Sept. 5, 1939. R. J. GOODNOW ET AL 2,172,243

MANUFACTURE OF ABRASIVE WHEELS

Filed June 16, 1938 2 Sheets-Sheet 1

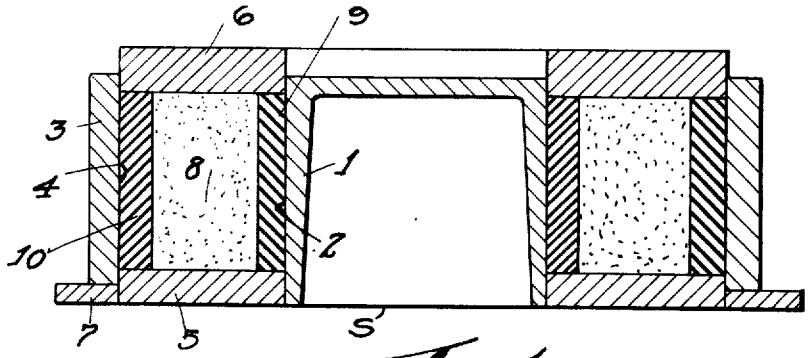


Fig. 1.

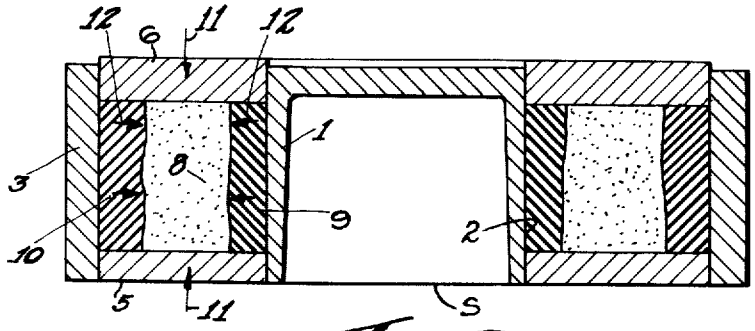


Fig. 2.

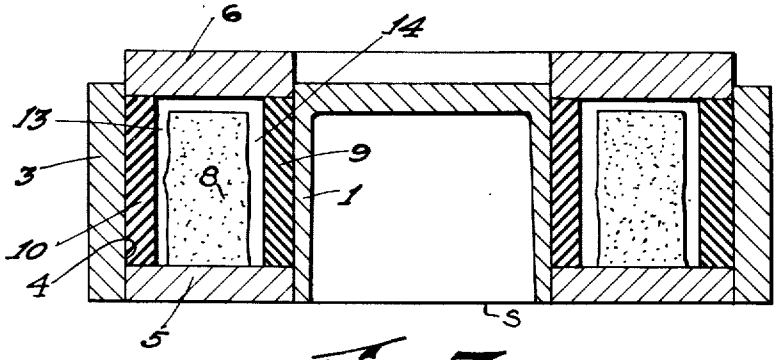


Fig. 3.

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MANUFACTURE OF ABRASIVE WHEELS

Filed June 16, 1938 2 Sheets-Sheet 2

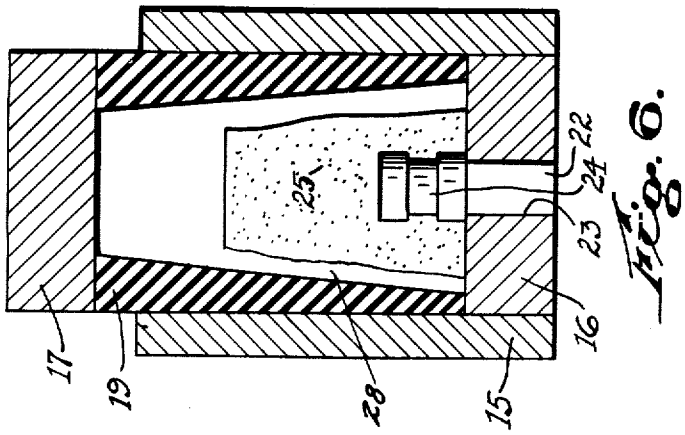


Fig. 6.

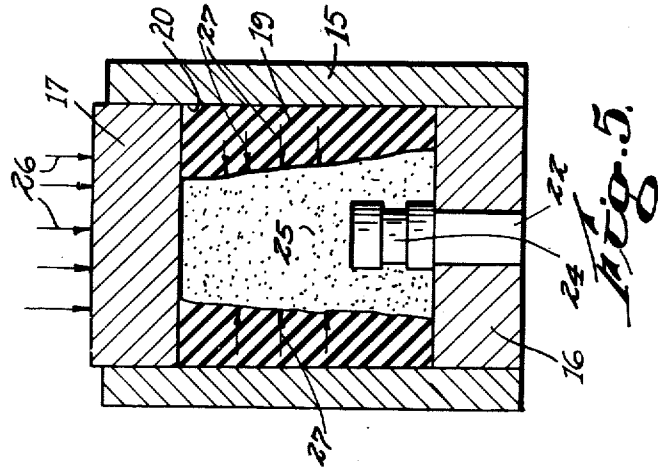


Fig. 5.

