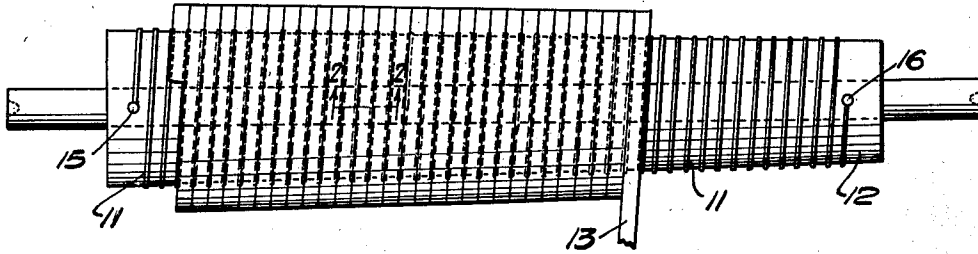


Fig. 2.

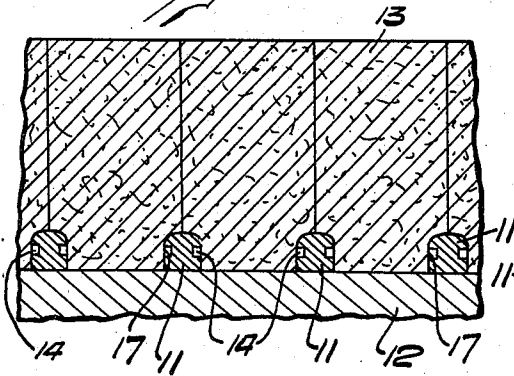


Fig. 3.

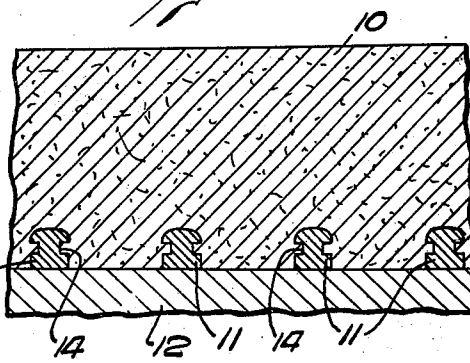


Fig. 4.

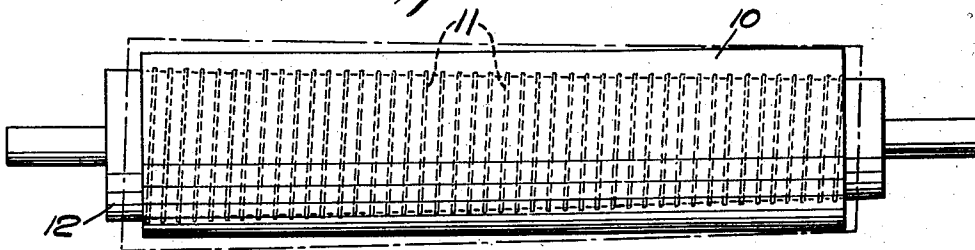


Fig. 6.

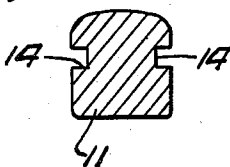
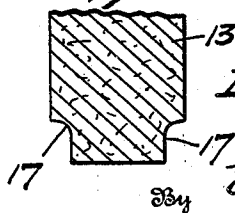


Fig. 5.



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2 Sheets-Sheet 2

Fig. 7.

