March 27, 1928. 1,663,703

F. J. HOHNHORST ET AL.

MECHANISM FOR TRUING AND DRESSING GRINDING WHEELS

Filed Feb. 16, 1925 3 Sheets-Sheet 1

Fig. 1.

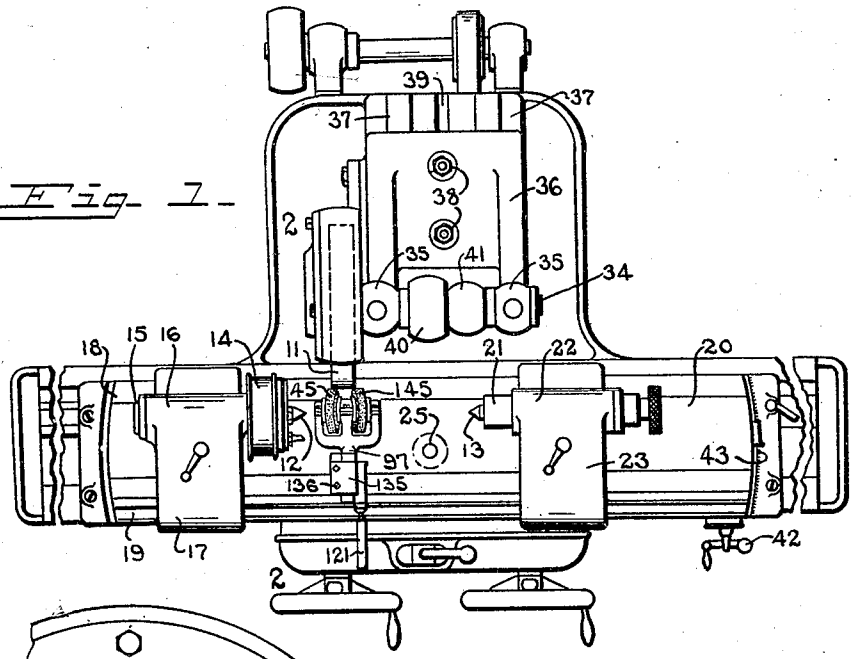

Fig. 2.

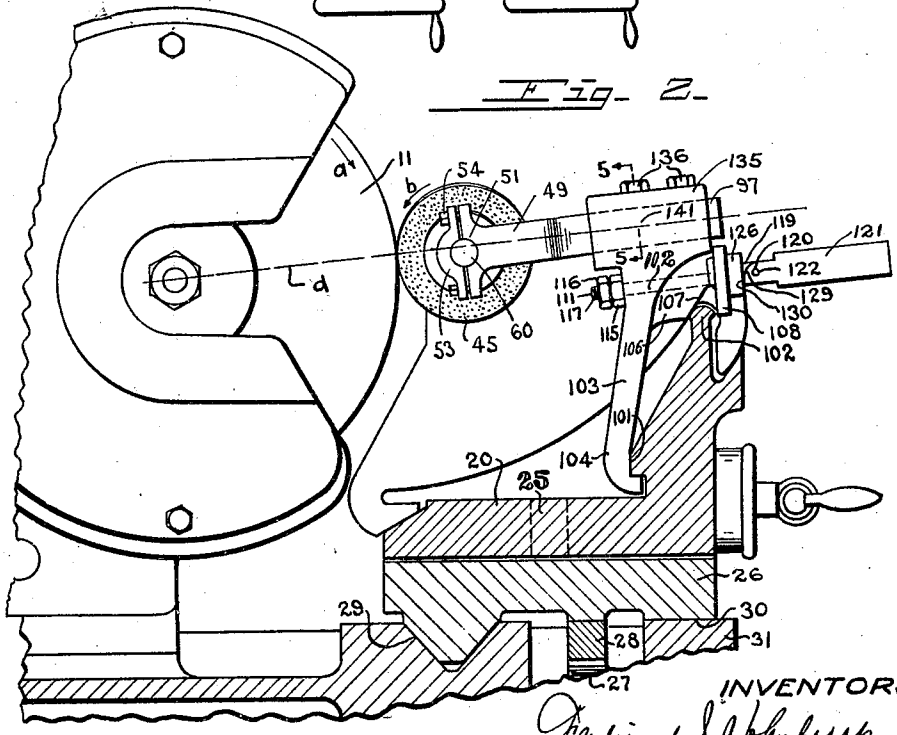

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Fig. 3.

