

[54] DISCARD MOUNT FOR DISC TYPE GRINDING WHEEL

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[57] ABSTRACT

[21] Appl. No.: 383,481

Related U.S. Application Data

For a disc type grinding wheel with a centrally located mounting hole therethrough, an integrated throwaway; wheel mount of hollow tubular configuration including internal mounting threads concentrically within the grinding wheel, a nut shaped external flange adjacent to one face of the grinding wheel, a tubular extension projecting from the other face of the grinding wheel, and a section of predetermined limited length and predetermined reduced wall thickness adjacent to the other face of the grinding wheel radially deformed outwardly to secure the wheel mount permanently to the grinding wheel.

[63] Continuation-in-part of Ser. No. 375,845. July 2, 1973, abandoned.

[52] U.S. Cl. 51/168; 51/376

[51] Int. Cl. B24b 45/00

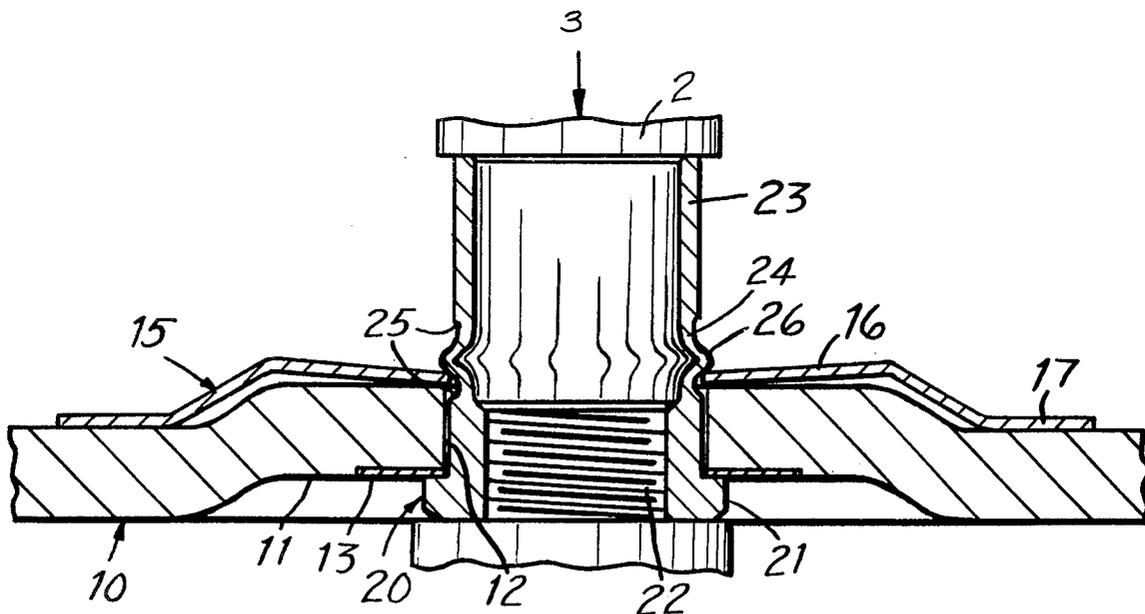
[58] Field of Search 51/358, 376-379, 51/170 T, 168, 169; 29/243.52, 522