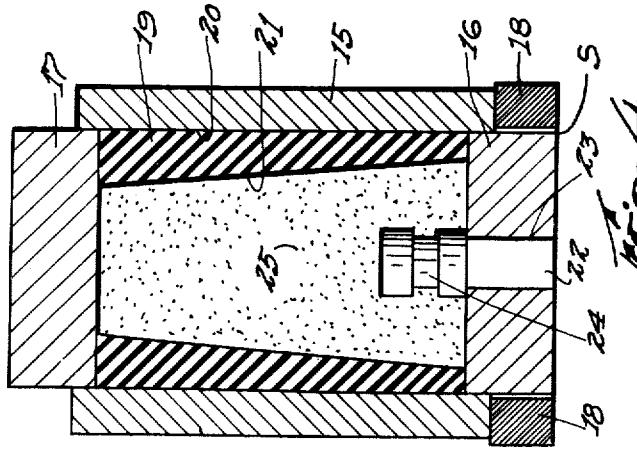


Fig. 4.

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UNITED STATES PATENT OFFICE

2,172,243

MANUFACTURE OF ABRASIVE WHEELS

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Application June 16, 1938, Serial No. 214,142

5 Claims. (Cl. 51—278)

The present invention relates to the manufacture of abrasive wheels, and particularly to a method of and apparatus for producing an abrasive wheel which has a uniform structure.

In the manufacture of abrasive elements, particularly wheels, the abrasive material is generally positioned in a mold made up of an inner sleeve and an outer cylinder between which the abrasive material is packed. End plates fitting between the sleeve and cylinder provide for compacting the wheel material by pressing the end plates toward each other. This compacting, which exerts pressure in an axial direction only does not necessarily provide a uniform compacting of the wheel material, as will be apparent.

Moreover the abrasive particles of the material rapidly wear away the cylindrical surfaces of the mold, especially adjacent to the corners of the end plates during the compressing of the wheel, and thus materially shorten the life of the mold. At the same time, as the cylindrical surfaces of the mold are worn away, removal of the wheel from the mold without injury to the wheel becomes progressively more difficult, since the end portions of the cylindrical elements of the molds are worn away to a less degree than the central portions. The removal of the compacted wheel material through the end portion of slightly smaller diameter necessarily upsets the compact grain structure in the periphery of the wheel. One of the principal objects of the present invention is to avoid the objections above noted by compacting the wheel material radially and thus providing a mold which is separable radially of the compacted abrasive material.

Moreover, where abrasive wheels having a substantial length as compared to the diameter are molded, the abrasive action, by reason of the resistance of the grains of the abrasive material to movement, prevents a uniform compacting of the entire abrasive material within the mold so that the ends of the wheel may be properly compacted, although the central part of the wheel being less properly compacted, will break down in use. Furthermore, with relatively long abrasive wheels, the inward movement of the end caps of the mold toward each other in compacting the abrasive material is necessarily substantial and the abrasive particles wedge between the corners of the end caps and the cylindrical surfaces of the mold, thereby resisting the compacting pressure and rapidly wearing away the mold surfaces. One of the objects of the invention is to avoid this difficulty by compacting the material in the mold by radial pressure on the abrasive material rather than by axial pressure.

A further feature of the invention is in the fastening of a nut or sleeve, or other metallic element, within the abrasive wheel by positively compacting the material around the notches or grooves in the periphery of the metallic element so that the element will be positively held within the wheel. By the use of the radial compacting pressure above referred to, the grains of the abrasive material are compacted tightly around the metallic element.

Other and further objects and advantages of the invention will more fully appear from the following detailed description taken in connection with the accompanying drawings in which—

Fig. 1 is a sectional view through a mold embodying the invention.

Fig. 2 is a sectional view similar to Fig. 1, showing the action of the mold under the compacting pressure.

Fig. 3 is a sectional view similar to Fig. 1, showing the mold parts after the compacting pressure is relieved.

Fig. 4 is a sectional view showing a different mold for forming conical or tapered wheels in accordance with the invention.

Fig. 5 is a sectional view similar to Fig. 4, showing the mold of Fig. 4 when the compacting pressure has been applied.

Fig. 6 corresponds to Figs. 4 and 5, showing the mold when the compacting pressure has been relieved.