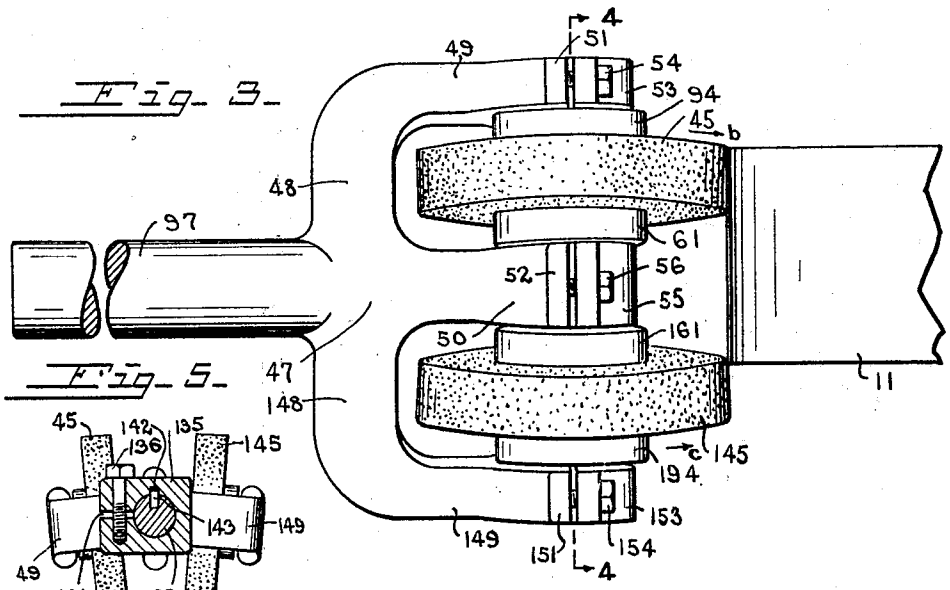
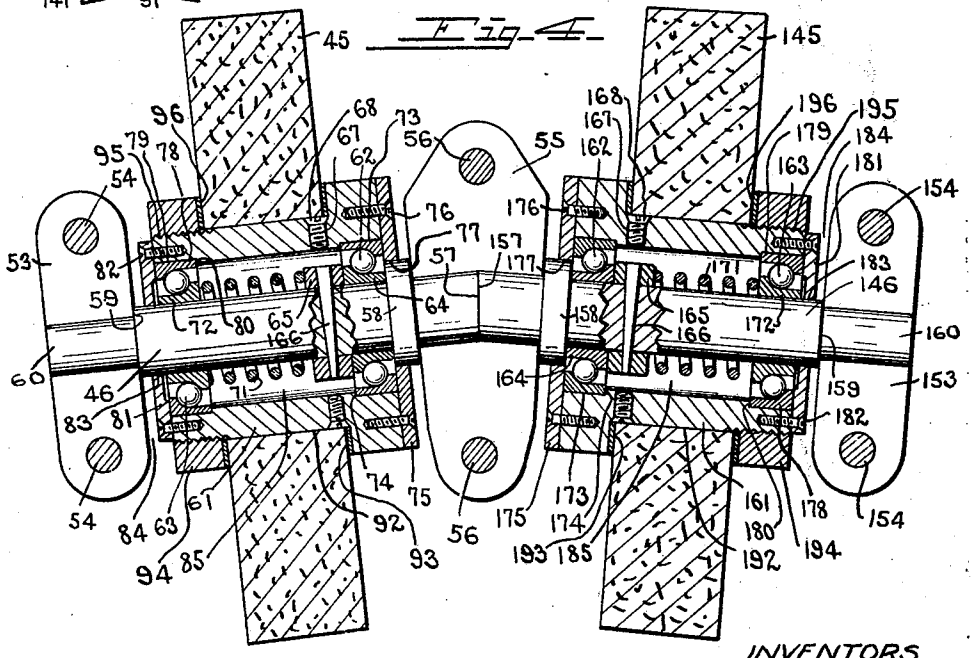


Fig. 5.

Fig. 4.



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MECHANISM FOR TRUING AND DRESSING GRINDING WHEELS

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Fig. 6.

