Jan. 16, 1951 E. C. OLIVER 2,538,532

GRINDING MACHINE

Filed Dec. 3, 1945 5 Sheets-Sheet 1

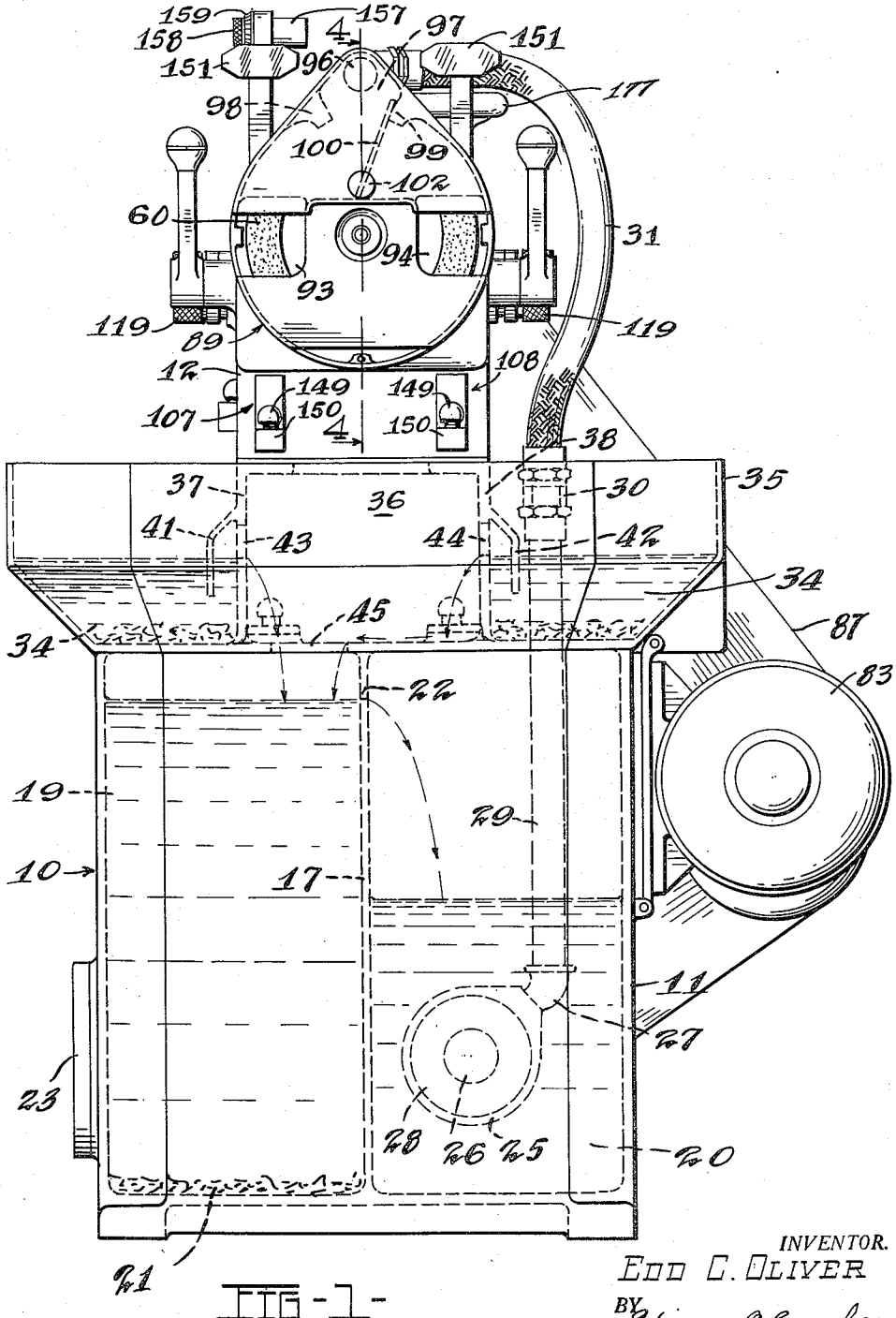


FIG-1-

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GRINDING MACHINE

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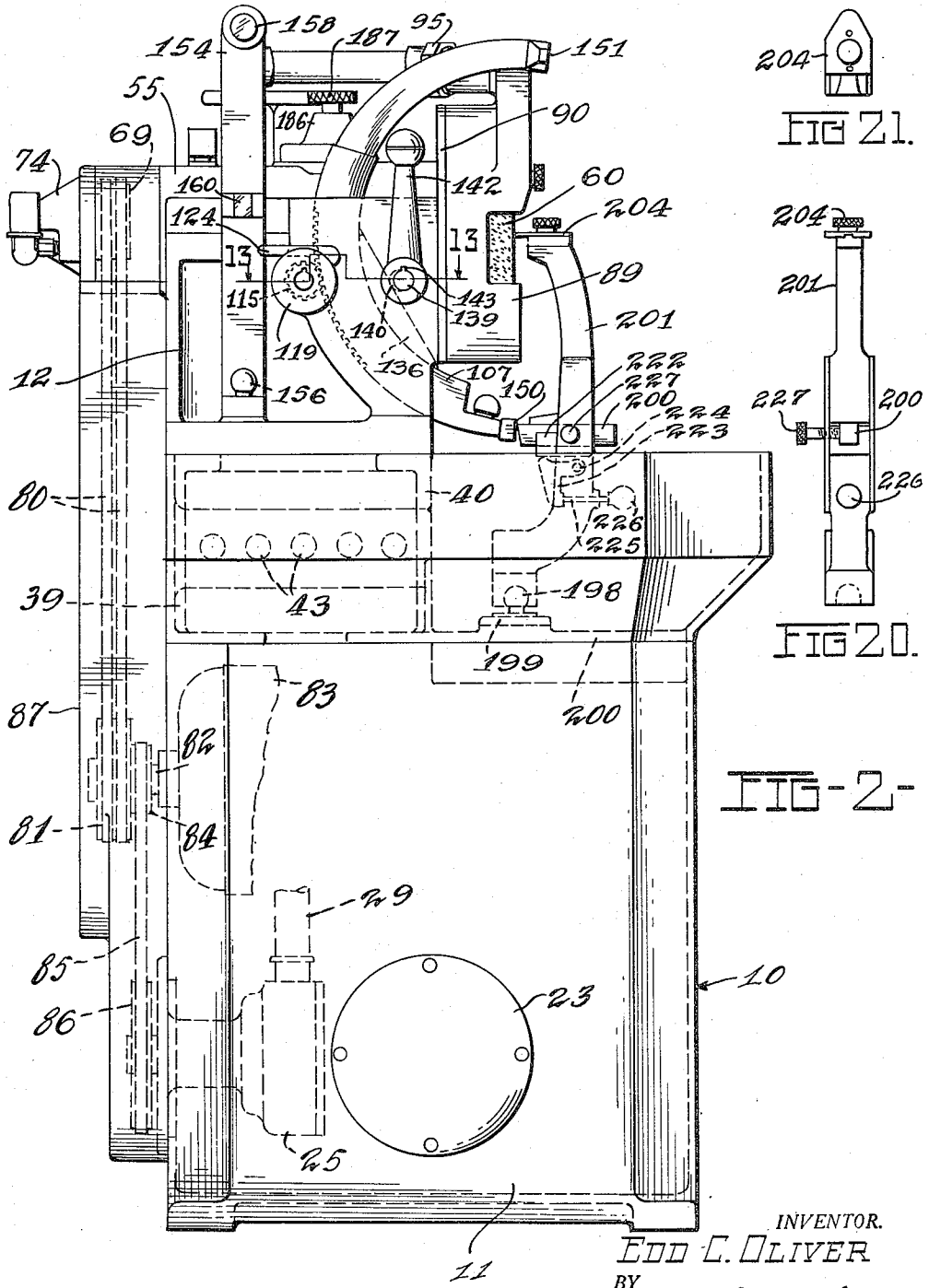


FIG 21.

