July 8, 1958 D. A. TRESCOTT 2,841,928

TRUING DEVICE FOR PERIPHERAL TYPE GRINDING WHEELS

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Fig. 4

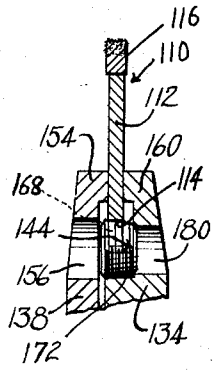


Fig. 1

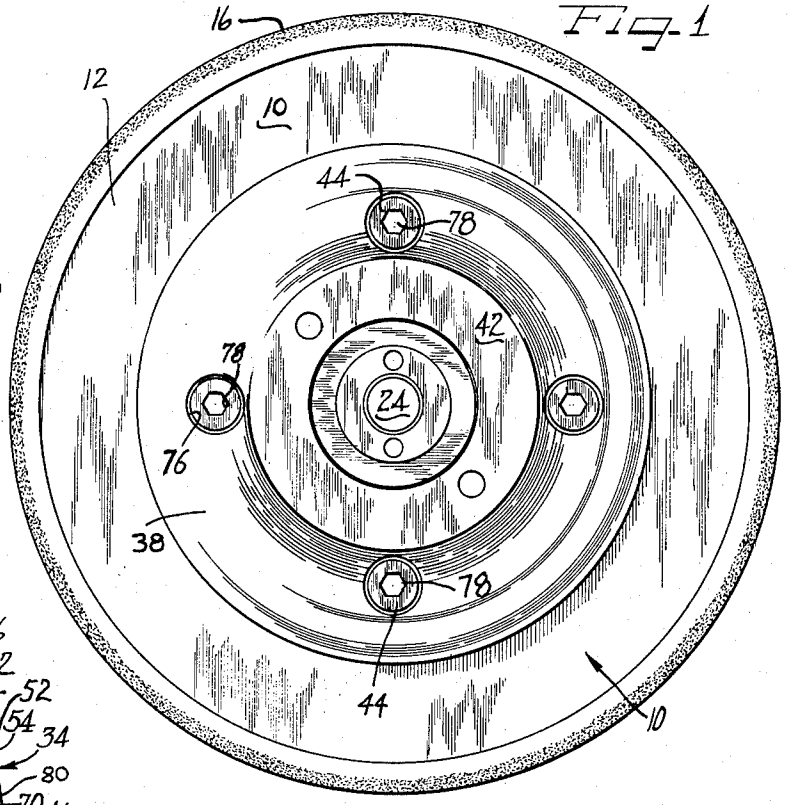


Fig. 2

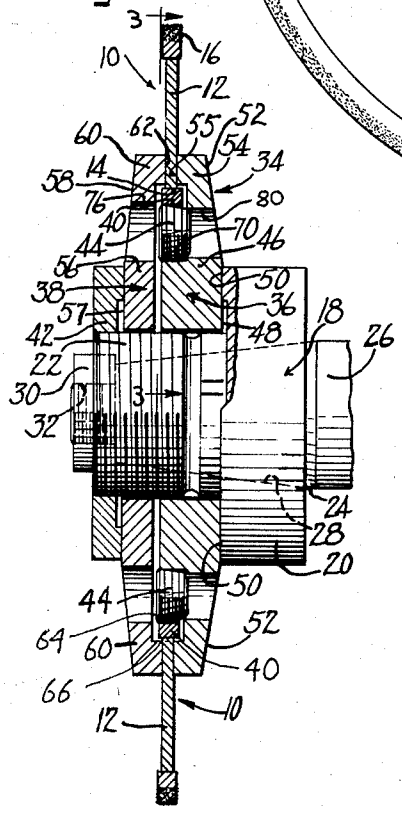
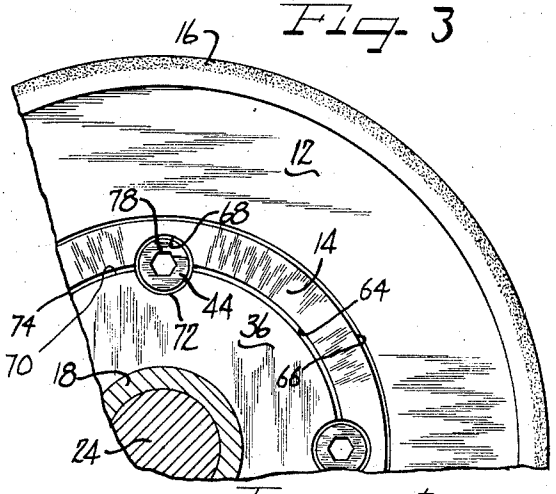


