

July 23, 1946.

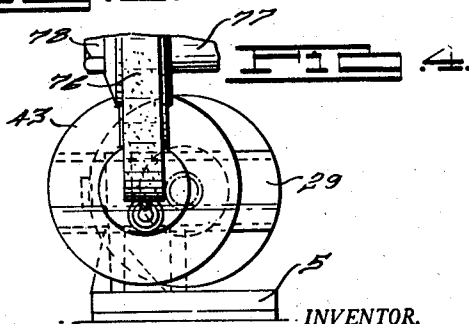
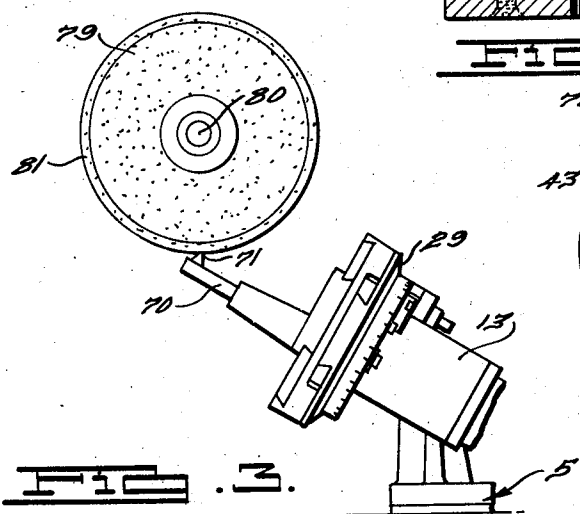
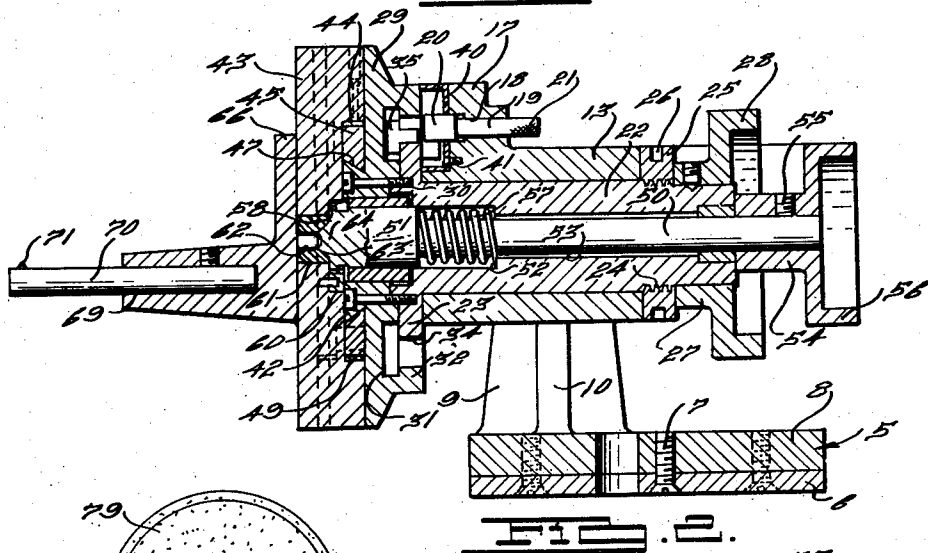
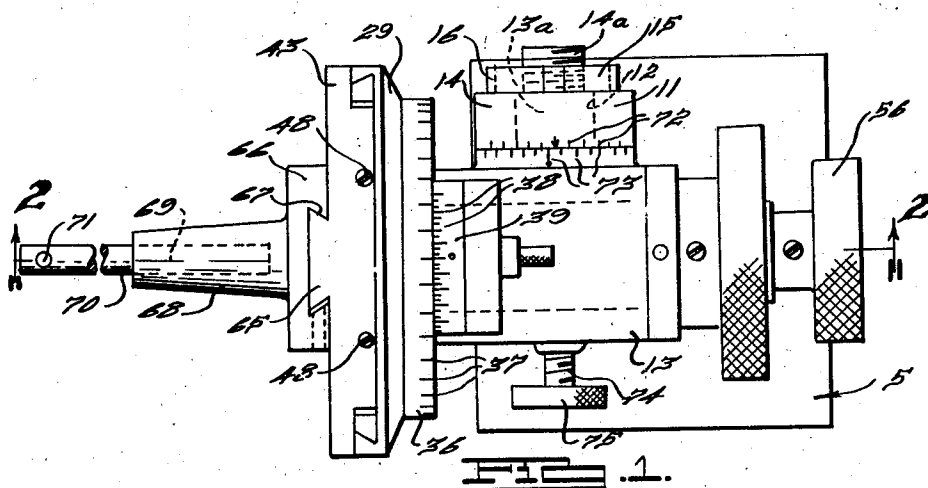
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2,404,465

RADIUS TO TANGENT COMPOUND ANGLE DRESSER

Filed Sept. 16, 1943

2 Sheets-Sheet 1



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2 Sheets-Sheet 2

FIG. 5.

