June 3, 1941. C. G. EKHOLM 2,244,057

SUPPORTING MEANS FOR GRINDING WHEELS

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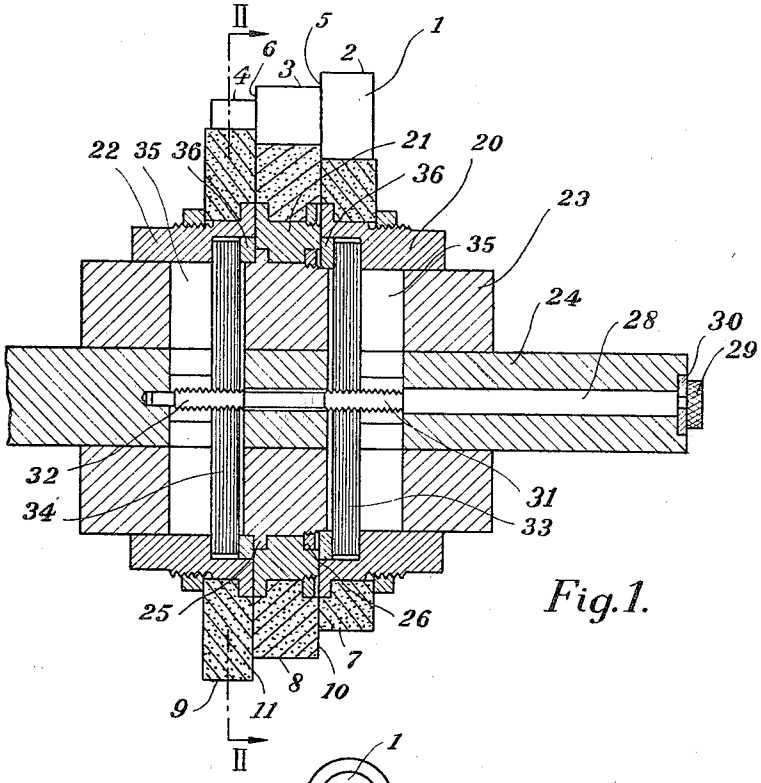


Fig. 1.

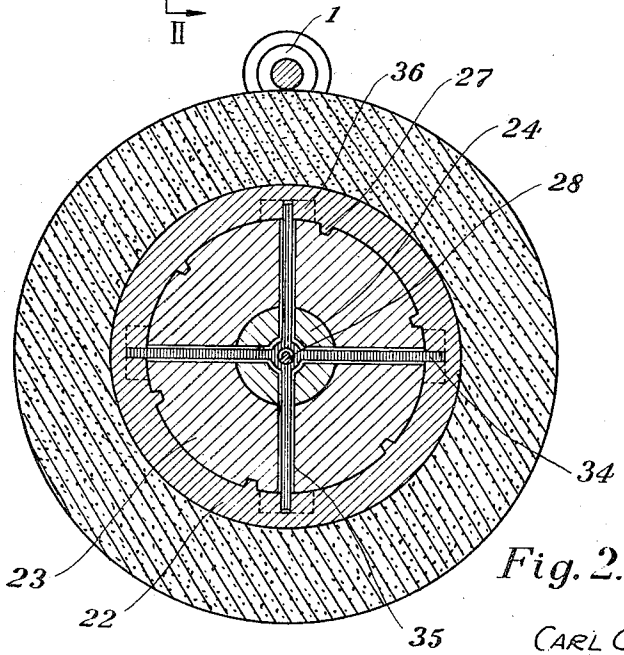


Fig. 2.

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SUPPORTING MEANS FOR GRINDING WHEELS

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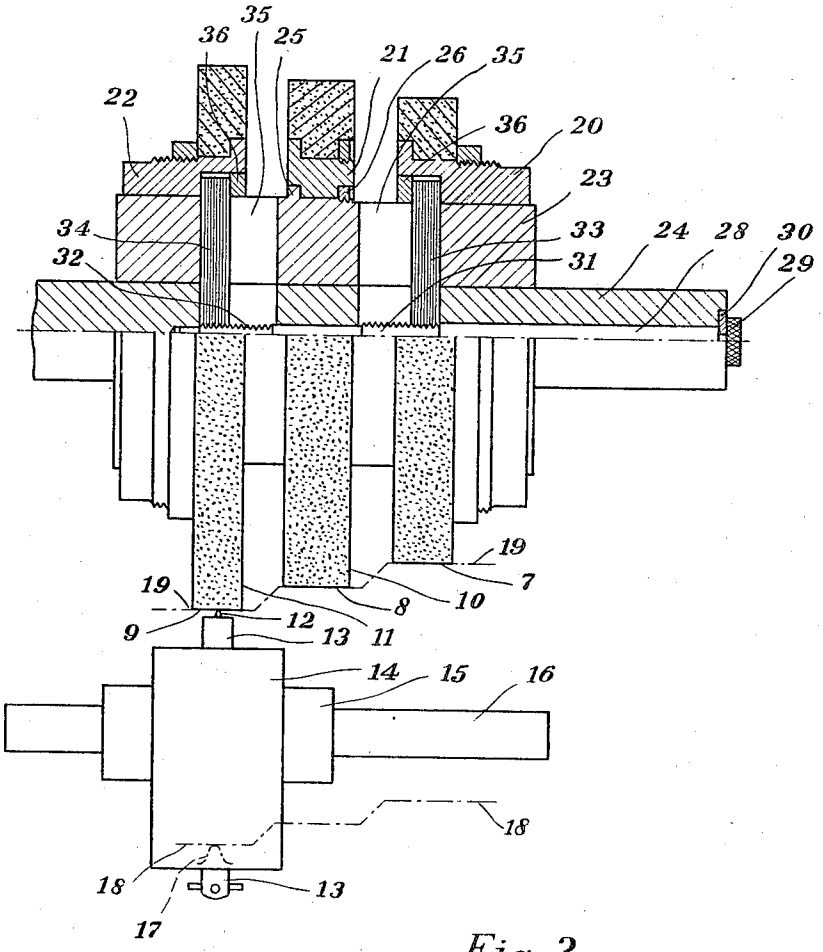


Fig. 3.