FIG 20.

FIG-2-

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GRINDING MACHINE

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FIG-3-

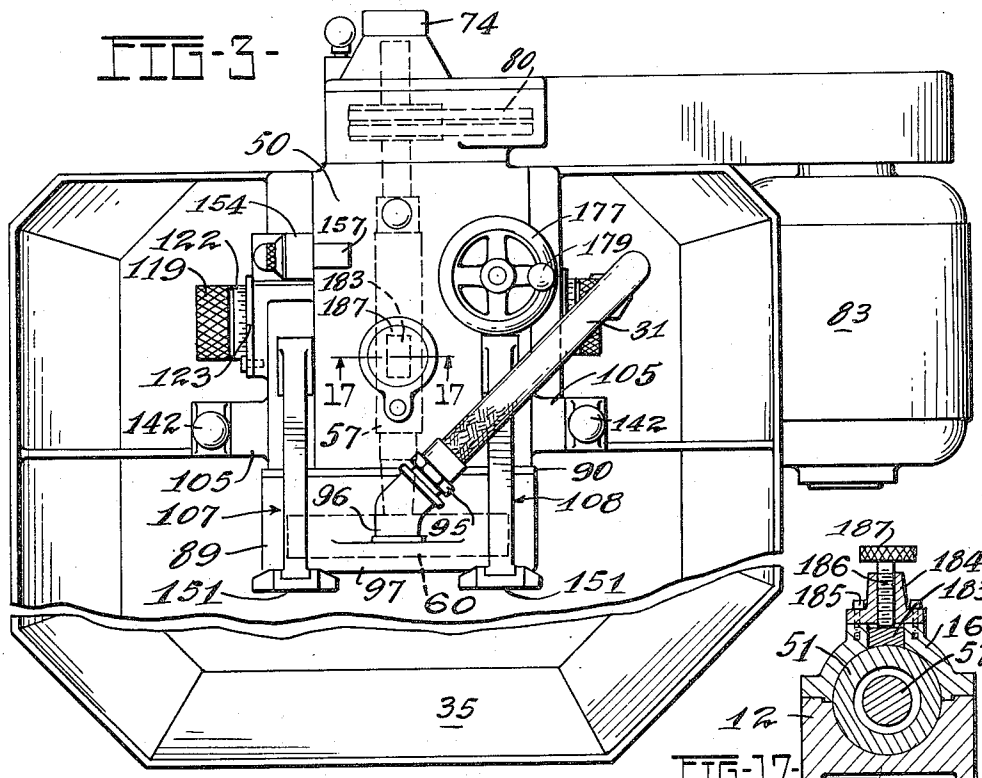


FIG-17-

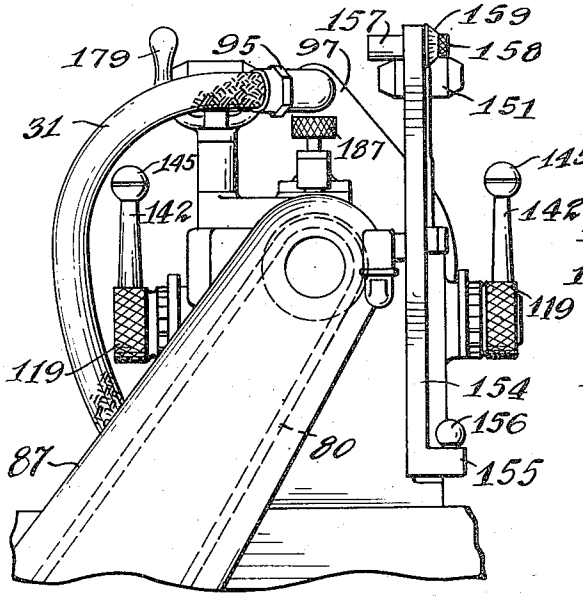


FIG-15-

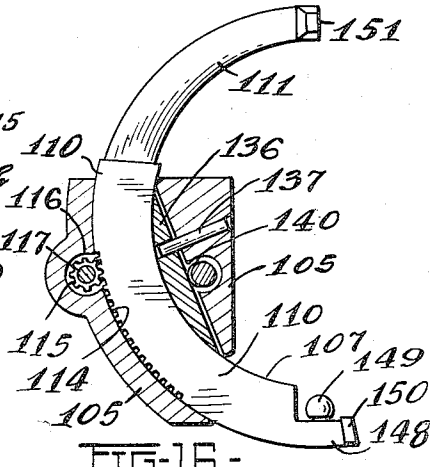


FIG-16-

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GRINDING MACHINE

Filed Dec. 3, 1945 5 Sheets-Sheet 4

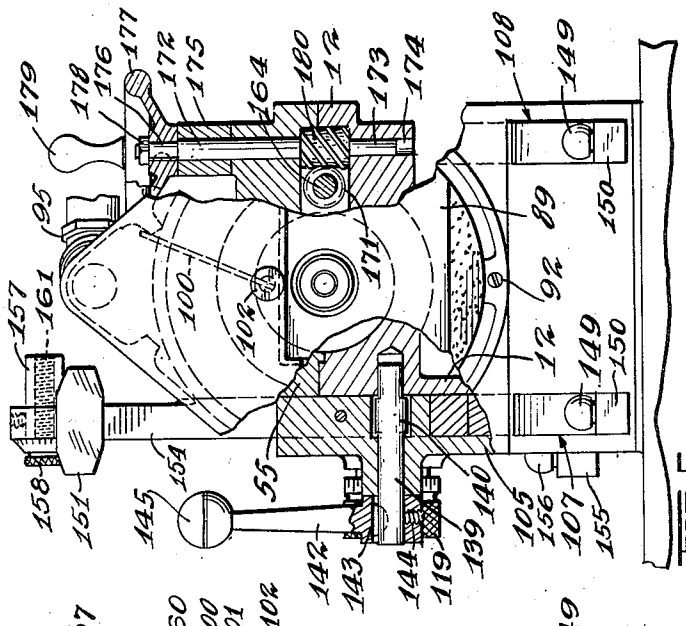


FIG-5-

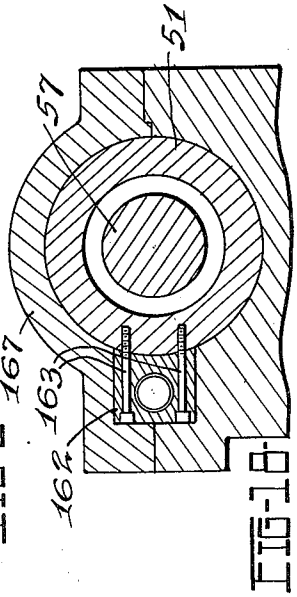


FIG-18-

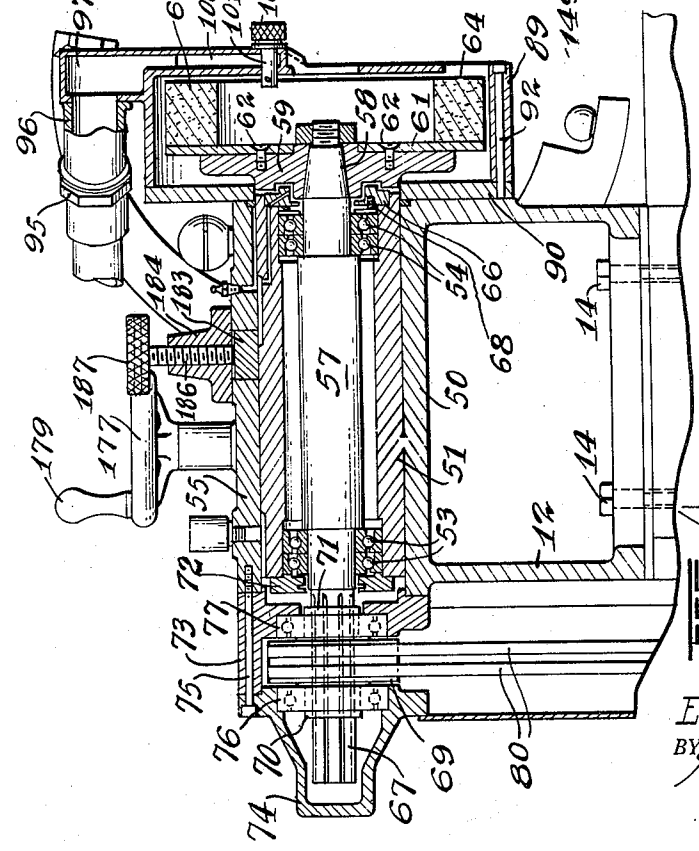


FIG-4-

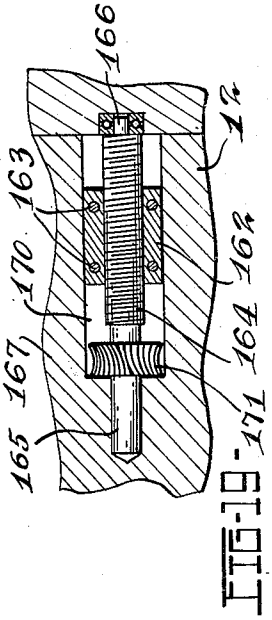


FIG-19-

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GRINDING MACHINE

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FIG-6-

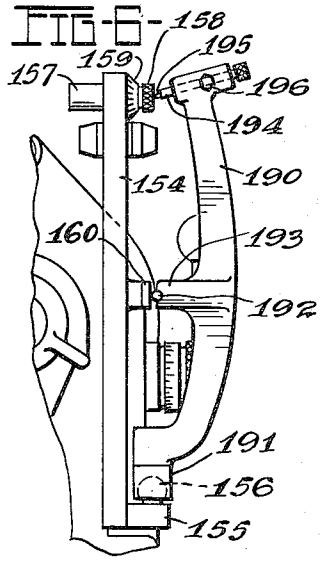


FIG-7-

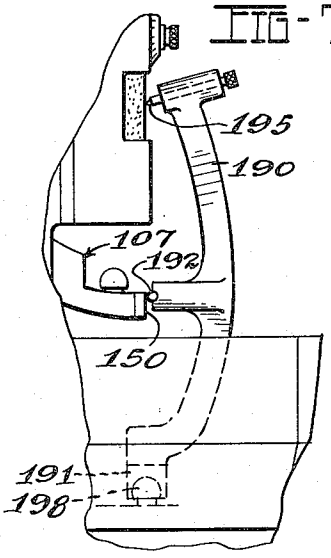
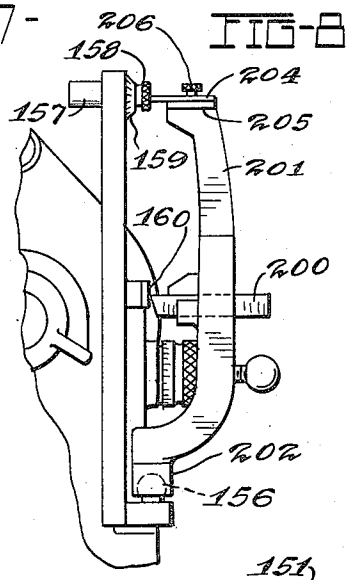


FIG-8-



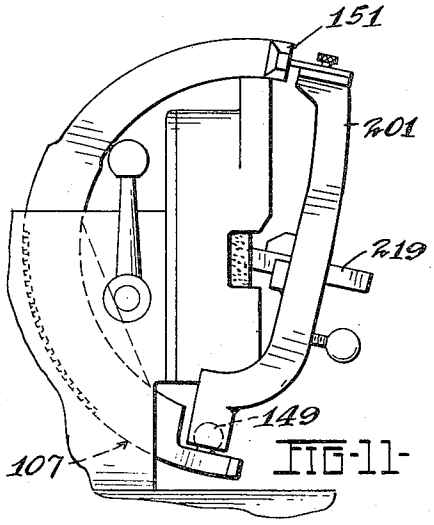


FIG-11-

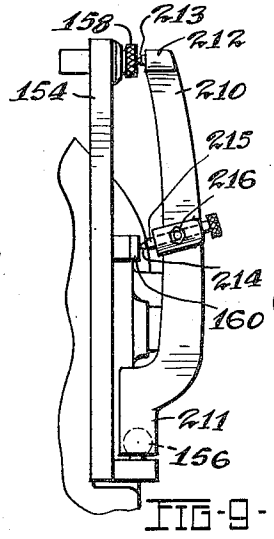