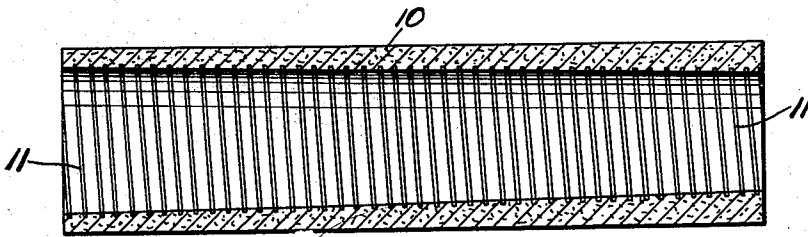
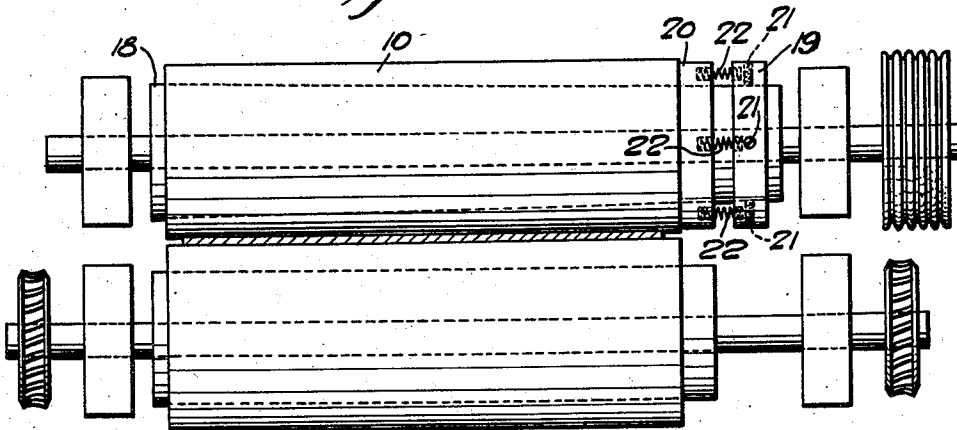


Fig. 8.



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UNITED STATES PATENT OFFICE

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ABRASIVE SLEEVE AND METHOD OF FORM-
ING THE SAME

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Application November 2, 1936, Serial No. 108,845

18 Claims. (Cl. 51-278)

This invention relates to abrasive sleeves and the method of forming the same which are primarily adaptable for use in machines for surfacing and polishing relatively thin and flexible materials, such as sheets of stainless steel and the like.

In metal sheets, such as those of stainless steel, Monel metal, copper, brass, nickel, etc., varying degrees of surface finish are required depending upon the intended use of the sheets. To remove the so-called open surfaces and other surface defects usually found in rolled metal sheets, particularly those which are relatively wide, and to obtain a fundamental surface condition as well as the desired surface finish, it has heretofore been necessary to subject the sheets to repeated abrading operations. These operations include roughing, intermediate and finishing steps. The roughing is accomplished by repeatedly subjecting the sheets to the action of a rotating wheel or roll provided with coarse abrasive grains which make rather deep scratches on the work so as to remove sufficient metal to obliterate the surface defects. In the subsequent intermediate and finishing steps, the metal between the coarse scratches in the surface is removed until the scratches themselves are no longer visible.

In the past, these abrading operations have been performed either by flexible belts or by flexible wheels which are made of disks of muslin or the like pressed together on rotatable shafts. The peripheries of these belts and wheels are coated with glue and abrasive grains which break into small segments during the abrading action and thus gives effect to the flexible character of the wheel or belt. The sheets are presented to the flexible wheels or belts in various mechanical ways, depending upon the equipment used and three or four wheels or belts each coated with a different grain size is necessary in the roughing, intermediate and finishing operations and the sheets must be passed back and forth in contact with each of them many times.

A high degree of skill is required to "set up" these wheels or belts and to maintain them in proper condition for efficient work. Varying weather conditions, such as either high or low humidity, seriously affect their efficiency and shorten their work life.

Even though it is highly desirable to provide metal sheets with a more or less coarsely ground or "toothed" surface in order to promote the adhesion thereto of coatings, such as zinc, vitreous enamel, lacquer, paint, etc., the high cost of doing this work by flexible wheels and belts has pre-

vented finishing sheets in this manner to any considerable extent.

The present invention has for its principal object the production of an abrasive sleeve capable of imparting to metal sheets a fundamental surface condition in a single pass.

Another object of the invention is to provide improved means for connecting the abrasive sleeve to a rotatable drum.

A primary feature of the invention consists in forming an abrasive sleeve by spirally winding a strip of abrasive material around a tapered mandrel to form a sleeve having a tapered outer surface and in subsequently modifying the sleeve to provide it with a cylindrical outer surface.