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SUPPORTING MEANS FOR GRINDING WHEELS

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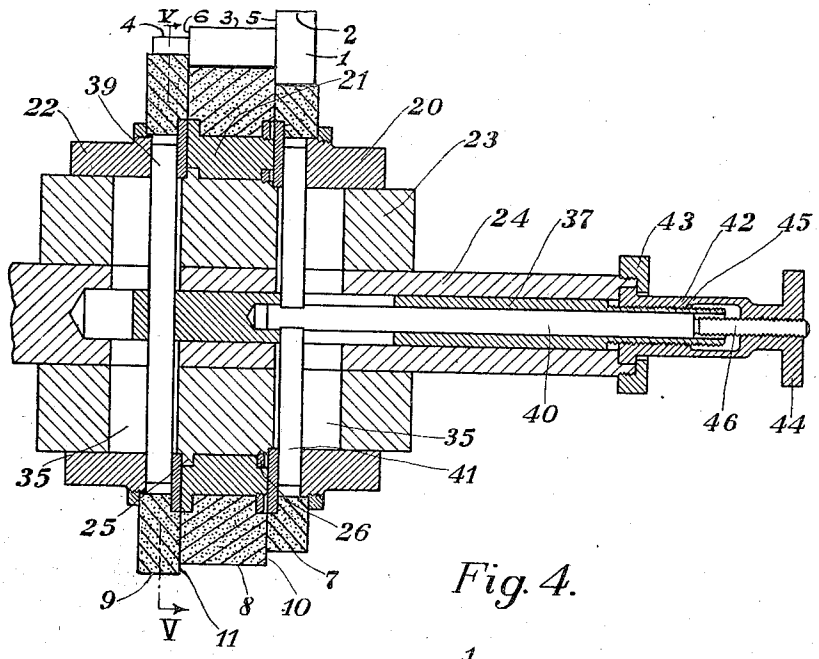


Fig. 4.

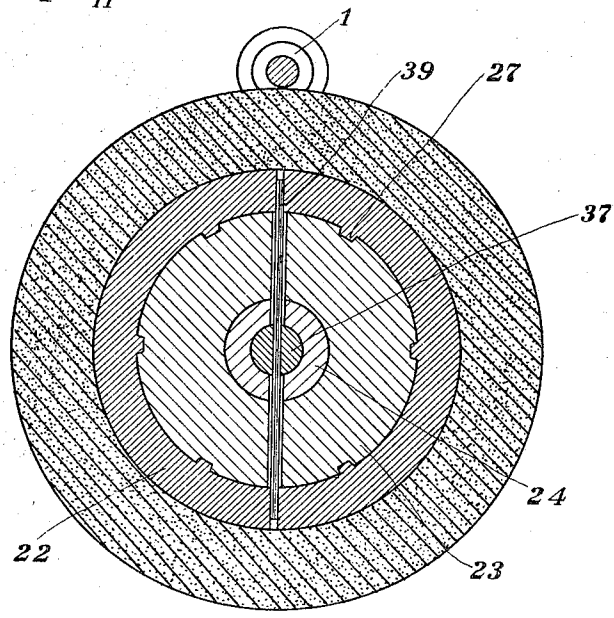


Fig. 5.

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SUPPORTING MEANS FOR GRINDING WHEELS

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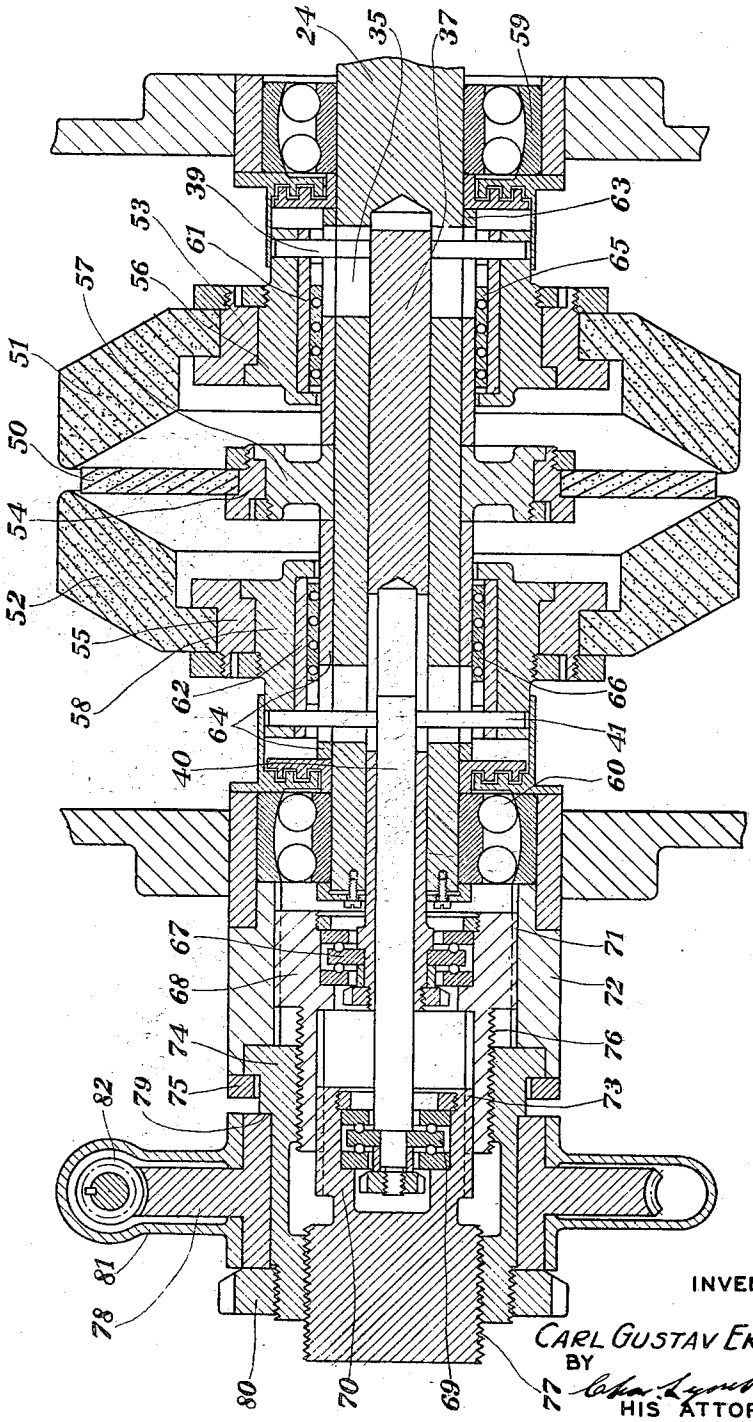


Fig. 6.