FIG-9-

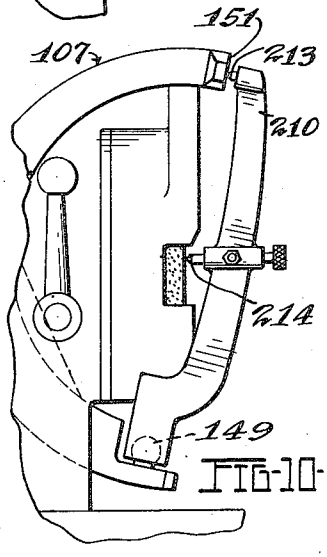


FIG-10-

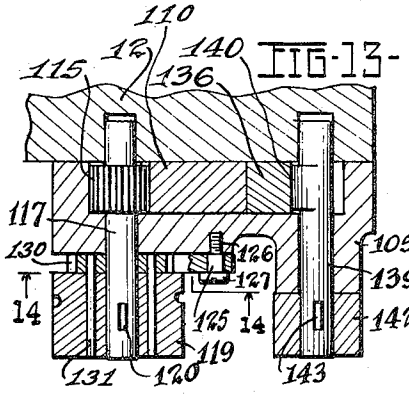


FIG-13-

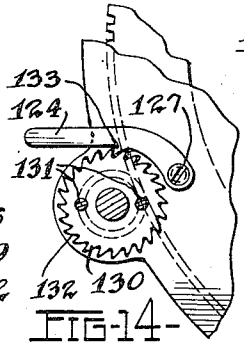


FIG-14-

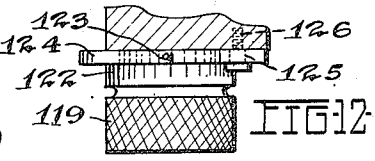


FIG-12-

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Patented Jan. 16, 1951 2,538,532

UNITED STATES PATENT OFFICE

2,538,532

GRINDING MACHINE

Edd C. Oliver, Adrian, Mich.; Genevieve R. Oliver, executrix of said Edd C. Oliver, deceased, assignor to Genevieve R. Oliver, Adrian, Mich.

Application December 3, 1945, Serial No. 632,370

8 Claims. (Cl. 51—127)

1

This invention relates to a grinding machine and more particularly to a grinding machine embodying a uniplanar grinding wheel surface for forming or configurating machine tool bits to predetermined profiles and for re-sharpening formed tool bits to maintain their pre-determined profiles as may be required for various types of cutting tools or bits used in machine operations.

