Oct. 14, 1941. J. N. KUZMICK ET AL 2,259,345

ABRASIVE WHEEL AND REINFORCING MOUNTING

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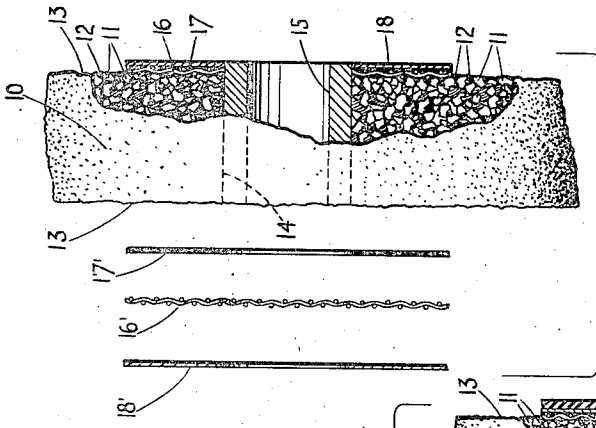

Fig. 2

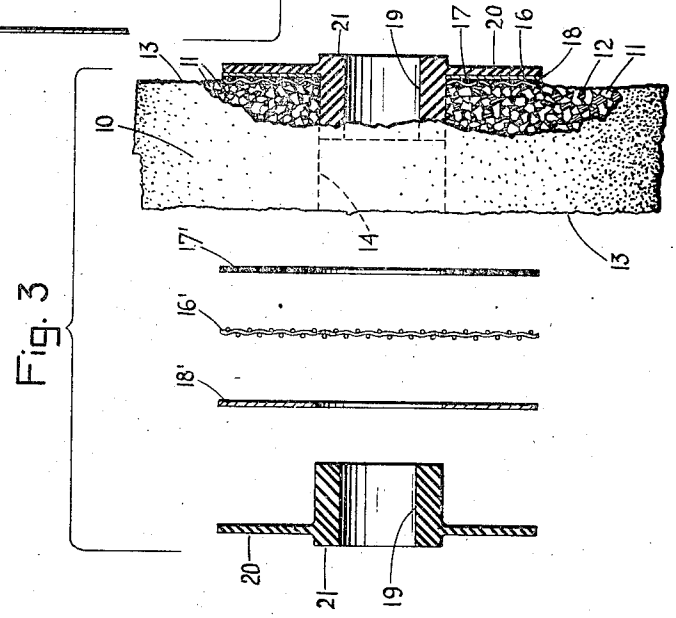

Fig. 3

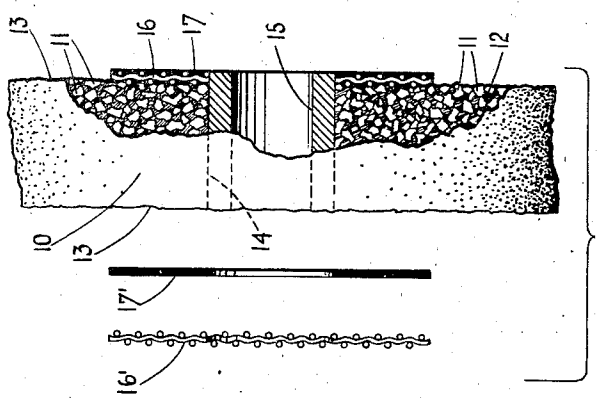

Fig. 1

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ABRASIVE WHEEL AND REINFORCING MOUNTING

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8 Claims. (Cl. 51—206)

This invention relates to abrasive or grinding wheels, and more particularly to abrasive wheels provided with reinforcing mountings.

The prime object of our present invention centers about the provision of an improved commercially practical mounting for abrasive or grinding wheels, which functions to substantially inhibit rupturing of the wheel in operation, and in the event of rupturing, to prevent wheel fragments from flying out radially under the action of centrifugal force and injuring the operator.

