

April 26, 1938.

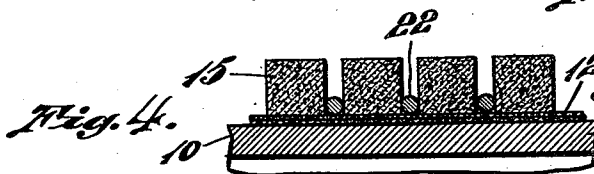
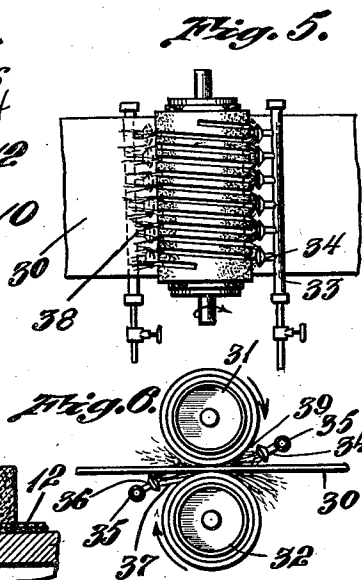
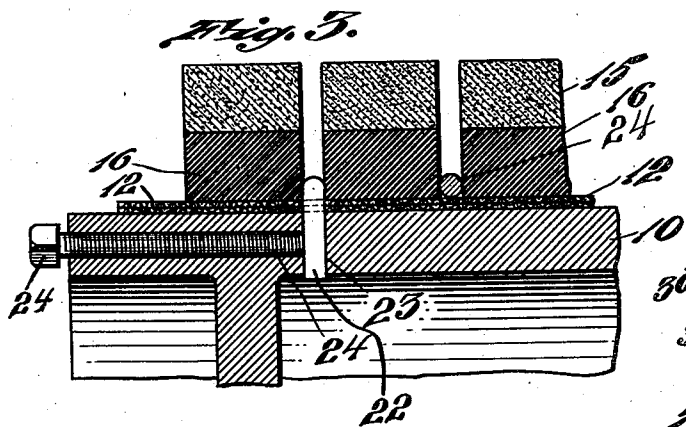
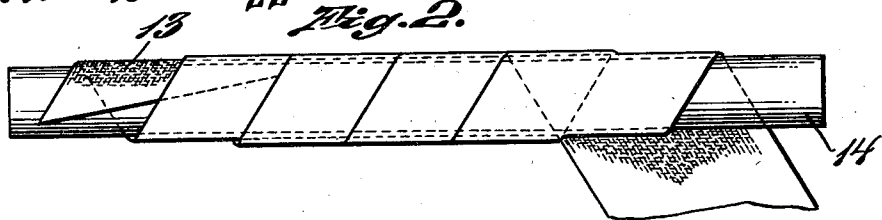
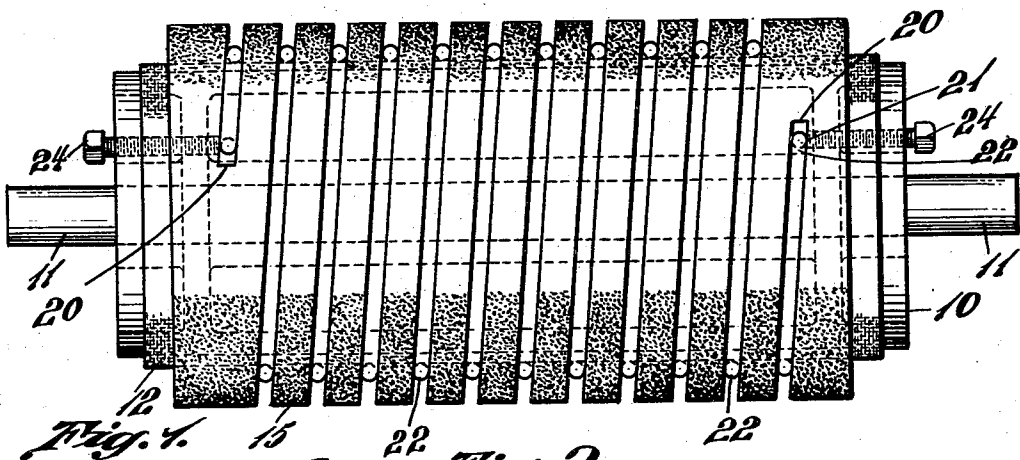
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2,115,210