Fig. 3



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TRUING DEVICE FOR PERIPHERAL TYPE GRINDING WHEELS

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The improved truing device comprising the present invention has been designed for use primarily in connection with the truing of peripheral type diamond grinding wheels. The invention is, however, capable of other uses and the same may, if desired, with or without suitable modification, be employed for truing and/or balancing shaft-mounted abrasive or other rotary tools which differ widely in their construction and design, as well as in the use to which they may be put. Irrespective, however, of the specific application of the present truing device, the essential features thereof are at all times preserved.

In the operation of peripheral type diamond grinding wheels, only extremely small eccentric tolerances are permitted between the axis of the effective wheel periphery and the axis of the central drive shaft or spindle, both from the standpoint of accurate control of the desired work contour and of vibrational effects in the grindwheel itself during free rotation thereof. Thus, where there is any discrepancy or lack of coincidence between the axis of the peripheral ring-like diamond matrix of the wheel and the axis of the central mounting opening in the wheel, the grinding wheel cannot be mounted for proper operation on the central drive spindle or on the adaptor associated with such spindle and, at least for certain types of precision work, the wheel must be discarded. Similarly, where there is a comparatively wide tolerance between the diameter of the spindle, or the cylindrical mounting surface of the grinding wheel adaptor and the diameter of the central opening in the grinding wheel, it is difficult to mount the wheel on the spindle in a condition of either trueness or balance, or both, and much time is consumed in an effort to obtain such trueness and balance.

The present invention is designed to overcome the above-noted limitations that are attendant upon the use of conventional peripheral diamond grinding wheels and, toward this end it contemplates the provision of a novel mounting for the grinding wheel whereby the latter may be operatively mounted on the drive spindle and adjusted thereon through very fine limits of adjustment and thereby brought to a precise position of trueness and condition of balance.

The provision of a grinding wheel mounting of the character briefly outlined above being among the principal objects of the invention, it is another object to provide an adjusting means for the grinding wheel on its drive spindle or adaptor whereby comparatively large increments of movement of the adjusting tool employed for adjusting purposes will result in comparatively small increments of radial shifting movement of the wheel relative to the central axis of the mounting spindle in the desired direction.

Yet another object of the invention, in a truing device of this character, is to provide an adjusting means for varying the radial position of the grinding wheel so that its eccentricity may be brought within tolerable limits and

whereby the necessary adjustments may be made at the time of initial installation of the wheel on the spindle or at any time thereafter, without requiring complete disassembly of the parts, removal and reapplication of the wheel from and to the spindle, or rearrangement of the various parts.

It is a further object of the invention to provide a truing device of this sort which utilizes plural interdependent adjusting means, all of which become effectively locked in their respective adjusted positions when a final adjustment on the last adjusting means of the series has been made.

The provision of a truing device for peripheral type diamond grinding wheels which is in the form of an adjustable mounting having a minimum number of relatively movable parts and which, therefore, is unlikely to get out of order; one which is rugged and durable and which, therefore, will withstand rough usage; one which is simple in its construction and which is thus easy to operate; and one which otherwise is well adapted to perform the services required of it, are further desirable features which have been borne in mind in the production and development of the present invention.

Numerous other objects and advantages of the invention, not at this time enumerated, will become more readily apparent as the following description ensues.

In the accompanying single sheet of drawings forming a part of this specification, two illustrative embodiments of the invention have been shown.

In these drawings:

Fig. 1 is a front elevational view partly in section of a peripheral type grinding wheel showing the same operatively mounted on a central adaptor by means of the present truing device;

Fig. 2 is a side elevational view, partly in section, of the structure shown in Fig. 1;

Fig. 3 is a quarter sectional view taken substantially along the line 3—3 of Fig. 2; and

Fig. 4 is an enlarged fragmentary detail sectional view taken on a radial plane transversely through a modified form of the truing device.