There has been a great demand in the art for a practical device for reinforcing the structure of an abrasive wheel at its mounting, and for reducing the hazards or risks resulting from the fracturing, breaking or rupturing of wheels particularly during high speed operation. Numerous suggestions have been made to meet this demand and to solve the involved problems. The suggestions thus far proposed, however, have had certain limitations which have prevented their general adoption or even their use to any practical commercial extent.

These previously suggested reinforcing devices embody the incorporation between the abrasive wheel faces and the usual clamping plates (used to clamp the wheel to the power shaft) of reinforcing members which are designed to exert a more effective grip on the abrasive wheel faces. It was quite common in the old art to use washers of a soft pliable material such as lead, rubber or leather, as the reinforcing members; but these were found entirely unsatisfactory. In the more recent art, it has been suggested to make these reinforcing members in the form of metal discs or plates, which are either clamped or permanently secured to the wheel faces by some yielding bonding material, such as resilient rubber; and in an endeavor to make this form of reinforcing means effective, the rubber bonding medium had to be applied in an extremely thin film, a film comparable to the depth of the interstices of the wheel face. A serious limitation with this type of reinforcing device is that the reinforcing discs or plates have to cover a very extensive area of the wheel, thus considerably reducing the available usable wheel volume. The requirement that the reinforcing plate had to extend over so large a part of the area of the wheel was probably due to the difficulty of securing the necessary adhesion to the metal discs or plates, because of the inadequate amount of bonding medium used and the smoothness of the plate or disc surface. In an attempt to solve this difficulty or limitation, it has been suggested to make the metal discs or plates in the form of plates scored in concentric circles so as to provide concentric annular portions which are removed one by one as the abrasive wheel is worn down. Such an arrangement, however, is impractical, since it necessitates the stopping of the grinding machine at various intervals and requires special tools to remove the scored annular portions. Also, since the workability of these suggested devices depends on the predetermined thinness of rubber bonding medium employed between the abrasive wheel face and the reinforcing plates or discs, the manufacture of the device becomes too costly, since skill is required to apply the reinforcing members and since the thickness of the bonding medium employed must vary with the type of grade and grain of the wheel, of which there is a very large variety. These are some of the reasons that these suggestions of more recent origin have not been adopted to any great extent.

In our present invention, we provide a primary reinforcing member in the form of a fine wire mesh screen (woven wire cloth), which is positioned immediately contiguous to the abrasive mounting face of the wheel so that the abrasive wheel face and the contiguous screen member provide a multitude of engaging points and intermeshing areas, the said wire screen member being then bonded to the abrasive wheel face by a cementing bonding material which is forcibly embedded in the interstices provided by both the abrasive face of the wheel and the wire mesh of the screen member. The cementing bonding material is supplied in an amount adequate to effect an integral union between the wire mesh screen member and the abrasive wheel face, and to cover the body of the screen member itself, the thickness of the layer of cementing material being in fact determined by the thickness of the screen member. In one of the preferred forms of the invention, we also provide a secondary reinforcing member in the form of a metal plate mounted over the screen member and bonded thereto by the outer surface of the layer of cementing medium, the cementing material being adequate in amount to wet and coat the entire surface of the said metal plate and unite the same over such entire surface to the wire mesh screen member. We have also found that this form of reinforcing device may be effectively combined with resilient elements for making a combined reinforcing and resilient mounting; and, according to another form of the invention, resilient mounting elements are integrally united

to the outer faces of the metallic plate secondary reinforcing members.

This reinforcing mounting for abrasive wheels in all of the modifications of the present invention, is found to possess the following important advantages:

1. The wire mesh screen or woven wire cloth forms a strong primary reinforcing member.

2. The position of the wire mesh screen member immediately contiguous to the abrasive mounting face of the wheel provides a multitude of engaging points and intermeshing areas, which, when combined with a suitable bond, provide an ideal means to resist fracturing of the wheel or radial movement of a broken wheel fragment due to centrifugal stress.

3. The cementing bonding medium embedded in the interstices provided by both the abrasive face of the wheel and the wire mesh of the screen member and filling the spaces therebetween, is effective in uniting the screen member elements to the abrasive wheel face elements so strongly as to produce the ideal reinforcement.