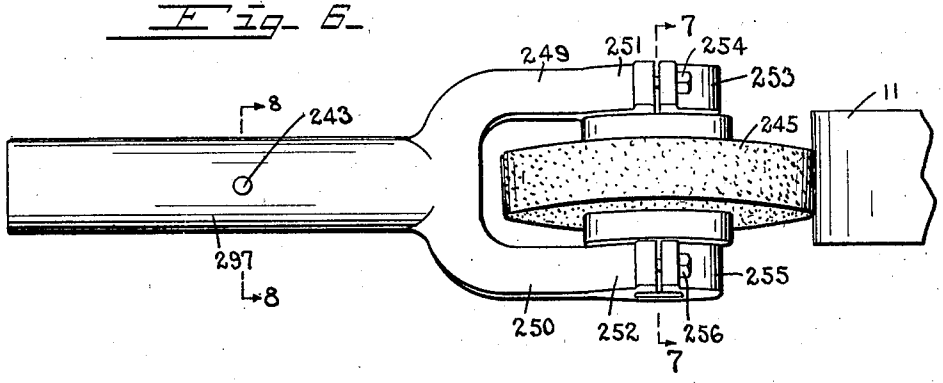


Fig. 8.

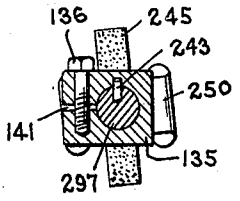
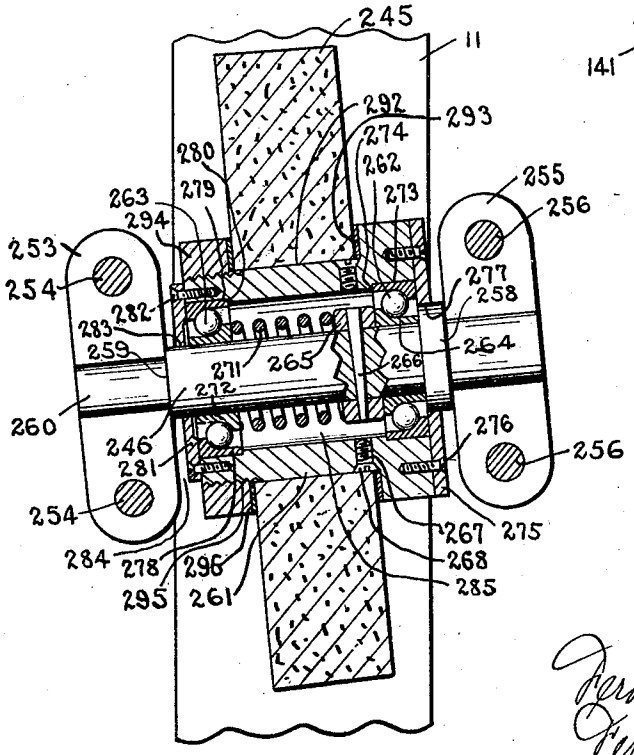


Fig. 7.



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UNITED STATES PATENT OFFICE.

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MECHANISM FOR TRUING AND DRESSING GRINDING WHEELS.

Application filed February 16, 1925. Serial No. 9,412.

Our invention relates to mechanism for truing and dressing grinding wheels, such as emery wheels employed in machinery for grinding or polishing surfaces of metal in precision grinding, and is exemplified as employable for truing or dressing the grinding wheel without removing the grinding wheel from the grinding or polishing machine.

Our invention is an improvement upon the devices shown, described and claimed in our copending applications for patents on improvements in mechanism for truing and dressing grinding wheels, respectively filed in the United States Patent Office May 31, 1924, as Serial No. 717,015, and January 30, 1925, as Serial No. 5,707.

We have found that in precision grinding or polishing, it is essential for obtaining best results that the grinding wheel shall be maintained in its true form, for instance, cylindrical form, and that for accomplishing this, it is advisable to employ an abrading wheel or abrading wheels located at an angle with relation to the plane of the grinding wheel, and, when more than one abrading wheel is employed, to locate these at angles with relation to each other, and to mount the abrading wheel or abrading wheels in such manner that vibrations thereof during the grinding or polishing are avoided, in order that no grooves, ridges or varying surfaces may be imparted to the grinding or polishing surface of the grinding wheel by the truing or dressing device.

It is an object of our invention therefore to provide a truing or dressing device of this character.

It is the object of our invention, further, to provide an abrading wheel having ball bearings at the respective sides thereof, and mounted on a stub, shaft or axle, hereinafter called an axle, which is preferably rigidly held, and having supports at its respective ends so positioned that the plane of the abrading wheel is at an angle to the plane of the grinding wheel.