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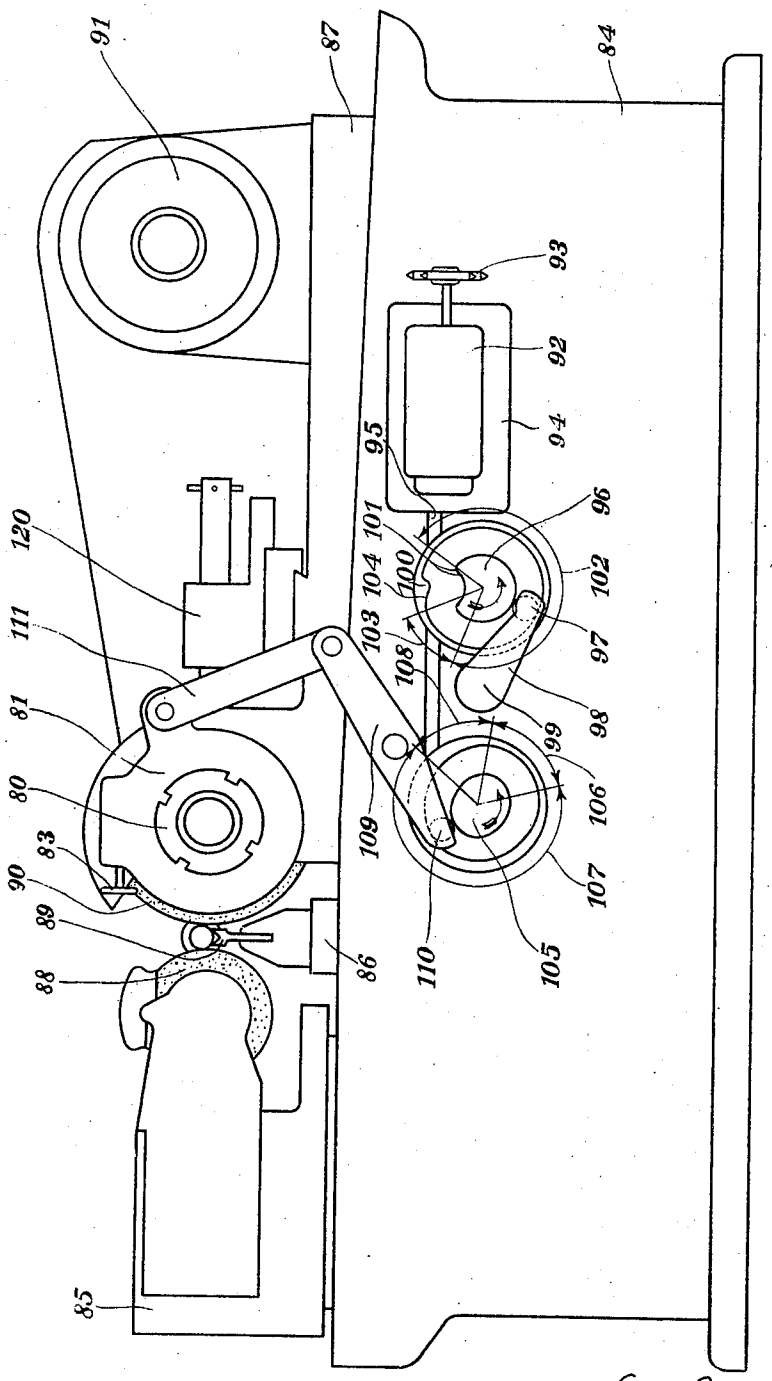


Fig. 7.

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SUPPORTING MEANS FOR GRINDING WHEELS

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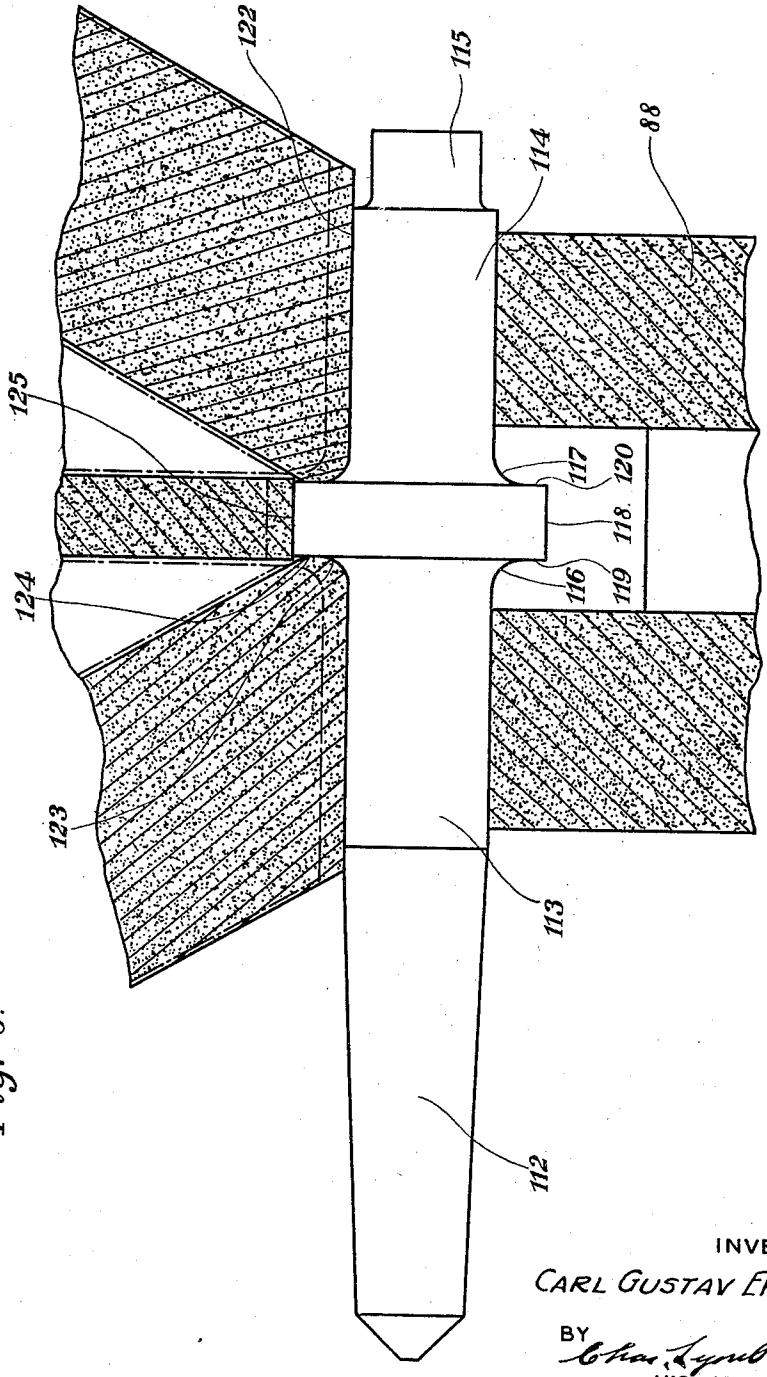


Fig. 8.