ABRASIVE WHEEL

Original Filed Jan. 22, 1935

2 Sheets-Sheet 1



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ABRASIVE WHEEL

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2 Sheets-Sheet 2

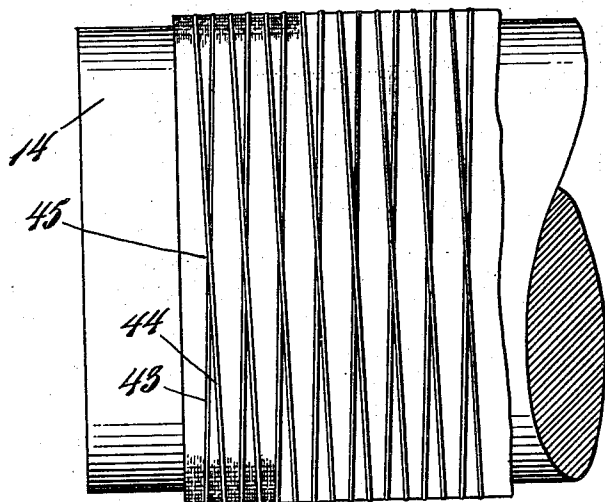


Fig. 8.

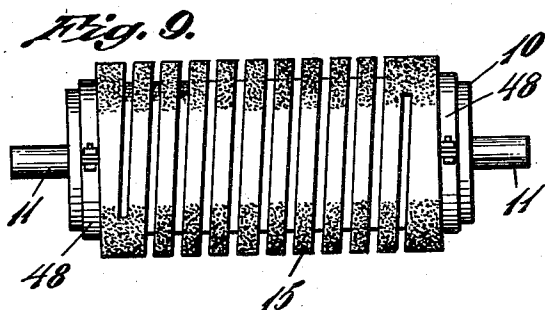


Fig. 9.

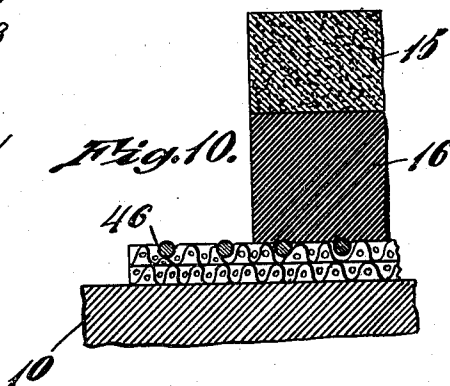


Fig. 10.

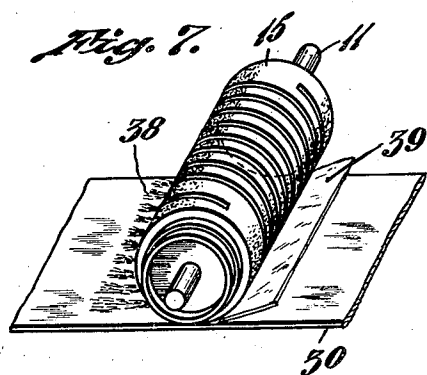


Fig. 7.

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UNITED STATES PATENT OFFICE

2,115,210

ABRASIVE WHEEL

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Application January 22, 1935, Serial No. 2,920
Renewed August 7, 1937

17 Claims. (Cl. 51—190)

This invention relates to an abrasive article more particularly to one for use in what is called "flexible polishing", and is closely related to co-pending application Serial No. 334,588, filed July 11, 1934, of which I am one of the joint inventors.

This invention while having for its object the advantages expressed in the afore-mentioned application, also has additional objects, one of which is the provision of a sleeve which will be flexible and yet such that the material mounted upon it may be readily secured thereto.