4. The wire mesh screen member acts as a well for the cementing medium and also as a metering device therefor, to control the thickness of the cementing layer, it being desired that this layer be thick enough to supply sufficient cementing material to accomplish all the functions necessary, namely, the filling of the said interstices, the covering of the screen member, and the coating of the secondary metal plate reinforcing member which is mounted on the screen member and united thereto.

5. This construction is unaffected by the grade or grain of the abrasive wheel and does not require individual modification for different types of abrasive wheels.

6. Because of the perfect adhesion obtained between the primary reinforcing member and the abrasive wheel face, the reinforcing device may be localized to the area of the usual clamping plates and flanges employed therewith, whereby the usable volume of abrading material is not reduced.

7. The reinforcing device may be readily combined with resilient mounting elements.

With the practice of our invention, we have been unable to rupture commercial abrasive wheels even when the same are over-speeded up to the limit of speed available on the usual testing equipment, the stress imposed on the wheels at such over-speeding points being 650% over normal operating speed. In order to further prove the efficiency of the device of the invention, a standard abrasive wheel broken into four quarters was reassembled and equipped with the reinforcing mounting of the invention. This wheel was and is capable of being operated at normal operating speed, without any of the fragments breaking loose. Even when a wheel of this character is overspeeded to 100% over operating speed (imposing a stress of over 400% normal on the broken fragments), small fragments begin to break loose, but only outside the sphere of the reinforcing mounting.

To the accomplishment of the foregoing objects and results, and such other objects as may hereinafter appear, our present invention comprises the structural combinations hereinafter sought to be defined in the claims and described more in detail hereinbelow in connection with the appended drawing, in which,

Fig. 1 is a view of the mounted section of an abrasive wheel, with one form of the reinforcing mounting of the present invention applied thereto, parts being shown in section explanatory of the finished product and other parts being shown detached, explanatory of the method of assembling and making the mounting; this Fig. 1 shows the use of only the primary reinforcing member;

Fig. 2 is a similar view of a modification, this view showing the additional use of the secondary reinforcing member; and

Fig. 3 is a view of a further modification similar to that of Fig. 2, but showing additionally the use therewith of resilient mounting elements.

Referring now more in detail to the drawing and having reference first to Fig. 1 which shows the first mentioned modification of the invention, the abrasive wheel 10, only the central or mounting section of which is shown (the other parts being broken away as indicated), comprises a wheel body composed of abrasive grains 11, 11 bonded together by any suitable bonding medium 12, such, for example, as rubber or a synthetic resin. The said wheel is formed with the opposed abrasive wheel faces 13, 13 (abrasive grains coated with the bond), which, because of the abrasive nature thereof, present a rough or broken face having numerous and irregular projecting points and interstices, as will be evident from an inspection of the said Fig. 1. The wheel 10 is formed with the usual mounting hole 14, which, in the modification shown in Fig. 1, may be provided with a conventional type of lead bushing 15.

The reinforcing mounting of this form of the invention comprises a metal wire mesh screen or woven wire cloth member 16 positioned immediately contiguous to the abrasive mounting face 13 of the wheel. Due to the structural characteristic of the screen member 16 and to the nature of the abrasive wheel face 11, a multitude of engaging points and intermeshing areas between the two are provided. This in itself, however, would be ineffective in yielding the desired reinforcement. However, when this screen member, positioned contiguously to the abrasive wheel face, is suitably bonded thereto, the desired reinforcement is effectuated. The screen 16 is, therefore, united to the wheel face 11 by a cementing medium 17 which is forcibly embedded in the interstices provided by both the abrasive face of the wheel and the wire mesh of the screen member and which fills all the spaces therebetween. This cementing bonding material also covers the body of the screen member and forms a bond layer of a thickness commensurate, that is to say, in equal extent, with that of the screen member, as is clearly shown in the assembled part of Fig. 1 of the drawing. The bonding material in this form of the invention may be a synthetic resin or resinoid composition such as a phenol aldehyde product.