The invention comprehends the provision of a grinding machine arranged and adapted to form templates of tool bit configurations or profiles whereby a template so formed may be subsequently utilized to produce form tool bits therefrom as well as to re-sharpen and reconfigurate worn tool bits to their proper profiles.

The invention embraces a machine arranged to produce templates, and which embodies gaging means for determining the proper relative positions of wheel dressing members, templates and forming tools carried by suitable fixtures or holders.

An object of the invention resides in a grinding machine embodying a rotary grinding medium arranged to present a plurality of stations, zones or positions for performing template configurating and tool bit forming and re-sharpening operations.

Another object of the invention resides in the provision of a grinding machine embodying a reversible grinding wheel, the machine being provided with a plurality of stations or zones for accomplishing grinding operations.

Another object of the invention is the provision of a grinding machine embodying means for performing grinding operations at different stations or zones whereby tools of different configurations or of different relief angularities may be ground or formed without the necessity of intermediate adjustments.

Another object of the invention resides in the provision of simple, yet effective means for adjusting the relative position of the grinding medium to effect proper grinding operations as well as to compensate for wear of the grinding medium.

Another object of the invention is the provision of simple tool holder supporting means which may be adjusted and locked in proper operative position.

Still another object of the invention is the provision of a tool supporting means associated with a grinding medium in conjunction with adjusting means to maintain the grinding surface and the cutting edge of a form tool bit in proper relation to perform accurate grinding operations.

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A further object of the invention resides in the provision of tool holder supporting means associated with a grinding machine and of such a nature that the various angles of relief may be formed on tool bits.

A further object of the invention resides in the provision of a grinding machine arranged and adapted to configurate or produce a template from a master tool in which the template form is enlarged in comparison with the size of the master tool bit cutting configuration and wherein such enlarged template may be utilized in forming a tool bit or for re-sharpening a worn tool bit whereby a high degree of accuracy of tool bit profile is obtained.

Still another object of the invention is the provision of an arrangement for dressing or "truing" a grinding wheel at the locus on the wheel surface which is adapted to be engaged by the profile configuration of the cutting edge of the tool bit to be formed or re-sharpened so as to maintain a proper relationship between wheel "truing" and tool grinding operations.

Further objects and advantages are within the scope of this invention such as relate to the arrangement, operation and function of the related elements of the structure, to various details of construction and to combination of parts, elements per se, and to economies of manufacture and numerous other features as will be apparent from a consideration of the specification and drawing of a form of the invention, which may be preferred, in which:

Figure 1 is a front elevation view of the grinding machine of my invention;

Figure 2 is a side elevational view of the grinding machine;

Figure 3 is a top plan view of the grinding machine;

Figure 4 is a detail sectional view taken substantially on the line 4—4 of Figure 1;

Figure 5 is a front elevational view of the upper portion of the machine, certain parts being shown in section;

Figure 6 is a fragmentary elevational view of the gaging means forming a component of the invention illustrating a fixture for mounting a grinding wheel dressing device in position for use on the gaging means;

Figure 7 is a detail view illustrating a method of dressing the grinding wheel preparatory to a template forming operation;

Figure 8 is a view illustrating a tool bit and template holder positioned upon the gaging device;

Figure 9 is a fragmentary view illustrating a wheel dressing tool and fixture therefor arranged upon the gaging device and utilized for wheel dressing prior to grinding tool bits;

Figure 10 is a side elevational view of a forward portion of the machine illustrating the wheel dressing tool in engagement with the grinding wheel for performing a wheel dressing operation preparatory to a tool bit forming or resharpening operation;

Figure 11 is an elevational view of the forward portion of the machine illustrating a tool bit holder, tool bit and template assembly illustrating the position of these elements during a tool bit forming or grinding operation;

Figure 12 is a top plan view of an adjusting means forming a component of the invention;

Figure 13 is a horizontal sectional view taken substantially on the line 13—13 of Figure 2;

Figure 14 is a vertical sectional view taken substantially on the line 14—14 of Figure 13;

Figure 15 is a rear elevational view of the upper part of the grinding machine;

Figure 16 is a fragmentary detail sectional view illustrating an adjustment and locking means for a component element of the grinding machine construction;

Figure 17 is an enlarged detail sectional view taken substantially on the line 17—17 of Figure 3;

Figure 18 is a fragmentary detail sectional view showing a portion of the adjusting means for the grinding wheel spindle;

Figure 19 is a fragmentary detail sectional view showing other components of the grinding wheel spindle adjusting means;

Figure 20 is a rear elevational view of the tool and template holder or fixture shown in Figure 2, and

Figure 21 is a top plan view of the tool and template holder.

While I have illustrated the grinding machine of my invention and the components thereof as especially arranged and adapted for the production of tool bit templates and the initial formation of and resharpening of formed tool bits, it is to be understood that I contemplate the utilization of my invention for any purpose wherever the same may be found to have utility.

Referring to the drawings in detail, the grinding machine is inclusive of a frame 10, which, in the embodiment illustrated, is inclusive of a pedestal or base 11 upon which is mounted an upper frame portion 12 which is secured in place by means of screws 14. The base 11 is of hollow configuration and is divided by means of a vertical wall 17 which, with the outer walls of the base, forms a pair of fluid chambers or reservoirs 19 and 20. The reservoir 19 forms a settling chamber functioning to permit abraded or comminuted materials entrained with a fluid or coolant to settle to the lower portion of the reservoir as indicated at 21. A suitable opening is provided in a wall of the chamber 19 for cleaning purposes, the opening being normally closed by a cover 23. The wall 17 terminates in its vertical dimension as indicated at 22, forming a spillway for passage of fluid from chamber 19 into chamber 20 and determines the level of coolant or fluid in the primary reservoir 19. Thus when the level of coolant in reservoir 19 is above the edge of the wall 17, the excess amount of coolant will flow into the supplemental reservoir 20 as indicated in the direction of the arrows in Figure 1.

Disposed in the supplemental reservoir or chamber 20 is a fluid circulating pump 25 which is preferably of a reversible type having an axial or central inlet opening 26 and a radial discharge outlet 27. The discharge outlet is connected to a rigid pipe or tube 29 which extends upwardly and which is provided at its upper extremity with a coupling 30 to which is connected a tube 31 formed of flexible material, the tubes 29 and 31 being arranged to convey coolant or fluid from the pump 25 to the grinding wheel in a manner to be hereinafter explained. The coolant or fluid performs, among others, the functions of cooling the grinding wheel and the tool bit or other instrumentality being ground, and entrains and conveys the cuttings or abraded material resulting from grinding operations away from the grinding zones.

The upper portion of the frame pedestal is configurated to form a trough or flared receptacle 34 bounded by flanges or walls 35. Positioned immediately beneath the frame portion 12 is a chamber 36 bounded laterally by walls 37 and 38 as shown in Figure 1 and by front and rear wall portions 39 and 40 as shown in Figure 2. The walls 37 and 38 are formed with projecting baffles or shields 41 and 42 which extend downwardly, as shown in Figure 1, to screen or baffle openings 43 and 44 through which fluid may pass from chamber 34 into chamber 36 and thence through opening 45 in the lower wall of chamber 36 into the primary reservoir 19. The chamber 34 also serves to retain some of the abraded material entrained in the coolant fluid in the same manner as this function is performed by the primary reservoir 19 as hereinbefore explained.