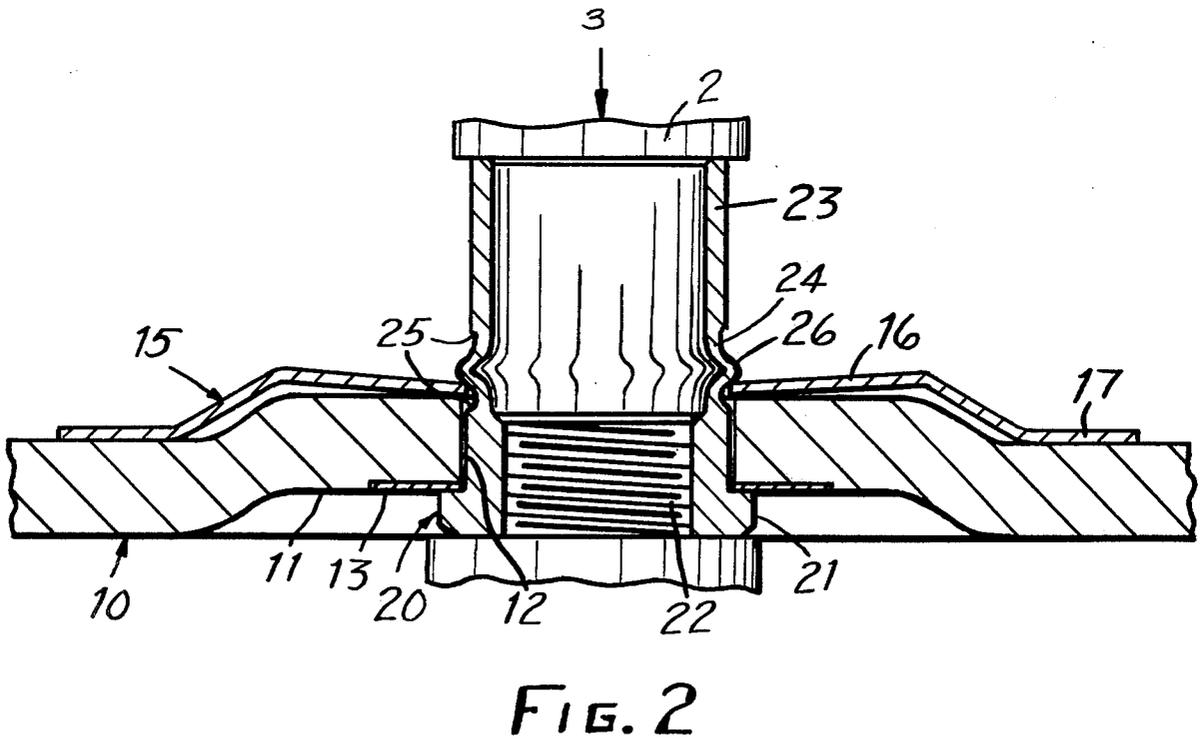
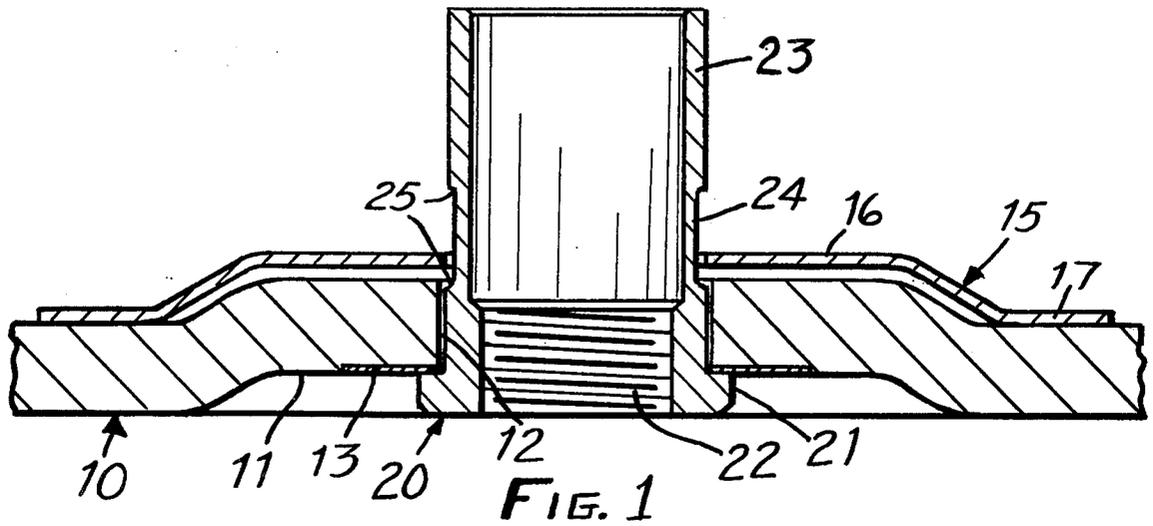
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6 Claims, 6 Drawing Figures