Another object of the invention is the provision of a sleeve which may be readily attached by binding on to a rigid body and which may as readily be detached and which although of a flexible nature, may be bound at such relatively closely spaced intervals along the body as to prevent any detrimental expansion by centrifugal force.

Another object of the invention is to provide a sleeve having a flexible foundation upon which an abrasive is mounted which is so reinforced as to require binding to a support only at its ends and yet not unduly expand in its middle due to centrifugal force.

Another object of the invention is to provide an abrasive article for flexible polishing, which will have a sleeve which will not be injured by a liquid coolant and lubricant.

Another object of the invention is the forming of a sleeve by helically winding a strip of fabric and then securing the abrasive material thereto, and in which the different helical layers of the sleeve, as well as the remainder of the wheel, may be firmly and yet flexibly secured together.

Another object of the invention is the provision of a sleeve which may be frictioned and secured to a partially rubber abrasive bond or backing therefor by vulcanization.

Another object of the invention is to provide a sleeve which will be dynamically balanced.

A further object of the invention is the provision of a sleeve which will cooperate to produce the desired effects mentioned in the co-pending application above referred to.

With these and other objects in view, the invention consists of certain novel features of construction, as will be more fully described, and particularly pointed out in the appended claims.

In the accompanying drawings:

Fig. 1 is an elevation of an abrasive wheel formed in accordance with my invention;

Fig. 2 is an elevation illustrating the helical winding of a strip of fabric material which forms the inner sleeve to which the abrasive surface

and the backing therefor are secured in holding the same in position;

Fig. 3 is a sectional view illustrating the manner of securing the sleeve to the rigid central body by means of a wire and a means of securing the wire at the ends thereof;

Fig. 4 is a sectional view of a fragmental portion of an abrasive wheel illustrating a modified construction;

Fig. 5 is a top plan view of the wheel with a sheet of work beneath it and the coolant as applied thereto;

Fig. 6 is an end view of the structure shown in Figure 5;

Fig. 7 is a diagrammatic perspective view illustrating the action of the liquid coolant between the abrasive wheel and work;

Fig. 8 is a plan of a fragmental portion of the sleeve of modified construction;

Fig. 9 is a plan of the completed modified construction wheel;

Fig. 10 is a fragmental section of this modified construction of wheel.

As pointed out in the co-pending application, above referred to, there are many difficulties experienced in so-called flexible polishing; and in developing a wheel to meet these conditions as set forth in the co-pending application above referred to, I have found that the use of a fabric sleeve for mounting the resilient backing as well as the abrasive outer surface of the wheel provides a very strong, tough and durable manner of mounting the outer material so that parts of the wheel can be arranged readily to be sufficiently flexible, and the wheel may lend itself readily to be bound in place by a helical wire. The surface of the fabric sleeve may be frictioned to which the rubberized composition can be readily secured by vulcanizing and the entire construction firmly secured in place and yet providing sufficient flexibility for binding the sleeve to a rigid body by means of a helical groove therein. This sleeve of fabric material also cooperates very nicely to accomplish the cooling and other objects mentioned in the above referred to co-pending application, and affords the wheel great tensile strength; and the following is a more detailed description of the present embodiment of this invention and illustrating the preferred means by which these advantageous results may be accomplished:

With reference to the drawings, 10 designates a rigid body, here shown as a metallic cylinder or drum, and which may be made up in other shapes than that illustrated. It may be mounted

upon a shaft 11 for rotation at the desired number of revolutions to secure the surface speed required for the wheel mounted thereon.

Upon this metallic drum, there is removably mounted a unit consisting of an inner fabric sleeve, designated 12 and an abrasive and bond therefor which may or may not be resiliently backed. This sleeve is made up from a strip 13 of fabric wound helically along a suitable arbor or core designated 14. This strip of fabric is formed of frictioned material, that is, the surface is rubbed with rubber to a sufficient extent to cause the rubber to impregnate the material and lodge in the interstices of the material, the frictioning taking place on the outer surface of the material, although it may also take place on the inner surface, if desired.