Like reference characters refer to like parts in the different figures.

With reference first to Fig. 1, the mold embodies a sleeve 1 having a substantially cylindrical outer surface 2. An outer ring 3 having a substantially cylindrical inner surface 4 is positioned around the sleeve 1 and a ring-shaped end cap 5 is positioned between the lower ends of the sleeve 1 and ring 3. An end cap 6 similar to the end cap 5 is placed above the abrasive material in the mold after the latter has been filled and the material is compressed by axial pressure on the end caps 5 and 6. In filling the mold, the ring 3 is generally held slightly above the supporting surface S on which the mold is positioned by suitable blocks 7. Such mold structure is well known and need not be described in further detail.

In accordance with the present invention the abrasive material 8 within the mold is compacted by a radial pressure instead of, or in addition to, an axial pressure with the radial pressure uni-

formly distributed over the entire area of the abrasive material. To this end a sleeve 9 of very resilient material, such as tough rubber, is positioned around the outer surface of the sleeve 1 and in engagement therewith. The sleeve 9 rests on the end cap 5 and is slightly longer in its normal state than the length of the finished abrasive wheel. A similar sleeve 10, also of resilient tough rubber, is positioned inside of the ring 3 and is also slightly longer than the length of the finished wheel to be molded. The abrasive material 8 is then positioned between the sleeves 9 and 10, the end cap 6 is placed in position, as shown in Fig. 1, and a compacting pressure is applied to the end caps 5 and 6, as indicated in Fig. 2, by the arrows 11. Obviously, before the compacting pressure is applied, the blocks 7 are removed from beneath the ring 3.

The compacting pressure on the end caps 5 and 6 squeezes the rubber sleeves 9 and 10 and causes them to expand laterally, as indicated in Fig. 2, thereby exerting a radial pressure on the abrasive material 8, the radial pressure being represented by arrows 12. The radial expansion of the sleeves must be toward the abrasive material, since the ring 3 and sleeve 1 prevent expansion in the opposite direction. The abrasive material having been compacted to the desired length for the finished abrasive wheel, this length being the spacing between the inner surfaces of the end caps 5 and 6, the axial pressure on the end caps is relieved and the rubber sleeves 9 and 10 assume their original position, thereby withdrawing radially of the compacted abrasive material to leave a space 13 between the inner surface of the sleeve 10 and the compacted abrasive material, and a corresponding space 14 between the outer surface of the sleeve 9 and the compacted abrasive material. The sleeve 1, the ring 3, the top end cap 6 and the sleeves 9 and 10 may then be removed without injury or damage to the compacted abrasive material. The compacted material is then ready to be placed in the curing oven.

It will be apparent that, by the above described structure, the wheel material is compacted by a radial pressure and substantially all wear on the mold is eliminated since the abrasive particles exert almost no wear on the rubber sleeve. It will be understood that the properties of the sleeve 1 and ring 3, as well as the end caps 5 and 6, must be varied from the standard mold structure to allow for the insertion of the sleeves 9 and 10 in order to produce the desired size of abrasive wheel, but such changes in shape from the standard mold are readily apparent.

With reference now to Figs. 4, 5, and 6, the mold shown is intended for the compacting of a substantially conical abrasive wheel and at the same time there is a provision for fastening into the abrasive wheel a permanent spindle. In these figures the mold comprises an outer ring 15 cylindrical in form, and a bottom end cap 16 of a diameter to fit within the cylinder or ring 15. An upper end cap 17 is slidable within the cylinder or ring 15 and suitable blocks 18 hold the ring 15 slightly above the surface S on which the mold is positioned. Positioned within the ring 15 is an element 19 formed of tough resilient material, such as rubber, having its outer surface 20 cylindrical to fit within the ring 15 and having its inner surface 21 tapered to correspond approximately to the taper of the abrasive wheel. The element 19 is slightly longer than the length of the finished abrasive wheel, as will be apparent.

In the use of this mold a pin 22, which is permanently mounted within the abrasive wheel, is positioned in a central bore 23 in the end cap 16. The portion of the pin 22 which is embedded in the abrasive wheel may have a groove 24 which is filled with abrasive material during the formation of the wheel to provide a more permanent attachment of the wheel to the pin. The mold is then assembled, as shown in Fig. 4, and the element 19 is filled with abrasive material 25 which may be slightly compacted, if desired. The upper end cap 17 is then placed in position and the blocks 18 are removed. An axial pressure, represented by the arrows 26, is then applied to the end caps 16 and 17 to compact the wheel axially to the desired length. During this compacting the rubber element 19 is compressed axially and therefore expands radially inwardly to exert on the abrasive material 25 a radial compacting pressure represented by the arrows 27, Fig. 5. This radial pressure is uniform over the entire surface of the abrasive material and it will be apparent that this radial pressure assures a uniform compacting of the abrasive material. Moreover the radial pressure forces abrasive material into the groove 24 for a more positive union between the pin and wheel.