Another feature of the invention consists in forming the abrasive sleeve by spirally winding a wire around a mandrel with spaces between each convolution of the wire and in subsequently winding a strip of abrasive material around the mandrel so as to cover the wire and fill the spaces between the convolutions thereof.

Another feature of the invention consists in forming an abrasive sleeve by spirally winding a strip of rubber bonded abrasive material around a mandrel with the edges of each convolution of the strip in abutting relation and in subsequently vulcanizing the material.

Another feature of the invention consists in providing a substantially rigid abrasive sleeve having a continuous outer surface and an inner surface adapted to have engagement with a driving drum.

A further feature of the invention consists in providing an abrasive sleeve with a tapered inner surface and a cylindrical outer surface.

A still further feature of the invention consists in providing an abrasive sleeve with a continuous outer surface consisting of abrasive grains bonded in rubber and with an inner surface including a circumferentially extending metallic reinforcement.

Another feature of the invention consists in providing an abrasive sleeve with a tapered inner surface for encircling a rotatable drum having a tapered periphery and in associating therewith means for maintaining the inner surface of the sleeve in frictional engagement with the periphery of the drum.

Other features of the invention, residing in advantageous forms, combinations and relations of parts, will hereinafter appear and be pointed out in the claims.

In the drawings,

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Figure 1 illustrates the abrasive sleeve in the process of being formed.

Figure 2 is an enlarged detail sectional view taken on line 2—2 of Figure 1.

Figure 3 is a view similar to Figure 2, illustrating the manner in which the abrasive material interlocks with the wire after being compressed and vulcanized.

Figure 4 is a side elevational view of the completed sleeve on the forming mandrel, the dotted lines indicating the outline of the sleeve prior to being trimmed.

Figure 5 is a transverse sectional view of the strip of rubber bonded abrasive material.

Figure 6 is a transverse sectional view of the wire reinforcement.

Figure 7 is a longitudinal sectional view of the completed abrasive sleeve.

Figure 8 is a side elevational view of the polishing and work supporting rolls of a polishing machine illustrating the manner of mounting the abrasive sleeve on the polishing roll.

Referring more particularly to the drawings, 10 indicates the comparatively rigid abrasive sleeve which is formed by first helically winding a wire 11 about a mandrel 12 so that the convolutions thereof are spaced from each other and then helically winding a strip of rubber bonded abrasive material about the mandrel with its convolutions in abutting engagement. The wire 11 is preferably of generally rectangular shape in cross section having its outer corners rounded and provided with longitudinally extending slots or recesses 14 in its side faces. Before being wound around the mandrel which, for a purpose as will hereinafter appear, has a tapered periphery, the wire is securely fastened as indicated at 15 to the mandrel adjacent one end thereof. It is then spirally wound about the mandrel in such manner that the convolutions thereof will be spaced apart a distance equal to the width of the abrasive strip minus the width of the wire and secured to the mandrel adjacent its opposite end, as indicated at 16.

The rubber bonded abrasive material is preferably made by compounding pure gum stock with sulphur and the usual commercial accelerators and mixing the compound with abrasive grains of a size depending upon the character of finish desired on a rubber mill whose rolls turn at different rates of speed. The sheeted material is folded and refolded as the abrasive grains are added and it is repeatedly passed through the rolls until the rubber bond and grains form as homogeneous a body as possible. While the sheeted material is still in a plastic condition from the heat generated in mixing, it is cut into narrow strips and fed into the hopper of a machine commonly known in the rubber industry as a "tube mill". Such machines are used for forming rubber stock into tubes and solid shapes before vulcanizing and they are provided with a cylinder having a die at one end behind which a screw operates for extruding the rubber stock in a continuous strip.