To produce this construction and this relation of the elements, the reinforcing mounting is made according to the following method: A ply of a plastic cementing material such as 17', which may be a synthetic resinoid composition in the potentially reactive state, is placed on the abrasive mounting face 13 of the wheel, and a screen member 16' is placed on said ply of plastic cementing material. This assembly is then subjected to heat and pressure between the platens of a hydraulic press. In this operation, the screen member 16' is forced through the ply

17' of cementing material and into direct engagement with the abrasive wheel face 13, the said cementing material being forced into and becoming embedded in the interstices provided by both the abrasive face of the wheel and the mesh of the screen member.

It will be noted that the cementing material completely fills and covers the body of the screen member 16', the screen acting as a well and also as a metering device to determine the thickness of the cementing medium and to prevent the reduction in thickness thereof which would otherwise take place under the pressure exerted by the platens of the hydraulic press.

When, as in the form shown in Fig. 1, the screen member alone is relied upon as the reinforcing means, the mesh screen may be somewhat thicker than the case where the mesh screen is employed in combination with a secondary reinforcing means (Figs. 2 and 3 of the drawing); and in the form shown in Fig. 1, this mesh screen may be approximately $\frac{3}{32}$'' in thickness. The layer of cementing medium 17' in this instance may also be approximately $\frac{3}{32}$'' in thickness. The ultimate thickness of the cementing layer is, as stated, governed by the thickness of the mesh screen, any excess of cementing material being squeezed out by the applied pressure in the assembling operation.

In the modification shown in Fig. 2 of the drawing, the primary reinforcing member is associated with a secondary reinforcing member, the latter in the form of a metal plate or disc. The other parts of this modification are otherwise the same as those of Fig. 1 of the drawing (with the differences to be noted), and are indicated by similar reference numerals. The differences are that in the modification of Fig. 2 of the drawing, the screen members 16 and 16' are substantially thinner and the wire thereof finer, and the cementing layers 17 and 17' are substantially thinner than those shown in the modification of Fig. 1 of the drawing. The screen members and the cementing layers of Fig. 2 may be, for example, approximately $\frac{1}{32}$'' thick. The secondary reinforcing members in the form of the plates or discs 18 and 18' are positioned immediately over the outer faces of the screen members 16 and 16', and are united or bonded thereto by the cementing layers 17 and 17', the amount of cementing medium being adequate to uniformly and completely coat the inside faces of the metal plates or discs 18 and 18' so as to effectively unite these to the screen members. In the form of the invention shown in this Fig. 2, which is one of the preferred inventive forms, the cementitious plies 17 and 17' comprise vulcanized rubber.

This form of the invention (Fig. 2) is assembled by the following method: The ply or layer 17' of unvulcanized rubber is placed on the abrasive mounting face of the wheel (on each side thereof), the metal screen member 16' is placed on the said ply or layer of unvulcanized rubber, and the metal plate or disc 18' is placed over the screen member. Each of these elements may be approximately $\frac{1}{32}$'' thick. The assembly is then placed between heated hydraulic platens and the components are united under heat and pressure. The resulting structure is similar to that described for Fig. 1 of the drawing, with the exception that the secondary reinforcing members are combined with the primary mesh screen reinforcing members, the secondary reinforcing members being integrally and strongly united with the primary reinforcing members.

In the modification of Fig. 3 of the drawing, we show the reinforcing device of Fig. 2 of the drawing combined with resilient mounting elements. The reinforcing device of Fig. 3 is the same (with the differences to be noted) as those of Fig. 2 of the drawing, and similar parts are indicated by similar reference characters. In this form of the invention, the cementing layers 17 and 17' consist preferably of plies of synthetic rubber such as Neoprene or Buna in the rubbery but unpolymerized state. The thickness of each of the elements 16 to 18 and 16' to 18' in this form of the invention is also approximately $\frac{1}{32}$''. Instead of the conventional type of lead bushing shown in Figs. 1 and 2 of the drawing, we provide in the Fig. 3 modification a resilient bushing mounting of the type set forth in the patent to Paul L. Kuzmick, No. 2,187,350, granted January 16, 1940, this comprising a resilient member (for each side or part of the wheel mounting) comprising a bushing part 19 insertable in the mounting hole 14 of the wheel, an integral disc part 20 radiating from the bushing part, and a compression bead 21 axially protruding from the bushing part, the resilient member being preferably a rubber unit.