Referring now to the drawings in detail and in particular to Figs. 1 and 2, a conventional peripheral type diamond grinding wheel is designated in its entirety at **10** and comprises the usual wheel body or annulus **12** provided with a central circular mounting or arbor opening **14** therein and the outer periphery of which has mounted thereon a matrix assembly **16** consisting of crushed or fragmented diamonds. The grinding wheel **10** is shown as being mounted on a conventional adaptor **18** having a rearwardly disposed radial clamping head **20** and a threaded shank portion **22** by means of the truing or mounting device of the present invention and which will shortly be described in detail. The adaptor **18** is carried at the outer tapered end **24** of a drive shaft or spindle **26**, associated with a conventional grinding machine (not shown) the end **24** fitting within a tapered bore **28** provided in the spindle. A clamping nut **30** which is countersunk in the adaptor **18** and threaded as at **32** on the reduced end of the spindle **26** serves to secure the adaptor on the spindle for rotation in unison therewith.

In the form of the invention shown in Figs. 1 to 3, inclusive, the mounting device per se is designed in its entirety at **34** and is comprised of four annular parts including a rear clamping ring **36**, a front clamping ring **38**, an intermediate radially shiftable centering ring **40**, and a pull-up or clamping nut **42**. The device further includes a series of adjusting or centering screws **44** of which there preferably are four in number although a

greater or lesser number of such screws may be employed if desired.

The rear clamping ring 36 is in the form of a relatively thick circular plate having a central hub portion 46 of uniform thickness presenting a flat radial rear side 48 which fits against a forwardly facing annular shoulder 50 formed on the adaptor head 20, and having an outer frusto-conical rear surface 52 of small slant height. The outer portion 54 of the ring 36 is of less thickness than the thickness of the hub portion 46 and has formed thereon a forwardly facing circular rib presenting a flat annular clamping surface 55 adapted to bear against the rear side of the wheel body 12. The front clamping ring 38 is similar in its design to the ring 36 and includes a central hub portion 56 presenting a flat radial front face 57 and having an outer frusto-conical surface 58 of small slant height. The outer portion 60 of the ring 38 is of less thickness than the thickness of the hub portion 54 and has formed thereon a rearwardly facing circular rib presenting a flat annular clamping surface 62 which opposes the surface 55 and is adapted to bear against the front side of the wheel body 12 so that the latter may be clamped between the two surfaces 55 and 62. The clamping nut 42 is adapted to be tightened on the threaded shank portion 22 of the adaptor 18 to draw the various parts together, thus clamping the two rings 36 and 38 between the nut 42 and shoulder 50 on the adaptor head 20 and, in turn, clamping the inner peripheral regions of the wheel body 12 between the surfaces 55 and 62 in selected positions of adjustment of the wheel under the control of the various adjusting screws 44 in a manner that will be made clear presently.

The ring 40 fits within the central opening 14 in the grinding wheel 12 with a tight frictional fit, there being no lost motion between these two parts. The ring 40 is of small radial width and the inner and outer peripheral edges 64 and 66 thereof respectively are truly cylindrical. The inner peripheral edge 64 is formed with a series of semi-circular recesses 68, four such recesses being shown for illustrative purposes as well as for most efficient operation of the device although a greater or lesser number of the recesses may be employed if desired. The four recesses 68 are circumferentially spaced with adjacent recesses being 90° from each other so that each recess is diametrically opposed by one of the other recesses. The outer surface 70 afforded by the hub portion 46 of the rear ring 36 is truly cylindrical and it is formed with a series of four similarly spaced semi-circular recesses 72 designed for opposition to and register with the four recesses 68 in the ring 40. The external diameter of the hub portion 46 of the ring 36 is slightly less than the internal diameter of the ring 40 so that the hub and ring are normally separated by a narrow circular space 74 (see particularly Fig. 3) with the former being capable of limited radial adjustment in any desired direction within the latter by means of the adjusting screws 44 as will be described in detail.

The opposed pairs of semi-circular recesses 68 and 72 define, in effect, therebetween four holes or "split openings" which are spaced 90° apart and each of which has its opposite walls threaded, thus providing a series of interrupted threads, each adapted to receive therein in threaded relationship one of the adjusting screws 44. The adjusting screws are of conventional threaded tapered design, the screws preferably being inserted into their respective split openings from the front side thereof and being capable of adjustment from the front of the machine, utilizing a suitable tool such as an Allen type wrench which may be passed through a series of openings 76 provided in the ring 38 in alignment with the split openings and received in hexagonal sockets 78 (Fig. 3) which are characteristic of screws of this type. Additional openings 80 are formed in the rear ring 36 in alignment with the openings 76 and afford the necessary clearance for the small ends of the tapered screws 44.