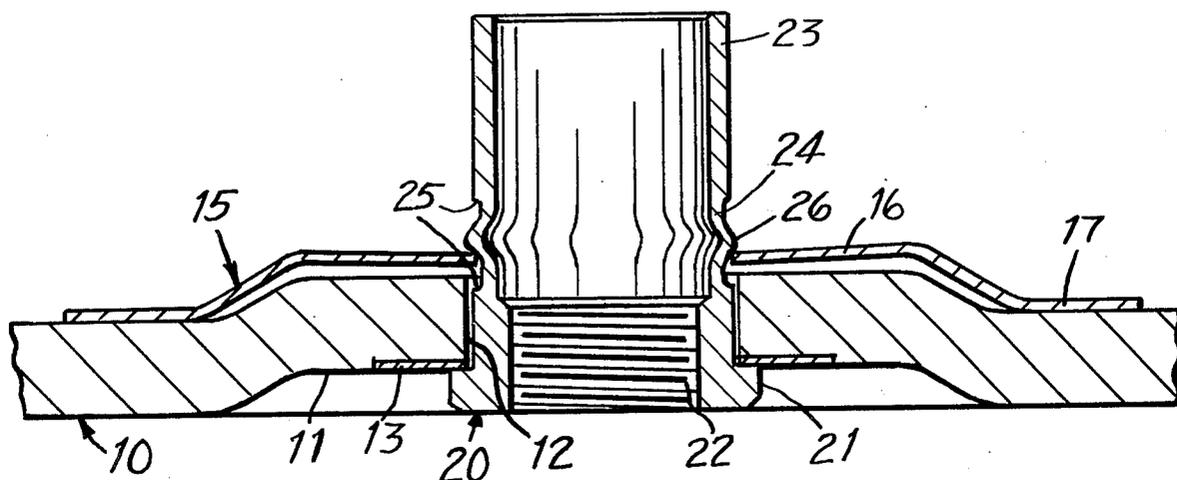


FIG. 3

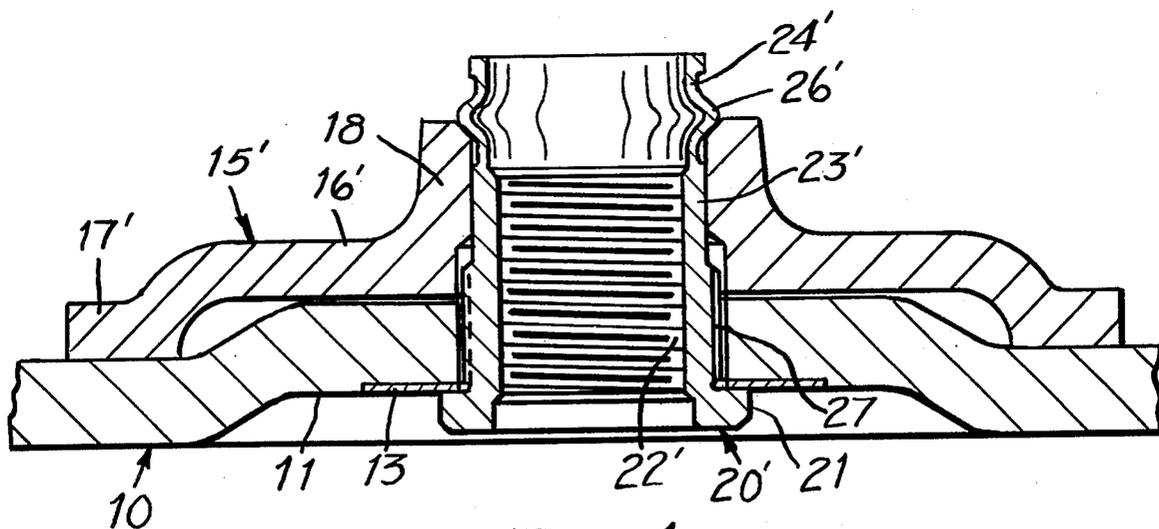


FIG. 4

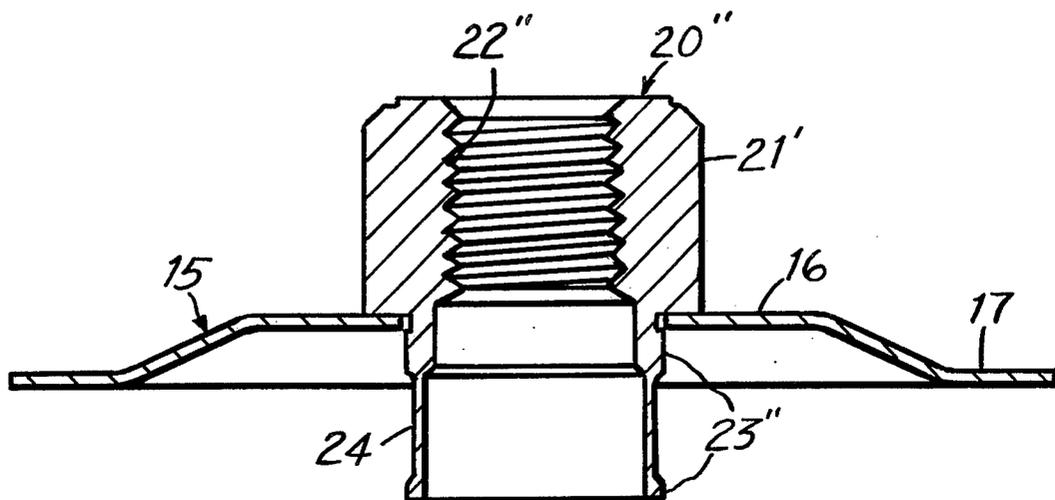


FIG. 5

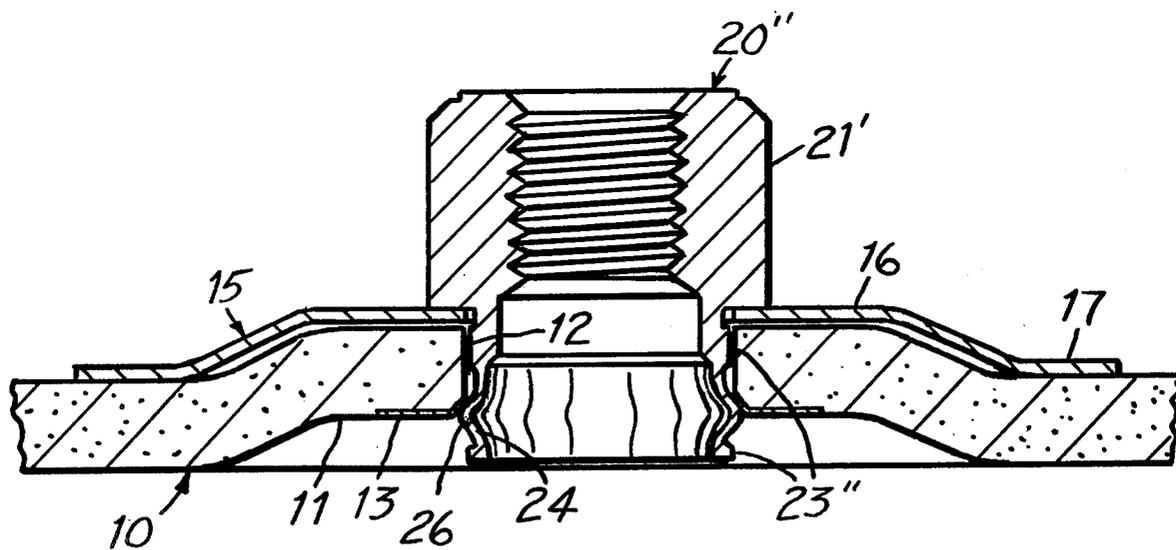


FIG. 6

DISCARD MOUNT FOR DISC TYPE GRINDING WHEEL

RELATED PRIOR APPLICATION

This patent application is a continuation-in-part of patent application Ser. No. 375,845 filed 7/2/73 in behalf of Robert W. Bosma, now abandoned.

BACKGROUND OF THE INVENTION

1. Field of the Invention

This invention relates to a permanent integrated mounting means for a disc type grinding wheel, and more particularly to the type of mounting means for a grinding wheel known as a discard or throw-away mount because it is attached permanently to the grinding wheel when it is manufactured, is sold and used with the grinding wheel, and is discarded with the grinding wheel when it is worn out.

2. Description of the Prior Art

The present invention is a simplified, lightweight, reliable improvement over the various types of discard or throw-away mounting means for disc type grinding wheels already well known in the art.

U.S. Pat. No. 3,362,114 issued Jan. 9, 1968 to R. H. Hurst discloses a solid spindle permanently secured to a disc type grinding wheel with a square centrally located mounting hole therethrough. The mounting means disclosed by Hurst includes an enlarged disc-shaped head portion 15 at one end provided with spaced pointed lug or prong portions 16 projecting therefrom for engagement with the grinding wheel, a deformable square shank portion 13 for engagement in the square mounting hole through the grinding wheel, and a reduced diameter elongated round shaft portion 14. This mounting means is secured to the grinding wheel by staking the square shank portion 13 against a holding washer 11 engaging the rear face of the grinding wheel.