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Patented June 3, 1941

2,244,057

UNITED STATES PATENT OFFICE

2,244,057

SUPPORTING MEANS FOR GRINDING WHEELS

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Application August 4, 1939, Serial No. 288,473
In Sweden August 12, 1938

18 Claims. (Cl. 51—168)

The present invention relates to grinding machines of the center as well as the centerless type. The primary object of the invention is to improve and facilitate the shaping of grinding wheels and of regulating wheels for centerless grinders.

For simultaneous grinding of several different surfaces of a workpiece the grinding wheel must at first be shaped by dressing it by means of a diamond or similar dressing tool. In such cases where the workpiece to be ground has projecting distinct edges between different surfaces the grinding wheel must be shaped with corresponding distinct inwardly directed corners between different surfaces. The shaping of the grinding wheel with such distinct transitions often causes difficulties or is quite impossible on account of that the support for the truing tools comes in contact with the grinding wheel and prevents the advancing of the truing tool to the end of the rotational surface to be trued.

According to the invention this disadvantage is avoided thereby that the grinding wheel consists of several sections, which are relatively movable in axial direction. During grinding these sections are set close to each other, but when the grinding wheel is to be shaped the sections are separated in axial direction. When the sections are axially separated the truing tool can be advanced to the ends of the different rotational surfaces, so that said surfaces when brought together will form sharp corners.

The invention also relates to an improved supporting means in which the sections of the grinding wheel can be axially displaced when the grinding wheel is stationary as well as when it is rotating. By axial displacement of the grinding wheel sections during the grinding operation certain advantages will be afforded as will be clear from the following specification:

The invention is more particularly set forth with reference to the accompanying drawings wherein—

Fig. 1 is a longitudinal section through an improved supporting means and a composite grinding wheel.

Fig. 2 is a cross section along line II—II in Fig. 1.

Fig. 3 shows partly in section the grinding wheel arrangement with its different parts separated and a truing device. The truing device forms per se no part of the invention and is therefore only schematically shown.

Fig. 4 shows a longitudinal section through a modified embodiment of the supporting means according to the invention.

Fig. 5 shows a cross section along the line V—V in Fig. 4.

Fig. 6 shows a longitudinal section through a third embodiment of the invention.

Fig. 7 shows on a smaller scale than Fig. 6 a centerless grinding machine in which the grinding wheel is arranged in accordance with Fig. 6, and

Fig. 8 shows on a greater scale than Fig. 6 the working surfaces of the grinding wheel and the regulating wheel and a work piece to be ground. Corresponding parts in the three shown embodiments are designated with the same numerals.

The grinding wheel shown in Figs. 1–5 is intended for the grinding of work pieces of the form shown at 1 in Figures 1, 2, 4 and 5. The workpiece 1 has three cylindrical surfaces 2, 3 and 4 with different diameters intersected by plane surfaces 5 and 6 perpendicular to the longitudinal axis of the work piece.

Before the grinding operation the grinding wheel is shaped with three cylindrical working surfaces 7, 8, 9 intersected by plane surfaces 10 and 11. With a view of obtaining distinct edges between the surfaces 2 and 5 resp. 3 and 6 on the work piece it is quite necessary that the corresponding grinding surfaces 7, 10 resp. 8, 11 form distinct lines of intersection.

The truing of the grinding wheel can for instance be performed by means of a truing device as schematically shown in Fig. 3. The truing tool proper consists of a diamond 12, which is fixed in the end of a rod 13. Rod 13 traverses a housing 14 and is supported by a slide 15, which is slidable on a guide 16. A spring (not shown) acts upon the housing 14 towards the grinding wheel. The housing 14 is on its underside provided with a feeling member 17, which bears against a guiding template, the guiding profile of which is shown by the dot and dash line 18—18. In order to limit the vibrations of the truing tool the rod 13 must be made rather stout. Therefore rod 13 would prevent the advancing of the diamond 12 into the corners between the surfaces 7 and 10 resp. 8 and 11 of the grinding wheel if the grinding wheel were made in one piece.

According to the invention the sections of the grinding wheel can be brought to the position shown in Fig. 3. In this position of the grinding wheel the diamond 12 can be advanced to the ends of the cylindrical surfaces 7 and 8 without difficulty. Therefore these surfaces can

be trued along their whole length and will form distinct lines of intersection with the plane surfaces 5 and 6 when the sections of the grinding wheel are brought close to each other as shown in Figs. 1 and 4. In Fig. 3 the path of the diamond point is indicated by a dot and dash line 19—19 the different parts of which are of equal length and parallel with the corresponding parts of the profile 18—18 of the template. As shown the diamond 12 moves parallel with the axis of the grinding wheel along and past each of the cylindrical grinding surfaces and moves at an angle of 45 degrees between the cylindrical surfaces. After the truing is completed thereby that the diamond has been moved the necessary number of strokes along the grinding wheel with intermittent feeding of rod 13 after each stroke, the sections of the grinding wheel are again brought to their position shown in Figures 1 and 4. The grinding wheel is now in order for grinding of work pieces.

The arrangement for axial displacement of the grinding wheel sections can be constructed in different ways and the invention is not limited to any specific construction of this arrangement. In the two embodiments shown in Figures 1–5 the grinding wheel consists of three sections, each of which is supported by a hub 20, 21, 22. The hubs are supported by a cylinder 23 which is secured to the grinding wheel spindle 24, which is rotatably mounted on the grinding machine and arranged to be driven in a manner not pertaining to the present invention. The intermediate hub 21 is secured to the cylinder 23 between a flange 25 and a nut 26. The hubs 20 and 22 are slidably mounted on the cylinder 23 and are held against rotation relative to the cylinder 23 by ribs 27 (Figures 2 and 5) arranged internally in the hubs and engaging with slots in the outer surface of the cylinder. All the parts described above are substantially equal in the two embodiments shown in Figures 1–5, but the operating mechanisms for axial displacements of the sections of the grinding wheel are different.