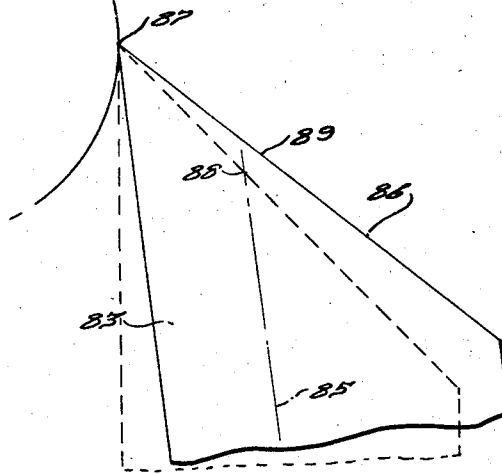
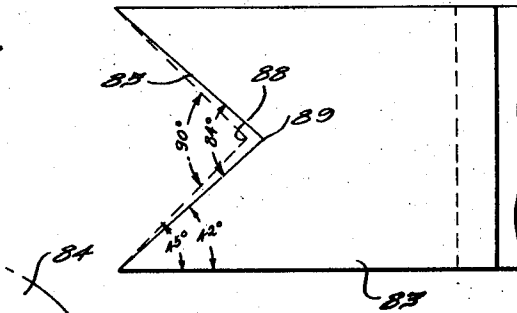


FIG. 6.

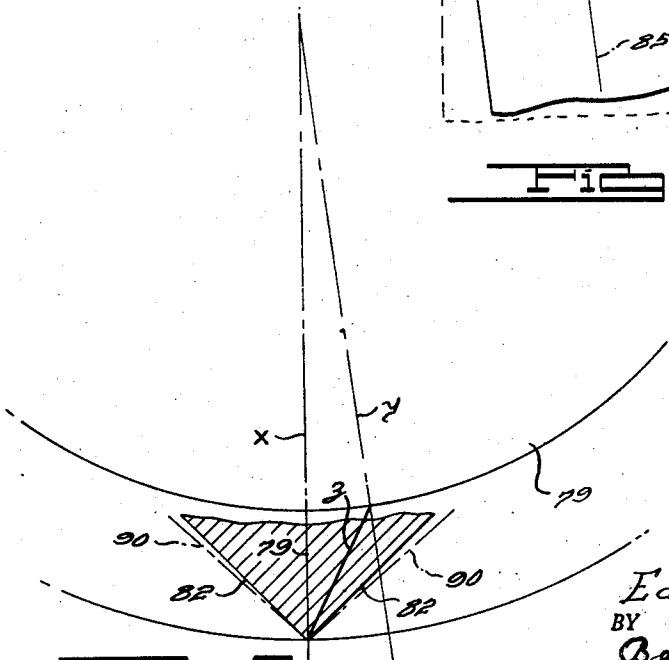


FIG. 7.

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RADIUS TO TANGENT COMPOUND ANGLE
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4 Claims. (Cl. 125—11)

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The present invention relates to angle to tangent radius dressers, and, more particularly, to a dresser which may be positioned for dressing surfaces on a compound angle.

The primary object of the invention is to provide a grinding wheel dressing tool which may be easily adjusted to position the cutter for movement on a projected compound angle without necessitating the use of extensive computation and the resultant loss of time.

Another object of the invention is to provide a radius tangent dressing tool for grinding wheels which is extremely accurate and is particularly adapted for high precision work.

Another object of the invention is to provide a dressing tool for grinding wheels whereby the surface of the wheel may be accurately trued or dressed on various compound angles by unskilled labor or others not having highly skilled or technical training whereby the grinding wheel surface will be conditioned to compensate for irregularities in work pieces resulting in the projection thereof.

Heretofore it has been common practice to position grinding wheel truing devices and dressers so that the cutter will move on a projected compound angle by tilting the base of the dresser and inserting Johansson or Hoke gauge blocks under the base to produce the necessary compound angle and the movement of the dressing cutter on said angle. In various pieces of work requiring the grinding wheel to be dressed so that the work produced therefrom will be of a predetermined angle, the dresser cutter is positioned by height gauges and the like and various other measurements are made in addition to the positioning of the base by means of gauge blocks, so that extensive arithmetical calculations and computations are necessary in order to arrive at the desired setting or angle of the dressing cutter movement.

The above practice is objectionable in that it consumes considerable time and requires highly skilled and trained mechanics in determining the proper positioning of the dressing cutter to produce the desired projected compound angle. By providing a dressing cutter as set forth in the present invention, the above objections and disadvantages are overcome and a dressing cutter is provided which will eliminate the use of gauge blocks and various other gauges to position the dresser cutter to move in a projected angle without necessitating the use of arithmetical computation and without sacrificing the precision of the work produced.