To impart to the abrasive strip 13 a configuration such that, when it is spirally wound about the mandrel upon which the wire 11 has been previously wound, it will extend into the spaces between the convolutions of the wire and its side edges will be in abutting relation, the tube mill is provided with a die for forming the strip with oppositely disposed recesses 17 generally conforming to the outline of adjacent portions of the wire. After the abrasive strip has been wound around the mandrel and its ends secured in any suitable

manner, the sleeve thus formed, while still on the mandrel, is wrapped tightly with wet fabric and it is then vulcanized. Not only do the convolutions of the abrasive strip unite to form a unitary sleeve during vulcanization, but the fabric wrapping contracts and subjects the rubber bonded material to pressure sufficient to force portions thereof adjacent the wire into the recesses 14 in the sides of the latter.

As the periphery of the mandrel 12 is tapered, the inner and outer surfaces of the sleeve will have a corresponding taper but, before the sleeve is removed from the mandrel, it is trimmed, as indicated in Figure 4, in any suitable manner, so that its ends will be at right angles to the axis of the mandrel and its outer surface will be of cylindrical form. Thus it will be perceived that an abrasive sleeve is produced having a cylindrical outer surface and a tapered inner surface, the latter being formed in part by a helical wire which is keyed and bonded to the abrasive material.

By providing the sleeve with a tapered inner surface, a driving connection between the sleeve and the rotating drum 18 may be effected by friction and the unsatisfactory clamping means heretofore employed for securing an abrading sleeve to a rotating drum may be entirely eliminated, as well as keys, feathers and the like. For this purpose, the periphery of the drum 18 is formed with a taper of the same order as the inside taper of the sleeve and, while any suitable means may be employed for exerting a force on the sleeve in a direction parallel with its axis so as to maintain it in frictional engagement with the drum, it is preferred to employ two ring-like members 19 and 20 which are mounted on the smaller end of the drum. The ring-like member 19 is removably fastened to the drum by set screws 21, while the ring-like member 20 is movable axially thereof; and interposed between the two are a plurality of coil springs 22 which cause ring 20 to exert a pressure on the sleeve sufficient to hold the inner surface thereof in intimate contact with the outer surface of the drum. The force exerted on the sleeve by its engagement with the work tending to rotate it relatively to the drum is less than that required to overcome the friction between the two members when they are maintained in intimate contact by the retaining ring 20.

It will be appreciated that, since the convolutions of the wire are supported laterally by the abrasive material between them, the wire effectively resists radial forces acting on the sleeve induced by wedging it on the drum which might possibly be of a magnitude sufficient to rupture the abrasive material. The helical wire which is in engagement with the driving drum serves, therefore, as an effective reinforcement for the rubber bonded abrasive material. Although the sleeve is comparatively rigid, it is probable, especially when considerable time elapses between the time it is made and the time it is used, that it might get somewhat out of round. However, the construction of the sleeve is such that it may be easily reshaped to cause its inner surface to again assume true conical form so as to intimately contact the periphery of the driving drum by merely heating it in hot water to soften the bonded abrasive material.

What I claim is:

1. The method of forming an abrasive sleeve consisting of spirally winding a strip of abrasive material around a tapered mandrel to form a sleeve having a tapered outer surface, and subse-

quently modifying the sleeve to provide it with a cylindrical outer surface.

2. The method of forming an abrasive sleeve consisting of spirally winding a strip of abrasive material about a tapered mandrel to form a sleeve having tapered inner and outer surfaces, and subsequently trimming the outer surface of the sleeve to cylindrical form.

3. The method of forming an abrasive sleeve consisting of spirally winding a wire around a mandrel with spaces between each convolution of the wire, and subsequently winding a strip of abrasive material around the mandrel so as to cover the wire and fill the spaces between the convolutions thereof.

4. The method of forming an abrasive sleeve consisting of spirally winding a wire around a mandrel with spaces between each convolution of the wire, and subsequently covering the wire and filling the spaces between the convolutions thereof by spirally winding a strip of abrasive material around the mandrel with portions of the side edges of each convolution of the strip in abutting relation.

5. The method of forming an abrasive sleeve consisting of winding a wire having recessed side edges around a mandrel to form a helix with spaces between the convolutions thereof, subsequently covering the wire and filling the spaces between said convolutions by spirally winding a strip of abrasive material around the mandrel, and then compressing the abrasive material to force portions thereof into the recessed side edges of the wire.