In the embodiment shown in Figures 1–3 a rod 28 extends in a central bore in the spindle 24. The rod 28 is held within the bore by a cover 30 and carries outside of the end of the spindle a hand wheel 29. Within the spindle the rod 28 is formed with two threaded portions 31, 32, which are threaded in opposite directions but have the same pitch. These threaded portions are in engagement with threaded bores in two four-armed crosses 33, 34 the arms of which extend through slots 35 cut out in the spindle 24 and the cylinder 25. The ends of the arms are retained in internal slots in the hubs 20, 22 by holding members 36.

When rod 28 is turned in relation to the spindle by means of hand wheel 29 the hubs 20, 22 are moved axially in opposite directions, so that the three sections of the grinding wheel are brought to the position shown in Figure 3. In this position the truing of the grinding wheel can be performed in the manner described above. By turning the hand wheel 29 in the opposite direction the grinding wheel sections are returned to the closed position shown in Fig. 1.

In the embodiment shown in Figures 4 and 5 a tube 37 is inserted in a longitudinal bore in the spindle 24. The solid end portion of the tube 37 is traversed in its transverse direction by an arm 39, which extends through slots 35 in the spindle 24 and the cylinder 23 and is out of contact with the walls of said slots. The ends of the arms are inserted into openings in the hubs and fixed to said hubs. A rod 40 extends along the bore of tube 37 and an arm 41 extends through the end of rod 40 in its transverse direction. The arm 41 extends through slots in the spindle 24 and the cylinder 23 and its ends are secured to the hub 22.

On the end of the spindle 24 is mounted an operating sleeve 42, which is held to the spindle by a nut 43 in such a manner that it is freely turnable in relation to the spindle. The sleeve 42 has a hand wheel 44 made integral therewith and has two internal threaded portions 45 and 46, which are threaded in opposite directions but have the same pitch. The threaded portion 45 is in engagement with an externally threaded portion of the tube 37, and the threaded portion 46 is in engagement with an externally threaded portion of the rod 40. By turning the operating sleeve 42 the hubs 20, 22 are moved in opposite directions as in the embodiment shown in Figures 1–3.

The two embodiments described above are constructed in such a manner that the sections of the grinding wheel can only be displaced axially when the grinding wheel spindle is at rest. In some grinding operations, however, certain advantages can be obtained through displacement of the grinding wheel sections during the grinding operation itself. Such an operation is, for instance, the grinding of workpieces having outstanding flanges to be ground on their opposite sides. Figures 6–8 show an embodiment of the invention in which the setting of the grinding wheel spindle is stationary as well as when it is rotating.

As in the two embodiments already described the grinding wheel consists of three sections. The intermediate section 50 is cylindrical and the two outermost sections 51, 52 are disc-shaped. The three sections are mounted on hubs 53, 54, 55 each one of which is mounted on an interior hub 56, 57, 58. The intermediate hub 57 is secured to the grinding wheel spindle, and the two end hubs 56, 58 are slidably mounted on the grinding wheel spindle, which is mounted in double-row spherical bearings 59, 60.

In order to reduce the friction between the hubs and the spindle, axially displaceable ball bearings are arranged between the hubs 56, 58 and the spindle. Each such ball bearing consists of a hardened steel bushing 61, 62 pressed into the hub and a hardened steel bushing 63, 64 pressed on to the spindle 24 and a ball retainer 65 resp. 66 placed between the bushings and containing a number of balls distributed in the longitudinal direction of the spindle as well as in the peripheral direction. In the shown embodiment each retainer consists of a cylindrical tube in which is drilled several holes for the balls. The balls are retained by flaps bent out of the material of the tube.

The operating member for axial displacement of the hubs 56, 58 corresponds in principle with the devices shown in Figures 4–5. Thus a tube 37 extends along a longitudinal bore in the spindle 24, and a rod 40 is placed in the tube. The tube 37 and the rod 40 are connected with the hubs 56, 58 through arms 39, 41. Slots 35 are cut in the tube 37 and the spindle 24 and in the bushings 63, 64 as well as in the ball retainers to allow movement of the arms 39, 41. The tube 37 is connected with a block 68 by means of a double-acting antifriction thrust bearing 67 sit-

uated outside of the end of the spindle 24. The rod 40 is connected to another block 70 by means of a double acting antifriction thrust bearing 69 situated outside of the end of the tube 37. The block 68 is slidably but not rotatably mounted on guides 71 in a housing 72 which is fixedly mounted on the machine. The block 70 is slidably but not rotatably mounted on guides 73 in the block 68. Thus the two blocks are slidable but not rotatable relative to each other and relative to the housing 72. An operating member 74 is rotatably mounted on the end of the housing 72 and is held by a ring 75. The operating member 74 has two internal threaded portions which are in engagement with external threaded portions 76, 77 on extensions of the blocks 68 resp. 70. The threaded portions in the shown embodiment have equal pitch but are differently directed, i. e. one is right-threaded and the other one left-threaded.

Owing to the thread-engagement between the member 74 and the blocks 68, 70 turning of the member 74 results in sliding movements of the blocks in one direction or the other. These movements are transmitted to the tube 37 and the rod 40 by the thrust bearings 67 resp. 69 and the movements are further transmitted to the hubs 53, 55 by the arms 39 resp. 41. In this manner the hubs are moved in opposite directions.

The arms 39, 41 act as coupling members between the spindle and the tube 37 and the rod 40, so that these parts partake in the rotation of the spindle. On account of the thrust bearings 67, 69, however, the displacements of the tube and the rod from the non-rotating blocks 68, 70 is also possible when the grinding wheel spindle is rotating.

A worm-wheel 78 is firmly mounted on the member 74 between a shoulder 79 and a nut 80. The worm-wheel 78 is enclosed in a casing 81 in which a worm 82 is rotatably mounted. The worm 82 is in driving engagement with the worm-wheel. The casing 81 is loosely mounted on the worm-wheel and is connected with the same in the peripheral direction only through the worm 82. Therefore the member 74 can be turned in two different ways, viz.