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Other objects and advantages of the invention will become apparent during the course of the following description of the accompanying drawings, wherein:

Figure 1 is a top plan view of the improved radius to tangent compound dresser illustrating the various parts and the arrangement thereof;

Figure 2 is a longitudinal cross-sectional view taken on line 2—2 of Figure 1 looking in the direction of the arrows and illustrating in detail various structural features of the radius to tangent compound angle dresser;

Figure 3 is a side elevational view of the radius to tangent compound angle dresser illustrating the same positioned adjacent a grinding wheel with the cutter presented to the operative face thereof showing the manner in which the cutter will move with respect to the grinding wheel to produce an angular surface thereon of a prescribed compound angle;

Figure 4 is a front elevational view of the radius to tangent angle dresser showing the same in position with respect to a grinding wheel for dressing the surface on a horizontal plane;

Figure 5 is an end elevational view of a work piece which is formed by a particular grinding wheel having predetermined angular faces thereon;

Figure 6 is a side elevational view of a work piece diagrammatically illustrating the use thereof under certain conditions; and

Figure 7 is an isometric cross-sectional view of a grinding wheel having angular surfaces produced by positioning the radius to tangent dressing cutter on a projected compound angle.

In the drawings, wherein for the purpose of illustration like reference characters will be employed to designate like parts throughout, attention is first directed to Figures 1 to 4 inclusive wherein the reference character 5 will generally be employed to represent a base having a substantially flat surface plate 6 secured to the bottom wall thereof by means of screws or the like as at 7. The base 5 is substantially rectangular and includes a thick body portion 8 having a top surface which is likewise relatively flat.

One corner portion of the base 5 has integrally formed therewith an upstanding support 9 having a reinforcing web 10 interconnecting the standard 9 and base 8. The upper portion of the vertical standard 9 is formed with a cylindrical bearing as at 11 which is provided with a horizontal bore 12 for receiving a supporting member.

The supporting member comprises a tubular sleeve-like member 13 having a circular off-set

boss 14 adapted to abut the cylindrical bearing portion 11 of the vertical standard 9 as is clearly shown in Figure 1. Formed integral with the circular offset boss 14 is a stub shaft 13a having the outer end thereof screw-threaded as at 14a for receiving a locking nut or the like as at 15. The locking nut is provided with circumferentially spaced notches 16 for receiving a tool or the like to facilitate tightening of the nut upon the threaded extension 14 and thereby lock the tubular supporting sleeve 13 in an adjusted position. The tubular support 13 is provided with an offset sector-shaped boss 17 having a horizontal bore 18 for receiving a reciprocating locking pin 19 one end of which is enlarged as at 20 while the opposite end is knurled as at 21 to provide a finger-grasping portion. The sliding pin 19 is adapted to provide a limiting stop for the dresser head in a manner which will be more fully described hereinafter.

Rotatably mounted in the bore of the tubular support 13 is an elongated sleeve 22 having a circular flanged portion 23 at one end thereof abutting one end of the tubular support 13 while the opposite end is threaded as at 24 for receiving an internally threaded locking collar 25 having diametrically opposed recesses 26 for the reception of a spanner wrench to facilitate tightening of the threaded collar 25 and the retention of the elongated sleeve 22 in position. The extreme free end of the elongated sleeve 22 is slightly reduced in diameter for receiving a collar 27 upon which is integrally formed a hand wheel 28 knurled around its circumference to provide a hand grasp surface.

A disk-shaped head 29 is secured to the flange 23 of the elongated sleeve 22 by means of bolts or the like as at 30 circumferentially spaced about the axis of the elongated sleeve and said head 29 is provided with an annular recess 31 having an overhanging flange 32 spaced from the circular flange 23 to provide a restricted circumferential slot 34. Slidably mounted in the annular groove 31 is the head of an arcuately shaped stop member 35 having a threaded portion for the reception of a nut or the like to retain the stop in place. The free end of the slot projects into the path of the enlarged head 20 on the sliding pin 19 to facilitate limiting rotation of the head 29 about a predetermined arc. The rotary head 29 is provided with a drum portion 36 having a series of circumferentially spaced graduations 37 which are adapted to register with vernier graduations 38 on an arcuately curved plate 39 having a flange portion 40 which is attached to the offset sector-shaped boss 17 by means of screws or the like as at 41.