6. The method of forming an abrasive sleeve consisting of spirally winding a strip of rubber bonded abrasive material around a mandrel with the edges of each convolution of the strip in abutting relation, and subsequently vulcanizing said material.

7. The method of forming an abrasive sleeve consisting of spirally winding a wire around a mandrel to form a helix with spaces between the convolutions thereof, subsequently winding a strip of rubber bonded abrasive material around the mandrel so as to cover the wire and fill the spaces between the convolutions thereof, and then vulcanizing said material.

8. The method of forming an abrasive sleeve consisting of spirally winding a wire around a mandrel to form a helix with spaces between the convolutions thereof, subsequently covering the wire and filling the spaces between the convolutions thereof by spirally winding a strip of rubber bonded abrasive material around the mandrel, and then vulcanizing the material under pressure.

9. The method of forming an abrasive sleeve consisting of spirally winding a wire around a mandrel to form a helix with spaces between the convolutions thereof, subsequently covering the wire by spirally winding about the mandrel a strip of rubber bonded abrasive material provided with portions extending into the spaces between the convolutions of the wire, and then simultaneously heating and compressing the abrasive material to cause the portions thereof adjoining the wire to conform to the contour of the latter.

10. The method of forming an abrasive sleeve consisting of spirally winding a wire around a tapered mandrel to form a helix with spaces between the convolutions thereof, subsequently spirally winding around the mandrel a strip of rubber bonded abrasive material to form a ta-

pered sleeve covering the wire and filling the spaces between the convolutions thereof, and then grinding the outer surface of the sleeve to cylindrical form.

11. An abrasive sleeve adapted to encircle a rotatable drum of a polishing machine, said sleeve having a continuous outer surface consisting of abrasive grains bonded in rubber and having an inner surface including a circumferentially extending metallic reinforcement of spiral form.

12. An abrasive sleeve adapted to encircle a rotatable drum of a polishing machine, said sleeve having a continuous outer surface consisting of abrasive grains bonded in rubber and having a tapered inner surface formed in part by abrasive grains bonded in rubber and in part by a spirally wound circumferentially extending metallic reinforcement.

13. An abrasive sleeve adapted to encircle a rotatable drum of a polishing machine, said sleeve having a continuous outer surface consisting of abrasive grains bonded in rubber and having an inner surface including a spirally wound wire adapted to frictionally engage the periphery of said drum.

14. An abrasive sleeve adapted to encircle a rotatable drum of a polishing machine, said sleeve consisting of abrasive grains bonded in rubber and having a continuous outer surface, and a helically wound wire having spaced convolutions embedded in the inner surface of the sleeve.

15. In combination in a polishing machine, a rotatable drum having a straight tapered periphery, an abrasive sleeve encircling said drum provided with a smooth inner surface formed in part by portions of said sleeve and in part by metal segments partially embedded in said sleeve, said surface having a taper of substantially the same order as the taper of the drum, and means for maintaining the inner surface of the sleeve in frictional engagement with the periphery of the drum.

16. In combination in a polishing machine, a rotatable drum having a tapered periphery, an abrasive sleeve encircling said drum provided with an inner surface formed in part by portions of said sleeve and in part by metal segments partially embedded in said sleeve, said surface having a taper of substantially the same order as the taper of the drum, and a collar encircling said drum and movable axially thereof for maintaining the inner surface of the sleeve in frictional engagement with the periphery of the drum.

17. In combination in a polishing machine, a rotatable drum having a tapered periphery, an abrasive sleeve encircling said drum provided with an inner surface having a taper of substantially the same order as the taper of the drum, and spring means carried by the drum for constantly urging said sleeve in a direction to maintain the inner surface thereof in frictional engagement with the drum.

18. An abrasive sleeve comprising abrasive grains in a bonding material adapted to encircle and frictionally engage the rotatable drum of a polishing machine, said sleeve having a tapered inner surface formed in part by portions of said sleeve and in part by metal segments partially embedded in said sleeve, said sleeve being removable from said drum without destructive effort.