It is the object of our invention, further, to provide a head and a plurality of axles in said head in non-parallel directions, and rotary abrading wheels about said axles in non-parallel planes, and supports at the respective ends of said axles so as to locate supports at the respective sides of said respective abrading wheels; further, to provide means whereby the axle or axles may be readily removed from and applied to the head, so that the parts may be readily assembled and dissembled for attention and repairs of the same.

The invention will be further readily understood from the following description and claim, and from the drawings, in which latter:

Fig. 1 is a plan view of our improved device applied to an exemplified grinding machine, partly broken away.

Fig. 2 is a cross-section of the same, taken on the line 2—2 of Fig. 1, and partly broken away.

Fig. 3 is a plan view of the abrading wheels and the mounting therefor in a preferred relation to a grinding wheel, the latter partly broken away.

Fig. 4 is a vertical axial section of the same, taken on the line 4—4 of Fig. 3, and partly broken away.

Fig. 5 is a detail in section on the line 5—5 of Fig. 2.

Fig. 6 is a plan view of a modified form of the mounting for the abrading wheel, shown in relation to a grinding wheel, partly broken away.

Fig. 7 is a vertical axial section of the same, taken on the line 7—7 of Fig. 6; and,

Fig. 8 is a detail in section taken on the line 8—8 of Fig. 6.

We have exemplified our invention as employed in connection with a so-called grinding or polishing machine employing a rotary grinding wheel 11 for effecting the grinding or polishing.

The work to be ground or polished, which may for instance be a shaft, is arranged to be placed between suitable centers 12, 13, of which 12 may exemplify a head-center, arranged to be rotated by suitable driving means, as by a pulley 14. A usual quill 15 in which the head-center is supported in usual manner is journaled in a bearing 16 of a head-stock 17, slidable laterally on guideways 18, 19, of a table 20.

The tail-center 13 is mounted in a suitable sleeve 21, movable axially in a bearing 22, in usual manner, the bearing being on a tail-stock 23 laterally adjustable on the guideways 18, 19, of the table 20.

The table is exemplified as pivotally mounted by a pivot 25 on a saddle 26, which has lateral reciprocating motion imparted thereto by power means, in usual manner, as by a pinion 27, suitably driven, meshing

with the rack 28 extending lengthwise of the saddle and fixed to the saddle. The saddle is slidable on guideways 29, 30, on the frame 31 of the machine.

The grinding wheel 11 is suitably fixed to a shaft 34 journaled in bearings 35 of a slide 36, and adjustable toward and from the work-table on guideways 37, by any suitable means, the slide being arranged to be clamped by means of suitable T-bolts and nuts 38, the heads of the T-bolts coacting with the T-slot 39 in the frame, and the nuts clamping the slide to the frame. The shaft is rotatable in suitable manner, as by a belt passing about suitable pulleys 40, 41, fixed to the shaft.

In the exemplification, the work located between the centers may be caused to reciprocate axially in planes parallel to the axis of rotation of the grinding wheel for grinding or polishing straight work, or the table may be adjusted to an angle with relation to said parallelism, effected, for instance, by rotation of the handle 42 according to the reading on the gage 43.

We have in the present exemplification illustrated a reciprocating table on which to mount the work, the grinding wheel having a stationary position, although the relation of the parts may be reversed, the work being stationarily positioned and the grinding wheel having reciprocations imparted to it. We have instanced the abrading parts as acting on the grinding wheel in the absence of work between the centers. The grinding machine may be of any desirable construction.

The rotary abrading parts are exemplified as abrading wheels 45, 145. These abrading wheels are preferably of a texture much harder than the grinding wheel and of smaller diameter than the diameter of the grinding wheel on which they operate. Both abrading wheels operate on the same grinding wheel. The rotation imparted to the grinding wheel is instanced as in the direction of the arrow *a*, while the rotations imparted to the abrading wheels through the medium of the grinding wheel are instanced as in the direction of the arrows *b*, *c*.

The grinding wheel during operation becomes impregnated with particles of dirt or metal from the work being operated on, and becomes comparatively glossy and thereby loses its grinding effect, its granular structure also becoming dull at the grinding face, thereby reducing its grinding or polishing properties.