The frame member 12 is integrally formed with a portion 50 of semi-cylindrical configuration which mates with a similar configuration formed on a cap or saddle 55, these configurations forming together a cylindrical bore adapted to accommodate a cylindrical sleeve or quill 51. Arranged within each end of cylindrical member 51 are anti-friction bearings 53 and 54 which, as illustrated, are of the ball type but which may be of any suitable type. The bearings 53 and 54 rotatably support a shaft or spindle 57. Projecting forwardly of bearings 54 is a tapered portion 58 integrally formed as a part of the spindle 57, the tapered portion supporting a fitting 59 carrying the grinding wheel construction. In the embodiment illustrated, the grinding medium or wheel 60 is of annular configuration and is bonded to a base 61, the latter being secured to the fitting 59 by means of screws 62. This form of grinding wheel, while generally of annular configuration, is sometimes referred to as a "cup" wheel. In the present embodiment, the face 64 of the grinding wheel 60 is utilized as the grinding surface for grinding or forming operations as hereinafter explained. There is provided a fluid sealing device 66 of conventional construction disposed between the fitting 59 and the bearing 54 to maintain lubricant in the bearings and to prevent the entrance of fluid coolant into the bearings. The member 66, which is secured to one end of the sleeve 51, is provided with a plurality of circumferentially spaced recesses adapted to contain expansive coil springs 68 for the purpose of biasing the thrust through the bearings 54, shaft 57 and bearings 53, so that the position of the grinding wheel will be determined by the thrust plate 72 secured to the other end of sleeve 51.

The spindle or shaft 57 is provided at its op-

posite end with an extension 67 of reduced diameter which is suitably splined to receive a pulley construction 69 arranged for slidable movement along the splined extension 67 and functions to rotate the spindle 57. The pulley construction 69 is provided with oppositely extending hubs 70 and 71 to insure a large bearing area. The extension 67 and pulley 69 are disposed within a closure or housing 73 which is provided with a cap 74 as shown in Figure 4, the housing 73 and cap 74 being secured to the portion 50 of the frame 12 by means of screws 75. The housing 73 and cap 74 are respectively formed to accommodate the outer races of antifriction or ball bearings 76 and 77 which serve to journally support the pulley 69 and to lend stability to the extension 67 of the spindle or shaft 57. The pulley 69 is connected by means of a pair of V-shaped belts or power transmission means 80 which take over a driving pulley 81 carried upon a motor shaft 82 of the driving motor 83. The motor shaft 82 is also arranged to support a second pulley 84 which is connected by means of a V-shaped belt 85 or other suitable means to a pulley 86 which drives the rotor 26 of the coolant circulating pump 25. By this arrangement the motor 83 serves to drive the grinding wheel 60 through the medium of pulleys 69, 81, and belts 80, and to drive the fluid circulating pump mechanism by means of pulleys 84 and 86 connected together by power conveying belt 85. The belts and pulleys are housed within a removable metal closure or shroud 87 as shown in Figure 2.

One of the major features of the present invention is the provision of a plurality of stations or zones for effecting tool bit grinding and template forming operations. The grinding wheel 60 is enclosed in a housing 89 which is secured to a plate 90 forming the rear wall of the housing, the plate 90 being secured to the frame portion 12 of the machine by suitable means (not shown). The housing 89 is secured to the plate 90 by means of screws 92. As particularly shown in Figure 1, the housing is configurated with slots or openings 93 and 94 exposing certain areas of the grinding wheel surface which provide grinding zones or stations.

The flexible tube 31 for conveying the coolant terminates in a fitting 95 as shown in Figure 4 which is connected with a tubular fitting 96 carried by the housing 89, the latter being formed at its upper portion with a hollow configuration or manifold 97 to receive and redistribute the coolant or fluid. The chamber 97 is inclusive of abutments or projections 98 and 99 as shown in Figure 1, with which a movable vane or valve 100 is adapted for cooperation to selectively divert or direct the fluid to the grinding zones 93 and 94. The vane 100 is secured to a stub shaft 101 as shown in Figure 4, the stub shaft being provided with a finger piece or manipulating means 102 for shifting the position of the fluid diverter or vane 100. As viewed in Figure 1, the vane is in the position to direct the coolant or fluid entering the manifold 97 from tube 96 to the grinding zone 93. If the manipulating knob 102 is turned in a counter-clockwise direction to bring the upper portion of the vane 100 into engagement with the abutment 98, the coolant or fluid will be directed to the grinding zone 94. It should be noted that the edge walls of manifold 97 which form the upper boundaries of the grinding zones 93 and 94 are canted in a direction toward the grinding wheel so as to direct the coolant or fluid into the area or zone of the grinding wheel surface at which grinding operations take place.

In the present embodiment of the invention I have illustrated two grinding stations in conjunction with dual supporting means for tool carrying fixtures, holders or the like. To this end, there is secured to each side of frame portion 12 members 105 secured thereto by screws or other suitable means (not shown), each of said members being formed with a recess to accommodate a supporting means 107 and 108 adapted to accommodate a tool holder or other instrumentality. Each of the supporting means 107 and 108 comprises a substantially semi-annularly shaped member 110, the upper portion 111 of each member 110 being of slightly lesser thickness than the remainder of the body of the supporting means as illustrated in Figure 16.

The larger portion of each member 110 is formed with a serrated or toothed portion 114, each serrated portion adapted for enmeshment with a pinion or gear 115 contained in each recess 116 formed in members 105. Each pinion 115 is fixedly secured upon a shaft 117 which is journaled in suitable aligned bores or cylindrical openings formed in frame portion 12 and members 105. Each shaft 117 has a projecting portion upon which is mounted a knurled manipulating knob 119 which is secured to the shaft by means of a key 120 or other suitable means. Rotation of the knob 119 will rotate the shaft 117 and pinion 115, and as pinion 115 is enmeshed with the tooth portion 114 of member 110, the latter may be adjusted to change the relative position thereof with respect to the grinding wheel for purposes to be hereinafter explained.

Each of the manipulating knobs 119 is provided with a peripheral portion bearing a series of indicia 122 adapted to cooperate with an index line 123 which is engraved or impressed in an arm or index member 124. Each arm or pawl 124 is pivotally supported upon the tenon portion 125 of a threaded member 126 which is mounted in member 105 as shown in Figures 13 and 14. The tenon 125 terminates in head portion 127 serving to maintain arm 124 in assembled position. Surrounding each of the shafts 117 and disposed between each manipulating knob 119 and members 105 is a ratchet or toothed wheel 130 which is secured to knob 119 by means of dowels 131. Each of the indices 122 is in alignment with a radial side of each of the ratchet teeth 132 formed on the periphery of wheel 130, and the space between each pair of indices representing a circumferential distance of movement of members 110 of one degree.

Thus if the operator wishes to secure a five degree adjustment of one of the supporting means 107 or 108, he simply manually lifts or elevates the index arm 124 and rotates the pinion 115 through manipulation of knob 119 until the indicia 122 indicating 5 degrees is in registration with index line 123, after which the arm 124 is released and permitted to engage the ratchet wheel. The pawl tooth 133 formed on arm 124 effects an accurate indexing of pinion 115 and hence the supporting means 107 by engaging the lateral side of one of the teeth 132 of ratchet wheel 130 which is in the proper position to be engaged by the tooth 133.

Locking or clamping means are provided for each of members 110 for securing the same in adjusted position. As will be more clearly seen from Figure 16, members 105 are suitably re-

cessed to accommodate brake shoes or clamping means 136, each having a convexly curved or arcuate surface to accurately fit the inner arcuate surface of member 110, as shown in Figure 16. Each of the brake shoes 136 and members 105 are formed with aligned openings which receive guiding means or pins 137 as shown in Figure 16 so as to maintain the proper relationship between each brake shoe and its juxtaposed member 110. The pins are snugly fitted into members 105 while the brake shoes are slidably accommodated therein to permit relative movement of the shoes.