The patent referred to above embodies at least two inherently disadvantageous features with respect to the strength of the wheel, mount assembly. First, the prongs 16 projecting from the head portion 15 so that they are embedded in the grinding wheel create stress concentrations and therefor points of weakness in the grinding wheel. Second, the swaging operation deforms the shank portion 13 radially outwardly against the periphery of the mounting hole through the grinding wheel to exert substantial force upon the grinding wheel structure in a critical area, strengthwise, adjacent to the mounting hole therethrough.

U.S. Pat. No. 872,932 issued Dec. 3, 1907 to L. E. Hall discloses a discard type mounting means for a disc type grinding wheel, as illustrated in FIG. 1 of Hall, comprising a hollow sleeve C flared outwardly adjacent to the front face of the grinding wheel to form a flange D and hopefully crimped as indicated at G adjacent to a washer F engaging the rear face of the grinding wheel to press the washer F firmly against the wheel.

Since sleeve C is illustrated as having a constant wall thickness along its entire length, there is no means provided by Hall to assure that axial compression of the sleeve C will produce a crimp G either perpendicular to the central axis of the sleeve C or immediately adjacent to the washer F so that it is in fact effective to press the washer F firmly against the wheel and to hold the sleeve C firmly in fixed relation to the wheel.

SUMMARY OF THE INVENTION

The present invention contemplates an integral mounting means for a disc type grinding wheel of relatively simple design and comprising a minimum of parts, yet of ample strength to be highly reliable in service throughout the life of the grinding wheel to which it is attached, characteristically relatively inexpensive to manufacture and also arranged to be quickly and easily secured to a grinding wheel by automated equipment for assembling, marking and packing the wheel assembly for shipment.

An object of this invention is the provision of a disposable mounting means for a disc type grinding wheel, which features a relatively uncomplicated wheel mount design arranged to be securely attached to a grinding wheel.

Another object is the provision of a mounting means for a disc type grinding wheel including integral means for securing the mounting means to the grinding wheel by deformation of the mounting means.