After the sleeve of fabric has been built up in this way, the additional layer or layers of material is or are mounted upon the fabric sleeve. In Figures 1 to 3 I have illustrated an outer layer 15 which is formed of an abrasive and a bond for the abrasive which is somewhat flexible and between this outer layer 15 and the sleeve there is positioned a layer 16 of a material containing a larger quantity of soft rubber and which is of a composition to be more flexible than the outer layer 15 so as to absorb some of the resiliency which may be transmitted thereto through the layer 15. The specific materials which go to make up the layers 15 and 16 being more fully and definitely defined in the application above referred to.

In applying the layers I wrap a sheet of material forming the layer 16 several times about the fabric sleeve until the desired thickness is built up and follow it by wrapping several layers of a sheet of material which forms the layer 15 about this more resilient material 16, or I may wind an assembled strip of two-ply material constituting layers 15 and 16, helically upon the sleeve 12 with the edges of the strip either slightly spaced or in substantial contact causing it to extend the entire length of the sleeve. In either case, after the assembly is completed, vulcanization takes place which firmly secures all of the parts together; that is, layer 15 is secured to the layer 16 and the layer 16 firmly secured to the frictioned fabric 12.

After vulcanization, the helical slot is cut in the two-plys 15 and 16 to the depth of the fabric 12, and in the case where a helical strip is laid in place, the helical cutting will follow the seams between these layers, which sometimes become vulcanized together, and this cutting will clear out the part of the rubber material which has run into the seams which is the part which is not homogeneous, and thus leave the homogeneous parts which embrace the bonded abrasive. Thus I provide by this helical cutting of the helically laid strip a surface throughout the length of the wheel which is homogeneous in that the bonded abrasive is equally disposed throughout the mass material which is presented to the face for abrasive action, thus providing a more even and better surfaced wheel.

This helical slot may be short of the end of the wheel as at 20, so as to prevent undue expansion from centrifugal force acting on the thinner edge which would otherwise be formed, and in this slot starting at an opening 21 at the end 20 thereof a wire designated generally 22 is inserted through an opening 23 in the body where it is locked by a set screw 24 and is then wound tightly in the helical groove the entire length of

the sleeve and then passed through a similar opening at the opposite end where it is similarly secured by another set screw 24 in the opposite end of the drum to hold the sleeve tightly in place throughout its length. By supporting the sleeve and binding it to the drum throughout the length, the centrifugal force acting on the sleeve is sufficiently well controlled so that the expansion of the sleeve by centrifugal force is uniform and a bellying or barrel-shape effect in the middle of the sleeve when running is prevented. For removal of this abrasive sleeve, it is merely necessary to loosen the wire and take the same from the helical groove and then slide the sleeve from the rigid body and replace it with a similar sleeve for further operation.

In Figure 4, I have illustrated an abrasive wheel which is formed all of a single layer 15 of abrasive and bonded material, that is, the resilient backing such as 16 in the previously shown figure, has been omitted. In this case, of course, the vulcanizing will secure the abrasive bonded material directly to the frictioned fabric sleeve, it being of a nature to break down in use sufficiently to expose new grain before the grains become dull, and yet not so resilient as to lose the grain without itself wearing away. On the other hand, there is sufficient resiliency so that flexible polishing can be had.

The material used in the sleeve is of such a character as to withstand water, which is the coolant and lubricant which I prefer to use in the operation of the wheel, and by means of this coolant and lubricant I am able to pass the work designated 30, through a pair of wheels designated 31 and 32, the coolant being supplied to the wheel 31 by means of a conduit 33 having a plurality of nozzles 34, each designed to project a fan-shaped spray therefrom so that the coolant 34 is projected between the wheel 31 and the work in a sheet form film 35. A conduit 36 is provided for directing coolant to the under wheel 32 and is likewise provided with a plurality of nozzles 36 also similarly designed to project the coolant in fan-shaped manner which join to form a sheet form film 37 of coolant and lubricant directed toward the point of contact of wheel 32 and the underside of the work. Each of these coolant and lubricant sheet films 35, 37 is projected with considerable force towards the contacting area of the wheel and work and moves to the opposite side of the wheel by filling and proceeding through the groove at the area of contact of the wheel with the work and emanates in streams such as 38, on the opposite side of the wheel from that towards which it is projected.