The frame member 12 and each of members 105 are formed with aligned openings which accommodate and receive transversely extending shafts 139 as particularly shown in Figures 5 and 13, each of which is provided with a cam portion or configuration 140 which is arranged adjacent the brake shoes 136. Each of the shafts 139 projects externally of members 105, the projecting portions being adapted to receive manipulating handles or levers 142 which are secured to shafts 139 by means of keys 143 and set screws 144. Each of the arms 142 is provided with a manipulating knob 145 for ease of manipulation of the locking means. From the above it will be apparent that the machine operator may lock or release the close frictional engagement of the brake shoe 136 with the inner curved surfaces of members 110 by simply manipulating or partially rotating arms 142.

Each of the supporting means 107 and 108 are provided with a ledge portion 148 which supports ball-like configuration 149 which forms a mounting or support for fixtures or tool bit holders, the construction and use of which will be hereinafter described. This ledge portion 148 terminates forwardly in a gage surface or straight edge 150 and the upper extremity of portion 111 of each supporting means terminates forwardly in a gage surface or straight edge 151, the functions of these surfaces being hereinafter explained.

The machine of my invention is provided with a gaging means for properly setting wheel dressing devices, tool bit blanks and form tools in suitable holders or fixtures. This gaging means is inclusive of a vertically disposed bar or member 154 which is secured to the frame 12 by suitable means (not shown), the lower portion of the bar being formed with a projecting ledge 155 upon which is mounted a support 156 which in the embodiment illustrated is of ball-like configuration of a size identical with the supports 149. The upper end of the bar 154 is adapted to support a housing 157 which encloses a micrometer screw 161 terminating in a manipulating portion 158 provided with a frusto-conically shaped disc 159. The disc 159 bears a series of indicia and rotation of disc 159 causes lengthwise movement of the micrometer screw equal to the measurement indicated by the indicia, the latter indicating comparatively small units of measurement, as for example thousandths of an inch.

I have incorporated means in the machine for adjusting the grinding wheel 60 axially, not only for the purposes of maintaining a definite relationship between the grinding surfaces thereof and the template and tool bit holder but also to compensate for wear of the grinding wheel. To this end, there is secured to the sleeve or cylindrical member 51 a runner or block 162 preferably of rectangular configuration which is secured to sleeve 51 by means of screws 163. The block or runner 162 is bored and threaded in an axis parallel to the longitudinal axis of the spindle 57 and adapted to accommodate a threaded member 164. The member 164 is provided at one end with a tenon 165 and at the other end with a tenon 166, the tenon 165 being journaled for rotation in semi-cylindrical registering recesses formed respectively in frame member 12 and cap 55. The tenon 166 of member or shaft 164 is journaled in housing 73. The runner 162, as illustrated in Figures 18 and 19, is disposed for slidable movement in a substantially rectangular socket or recess 170 which also accommodates a worm wheel 171 fixedly secured upon the shaft 164. Spaced from shaft or member 164 is a shaft 172 arranged in a vertical position as illustrated in Figure 5, thus substantially at right angles to the axis of shaft 164. The shaft 172 is journaled in a bore in cap 55 and is also provided with a tenon 173 which is journaled in a bore 174 formed in frame member 12. Surrounding the upper portion of shaft 172 is a spacing collar 175, and secured to a tenon 176 integrally formed at the upper portion of shaft 172 is a manipulating or hand wheel 177 which is keyed or otherwise fixed upon shaft 172 to rotate therewith, the hand wheel being held in position by means of nut 178. The hand wheel 177 is preferably provided with a crank or handle 179 to facilitate ease of manipulation. Fixed upon the shaft 172 and in enmeshment with the worm wheel 171 is a worm 180.

It will be noted from the foregoing description that rotation of hand wheel 177 causes rotation of shaft 172 and worm 180, which in turn rotates worm wheel 171 and threaded member 164 to move the runner or block 162 longitudinally causing corresponding longitudinal or axial slidable movement of sleeve or quill 51 which carries with it the grinding spindle 57 and grinding heel 60. It should be noted from figure 4 that the driving pulley 69 is splined for slidable movement upon the extension 67 formed upon a shaft 57 so that relatively slidable movement may take place between the pulley and extension to permit relative longitudinal movement of the shaft 57.

Locking means are provided for securing the sleeve 51 and grinding wheel spindle or shaft 57 in adjusted position. This means is inclusive of a locking or clamping block 183 as shown in Figures 4 and 17, the same being disposed in a suitable recess formed in the cap 55. Disposed above the cap 55 is a fitting 184 held in place by suitable screws 185 which is bored to receive a threaded member 186, the latter being equipped with a knurled manipulating knob 187 as shown in Figures 4 and 17. Thus pressure for frictionally locking the block 183 in engagement with sleeve 51 may be obtained by manipulating the threaded member 186 in one direction, and release of the locking action of block 183 may be obtained by rotating the screw 186 in the opposite direction.

The tool bit and template holders or fixtures and grinding wheel dressing means will be described in connection with the statement of operation of the machine.

The operation and function of the machine of my invention in dressing or "truing" the grinding wheel and in producing a master template from a master tool bit configuration will now be explained. Figures 2, 6, 7 and 8 illustrate several operations performed upon the machine of my invention.

First, when it is desired to pre-form a template from a master tool bit configuration, it is desirable to properly dress or "true up" the grinding surface of the grinding wheel to establish the proper relationship of said surface with respect to a straight edge or gaging surface and a support. Figure 6 illustrates the operation of presetting of a grinding wheel dressing tool in a holder or fixture 190. The holder 190 is provided at its lower extremity with a portion 191 formed with a suitable semi-spherically shaped socket adapted to fit over the ball-like support 156 carried by the ledge 155 formed on bar 154. The gaging means is formed with an abutment or straight edge 160 which is adapted to be engaged by a cylindrical bar or abutment 192 carried in a laterally projecting portion 193 of the holder 190. The micrometer screw 159 is set in zero position so that the face of portion 158, the face of abutment 160 and the center of support 156 lie in the same plane. With the socket 191 of the holder 190 in engagement with ball support 156 and gaging member 192 in contact with the gaging face of abutment 160, a member 194 carrying at its tip a wheel dressing diamond 195 is adjusted with respect to the holder until the tip of the wheel dressing member 195 engages the frontal face of member 158, after which the locking screw 196 may be drawn up to lock the member 194 in adjusted position.