Still another object is the provision of a mounting means for a disc type grinding wheel including integral means for attaching the mounting means to the grinding wheel fully capable of withstanding fatigue loads in excess of the fatigue load to which it is subjected during the entire life of the grinding wheel with a margin of safety sufficient to satisfy the recently adopted vigorous federal safety standards.

Other objects and advantages of this invention will be apparent from consideration of the following description thereof and of the showing in the accompanying drawings.

Referring now to the drawings wherein like reference numerals identify like or corresponding parts, the showing in the several views is as follows:

FIG. 1 is a vertical section through the central axis of a disc type grinding wheel and a cooperating expendable mount therefor, shown assembled in operative relation, but with the mount not secured to the grinding wheel,

FIG. 2 is a vertical section through the central axis of an assembled disc type grinding wheel and a cooperating expendable mount therefor, showing a back pad located adjacent to the grinding wheel clamped tightly to the grinding wheel by deformation of the mount,

FIG. 3 is a vertical section through the central axis of an assembled grinding wheel and a cooperating expendable mount therefor, showing the central portion of a back pad mounted adjacent to the grinding wheel biased toward the grinding wheel by deformation of the mounting means therefor, but spaced from the adjacent surface of the grinding wheel,

FIG. 4 is a vertical section through the central axis of the preferred embodiment of an assembled grinding wheel and a cooperating expendable mount therefor, showing a relatively thick back pad including a centrally located flange projecting rearwardly therefrom along the elongated tubular portion of the expendable mount,

FIG. 5 is a vertical section through the central axis of an alternative embodiment of a discard type mount for a grinding wheel with the enlarged flange adjacent the rear surface of the grinding wheel and the cooperating pleat adjacent the front surface of the grinding wheel, and

FIG. 6 is a vertical section through the central axis of the embodiment of a discard type mount illustrated in FIG. 5, shown in operative relation to and secured to a cooperating grinding wheel.

DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring first to FIG. 1, a conventional disc type grinding wheel generally designated by reference numeral 10 is shown in section, including a central annular depression 11 on its front face surrounding a central circular mounting hole 12 therethrough encircled by a suitable washer 13 of metal or other relatively hard material which may be molded within the external contour of the grinding wheel when the grinding wheel is formed in a suitable press therefor.

As shown, the grinding wheel 10 is backed up by a conventional annular back pad generally designated by reference numeral 15 of metal or plastic or other suitable relatively rigid, but resilient, material. While the back pad 15 as shown includes an offset central portion 16 and a surrounding peripheral flange 17, it will be understood the back pad may be of relatively reduced diameter smaller than the outer diameter of the offset portion thereof 16 so that it rests in engagement with the raised rear surface of the grinding wheel corresponding to the depression 11 on the front face of the grinding wheel.

The wheel mount comprising a circular hollow cylindrical unitary member generally designated by reference numeral 20 as shown in FIG. 1 includes a radially enlarged outer flange portion 21 which may conveniently be shaped on its peripheral surface to form a hexagonal nut adapted to the application of a wrench thereto for mounting and removing the grinding wheel from a grinding machine. The wheel mount 20 also includes an internally threaded portion 22 located concentrically within the grinding wheel 10 for attaching the grinding wheel to any of the various grinding machines on which such grinding wheels are used. The wheel mount 20 also includes an elongated tubular portion 23 projecting substantially beyond the rear face of the grinding wheel for a distance such that when it is deformed to secure the mount 20 to the grinding wheel 10, as described below, the tubular extension 23 is of the proper standard length for mounting the grinding wheel on various types of grinding machines available commercially. Finally, the wheel mount 20 includes, at a critical location lengthwise of the mount 20, intermediately between the internally threaded portion 22 and the elongated tubular portion 23 a deformation tube 24 of critical limited length and critical reduced wall thickness and having substantial radii 25 at its opposite ends.

Referring now to the showing in FIGS. 2 and 3, the wheel mount 20 is permanently secured to the grinding wheel 10 by the application of sufficient force axially of the wheel mount 20 to form a radially expanded pleat 26 in the deformation tube 24 radially overlapping the central hole through the back pad 15 and thereby securing the grinding wheel 10 and the back pad 15 between the radially extending flange 21 and the radially enlarged pleat 26 of the mount 20.

Referring now particularly to the showing in FIG. 2, sufficient force may be applied axially of the wheel mount 20 to fully deform the pleat 26 and thereby clamp the central portion of the back pad 15 firmly

against the rear face of the grinding wheel 10. From inspection of the showing in FIG. 2 it will be apparent that the central hole through the back pad 15 may be selected to be of such a shape and size as to provide interference between the inner edge of the back pad 15 and the pleat 26 and thereby enhance the clamping engagement of the pleat 26 with the back pad 15 and the grinding wheel 10.