After the compacting pressure is relieved, the resiliency of the rubber element 19 causes it to assume its original or normal shape, as shown in Fig. 6, thereby withdrawing the rubber radially from the compacted abrasive material to leave an annular space 28 entirely surrounding the abrasive material. The upper end cap 17, the element 19 and the ring 15 may then be removed in readiness for curing the abrasive material.

It will be understood that the dimensions of the rubber element 19 must be so controlled as to assure a proper compacting of the abrasive material by the time that the material has been compacted axially to the desired length. It will be further understood in connection with Figs. 1 to 3 inclusive, that in certain instances either the sleeve 9 or the sleeve 10 may be eliminated, since either sleeve by itself will provide the radial pressure desired. Where only one of the sleeves 9 or 10 is utilized, the compacted abrasive material remains in contact with the mold surface opposite to the rubber sleeve and must be pressed from that portion of the mold with which it engages. On the other hand the use of a single rubber sleeve will assure a smooth face on the opposite cylindrical side of the finished wheel. Obviously, if either sleeve 9 or 10 is shaped other than a cylinder, as for example, the shape of the sleeve 19, a corresponding contour will be produced in the wheel when molded. Such sleeves can therefore be utilized in the molding of formed wheels, whose periphery must have a predetermined configuration, and such formed wheels can be molded in a conventional type of mold normally used for cylindrical wheels.

We claim:

1. In the manufacture of abrasive wheels, the step which involves placing a resilient liner in a mold of a length greater than the length of the article being molded, and axially compacting the abrasive material and liner simultaneously to provide a radial compacting of the material.

2. In the manufacture of abrasive wheels in a mold comprising end caps and a cylindrical outer ring within which the end caps are movable, the steps which involve placing a resilient liner in

the mold, said liner being longer than the length of the article being molded and one surface of the liner corresponding approximately to the shape of one surface of the article being molded, and axially compacting the abrasive material and liner simultaneously to provide, by the radial expansion of the liner, a radial compacting of the abrasive material.

3. In the manufacture of conical abrasive wheels in a mold comprising end caps and a cylindrical outer ring within which the end caps are movable, the steps which involve placing a resilient liner in the mold, said liner being longer than the length of the article being molded and the inner surface of the liner being conical, and axially compacting the abrasive material and liner simultaneously to provide, by the radial expansion of the liner, a radial compacting of the abrasive material.

4. In the manufacture of abrasive wheels in a mold comprising end caps, a cylindrical outer ring and a central sleeve, said end caps being positioned between the sleeve and the outer ring and movable axially thereof, the steps which involve placing a resilient liner in the mold, said liner being longer than the length of the article being molded and extending axially of the mold between the end caps, one surface of the liner being engageable with the abrasive material in the mold, and axially compacting the abrasive material and liner simultaneously to provide, by the radial expansion of the liner, a relative compacting of the abrasive material.

5. In the manufacture of abrasive wheels in a mold comprising end caps, an outer ring having a cylindrical inner surface and an inner sleeve having an outer cylindrical surface, said end caps being positioned between said sleeve and ring and movable axially thereof, the steps which involve placing a resilient liner in the mold in engagement with one of said cylindrical surfaces, said liner being longer than the length of the article being molded, and axially compacting the abrasive material and liner simultaneously to provide by the radial expansion of the liner, a radial compacting of the abrasive material.

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DONALD B. WILSON.

CERTIFICATE OF CORRECTION.

Patent No. 2,172,243. September 5, 1939.

ROLAND J. GOODNOW, ET AL.

It is hereby certified that error appears in the printed specification of the above numbered patent requiring correction as follows: Page 2, first column, line 50, for the word "properties" read proportions; and that the said Letters Patent should be read with this correction therein that the same may conform to the record of the case in the Patent Office.

Signed and sealed this 3rd day of October, A. D. 1939.

(Seal)

Henry Van Arsdale,
Acting Commissioner of Patents.

the mold, said liner being longer than the length of the article being molded and one surface of the liner corresponding approximately to the shape of one surface of the article being molded, and axially compacting the abrasive material and liner simultaneously to provide, by the radial expansion of the liner, a radial compacting of the abrasive material.

3. In the manufacture of conical abrasive wheels in a mold comprising end caps and a cylindrical outer ring within which the end caps are movable, the steps which involve placing a resilient liner in the mold, said liner being longer than the length of the article being molded and the inner surface of the liner being conical, and axially compacting the abrasive material and liner simultaneously to provide, by the radial expansion of the liner, a radial compacting of the abrasive material.

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