After the above described gaging operation for obtaining the proper setting of the wheel dressing diamond 195 is completed, the holder 190 is placed with the socket portion 191 thereof in engagement with a ball-shaped support 198 which is carried in a boss portion 199 formed on the bottom or base 200 of the chamber 34, this position of the holder being illustrated in Figure 7. The straight edge or abutment 150 of the supporting means 107 is adjusted by means of the adjusting knob 119 and index arm 124 until the abutment face 150 is in vertical plane passing through the center of the ball-like support 198. In the embodiment illustrated, the index 123 is in registration with a zero indicia on the gaging cylinder 122 as shown in Figure 12, when the center of ball-support means 149 is in a vertical plane passing through the second ball-support 198. By elevating the index arm 124 and then rotating the manipulating knob 119 until the graduation of the indicia 122 indicating ten degrees is in registration with the index line 123, the supporting means 107 will be moved to a position as shown in Figure 7 with the face of the straight edge 150 in a vertical plane passing through the center of the ball-like support 198. Thus, by positioning the holder 190 in the position shown in Figure 7 with the cylindrical gaging block 192 in contact with the straight edge 150 formed on the supporting means 107, the wheel dressing member 195 is in a position to properly dress or "true up" the grinding wheel. This is accomplished by releasing the grinding wheel locking means 183 (see Figure 4) and rotating the hand wheel 177 which, through the medium of gearing 171 and 180 effects a longitudinal movement of the grinding wheel spindle 57 and hence the grinding wheel 60. The grinding wheel is adjusted forwardly until the face 64 thereof is in a position to be brought into engagement with the wheel dressing diamond 195 as shown in Figure 7. The grinding wheel supporting spindle 57 and associated mechanisms are locked in position by means of the block or shoe 183 through the manipulation of the knob 187, after which the holder 190 carrying the dressing diamond is oscillated transversely of the machine with gage block 192 in contact with the abutment or straight edge 150 until the diamond 195 has effectively "dressed" the face 64 of the grinding wheel. When the abrasion of the wheel ceases under the application of the dressing tool 195, the face of the grinding wheel then lies in the plane passing through the face or straight edge 150 and through the center of the ball support 198.

The grinding wheel is now in a position without further adjustment to form a template blank simulated to the form of a master form tool bit from which duplicates are to be produced. To pre-form a template a master tool bit 200 is mounted in a tool bit holder 201 as shown in Figure 8, the holder 201 having a depending portion 202 which is configurated with a semi-spherically shaped socket adapted to fit over the ball-like support 156 carried by the gaging means. The tool holder 201 is provided with readily releasable means for securing a master tool, tool bit blank or a worn tool bit in position for grinding or re-forming. The holder is provided with a slot adapted to receive a block 222 which is channeled to accommodate a tool bit blank or tool bit, the block and tool bit being locked in position by means of a cam 223 pivoted about a pivot pin 224 and actuated by a threaded member 225 in engagement with cam 223, the threaded member having manipulating knob 226 to facilitate manipulation of the threaded member 225, as shown in Figure 2. The block 222 in direct engagement with the tool bit blank or tool bit is secured in the holder in proper position by means of a set screw 227.

A template blank 204 is secured to a pad portion 205 formed upon the opposite end of the holder 201, the template blank being held in position by a clamping means 206 which may be drawn into engagement with the template blank. With the holder mounted upon the gaging means the master tool bit 200 may then be adjusted in holder 201 to establish the proper relationship between the nose or cutting end of the master tool bit 200 and the template blank 204 so as to properly reproduce the configuration of the tool bit in simulation on the template blank. The holder 201 is then transferred and mounted in the position as shown in Figure 2 with the socket portion in engagement with the ball support 198, and the cutting end or nose of the master tool bit 200 in engagement with the straight edge 150 on the supporting means 107 so as to bring the template blank 204 into engagement with the face 64 of the grinding wheel. The holder 201 is then oscillated and rotated about the center of the ball support 198 until the configuration of the nose end of master tool bit 200 is reproduced on the template blank 204 through engagement of the latter with the face of the grinding wheel. It should be noted that in the present embodiment of my invention, the template is twice as far from the center of the ball support 198 as the cutting or nose end of the master tool bit 200 so that the resulting configuration on the template blank 204 will simulate the configuration of the cutting end of the form tool bit and twice the size thereof. This is an important factor as in subsequent forming of tool bits or re-grinding of worn tools, the accuracy of grinding is greatly enhanced through a template or pattern configurated to a larger size than the configuration of the master tool bit.

Preparatory to initially forming a tool bit blank into a finished configuration it is necessary to dress the grinding wheel in the zone of the wheel, that is engaged by the tool bit blank. To this end, a fixture or holder 210 as shown in Figure 9, having a depending portion 211 formed with a semi-spherically shaped socket to fit over the ball support 156 of the gaging means, is also formed at its upper end with a pad portion 212 fitted with a cylindrical gaging bar 213. The micrometer screw member 158 is set in initial or zero position when engaged by the abutment 213 carried by the holder 210. In this position, a grinding wheel dressing diamond 214 carried by an adjustable supporting member 215 mounted in holder 210 is adjusted longitudinally until the dressing diamond 214 engages the gaging face or straight edge 160 carried by the bar 154. After the dressing diamond is adjusted to proper position, the same is retained in adjusted position by a locking screw 216. The holder 210 is then transferred to the position indicated in Figure 10 with the socket in portion 211 fitting over the support 149, with the gaging bar 213 in engagement with the straight edge or surface 151 formed on the upper extremity of the adjustable supporting means 107. As will be noted in Figure 10, the adjusting means 107 has been moved or adjusted by manipulation of index arm 124 and manipulating knob 119 to rotate pinion 115 enmeshed with the tooth portion of means 107 until the graduation on the indicia 122 registers with the index 123 corresponding to the angle of relief to be formed upon a tool bit blank 219 as shown in Figure 11. Thus if a ten degree angle for the nose end of the tool 219 is desired, the graduation of the indicia 122 indicating 10 degrees is moved into registration with the index 123 on the index arm 124. After proper angular adjustment has been made for the tool supporting means 107 and the said means securely locked in position by urging cam 140 into engagement with the shoe 136 through manipulation of the operating handle 142, the grinding wheel 60 is then adjusted forwardly by releasing the brake shoe 183 (see Figure 4) and manipulating the hand wheel 177 to advance the grinding wheel toward the dressing diamond 214 to bring the wheel into engagement with the diamond as shown in Figure 10. The grinding wheel is then locked in position by manipulating the finger piece 187 to frictionally urge the brake shoe 183 to lock the sleeve 51 and hence the spindle 57 and grinding wheel 60 in adjusted position, after which the holder 210 is oscillated in a plane of the grinding wheel face so that the dressing diamond 214 is brought into engagement with all portions of the grinding wheel face until the abrasion of the wheel or "truing" of same is accomplished.

The tool holder 201 is then provided with a tool bit blank 219 as shown in Figure 11 which is mounted in the tool holder, the latter placed upon the support 156 of the gaging means and the nose end of the tool bit blank 219 brought into engagement with the surface or straight edge 160 of the gaging means. The finished template, produced from the template blank 204 as hereinbefore explained, is brought into engagement with the frontal face of the micrometer screw member 158, the latter having been adjusted to a position pre-determining the amount of stock or material to be removed from the tool bit blank in configurating the form tool bit. Thus if ten thousandths of an inch is to be initially removed from the cutting edge portion of a tool bit blank or from a worn tool bit to be re-conditioned or re-configurated, the gage 159 is moved, through rotation of member 158, to indicate ten thousandths of an inch. The tool bit blank 219 is adjusted with its cutting edge or cutting end in engagement with the straight edge 160 so as to pre-determine the proper relationship between the template and the support 149 to produce the proper configuration on the tool bit. The holder 201 is then transferred into engagement with the ball like support 149 carried by the supporting means 107 and the working or nose end of the tool bit blank upon which a configuration is to be formed is brought into engagement with the grinding wheel face 64 as shown in Figure 11. The holder 201 is oscillated and rotated about the ball-like support 149 until all parts of the nose end of the tool blank 219 have been configurated by abrasive engagement with the grinding wheel, this action continuing until all portions of the configurations of the template 204 engage the straight edge 151 and all abrasive action ceases between the grinding wheel and the tool bit blank 219, thus indicating to the operator that the finished tool bit configuration has been formed.