By virtue of its shape, the generally conical tapered surface of the pleat 26 adjoining the back pad 15 not only acts lengthwise of the wheel mount 20 to constrain fully the wheel 10 and the back pad 15 longitudinally of the wheel mount 20, but also acts radially against the periphery of the central hole through the back pad 15 to constrain fully the back pad 15 radially relative to the wheel mount 20. See particularly the showing of pleat 26 in FIG. 2.

The grinding wheel assembly illustrated in FIG. 2 may additionally be secured by the application of an adhesive such as a suitable epoxy adhesive to the narrow space between the surface of the hole 12 in the wheel 10 and the adjoining outer surface of the wheel mount 20.

Referring next to the showing in FIG. 3, the deformation axially of the wheel mount 20 may be relatively reduced, as compared to the amount of deformation of the arrangement shown in FIG. 1 to produce the secured configuration shown in FIG. 2, so that the offset central portion 16 of the back pad 15 is spring biased toward but maintained out of engagement with the adjoining rear surface of the grinding wheel 10. Here again, the attachment of the wheel mount 20 to the wheel 10 may be augmented by the application of a suitable adhesive such as an epoxy adhesive to the space between the surface of the hole 12 in the grinding wheel 10 and the adjoining outer surface of the wheel mount 20.

Referring now to FIG. 4 showing the preferred embodiment of the invention, it will be apparent that the general arrangement of a disc type grinding wheel 10 and a mount 20' therefor is similar to that shown in FIGS. 1 through 3, with the exception that the back pad 15' may be characterized by a relatively thick section and includes a rearwardly projecting flange 18 extending lengthwise along the elongated tubular section 23' of the mount 20'. The back pad 15' may be manufactured conveniently from a suitable non-metallic molded plastic material, or may be die cast from a suitable metal such as zinc or aluminum or the like, or be formed by drawing a relatively thinner steel stamping to the shape shown in FIG. 4.

This embodiment of the present invention is also characterized by the relocation of the deformation tube 24' further toward the rearmost end of the elongated tubular section 23' more closely adjacent to a cooperating grinding machine to which the wheel 10 and the mount 20' are attached by the internal threads 22', in this embodiment substantially extended rearwardly along the length of the elongated tubular portion 23', to provide for engagement with the threaded wheel driving shaft of a grinding machine along a substantially extended length thereof and closer to the associated grinding machine.

The embodiment of the instant invention shown in FIG. 4 may include a back pad 15' arranged to be clamped tightly in engagement with the rear surface of the grinding wheel 10 adjacent to the central mounting

hole 12 therethrough, in a manner corresponding to the showing in FIG. 2.

Alternatively, the face of the back pad 15' adjacent to the rear surface of the grinding wheel 10 may be so shaped that it engages the surface of the grinding wheel 10 adjacent to its outer periphery 17' as illustrated in FIG. 4, and is merely biased toward the rear surface of the grinding wheel 10 adjacent to the mounting hole 12 therethrough by the pleat 26' in an assembled configuration corresponding to that illustrated in FIG. 3.

Once again, by virtue of its shape, the tapered conical surface of pleat 26' engaging the beveled surface of the back pad 15' not only acts longitudinally of the wheel mount 20' to constrain the grinding wheel 10 and the back pad 15' longitudinally of the wheel mount 20', but also acts to constrain the back pad 15' radially relative to the wheel mount 20'. See particularly the showing of the pleat 26' in FIG. 4.

In this embodiment as in those illustrated in FIGS. 2 and 3, additional means of attaching the mount 40' to the grinding wheel 10 may be provided by including between the mount and the surface of the mounting hole 12 of the grinding wheel 10 a suitable adhesive such as an epoxy adhesive. In order to provide a mechanical interconnection between the mount 20' and the included adhesive, the outer surface of the mount 20' may be provided with straight knurls or splines 27, as shown in FIG. 4.

As illustrated schematically in FIG. 2, the wheel mount assemblies illustrated in each of FIGS. 2, 3, and 4 may be assembled by supporting the flanged end of the mount 20 or 20' upon a suitable anvil 1, and by forcing a suitable arbor 2 against the free end of the tubular portion 23 or 23' of the mount 20 or 20' in the direction of arrow 3.

Referring, finally, to the showing in FIGS. 5 and 6 of an alternative embodiment of the discard type mount, the mount 20'' includes a relatively long enlarged flange 21' preferably provided with a hexagonally shaped outer surface to which a wrench may be applied, located adjacent the rear face of a cooperating grinding wheel and encircling an internal threaded portion 22'', a tubular portion 23'' initially projecting through and beyond the front face of a cooperating grinding wheel, and a reduced section 24 located lengthwise of the tubular portion 23'', so that when the tubular section is deformed lengthwise of the mount 20'' a radially outwardly extending pleat 26'' is formed adjacent to the washer 13 embedded in the front face of the grinding wheel 10.