I. By turning the whole casing 81, whereby the worm 82 connects the casing with the worm-wheel.

II. By turning the worm 82 about its own axis by means of a hand wheel 83 (Fig. 7), whereby the worm-wheel is rotated relatively the casing 81.

When the grinding wheel sections are automatically displaced during a grinding operation the displacement takes place as stated in section I and the movements of the section are very small. When the grinding wheel sections are to be separated axially for truing, the displacement is performed as stated in section II, this also being the case whenever the sections are to be manually adjusted relative to each other.

Figure 7 shows a centerless grinding machine with a divided grinding wheel as shown in Figure 6 and having an automatical driving mechanism for displacement of the end sections of the grinding wheel. The grinding machine consists of a bed 84 and three heads 85, 86, 87 mounted on the bed. The head 85 supports a regulating wheel 88 and the head 86 supports a work rest 89 and the head 87 supports the grinding wheel which in this figure is designated 90. The regulating wheel head and the grinding wheel head are slidably mounted on guides in the bed, while head 87 is firmly mounted on the bed. The grinding wheel head supports an electric motor 91 from which the grinding wheel is driven through a belt transmission. The regulating wheel 88 is driven from a separate motor not shown in the drawings.

In order to give the machine a great capacity in mass-production of similar work pieces an operating device is arranged for automatically moving the grinding wheel head towards the regulating wheel head and vice versa. The power for the displacement of the grinding wheel slide is delivered by an auxiliary motor 92 mounted on the side of the bed. The motor 92 is connected with the input shaft of a gear box 94, the output shaft 95 of which extends horizontally along the side of the machine bed 84. Shaft 95 carries a worm (not shown) in engagement with a worm-wheel (not shown) firmly connected with a curve disc 96 having a closed guiding groove therein. A roller 97 rotatably mounted on the end of a crank arm 98 is situated in the guiding groove and is governed by the walls of the groove. The crank arm 98 is firmly mounted on a shaft 99 extending in the transversal direction of the bed 84 below the grinding wheel slide. The shaft 99 carries on its end below the grinding wheel slide a gear wheel (not shown) in driving connection with a rack secured to the underside of the grinding wheel slide.

When the auxiliary motor 92 is working the curve disc 96 is turned relatively slowly in the direction indicated by an arrow and hereby causes a turning of the arm 98 and a sliding movement of the grinding wheel slide in first one and then the other direction.

When the auxiliary motor 92 is stationary, point 100 on the curve disc 96 is in contact with the roller 97. At this moment the grinding wheel slide is in its position most remote from the regulating wheel slide. During the first part of the rotation of the curve disc 96 the profile portion 101 guides the roller 97 and causes a relatively rapid advancing of the grinding wheel slide 87 towards the regulating wheel slide. The following profile portion 102 causes a continued advancing of the grinding wheel slide with a reduced speed. The following profile portion 103 is shaped as a circular arc having its centre situated on the axis of rotation. When this portion comes in contact with the roller 97, the sliding movement of the grinding wheel slide ceases. The following profile portion 104 causes a relatively rapid returning of the grinding wheel slide to its initial position.

In the embodiment of the invention shown in Fig. 7 the described operating device is also utilised for automatical displacement of the grinding wheel sections. For this purpose the shaft 94 is extended and provided with a second worm (not shown) in engagement with a worm wheel (not shown) arranged below the worm, said worm wheel being firmly connected with a curve disc 105 having a closed guiding groove. The guiding profile of this groove consists of a portion 106 in the shape of a circular arc having its centre situated on the axis of rotation of the curve disc, and a portion 107 extending helically towards the axis of rotation in the direction opposite to the arrow shown in the drawing, and finally a portion 108 extending helically out from the axis of rotation. A pivotable double-armed lever 109 carries in one end a roller 110, which

is situated in the guiding groove of the curve-disc 105 and is guided by the walls of said groove. The opposite end of the lever is connected with a projecting lug on the casing 81 by means of a link 111.

When the auxiliary motor 92 is started the curve disc 105 is thus rotated with the same angular velocity as the curve disc 96. The rotation of the curve-disc 105 results in a turning of the lever 109 in first one and then the other direction. The turning movement of the lever 109 is through the link 111 transferred to the casing 81 (Fig. 6), said casing being connected with the member 74 through worm 82 and worm-wheel 78. The turning of the member 74 as stated earlier in this specification results in displacement of the grinding wheel sections 50, 52 towards each other and from each other.

Figure 8 illustrates the grinding of a rock drill hammer on the centerless grinding machine shown in Figure 7. The hammer consists of a tapering part 112 and two cylindrical parts 113, 114 and a projecting flange situated between said cylindrical parts and a square end portion 115. The cylindrical parts 113, 114 are connected with the flange through fillets 116, 117.

Before the grinding operation the grinding wheel sections are separated axially by turning the hand wheel 76 and the grinding wheel sections are then trued by means of a truing device of the same construction in principle as the truing device shown in Fig. 3. Each of the end sections 50, 52 is trued with a cylindrical working surface 122 and a working surface 123 in the shape of a rotational surface having a generatrice in the shape of a circular arc and a plane annular working surface 124. The intermediate grinding wheel section 51 is trued with a cylindrical working surface 125 having a smaller radius than the interior radius of the plane working surfaces 123. The regulating wheel 83 is trued with two cylindrical supporting surfaces intended to bear against the cylindrical surfaces 113, 114 of the work piece.

When the truing of the grinding and regulating wheels is completed the regulating wheel slide is set in such a position in relation to the work blade that the regulating wheel will bear against a work piece placed on the work blade and will control the rotation of the work piece. The grinding wheel slide is set in such a position that the three cylindrical working surfaces of the grinding wheel are situated in a certain distance from the corresponding surfaces of the work piece. Furthermore the grinding wheel sections 50, 52 are set in a somewhat greater mutual distance than the thickness of the flange when not ground. The profile of the divided grinding wheel as ready for the grinding operation is indicated in dot and dash lines in Fig. 8. The grinding of a member of work piece can now be started.

The working cycle in grinding a work piece as shown in Fig. 8 consists of the following phases:

I. The point 100 on the curve disc 96 is in contact with the roller 97, the grinding wheel slide being in its position most remote from the regulating wheel slide. The profile-part 106 of the curve disc 105 is in contact with the roller 110, and thus the grinding wheel sections are axially separated. A work-piece is placed on the work blade 89 either manually or by means of a mechanical infeeding device.