The clamping nut 42 may be of the circular type and is formed with a pair of diametrically opposed spaced holes 75 therein designed for cooperation with a suitable tool such as a spanner wrench or the like and by means of which the hub may be tightened on the threaded shank portion 22 of the adaptor 18.

In operation of the above described mounting device 34, the grinding wheel 10 is first mounted on the adaptor 18 with the ring 40 fitted within the arbor openings and with the ring 40 disposed between the opposed inner faces of the rings 36 and 38 in floating relationship with respect thereto and with the pull-up nut 42 drawn up loosely against the front face 57 of the front clamping ring 38. It is then necessary only to insert a wrench into and through one or more of the openings 76 in the ring 38 and into the hexagonal sockets 78 for proper cooperation with one or more of the adjusting screws 44, turning the latter in one direction or the other to advance or retract the same longitudinally in the split openings afforded by the opposed semi-circular threaded portions 68 and 72 and thus bring the floating ring 40, and consequently, the grinding wheel 10, to a precise adjustment wherein an indicating instrument or gauge will indicate that the diamond matrix of the wheel is true with respect to the axis of the spindle 26. Ordinarily, truing of the grinding wheel 10 in this manner will, to a large extent, compensate for any unbalanced forces which might otherwise arise in the rotating wheel and the latter will be in perfect balance, as well as being true on the driving spindle.

During the actual adjusting operation as described above, turning of any one of the adjusting screws 44 in a direction to advance the same axially in the split opening provided for it will serve to spread the opposed semi-circular walls of the recesses 68 and 72 apart by a combined camming and wedging action, thus applying a direct radial thrust to the ring 40, or, depending upon the particular setting of the other adjusting screws, applying a vectorial component of radial thrust to the ring. Experience will dictate the particular order of adjustment of the various screws 44 as well as the extent to which each screw shall be turned to effect the desired adjustment. The adjusting of the last screw 44 in the series will effect a four-way binding of the ring 40 and tightening of that particular screw against the recess wall 68 will draw the ring firmly into locking engagement with all of the adjusting screws so that the inwardly directed counter-thrust applied thereto will lock the grinding wheel in its final adjusted position. After the necessary adjustment of the screws 44 has been made, the clamping screw 30 may be tightened against the adaptor 26 and the machine set into operation.

In the form of the invention shown in Fig. 4, the front and rear clamping rings remain substantially the same as in the previously described form shown in Figs. 1 to 3, inclusive. In this instance however, the intermediate ring 40 has been omitted. To avoid needless repetition of description, similar reference numerals of a higher order have been applied to the corresponding parts in Fig. 4. With the intermediate ring 40 omitted, the inner periphery 114 of the grinding wheel body 112 is provided with semi-circular threaded recesses 168 which cooperate with the opposed threaded recesses 172 formed in the hub portion 146 of the rear clamping ring 136 and with the adjusting screws 144 in the manner previously described in connection with the recess walls 68 and 72 and adjusting screws 44. In this instance, the radial thrust or the vectorial thrust occasioned by the spreading action of the adjusting screws 144 will be applied directly to the grinding wheel body 112 instead of through the intermediate ring 40 as in the other form of the invention.

The purpose of the ring 40 in the previously described form of the invention is threefold. Firstly, since it is of greater thickness than the body of the grinding wheel body 12, it affords greater thread area and consequently a more positive spreading action, as well as better fric-

tional binding characteristics; secondly, it extends the radial reach of the clamping surfaces 55 and 62 to secure a better clamping action therebetween on the wheel body; and thirdly, it eliminates special machining of the grinding wheel body which, of course, is unnecessary where the latter is to be installed on an adaptor directly and without benefit of the advantages of the present invention.

In compliance with title 35 U. S. Code, section 22, a preferred form of the invention and one modification thereof have been shown in the drawings and described herein, but it should be understood that the invention is not to be limited to the specific disclosure made inasmuch as various changes in the details of construction may be resorted to without departing from the spirit of the invention. The ensuing claims therefore should be construed as broadly as the prior art will permit.