Here again the tapered conical surface of the pleat 26'' formed adjacent to the washer 13 embedded in the front face of the grinding wheel 10 not only acts longitudinally of the wheel mount 20'' to constrain fully the grinding wheel 10 and the back pad 15 lengthwise of the wheel mount 20'', but also to constrain fully the grinding wheel radially relative to the wheel mount 20''. See particularly the showing of the pleat 26'' in FIG. 6.

Thus, as indicated in the drawings, in each embodiment of the instant invention, the conical surface of the pleat not only acts to constrain longitudinally of the wheel mount mutually engaged elements of the wheel-wheel mount assembly, namely the grinding wheel and the back pad, but also acts to constrain radially of the wheel mount the element of the wheel-wheel mount assembly engaged directly thereby, namely the back pad

or the washer embedded in the front face of the grinding wheel, either one protecting the grinding wheel against the forces exerted thereon by the pleat.

While it may not be immediately apparent that the instant invention offers substantial advantages over the teachings of the Hall patent referred to above featuring a wheel mount secured to a wheel by a crimp G in a sleeve C of constant wall thickness, there is no means whatsoever provided by Hall to assure that the crimp G will be formed perpendicular to the central axis of the sleeve C and at the proper point lengthwise of the sleeve C to effectively clamp the sleeve C to the associated grinding wheel.

In contrast to the teachings of Hall, the present invention discloses a reduced section of wheel mount 20 comprising a deformation tube 24 of a critical length to assure that the pleat 26 will always be formed perpendicular to the central axis of the mount 20 and the wheel 10, and at a critical location lengthwise of the mount 20 in which the pleat is fully effective to secure the mount 20 to the wheel 10 either as shown in FIG. 2 or as shown in FIG. 3 depending upon the amount of axial displacement of the elongated tubular portion 23 relative to the flange 21 of the mount 20, and of a wall thickness determined by the properties of the material from which the mount 20 is manufactured, consistent with relative ease of forming the pleat on one hand and with sufficient strength of the formed pleat on the other hand.

From consideration of the showing in the drawings, it will be apparent the structural configuration of each of the other embodiments of the instant invention is such that it may feature the same critical dimensional relationships in the reduced section of the tubular portion of the mount 20.

In the embodiment of FIG. 4, the critical length of the deformation tube 24' is selected to assure that the pleat 26' is always formed perpendicular to the central axis of the wheel mount 20' and the position of the deformation tube 24' lengthwise of the tubular portion 23' of the wheel mount 20' is selected so that the pleat 26' effectively engages the flange on the back pad 15'.

In the embodiment of FIG. 6, the critical length of the deformation tube 24 is selected to assure that the pleat 26'' is always formed perpendicular to the central axis of the wheel mount 20'', and the position of the deformation tube 24 lengthwise of the tubular portion 23'' of the wheel mount 20'' is selected so that the pleat 26'' effectively engages the washer 13 embedded in the front face of the grinding wheel 10.

Noting it is common practice to mount a grinding wheel of the type illustrated in the accompanying drawings upon a cooperating grinding machine by first engaging two or three turns of the internal threads 22 or 22' with the external threads on the wheel driving shaft projecting from the grinding machine, and then by starting the grinding machine to "wind" the grinding wheel onto the grinding machine until the shoulder at the rear end of the mount 20 or 20' is jammed against a cooperating shoulder on the wheel driving shaft of the grinding machine, the pleat 26 or 26' as shown in FIGS. 2 and 3 or in FIG. 4, respectively, performs a useful additional function as a shock absorbing means, with the advantage that the grinding wheel 10 is much easier to remove from the grinding machine when it is worn sufficiently to require replacement.

From the showing in the drawings, it will be apparent that the pleat 26 or 26' is in each case composed of an opposing pair of generally conical sections individually or collectively permanently deformable on impact to absorb energy, and thereby well adapted to the important additional shock absorbing function.

Since the adhesive between the surface of the mounting hole 12 and the outer surface of the mount 20 or 20' may optionally be omitted, a variation of any of the embodiments illustrated in FIGS. 2, 3, and 4 not including the adhesive provides an additional shock absorbing means during the wheel mounting operation, because the interaction between the grinding wheel 10 and wheel mount 20 or 20' at their point of interconnection is in the nature of a slip clutch which allows for relative angular displacement of the wheel and the mount responsive to the extreme inertial loading on the wheel, mount assembly, imposed during a wheel mounting operation, effected by "winding" the wheel assembly onto the cooperating grinding machine.

The written description herein and the showing in the accompanying drawings are illustrative of the instant invention, rather than limiting in any sense, and the scope of the instant invention is limited only by the scope of the claims appended hereto.