It should be noted that the supporting means 107 and 108 are of identical construction, and that the templates may be formed or the tools ground at either of the grinding zones 93 or 94 by placing the tool holder on the supporting means 107 or on supporting means 108. When the tool holder supporting means 108 is utilized the grinding wheel 60 is rotated in the opposite direction by reversing the direction of rotation of the motor 83. This will also effect a reversal of direction of rotation of the pump rotor 28, but the pump 25 is of a construction to deliver fluid through tube 29 and 31 to the grinding wheel irrespective of the direction of rotation of the pump rotor. It should be noted that when grinding is to be carried on in the grinding zone 93, the coolant or fluid diverting vane 100 is positioned as shown in broken lines in Figure 1. When grinding is to be performed upon the right hand side of the grinding wheel in zone 94 as viewed in Figure 1 by utilizing the tool bit supporting means 108, the coolant fluid should be diverted to the grinding zone 94 by manipulation of the knob 102 to reverse the position of the vane 100 into engagement with the abutment 98.

Through the provision of dual grinding stations and through the employment of two tool bit holder supporting means 107 and 108, said supporting means may be selectively adjusted for forming tools of different angularities of relief or clearance, thus facilitating the variety of work that may be performed on my machine without the necessity of re-setting a supporting means with the formation or re-sharpening of each tool bit. Thus, a tool bit may be ground upon supporting means 107 wherein the relief angle may be ten degrees for such tool bit, and another tool bit of different angularity may be ground upon the opposite grinding zone of the wheel. The only adjustment of the mechanism to utilize either of the grinding zones 93 and 94 is to reverse the motor 83 through suitable electrical switching means (not shown) and changing the position of the coolant fluid diverting vane 100.

It is apparent that, within the scope of the invention, modifications and different arrangements may be made other than is herein disclosed, and the present disclosure is illustrative

merely, the invention comprehending all variations thereof.

I claim:

1. In a grinding machine, in combination; a frame; a grinding wheel journaled for rotation on said frame; a pair of laterally spaced semi-annularly shaped members adjustably mounted upon said frame for movement about a horizontal axis; a ball shaped element mounted upon each of said members; each of said members being formed with a toothed rack portion; pinions engageable with said rack portions for adjusting the relative positions of said members; a pawl and ratchet mechanism for indexing each of said members; means including clamping shoes for securing said members in indexed position; manually operated cam means for moving said shoes to clamping position; the ball shaped elements on said semi-annularly shaped members being arranged to support tool and template holders during tool grinding operations.

2. In a grinding machine for grinding form tool bits, in combination, a grinding wheel journaled for rotation on said frame; a pair of laterally spaced semi-annularly shaped members mounted upon said frame and selectively adjustable about a common axis; a ball shaped element carried by each of said members; said members adapted to support holders whereby form tools carried thereby may be brought into engagement with the uniplanar surface of the grinding wheel; manually operated means for selectively adjusting each of said supporting means; manually operated means for locking said members in adjusted position, means for adjusting the grinding wheel axially whereby the uniplanar surface thereof is movable into coincidence with the axis of adjustment of the semi-annularly shaped members.

3. In a grinding machine, in combination, a frame; a grinding wheel journaled for rotation on said frame; a pair of laterally spaced tool holder supporting members of semi-annular shape; said members being mounted for adjustment about a common axis; means for selectively adjusting each of said members about said axis; the axis of said members intersecting the axis of rotation of the grinding wheel; a straight-edge provided at one end of each of said members; a ball shaped element carried adjacent the other end of each of said members and adapted to support tool holders; the center of said ball shaped element and said straight-edge on each of said members being on a line passing through the common axis of adjustment of said semi-annular shaped members; means for adjusting the grinding wheel longitudinally of its axis to bring a uniplanar surface thereof into coincidence with the common axis of adjustment of said members whereby the edges of tools carried by the tool holders engage the grinding wheel substantially at the intersection of a plane passing through a ball shaped element and straight-edge with the common axis of adjustment of said members.

4. In a grinding machine, in combination; a frame; a grinding wheel journaled for rotation on the frame; a tool holder supporting means including a semi-annularly shaped member adjustably mounted upon the frame; said member having a ball shaped projection formed adjacent one end adapted to be engaged by and to properly position a tool holder on said ball shaped projection; a straight-edge formed at the other end of the member; said semi-annularly shaped member being arranged for arcuate movement about an axis disposed in a horizontal plane passing through the axis of rotation of the grinding wheel; the center of the ball shaped projection and the straight-edge lying on a plane intersecting the axis of adjustment of said member whereby engagement of a tool carried by a tool holder with a uniplanar surface of the grinding wheel is effected at said intersection; means for adjusting and locking said semi-annularly shaped member in adjusted position; said adjusting means including a gear; said semi-annularly shaped member being formed with a serrated surface adapted to be meshed with said gear; and indexing means for determining the relative angular position of said tool holder supporting means with respect to the uniplanar face on the grinding wheel.

5. In a grinding machine, in combination, a frame; a grinding wheel journaled for rotation on said frame; a pair of semi-annularly shaped members adjustably mounted upon the frame for movement about a common axis of curvature of said members; means for adjusting the grinding wheel longitudinally of its axis of rotation to bring the grinding face of the wheel into coincidence with the common axis of curvature of the semi-annularly shaped members; means for locking the grinding wheel adjusting means in adjusted position; a ball shaped element mounted upon each of said members; each of said members being formed with a toothed portion; pinions enmeshed with the toothed portions for adjusting the members about their axis of curvature; means for selectively securing said members in adjusted position; manually operated means for actuating said member securing means; the ball shaped elements being adapted to support tool and template holders during tool grinding operations.

6. In a grinding machine, in combination, a frame; a grinding wheel journaled for rotation on said frame; a semi-annularly shaped member adjustably mounted upon the frame for movement about the axis of curvature of the member; means for adjusting the grinding wheel longitudinally of its axis of rotation to bring the grinding face of the wheel into coincidence with the axis of curvature of the semi-annularly shaped member; a ball shaped element mounted upon said member; means including rack and pinion mechanism for adjusting the member about its axis of curvature; indexing means for determining the relative angular position of adjustment of said member with respect to the frame; means for securing said member in indexed position; manually operated means for actuating said member securing means; the ball shaped element being adapted to support a tool and template holder during tool grinding operations.

7. In a grinding machine, in combination, a frame; a grinding wheel journaled for rotation on said frame; a pair of semi-annularly shaped members adjustably mounted upon the frame for movement about a horizontal axis; means for adjusting the grinding wheel longitudinally of its axis of rotation to bring the grinding face of the wheel into coincidence with the horizontal axis of adjustment of the semi-annularly shaped members; a ball shaped element mounted upon each of said members; each of said members being formed with a toothed portion; pinions enmeshed with the toothed portions for adjusting the members about the horizontal axis; indexing

means for determining the relative position of adjustment of said members with respect to the frame; means including clamping shoes for securing said members in indexed position; manually operated means for actuating said clamping shoes; the ball shaped elements being adapted to support tool and template holders during tool grinding operations.

8. In a grinding machine, in combination, a frame; a grinding wheel journaled for rotation on said frame; a semi-annularly shaped member adjustably mounted upon the frame for movement about the axis of curvature of the member; means for adjusting the grinding wheel longitudinally of its axis of rotation to bring the grinding face of the wheel into conincidence with the axis of curvature of the semi-annularly shaped member; means for locking the grinding wheel against longitudinal movement in adjusted position; a ball shaped element mounted upon said member; said member being formed with a toothed portion; a pinion enmeshed with the toothed portion for adjusting the member about its axis of curvature; indexing means for determining the relative position of arcuate adjustment of said member with respect to the frame;

a clamping shoe for securing said member in indexed position; manually operated cam means for actuating said clamping shoe; the ball shaped element being adapted to support a tool and template holder during tool grinding operations.

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