II. The auxiliary motor 92 is started and turns the curve-discs 95, 105 in the directions indicated by arrows. The part 101 of the curve disc 96 comes in contact with the roller 97 and causes a relatively rapid advancing of the grinding wheel slide to its working position proper. The circular arc shaped part 106 of the curve disc 105 is still in contact with the roller 110, and therefore the grinding wheel sections remain in their separated axial position shown by dot and dash lines in Figure 8.

III. The profile part 102 of the curve-disc 96 comes in contact with the roller 97 and causes a continued feeding movement of the grinding wheel slide but with less speed than during the phase II. The grinding of the three cylindrical surfaces of the workpiece is commenced. The profile part 107 of the curve disc 105 comes in contact with the roller 110 and slides the grinding wheel sections together. At the end of this phase the working surfaces 78, 79 come in contact with the work-piece and grind the plane surfaces 118, 119 and the fillets 115, 116. The profile-part 106 is preferably so shaped that the sliding together of the end sections takes place more slowly during the grinding of these surfaces.

IV. The circular arc shaped profile part 103 of the curve-disc 96 comes in contact with the roller 97, whereby the feeding movement of the grinding wheel slide ceases. The profile-part 108 of the curve-disc 105 comes in contact with the roller 110. The direction of movement of the grinding wheel section is now opposed so that they are moved from each other. During this phase the grinding of the cylindrical surfaces of the work-pieces is finished.

V. The profile part 104 of the curve disc 96 comes in contact with the roller 97 and causes a relatively rapid removing of the grinding wheel slide from the work blade. The circular arc shaped profile part 106 of the curve-disc 105 comes in contact with the roller 109, whereby the end sections of the grinding wheel remain in their separated position. At the end of this phase the motor 92 is stopped. The ready ground work-piece is taken out of the grinding gap and a new work-piece is inserted, whereafter the working cycle described above will be repeated.

The invention is not restricted to the embodiments described above but includes also other mechanical devices as well as electrical, hydraulical and pneumatical devices for the same purpose. The grinding wheel may be composed of only two but also of more than three sections. In the last mentioned case the operating member preferably consists of an internally threaded sleeve, similar with the member 42 shown in Figure 4 or the member 74 shown in Figure 6. The threaded portions of the sleeve have different thread-pitches and/or different thread-directions and the number of threaded portions corresponds with the number of slidable grinding wheel sections. As connecting members between the operating member and the hubs is preferably used a member of tubes telescopically arranged, said tubes being connected with the hubs through arms.

The invention is applicable in connection with grinding wheels of any desired shape, for instance having several cylindrical and conical surfaces and surfaces of rotation having curved generatrices. In such cases where it is important that every grinding wheel section during the truing operation occupies a certain position in relation to the template, the supporting arrangement may suitably be provided with stopping members

adapted to stop the grinding wheel sections when they assume their desired positions.

In the embodiment shown in Fig. 6 the sliding bearings may consist of an inner bushing secured to the spindle and having projecting ribs extending in the axial direction and an outer bushing firmly connected with the grinding wheel hub and having inwardly projecting ribs situated between the first mentioned ribs and a member of balls or rollers inserted between said ribs. Such sliding bearings can also have the function of transmitting the rotation of the spindle to the grinding wheel. As a further alternative the rotation may be transmitted thereby that the spindle and the bore of the hub are polygonal, preferably square in cross section, a member of balls or rollers being inserted between the spindle and the hub in order to reduce the friction in sliding the hubs. When the arms 39, 41 are relieved from the function to transmit rotation they need not be in contact with the sleeve 37 and the hub 56 resp. the rod 40 and the hub 59, so that every sliding friction on account of the movements of the arms is obviated.

The device shown in Fig. 7 may be simplified thereby, that the same curve disc 96 is used for the sliding of the grinding wheel slide and for the sliding of the grinding wheel sections towards and from each other. For this purpose the lever 98 may be made double armed, one arm carrying the roller 96 and the other arm being connected with the casing 81 through a link. In this arrangement the feeding movement of the grinding wheel slide and the sliding together of the grinding wheel sections will take place simultaneously as well as the return movement of the grinding wheel slide and the separating movement of the grinding wheel sections. With regard to the possibility to change the curve disc for various purposes, however, the arrangement shown in Fig. 7 is more advantageous.

In grinding projecting flanges between the movable parts of the grinding wheel there is a tendency of the grinding wheel to give the workpiece the same peripheral velocity which would result in a reduction or ceasing of the grinding effect. In order to obviate this inconvenience it may be necessary to mount a pressure roller above the work blade to bear against the work piece so that the resistance against the rotation of the work-piece is increased and the workpiece will rotate with the same peripheral velocity as the regulating wheel.

Having thus described my invention, I claim and desire to secure by Letters Patent the following:

1. In a supporting means for grinding wheels and the like, the combination of a grinding wheel spindle and a plurality of hubs mounted thereon and adapted to carry each one grinding wheel element, said hubs being axially slideable, an operating member being rotatably mounted on the end of the spindle, a number of telescopic shafts arranged in a longitudinal bore in the spindle, a number of threaded portions connected with the shafts and having thread-engagement with the operating members, said threaded portions having different thread directions.

2. In a supporting means for grinding wheels and the like, the combination of a grinding wheel spindle and a plurality of hubs mounted thereon, each hub being adapted to carry one grinding wheel element, said hubs being axially slidable on the spindle, an operating member rotatably mounted on the end of the spindle, a number of internally threaded portions in the operating member, a number of shafts slidably but not rotatably mounted in relation to the spindle, each shaft being connected with one hub through arms extending substantially radially in relation to the spindle and each shaft being externally threaded on its end situated outside the end of the spindle, said threaded ends being in engagement with the internally threaded portions of the operating member.

3. A supporting means in accordance with claim 1, characterized therein that the shafts are connected with threaded blocks through the intermediary of thrust bearings, said blocks being slidably but not rotatably mounted and having thread-engagement with the operating member, whereby the hubs may be axially adjusted when the grinding wheel spindle is rotating.