By means of our invention, particles of dirt and metal are removed from the grinding surface of the grinding wheel by coacting rotary abrading parts which act counter to each other or crossingly with relation to each other upon the grinding surface of the grinding wheel, whereby to clear the recesses and pores in the grinding surface, as by having the respective abrading parts coact in different directions for drawing and wiping the particles of dirt and metal out of the recesses and pores, and for sharpening the particles or grains in the abrading surface, by successive actions thereon by the respective rotary abrading parts, effected, for instance, by the opposite positions and opposite formations of the rotary abrading parts.

By means of our invention further, the rotary abrading parts are located about rigid axles and are caused to rotate in fixed paths for imparting regular and unvarying form to the grinding wheel throughout the grinding surface of the grinding wheel, in order that coaction between all portions of said grinding surface and the work may be equal for imparting regular and unvarying contour and polish to said work.

The swirling actions of the respective rotary abrading parts upon the grinding surface are in opposite directions, so that the swirling action of one of said rotary abrading parts is to draw the dirt or particles of metal out of the interstices or contours in one direction, whereas the other rotary abrading part acts upon said dirt or particles in the opposite direction, so as to insure that said particles of dirt and metal are dislodged from said interstices or contours. The abrasive actions of the respective rotary abrading parts upon the particles or grains in the grinding surface are also in similar opposite directions, whereby a highly effective cleaning, abrading and sharpening action is quickly obtained.

The abrading wheels are exemplified as having their points of closest approach below their axes of rotation, the axles on which they are mounted drooping laterally preferably from a point preferably in the plane, exemplified by the dotted line *d* in Fig. 2, in which the axis of rotation of the grinding wheel and the point of intersection between the lines of contact, extended, between the abrading wheels and the grinding wheel are located, also exemplified as the plane in which the axis of rotation of the grinding wheel and the axis of the shank of our improved device are located, which has the effect, as exemplified in Fig. 3, of causing the outer edges of the abrading wheels to reach under the grinding wheel to greater extent than the inner edges of said abrading wheels, when grinding or polishing said grinding wheel on a true cylinder.

The abrading wheels are further mounted on axles having supports at their respective ends, these axles being preferably fixed in their supports, and having ball bearings about said axles adjacent to the respective supports of said axles, the abrading wheel

or wheels being located between the outer ends of said ball bearings, the construction being such that an axle of relatively small diameter may be employed, whereby ball bearings of small diameters may be received about the axle, and the hole in the abrading wheel be correspondingly small, so as to provide an abrading wheel of relatively small diameter containing a maximum amount of abrading material for the diameter of the same.

The abrading wheels are normally quiescent and rotation is imparted to them by means of the friction contact of the rotating grinding wheel therewith.

We shall describe the mounting of the abrading wheel 45, the mounting of the abrading wheel 145 being similar thereto, but having the parts disposed in opposite directions, the parts being designated by similar reference numerals increased to the series 100.

Stubs, shafts or axles are provided, hereinafter referred to as axles, about which the abrading wheels are arranged to rotate. Referring to Figs. 1 to 5 inclusive, axles 46, 146, are mounted on a head 47, exemplified as including a plurality of yokes 48, 148, comprising outer fork-arms 49, 149, and an intermediate fork-arm 50, these fork-arms being laterally arranged. Supports 51, 151, are located on the outer ends of the outer fork-arms, and supports 52, 152, are located at the outer end of the intermediate fork-arm. These latter supports may be formed as one and have their supporting portions for the respective axles extend in angular relation to each other.

Caps 53, 153, form releasable parts of the supports on the outer fork-arms, and are secured to the supporting parts rigid with the fork-arms by bolts 54, 154. A cap 55 for the intermediate supports 52, 152, is secured to the intermediate fork by bolts 56, this last-named cap having supporting portions arranged at angular relations to each other for receiving the respective axles.

The axles are preferably held fixed in their respective supports. Thus they may be clamped firmly in their supports. In order to further avoid relative rotation between the axles we provide their proximate ends with coacting faces, represented as the end faces 57, 157, which abut each other in the supports 52, 152, and are at angles to the respective shafts, whereby relative rotations between the shafts is prevented.

The axles are preferably also held endwise in their supports, as by providing one of their ends with a collar 58, 158, which hold the axles against approach toward each other, such approach being limited by the intermediate supports 52, 152, the other end of the axles being provided with shoulders 59, 159, which prevent axial separation between the axles by coaction with the outer supports 51, 151, these latter supports receiving the reduced ends 60, 160, of said axles. The pressures on these axles by the grinding wheel is toward the solid parts of the supports.