In assembling and making this form of the invention, the following method or procedure is employed, the assembling being carried out for both sides of the wheel: The layer of synthetic rubber 17' is placed on the abrasive mounting face of the wheel, the screen member 16' is then placed over the ply 17' of synthetic rubber, the metal plate or disc 18' is then placed over the screen member 16', and the upper or exposed side of this metal plate 18' is then coated with any suitable fluid cement after which the bushing member 19—21, premolded to shape, is inserted in position. The assembly is then placed between the heated platens of a hydraulic press and the elements thereof united under the influence of heat and pressure. The resulting structure is the same as that produced with Fig. 2 of the drawing, except that the wheel and its mounting are now resiliently carried by the united resilient bushing elements.

The manner of making and using abrasive wheels and the reinforcing mountings therefor of our present invention and the many advantages thereof, will, in the main, be fully apparent from the above-detailed description thereof. Because of the perfect adhesion obtained between the primary reinforcing member and the abrasive wheel face, the reinforcing device may be localized as shown in each of Figs. 1 to 3 of the drawing, to the area of the usual clamping plates whereby the usable volume of abrading material may be utilized. This is a factor of great economical and commercial importance. The improved reinforcing mounting is relatively simple in construction in any of its forms. It functions to substantially inhibit rupturing or bursting of the wheel at high speed operation, and even when the same is operated substantially above normal operating speed. It also effectively functions in the event of a rupture, to prevent the wheel fragments from breaking loose or from flying out radially under centrifugal force. By means of the construction provided and the method of making the same, the primary reinforcing members are very intimately and strongly united to the abrasive wheel faces. The primary reinforcing members determine the thickness of the ce-

menting medium and assure that an adequate supply thereof is available for all of the uniting functions necessary, particularly when the secondary reinforcing members are combined with the primary reinforcing members. A structure is produced which is unaffected by the grade or grain of the abrasive wheel, and which does not require individual modification for different types of abrasive wheels, of which there are a great variety. The reinforcing device of the invention is so designed that it may be readily combined with resilient mounting elements so as to produce a combined reinforcing and resilient mounting for the abrasive wheel.

It will be apparent that many changes may be made in the construction and in the method of making the same, without departing from the spirit of the invention defined by the following claims.

We claim:

1. An abrasive wheel and reinforcing mounting comprising, an abrasive wheel body having an abrasive mounting face, a woven wire cloth member positioned immediately contiguous to and in engagement with the abrasive mounting face of the wheel, the said abrasive wheel face and the contiguous woven wire cloth member providing a multitude of engaging points and intermeshing areas, and a cementing medium bonding the woven wire cloth member and the abrasive wheel face, the cementing bonding material being embedded in the interstices provided by both the abrasive face of the wheel and the wire mesh of the woven wire cloth member and filling the spaces therebetween, the cementing bonding material also covering the body of the woven wire cloth member and forming a bond layer of a thickness substantially equal to that of the woven wire cloth member.

2. An abrasive wheel and reinforcing mounting comprising, an abrasive wheel body having an abrasive mounting face, a woven wire cloth member positioned immediately contiguous to and in engagement with the abrasive mounting face of the wheel and limited in size to the normal clamping area of the said wheel, the said abrasive wheel face and the contiguous woven wire cloth member providing a multiude of engaging points and intermeshing areas, and a cementing medium bonding the woven wire cloth member and the abrasive wheel face, the cementing bonding material being embedded in the interstices provided by both the abrasive face of the wheel and the wire mesh of the woven wire cloth member and filling the spaces therebetween, the cementing bonding material also covering the body of the woven wire cloth member and forming a bond layer of a thickness substantially equal to that of the woven wire cloth member.