By reason of the helical groove which is of a substantial depth and is filled with water, this entire body of coolant which is in the groove moves axially of the wheel to sweep the work one or more times each revolution of the wheel and more effectively cools the work than any other known means of cooling the engaging surface area of an abradant wheel with its work, and thus prevents the work from becoming overheated. This overheating sometimes permits buckling of thin work, and where I have provided wheels acting on the surfaces of the work at the same time as these travel in opposite direction a very thin sheet of material may pass there-through without buckling or curling around a single wheel, as sometimes occurs in practice.

I prefer a water coolant and lubricant, although it will be readily apparent that other fluid cool-

ants can be utilized with effective results with my helically grooved wheel while the coolant is permitted and caused to sweep the surface of the work axially of the wheel one or more times each revolution of the wheel.

It will be understood that I may use all character and sizes of grains for effecting better polishing on certain metals or alloys which are more susceptible or better attacked by one size or character of grain than by another.

In Figure 8 I have illustrated a modified form of fabric sleeve in that this sleeve is wrapped fairly closely with right and left hand turns of wire 43 and 44 wound helically about the fabric with the same or different pitches and crossing at 45 at diametrically opposite points of the wheel, which serves to prevent expansion of this fabric member and firmly support the sleeve against centrifugal forces tending to expand the sleeve into generally barrel-shape formation. These wire wrappings compress the fabric and become indented therein, as at 46 in Figure 10, and are in turn covered with the cushion member and the abrasive and bond therefor, as shown in Figure 10, or with merely the abrasive member without the cushion, as in Figure 4; and in cases of this character, the sleeve could be tightly bound by clamps 48 at its end, which would avoid the use of the wire in the helical groove extending the length of the sleeve to secure it in position and yet would prevent the bellying or barrel-shaped effect in the center due to centrifugal force were there no support for the sleeve when assembled upon the steel drum.

The foregoing description is directed solely towards the construction illustrated, but I desire it to be understood that I reserve the privilege of resorting to all the mechanical changes to which the device is susceptible, the invention being defined and limited only by the terms of the appended claims.

I claim:

1. An abrasive wheel having a rigid support, a sleeve mounted thereon, a bonded abrasive portion forming its outer face and fixed to said sleeve, said bonded abrasive portion being provided with a peripheral coolant conducting groove extending inwardly to said sleeve, and means in said groove for securing said sleeve in position on said support.

2. An abrasive wheel having an inner sleeve, and an abrasive and bond therefor forming its outer face and fixed to said sleeve, said sleeve being continuous along the length of the wheel and said abrasive and bond being provided with a coolant conducting groove extending to said sleeve, and means in said groove for securing said sleeve in position.

3. An abrasive wheel having a sleeve with an inner flexible layer of material and a bonded abrasive portion forming its outer face and fixed to said flexible layer, said bonded abrasive being arranged with spaced portions of face material separated by a helical groove extending inwardly to said sleeve.

4. An abrasive wheel composed of a rigid central body adapted to be mounted on a shaft, a helically wound flexible material contacting said body and an abrasive and bond therefor forming its outer face and fixed to said flexible material.

5. An abrasive wheel composed of a rigid central body adapted to be mounted on a shaft, a sleeve removably mounted on said body and an abrasive and bond therefor forming its outer

face and fixed to said sleeve, said abrasive and bond being provided with a helical groove extending to said sleeve, and means in said groove engaging said sleeve to bind it to said body at a plurality of spaced intervals.