Shells 61, 161, are received about the axles, ball bearings 62, 162, being located between the proximate ends of said shells and axles, and ball bearings 63, 163, being located between the outer ends of said shells and axles.

The inner raceways 64, 164, of the inner ball bearings are positioned between the collars 58, 158, on the axles and collars 65, 165, releasably secured to said axles, as by tapered pins 66, 166, which may be inserted or removed through holes 67, 167, in the sleeves, normally closed by screws 68, 168.

Helical springs 71, 171, are located between the collars 65, 165, and the inner raceways 72, 172, of the outer ball bearings.

The outer race-ways of the proximate ball bearings are located in annular rabbets 73, 173, in the inner peripheries of the shells, being held therein between shoulders 74, 174, in said bores and annular flanges 75, 175, on said shells, at the proximate ends of the latter, the said flanges being fixed to said shells by screws 76, 176. Holes 77, 177, are in these flanges, the walls of the holes making close joint with the outer peripheries of the collars 58, 158, for preventing dust and dirt getting into the ball bearings and the interior of the shells.

The outer raceways 78, 178, of the outer ball bearings are located in annular rabbets 79, 179, in the bores of the shells, and are held between shoulders 80, 180, in said bores and outer end flanges 81, 181, fixed by screws 82, 182, to the outer ends of said shells. These latter flanges are provided with central holes 83, 183, received about the axles adjacent to the outer shoulders on said axles, and the walls of said holes have close union with said axles for preventing the admission of dust and dirt into the interior of the shells and the ball bearings therein.

The springs 71, 171, are located between the collars 65, 165, and the inner raceways of the outer ball bearings about the axles, for normally causing separation between the inner raceways of the ball bearings at the respective ends of the respective axles. One of the ends of the springs bear against the collars 65, 165, the other ends of the springs bearing against the inner raceways of the outer ball bearings, for urging the latter axially outward. This causes axial outward urging of the outer raceways of the outer ball bearings, for causing similar urging of the shells, and consequently of the outer raceways of the proximate ball bearings, for urging the inner raceways of the latter toward said collars 65, 165, and thereby caus-

ing intimate engagement between the raceways and the balls, and maintaining the shells concentric with said axles, the resistances of the springs being sufficient to prevent axial movements of the shells, which might be due to the lateral stress upon the abrading wheels during operation.

Slight spaces 84, 184, are left between the flanges 81, 181, and the outer bearings 51, 151, of the yokes. The ball bearings are combined radial and end thrust bearings. The construction maintains the abrading wheels continuously in given paths of rotation and avoids lateral vibrations thereof, and at the same time permits their ready rotation.

The spaces 85, 185, in the interior of the shells may receive a lubrication through the holes 67, 167, normally closed by the screws 68, 168.

The shells have the abrading wheels fixed thereto, which latter are received in annular rabbets 92, 192, in the outer periphery of said shells, between shoulders 93, 193, thereon and nuts 94, 194, threaded to the outer threaded ends 95, 195, of said shell. Suitable washers 96, 196, preferably fibrous in nature, are located between said abrading wheel, the shoulder and the nut. The threadings of the threaded ends are preferably in such directions as to cause tightening of the nuts during operation of the abrading wheels.

The axles being normally stationary, they may be of comparatively small diameter, whereby ball bearings of comparatively small diameters may be employed, in order that the holes in the abrading wheels may be of comparatively small diameters, the construction being such, however, that the abrading wheels will withstand great lateral strains, and maintain their paths of rotations truly, as they are provided with a ball bearing and a bearing for the axle at each of their sides, preventing lateral play and wobbling, and enabling comparatively long axles and sleeves to be employed while placing the abrading wheels in angular and close relation to each other for simultaneously acting upon the same grinding wheel in order to true and dress the latter.

The head is provided with a shank 97 extending therefrom, and shown of heavy and substantial nature and arranged to be rigidly secured in place on the grinding machine.

The exemplified means for fixing the shank in place comprise the following instrumentalities: The table of the grinding or polishing machine is provided with a guide 101 and a rail 102. A clamp 103 is provided with a jaw 104 coacting with the guide and a clamping means, the latter comprising a jaw 106 having an inclined face 107 on the body of the clamp and a clamp-plate 108, the inclined face and the clamp-plate being arranged to clamp upon the rail 102.