What is claimed is:

1. A disc type grinding wheel with a disposable mount permanently attached thereto, said mount comprising

a hollow elongated cylindrical body symmetrical about a central axis and extending through a central hole in said grinding wheel, including a radially enlarged flange adjacent one end thereof, a tubular portion of predetermined wall thickness adjacent to the other end thereof, and a lengthwise section of said tubular portion of a relatively reduced wall thickness to facilitate forming a pleat therein, and disposed at a predetermined location lengthwise of said tubular portion such that a pleat with a conical surface formed therein constrains said grinding wheel, and of a predetermined limited length such that a pleat with a conical surface formed therein must be formed perpendicular to the central axis of said cylindrical body, said lengthwise section being bowed outwardly by displacement of said tubular portion a predetermined distance toward said radially enlarged flange to form a radially outwardly extending pleat with a conical surface effective to constrain the body of said mount radially thereof and effective in combination with said radially enlarged flange to secure the body of said mount lengthwise thereof to said grinding wheel.

2. A disc type grinding wheel with a disposable mount permanently attached thereto, said mount comprising:

a hollow elongated cylindrical body symmetrical about its central axis and extending through a central hole in said grinding wheel, including a radially enlarged flange adjacent the rear face of said grinding wheel, a tubular portion extending from adjacent said radially enlarged flange to the front end of said circular body projecting beyond the front face of said grinding wheel, and a lengthwise section of said tubular portion of relatively reduced wall thickness as compared to the

front end of said circular body to facilitate forming a pleat therein, and disposed at a predetermined location lengthwise of said tubular portion such that a pleat with a conical surface formed therein constrains said grinding wheel, and of a predetermined limited length such that a pleat with a conical surface formed therein must be formed perpendicular to the central axis of said cylindrical body, said lengthwise section being bulged outwardly by displacement of the front end of said circular body and thence said tubular portion a predetermined distance toward said radially enlarged flange to form a radially outwardly extending pleat with a conical surface effective to secure fixedly the body of said mount radially relative to said grinding wheel and effective in combination with said radially enlarged flange to secure fixedly the body of said mount lengthwise thereof to said grinding wheel.

3. A disc type grinding wheel with a front face and a rear face and with a disposable mount permanently attached thereto, said mount comprising:

a hollow elongated cylindrical body symmetrical about a central axis including a radially enlarged flange adjacent one end thereof and engaged with the front face of said grinding wheel,

a tubular portion of predetermined wall thickness adjacent to the other end thereof and projecting through a central opening in said grinding wheel and beyond the rear face of said grinding wheel, and

a lengthwise section of said tubular portion of relatively reduced wall thickness to facilitate forming a pleat therein, and disposed at a predetermined location lengthwise of said tubular portion such that a pleat with a conical surface formed therein constrains said grinding wheel, and of a predetermined limited length such that a pleat with a conical surface formed therein must be formed perpendicular to the central axis of said cylindrical body, said lengthwise section being bowed outwardly by displacement of said tubular portion a predetermined distance toward said radially enlarged flange to form a radially outwardly extending pleat with a conical surface effective to constrain the body of said mount radially thereof and effective in combination with said radially enlarged flange to secure the body of said mount lengthwise thereof to said grinding wheel.

4. A device as described in claim 3, additionally including

a radially extended back pad with a circular inner edge defining the periphery of a central opening through said back pad, said back pad being maintained in engagement with the rear face of said grinding wheel by engagement of the conical surface of said pleat with the periphery of the central opening through said back pad.

5. A device as described in claim 4, wherein said back pad includes a flange encircling the central opening through said back pad extending rearwardly of the back pad and lengthwise of said mount,

said flange having a beveled surface located adjacent the periphery of the central opening through said back pad and also engaged by the conical surface of said pleat.

6. A disc type grinding wheel for a grinding machine having an externally threaded wheel driving shaft, said wheel having a front face and a rear face and with a disposable mount permanently attached thereto, said mount comprising:

a hollow elongated cylindrical body symmetrical about a central axis including

a radially enlarged flange adjacent one end of said cylindrical body and engaging the front face of said grinding wheel,

an internally threaded portion extending from said flange toward the other end of said cylindrical body,

a tubular portion of predetermined wall thickness adjacent to the other end of said cylindrical body extending through a central opening in the grinding wheel and beyond the rear face of said grinding wheel, and

a lengthwise section of a relatively reduced wall thickness to facilitate forming a pleat therein, and disposed at a predetermined location lengthwise of said tubular portion such that a pleat including op-

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posed conical sections formed therein constrains said grinding wheel, and of a predetermined limited length such that a pleat including opposed conical sections formed therein must be formed perpendicular to the central axis of said cylindrical body, said lengthwise section being bowed outwardly by displacement of said tubular portion a predetermined distance toward said radially enlarged flange to form a radially outwardly extending pleat having opposed conical sections effective to constrain the body of said mount radially thereof and effective in combination with said radially enlarged flange to secure the body of said mount lengthwise thereof to said grinding wheel, and also effective as a shock absorbing means by permanent deformation of at least one of the opposed conical sections of said pleat when said grinding wheel is spun on said grinding machine by first engaging a few said internal threads with the external threads of a wheel driving shaft and then energizing said grinding machine.

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