4. In a supporting means for grinding wheels and the like, the combination of a grinding wheel spindle and a plurality of hubs mounted thereon and adapted to carry each one grinding wheel element, said hubs being axially slidable, an operating member being rotatably mounted coaxially with the grinding wheel spindle and being firmly connected with a number of threaded portions, a number of telescopic shafts arranged in a longitudinal bore in the spindle, a number of threaded blocks being slidably but not rotatably mounted, each block having thread-engagement with one of said threaded portions and each block being connected with one shaft through the intermediary of a thrust bearing, preferably an antifriction bearing.

5. Supporting means according to claim 10 characterized therein that the operating member consists of a worm wheel enclosed in and carrying a casing in which is rotatably mounted a worm in engagement with the worm-wheel, said worm forming the only connection in the direction of rotation between the casing and the worm wheel.

6. In a supporting means for grinding wheels and the like, the combination of a grinding wheel spindle and a plurality of hubs mounted thereon and adapted to carry each one grinding wheel element, said hubs being axially slidable, a number of shafts telescopically arranged in a bore in the spindle, a number of arms connecting each shaft with one hub, a number of threaded blocks slidably but not rotatably mounted outside the spindle, each block being connected with one of the shafts through the intermediary of thrust bearings, preferably antifriction bearings, a member having a number of threaded portions with different directions and different pitches in thread-engagement with said blocks, a worm-wheel firmly connected with the threaded member, a casing enclosing the worm wheel and supported by the same, a worm rotatably mounted in the casing and being in driving engagement with the worm-wheel, said worm forming the only connection in the direction of rotation between the casing and the worm-wheel, a hand wheel or the like connected with the worm and situated outside of the casing and means for automatically oscillating the casing, whereby the grinding wheel sections are automatically brought closer to each other and separated from each other.

7. In a supporting means for grinding wheels and the like, the combination of a grinding wheel spindle and a plurality of hubs mounted thereon and adapted to carry each one grinding wheel element, said hubs being axially slidable, a rod

being rotatably but not slidably mounted in a bore of the spindle, a hand wheel or the like mounted on the rod outside the end of the spindle, a number of threaded portions formed on the rod and situated inside the spindle, a number of arms connected with the hubs and having internal threads in thread-engagement with the threaded portions of the rod, said threaded portions having different thread-directions.

8. In a supporting means for grinding wheels and the like, the combination of a grinding wheel spindle and a plurality of hubs mounted thereon and each carrying a grinding wheel element, said hubs being axially slidable, an operating member being mounted outside the end of the grinding wheel spindle and connected with the slidable hubs through a number of shafts slidably mounted in a bore of the spindle and arms extending from the shafts to the hubs and being substantially radially disposed relative to the grinding wheel spindle.

9. In a supporting means for grinding wheels and the like, the combination of a grinding wheel spindle, a cylinder fixedly mounted on the spindle, a number of hubs slidably but not rotatably mounted on the cylinder, an operating member mounted outside one end of the spindle, a number of shafts slidably mounted in a bore in the spindle and operatively connected with the operating member, a number of arms connected with the shafts and extending substantially radially through slots in the spindle and the cylinder and being connected with the slidable hubs.

10. Supporting means according to claim 9 characterized thereby that besides the slidable hubs there is also a hub fixedly mounted on the cylinder.

11. In a supporting means for grinding wheels and the like, the combination of a grinding wheel spindle mounted in bearings on both sides of the grinding wheel, a cylinder fixedly mounted on the spindle, a number of hubs slidably but not rotatably mounted on the cylinder, an operating member mounted outside one end of the spindle, a number of shafts slidably mounted in a bore in the spindle and operatively connected with the operating member, a number of arms connected with the shafts and extending substantially radially through slots in the spindle and the cylinder and being connected with the slidable hubs.

12. In combination with a supporting means for grinding wheels having a spindle and a plurality of hubs mounted on the spindle and being axially adjustable relative to the spindle, of a plurality of grinding wheel sections mounted on said hubs axially beside each others, said grinding wheel sections being so shaped, that in one position of the hubs they form sharp edges with each others and in another position of the hubs they are axially separated from each others.

13. In a supporting means for grinding wheels and the like, the combination of a grinding wheel spindle and a plurality of hubs mounted thereon and adapted to carry each one grinding wheel element, said hubs being axially slidable, an operating member being rotatably mounted on the end of the spindle, a number of telescopic shafts arranged in a longitudinal bore in the spindle, a number of threaded portions connected with the shafts and having thread-engagement with the operating members, said threaded portions having different thread-pitches.

14. In a supporting means for grinding wheels and the like, the combination of a grinding wheel spindle and a plurality of hubs mounted thereon and adapted to carry each one grinding wheel element, said hubs being axially slidable, an operating member being rotatably mounted on the end of the spindle, a number of telescopic shafts arranged in a longitudinal bore in the spindle, a number of threaded portions connected with the shafts and having thread-engagement with the operating members, said threaded portions having different thread directions and thread-pitches.

15. A supporting means in accordance with claim 13, characterized therein that the shafts are connected with threaded blocks through the intermediary of thrust bearings, said blocks being slidably but not rotatably mounted and having thread-engagement with the operating member, whereby the hubs may be axially adjusted when the grinding wheel spindle is rotating.

16. A supporting means in accordance with claim 14, characterized therein that the shafts are connected with threaded blocks through the intermediary of thrust bearings, said blocks being slidably but not rotatably mounted and having thread-engagement with the operating member, whereby the hubs may be axially adjusted when the grinding wheel spindle is rotating.

17. In a supporting means for grinding wheels and the like, the combination of a grinding wheel spindle and a plurality of hubs mounted thereon and adapted to carry each one grinding wheel element, said hubs being axially slidable, a rod being rotatably but not slidably mounted in a bore of the spindle, a hand wheel or the like mounted on the rod outside the end of the spindle, a number of threaded portions formed on the rod and situated inside the spindle, a number of arms connected with the hubs and having internal threads in thread-engagement with the threaded portions of the rod, said threaded portions having different thread-pitches.

18. In a supporting means for grinding wheels and the like, the combination of a grinding wheel spindle and a plurality of hubs mounted thereon and adapted to carry each one grinding wheel element, said hubs being axially slidable, a rod being rotatably but not slidably mounted in a bore of the spindle, a hand wheel or the like mounted on the rod outside the end of the spindle, a number of threaded portions formed on the rod and situated inside the spindle, a number of arms connected with the hubs and having internal threads in thread-engagement with the threaded portions of the rod, said threaded portions having different thread-directions and thread-pitches.

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