6. An abrasive wheel composed of a rigid central supporting body adapted to be mounted on a shaft for rotation thereby, a sleeve removably mounted on said body, a bonded abrasive portion forming its outer face and fixed to said sleeve, said sleeve being continuous axially of the wheel, said bonded abrasive portion being arranged with spaced portions of face material separated by a helical groove extending to said sleeve, and means in said groove engaging said sleeve to bind it to said supporting body at spaced intervals.

7. An abrasive wheel composed of a rigid central body adapted to be mounted on a shaft for rotation thereby, a fabric sleeve removably mounted on said body, a bonded abrasive portion forming its outer face and fixed to said sleeve, and a layer of material more resilient than the bonded abrasive between said sleeve and said bonded abrasive portion, said abrasive portion and backing being grooved helically inwardly to the depth of said fabric sleeve to provide a coolant conduit in the wheel face.

8. An abrasive wheel composed of a rigid central body adapted to be mounted on a shaft, a fabric sleeve removably mounted on said body, a bonded abrasive portion forming its outer face and fixed to said sleeve, a layer of material more resilient than the bonded abrasive between said sleeve and said bonded abrasive portion, said abrasive portion and backing being grooved helically inwardly to said fabric sleeve, and a wire in said helical groove to bind the sleeve to said central body.

9. An abrasive wheel comprising an inner sleeve of fabric material bonded granular abrasive material secured thereto, and a wire helically wrapped about and in contact with the outer surface of said sleeve to reinforce it against expansion under the influence of centrifugal force.

10. An abrasive wheel comprising an inner sleeve of fabric material bonded granular abrasive material secured thereto, and a wire helically wrapped with a right and left hand pitch about and in contact with the outer surface of said sleeve to reinforce it against expansion under the influence of centrifugal force.

11. An abrasive wheel comprising an inner sleeve, abrasive material secured thereto, a wire helically wrapped about said sleeve to reinforce it against expansion under the influence of centrifugal force, said sleeve extending beyond the abrasive at either end thereof, and bands about said sleeve at its ends to clamp the same in position on the body on which it is mounted.

12. An abrasive wheel having a rigid support, a sleeve mounted thereon, a bonded abrasive portion forming its outer face and integrally fixed to said sleeve, and clamping means of elongated form extending axially along said sleeve and in contact with and about the outer surface of the sleeve along substantially the entire length of said clamping means for removably securing said sleeve in position on said support.

13. An abrasive wheel having a rigid support, a sleeve mounted thereon, an abrasive portion of bonded granular abrasive material forming the outer face of said wheel, a layer of material more resilient than the bond for the abrasive material of said outer portion and interposed between and

integrally uniting said sleeve and said outer bonded-abrasive face portion, and clamping means about the outer surface of the sleeve and extending axially therealong for removably securing said sleeve in position on said support, said clamping means being positioned inwardly from the working surface of said bonded abrasive portion.

14. An abrasive polishing wheel having an inner sleeve formed of a helically disposed fabric material, an outer peripheral polishing portion of rubber bonded granular abrasive material integrally fixed to said sleeve, said fabric sleeve material being impregnated with rubber and vulcanized to said abrasive polishing portion to secure it in position.

15. An abrasive wheel having a rigid central support, a sleeve mounted thereon having a peripheral abrading portion of bonded abrasive grains secured to the outer surface of the sleeve, and clamping means about the outer surface of the sleeve and extending axially therealong and circularly thereabout for removably secur-

ing said sleeve in position on said support, said clamping means being positioned inwardly from the working surface of said bonded abrasive portion.

16. An abrasive wheel comprising a rigid central support, a sleeve mounted thereon having a peripheral abrading portion of bonded abrasive grains, and clamping means of elongated form extending lengthwise of the wheel and extending thereabout and lying below the level of the working surface of the abrading portion for securing said sleeve in position on said support.

17. An abrasive wheel comprising a rigid central support, a sleeve mounted thereon having a peripheral abrading portion of bonded abrasive grains, and clamping means of helically wound form engaging said sleeve and extending axially therealong to bind it to said support at a plurality of spaced intervals extending lengthwise of the wheel and lying below the level of the working surface of the abrading portion for securing said sleeve in position on said support.

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