3. An abrasive wheel and reinforcing mounting comprising, an abrasive wheel body having opposite abrasive mounting faces, a woven wire cloth member positioned immediately contiguous to and in engagement with each abrasive mounting face of the wheel, each said abrasive wheel face and contiguous woven wire cloth member providing a multitude of engaging points and intermeshing areas, and a cementing medium bonding each woven wire cloth member to the associated abrasive wheel face, the cementing bonding material being embedded in the interstices provided by both the said abrasive face of the wheel and the wire mesh of the woven wire cloth member and filling the spaces therebetween, the cementing bonding material also covering the body of each woven wire cloth member and forming a bond layer of a thickness substantially equal to that of the said woven wire cloth member.

4. An abrasive wheel and reinforcing mounting comprising, an abrasive wheel body having an abrasive mounting face, a wire mesh screen primary reinforcing member positioned immediately contiguous to and in engagement with the abrasive mounting face of the wheel, the said abrasive wheel face and the contiguous screen member providing a multiple of engaging points and intermeshing areas, a metal plate secondary reinforcing member mounted over said screen member, and a cementing medium bonding the screen member to the abrasive wheel face and the metal plate member to the screen member, the cementing bonding material being embedded in the interstices provided by both the abrasive face of the wheel and the wire mesh of the screen member and filling the spaces therebetween, the cementing material also covering the body of the screen member and uniting the metal plate member thereto, the cementing material forming a bond layer of a thickness commensurate with that of the screen member.

5. An abrasive wheel having opposed abrasive mounting faces, and a reinforcing mounting therefor limited in size to the normal wheel clamping area for each mounting face including the following: a wire mesh screen primary reinforcing member positioned immediately contiguous to and in engagement with the abrasive wheel face, the said abrasive wheel face and the contiguous screen member providing a multiple of engaging points and intermeshing areas, a metal plate secondary reinforcing member mounted over said screen member, and a cementing medium bonding the screen member to the abrasive wheel face and the metal plate member to the screen member, the cementing bonding material being embedded in the interstices provided by both the abrasive face of the wheel and the wire mesh of the screen member and filling the spaces therebetween, the cementing material also covering the body of the screen member and uniting the metal plate member thereto, the cementing material forming a bond layer of a thickness commensurate with that of the screen member.

6. An abrasive wheel and reinforcing and resilient mounting comprising, an abrasive wheel body having an abrasive mounting face, a wire mesh screen primary reinforcing member positioned immediately contiguous to the abrasive mounting face of the wheel, the said abrasive wheel face and the contiguous screen member providing a multitude of engaging points and intermeshing areas, a metal plate secondary reinforcing member mounted over said screen member, a cementing medium bonding the screen member to the abrasive wheel face and the metal plate member to the screen member, the cementing bonding material being embedded in the interstices provided by both the abrasive face of the wheel and the wire mesh of the screen member and filling the spaces therebetween, the cementing material also covering the body of the screen member and uniting the metal plate member thereto, the cementing material forming a bond layer of a thickness commensurate with that of the screen member, and a resilient member having a bushing part received by the mounting hole of the wheel and a disc part cemented to the outer face of said metal plate.

7. An abrasive wheel and a reinforcing and resilient mounting therefor comprising, an abrasive wheel body having an abrasive mounting face, a wire mesh screen member positioned immediately contiguous to the abrasive mounting face of the wheel, a metal plate member mounted over said screen member, and a cementing medium bonding the screen member to the abrasive wheel face and the metal plate member to the screen member, the cementing material forming a bond layer of a thickness commensurate with that of the screen member, and a resilient member having a bushing part received by the mounting hole of the wheel and a disc part cemented to the outer face of the metal plate.

8. An abrasive wheel having opposed abrasive mounting faces, and a reinforcing and resilient mounting therefor comprising for each mounting face the following: a wire mesh screen member positioned immediately contiguous to the abrasive mounting face, a metal plate member mounted over said screen member, and a cementing medium bonding the screen member to the abrasive wheel face and the metal plate member to the screen member, the cementing material forming a bond layer of a thickness commensurate with that of the screen member, and a resilient member having a bushing part received by the mounting hole of the wheel and a disc part cemented to the outer face of the metal plate.

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