A stem 111 is located in the bearing 112 of the clamp. An adjusting nut 115 and a lock nut 116 are received over the threaded end 117 of said stem. Said stem is provided with a flattened head 119, a fork 120 of a handle 121 being received about said head and articulated therewith by means of a pin 122.

The head 119 is received through a slot in a cap 126. The inner end of the fork 120 is provided with cams 129 and shoulders 130 at the respective sides of the flattened head 119. These cams and shoulders are arranged to bear against the cap, and to cause clamping movement between said cap and the clamp-plate 108 at one side of the rail 102 and the inclined face 107 at the other side of said rail, causing clamping of the jaw upon said rail.

The body of the clamp is provided with a bearing 135, shown as a clamp-bearing, in which the shank 97 is received and rigidly held, the clamp-bearing being clamped to the shank by means of bolts 136, received through holes of a cheek 138, and threaded in threaded holes of a cheek 140, the cheeks being located at the respective sides of the split 141 in said clamp-bearing, which is thereby constituted a split-bearing. In order to position the shank rotatively in the clamp, we provide the inner face of the clamp with a groove 142, in which a pin 143 in said shank is received. The shank may be axially adjusted in the clamp-bearing.

The shank is preferably so positioned that its axis is parallel with a radial line of the grinding wheel, as indicated by the dotted line *d*, and so that each of the abrading wheels will be inclined equally with relation to a plane perpendicular to the axis of the grinding wheel. This inclining may be exemplified as a drooping inclination of five degrees from the perpendicular for each of the abrading wheels.

One or both of the abrading wheels may be employed, both being employed preferably when grinding wheels having comparatively wide faces are to be trued or dressed, so that the truing and dressing operation may be performed before detrimental wear sets in in the abrading wheels, in order that a truly cylindrical grinding wheel having an even surface throughout may result from the employment of the abrading wheels.

If it is desired to employ one of the abrading wheels, a structure like the modification shown in Figs. 6 to 8 inclusive may be employed, in which parts similar to the parts shown and described in Figs. 1 to 5 inclusive, are identified by similar reference numerals, raised to the series 200.

In this modification, the axle 246 has its respective ends mounted in supports 251, 252,

at the outer ends of fork-arms 249, 250, of said head, the said supports comprising releasable caps 253, 255, fixed in place by bolts 254, 256. Said head has a shank 297 extending therefrom and arranged to be clamped in place in the bearing 135 of the clamp 103, the shank being provided with a pin 243 to locate said shank in rotated position in said clamp, for locating the abrading wheel 245 in a plane which is at an angle to the plane of the grinding wheel, preferably similar in nature to the angles of the abrading wheels 45, 145, to said grinding wheel. The shank 297 may be axially adjusted in said bearing 135.

Our improved device provides ready, simple, strong and accurate means for obtaining quick and effective truing, dressing, cleaning and sharpening of the grinding wheel in novel manner, and when employing a plurality of abrading wheels acting simultaneously on the grinding wheel, the abrading wheels act with a cross-wiping motion in paths which cross each other upon the surface of the grinding wheel in highly effective manner, the lateral stresses of the grinding wheel upon the abrading wheels being counteracted by ball-bearings and yoke supports at the respective sides of each of the abrading wheels.

Having thus fully described our invention, what we claim as new, and desire to secure by Letters Patent, is:

In mechanism for truing and dressing grinding wheels, the combination of a head comprising a pair of outer fork-arms and an intermediate fork-arm complemental to said respective outer fork-arms and forming a pair of yokes having an integral intermediate fork-arm which is common to both said yokes, an axle for each of said yokes, each of said outer fork-arms comprising a supporting portion at its outer end, a releasable cap for each of said supporting portions, said intermediate fork-arm comprising an intermediate duplex supporting portion at its outer end, a releasable intermediate duplex cap for said intermediate duplex supporting portion, said axles located in non-parallel endwise relation, the outer ends of said axles located in said first-named supporting portions and clamped in place by said first-named releasable caps, and the inner ends of both said axles located in said intermediate duplex supporting portion and clamped in place by said duplex cap, each of said axles provided with shoulders at its respective ends coacting respectively with said outer supporting portions and said intermediate duplex supporting portion for endwise positioning of said axles, and the proximate ends of said axles provided with parallel abutting end faces having opposite inclinations from the same sides of said respective axles and of the same degree to the longitudinal axes of said respective axles and coacting with each other for resisting rotations of both said axles, and abrading wheels rotatable about said respective axles.

In testimony whereof, we have hereunto signed our names.

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