Having thus described the invention what I claim as new and desire to secure by Letters Patent is:

1. In a device for operatively mounting a peripheral type grinding wheel or the like having a mounting opening therein on a machine spindle between a shoulder normal to and rotating with the spindle and a pull-up nut on the forward end of the spindle, in combination, front and rear clamping rings surrounding the spindle between said shoulder and nut in concentric relation with respect to the spindle and in engagement with the opposite faces respectively of the wheel in clamping relation thereto under the influence of said pull-up nut, a hub portion formed on said rear clamping ring presenting an outer cylindrical surface, an intermediate mounting ring fitting within said mounting opening of the wheel and surrounding said cylindrical surface on the hub and spaced from the latter, said intermediate ring being loosely disposed between said front and rear clamping rings and capable of radial adjustment relative to the hub in any angular direction, and an adjustable wedge member interposed between said hub and intermediate ring at at least three widely and circumferentially spaced regions therearound, said wedge members each being operable upon progressive adjustment thereof in one direction to exert increasing increments of outward radial thrust on the intermediate ring member.

2. In a device for operatively mounting a peripheral type grinding wheel or the like on a machine spindle, the combination set forth in claim 1 wherein said wedge members are each shiftable in opposite directions longitudinally of the spindle and grinding wheel.

3. In a device for operatively mounting a peripheral type grinding wheel or the like on a machine spindle, the combination set forth in claim 1 wherein each of said wedge members is in the form of a tapered body having opposite side surfaces in sliding contact with the outer cylindrical surface of the hub and the inner peripheral surface of said intermediate ring respectively.

4. In a device for operatively mounting a peripheral type grinding wheel or the like on a machine spindle, the combination set forth in claim 1 wherein each of said wedge members is in the form of a longitudinally extending tapered adjusting screw having a frusto-conical threaded surface in threaded engagement with the outer cylindrical surface of the hub and the inner peripheral surface of said intermediate ring respectively.

5. In a device for operatively mounting a peripheral type grinding wheel or the like having an arbor opening therein on a machine spindle between a shoulder normal to and rotating with the spindle and a pull-up nut on the forward end of the spindle, in combination, front and rear clamping rings surrounding the spindle between said shoulder and nut in concentric relation with respect to the spindle and in engagement with the opposite faces of the wheel respectively in clamping relation thereto under the influence of said pull-up nut, a hub portion formed on one of said clamping rings presenting an outer cylindrical surface, an intermediate mounting ring fitting within said mounting opening of the wheel and surrounding said cylindrical surface on the hub and spaced from the latter, said intermediate ring being loosely disposed between said front and rear clamping rings and capable of radial adjustment relative to the hub in any angular direction, and an adjustable wedge member interposed between said hub and intermediate ring at at least three circumferentially spaced regions therearound, said wedge members each being operable upon progressive adjustment thereof in one direction to exert increasing increments of outward radial thrust on the intermediate ring member.

6. In a device for operaively mounting a peripheral type grinding wheel or the like on a machine spindle, the combination set forth in claim 5 wherein each of said wedge members is in the form of a longitudinally extending tapered adjusting screw having a frusto-conical threaded surface in threaded engagement with the outer cylindrical surface of the hub and the inner peripheral surface of said intermediate ring respectively.

7. In a device for operatively mounting a peripheral type grinding wheel or the like on a machine spindle, the combination set forth in claim 5 wherein each of said wedge members is in the form of a longitudinally extending tapered adjusting screw having a frusto-conical threaded surface, and in which the outer cylindrical surface of the hub and inner spaced surface of the intermediate ring are formed with opposed semi-circular recesses at said circumferentially spaced regions respectively, each of which partially embraces and threadedly engages one of said adjusting screws.

8. In a device for operatively mounting a peripheral type grinding wheel or the like on a machine spindle, the combination set forth in claim 5 wherein said wedge members are four in number and are circumferentially spaced 90° apart.

9. In a device for operatively mounting a peripheral type grinding wheel or the like having an arbor opening therein on a machine spindle between a shoulder normal to and rotating with the spindle and a pull-up nut on the forward end of the spindle, in combination, front and rear clamping rings surrounding the spindle between said shoulder and nut in concentric relation with respect to the spindle and in engagement with the opposite faces of the wheel respectively in clamping relation thereto under the influence of said pull-up nut, a hub portion formed on one of said clamping rings and extending axially into the grinding wheel arbor opening, said hub portion presenting an outer cylindrical surface in radial opposition to and spaced from the inner peripheral edge of said grinding wheel, and an adjustable wedge member interposed between said surface and the inner peripheral edge of said grinding wheel at at least three circumferentially spaced regions therearound, said wedge members each being operable upon progressive adjustment thereof in one axial direction to effectively exert increasing increments of outward radial thrust on the grinding wheel.

10. In a device for operatively mounting a peripheral type grinding wheel or the like on a machine spindle, the combination set forth in claim 9 wherein said hub portion is formed on the rear clamping ring.

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