The rotary head 29 is provided with a diametrical slide guide 42 upon which is slidably mounted an adjustable rotary head 43 movable diametrically over the axis of rotation of said elongated sleeve 22. The adjustable rotary head 43 is cut away as at 44 for receiving finely machined bevelled strips 45, the bevelled edges of which as at 47 being adapted to cooperate with the slide guide 42 and the complementary surfaces thereon to provide a snug fit between the diametrically adjustable rotary head 43 and the rotary head 29. The slide key guides 45 are retained in position by means of screws or the like 48 and may be adjusted from time to time to take up any wear between the bevelled surfaces of the slide guide 42 and the key guide strips 45. If desired, shims 49 may be positioned along the edges of

the cutaway portion 44 and between the bevelled slide guides 45.

Rotatably mounted in the elongated sleeve 22 is a control shaft 50 having an enlarged head portion 51 at one end thereof which is adapted to slidably operate in an enlarged bore portion 52 at one end of the elongated sleeve bore 53. The other end of the control shaft 50 has secured thereto a collar 54 by means of a set screw 55 and formed on said collar is a hand wheel 56 having a knurled peripheral surface similar to the hand wheel 28. The hand wheel 56 is positioned adjacent the hand wheel 28 to facilitate manipulation of the rotary head in two directions in a manner which is shown in my co-pending application Serial No. 459,800, filed September 26, 1942, patented December 14, 1943, under No. 2,336,758.

A coil spring 57 encircles one end of the shaft 50 and is received in the enlarged bore 52 so that one end thereof will abut the enlarged head 51 and project the same in the direction of the rotary head 29. The enlarged head 51 is provided with a series of gear teeth 58 adapted to mesh with a rack bar 59 secured in a chamfered portion 60 of the adjustable rotary head 43 so that rotation of the shaft 50 as by means of the hand wheel 56 will cause said pinion 58 to mesh with the gear teeth on the rack bar 59 and thereby slide the adjustable rotary head 43 diametrically of the axis of the control shaft 50 and along the slide guide 42.

The adjustable rotary head 43 is provided with a bore 61 in axial alignment with the control shaft 50 and said bore is provided with a recess 62 having a bevelled portion 63 for the reception of an integral projection 64 formed on the enlarged head 51. The coil spring 57 normally urges the projection 64 into the bevelled recess 63 to lock the adjustable rotary head 43 in axial alignment with the head 29, elongated sleeve 22 and control shaft 50.

The adjustable rotary head 43 is provided with a dovetailed slide guide 65 upon which is slidably mounted a tool-carrying block 66 having ways 67 similar to the ways 42. The tool carrying block 66 is provided with an axial extension 68 having a central bore 69 for receiving a diamond cutting tool 70 having a diamond cutting point 71.

It is to be noted that the circular portion 11 of the vertical standard 9 is graduated as at 72 in degrees and vernier graduations 73 may be provided on the offset circular boss 14 to register with said graduations 72 thereby facilitating angular adjustment of the supporting collar 13 with respect to the horizontal so that in addition to the angularity of the adjustable head 43 the axis thereof may be tilted to project a compound angle by tilting the supporting collar 13 the required amount. A set screw 74 is threaded in the tubular support 13 and is provided at its outer end with a knurled thumb-piece 75 to facilitate locking the elongated sleeve 22 in an adjusted position to prevent rotation of the head 29 and adjustable head 43, after the rotary head 29 has been shifted to a predetermined position. It is to be understood that the locking screw 74 may be released when moving the cutter 71 in an arcuate path between the limits of the stop members 20 and 35 so that the head may be rotated by the hand wheel 28 between said limits while the hand wheel 56 is rotated to shift said head from stations at the ends of said limits.

By reference to Figure 4 it will be seen that

the angle to tangent radius dresser is presented to a grinding wheel 76 mounted on an arbor 77 and held in position by a locking nut 78. The diamond cutting point 71 is presented to the peripheral surface of the grinding wheel 76 to trim a straight surface and in this position of the angle to tangent dresser, the set screw 74 may be tightened to maintain the rotary head 29 in a preset position. The knurled hand piece 56 is simply operated to move the adjustable rotary head 43, tubular socket 68 and diamond tool 70 in a straight line path as illustrated by the dotted line. Obviously if it is desired to cut a concave or convex face on the grinding wheel 76, the adjustable head 43 is positioned in centered relation with respect to the rotary head 21 and the tool supporting slide 68 is moved above or below the axis of the control shaft 50 to the desired amount to produce the curved convex or concave surface on the periphery of the grinding wheel.

By reference to Figure 3 it will be seen that the angle to tangent radius dresser is presented to a grinding wheel 79 mounted on a suitable spindle 80 and said grinding wheel is provided with an angular peripheral surface 81 having converging walls at an angle of approximately 90 degrees. The cutter of the dresser 71 is positioned at a point directly below the axis of said grinding wheel 79 to move in an angular direction of approximately 45° corresponding to the angular position of the head 43. By way of illustration, attention is directed to the projected view in Figure 7 wherein a grinding wheel similar to the grinding wheel 79 is shown with faces angularly arranged at approximately 90° as at 82 which would be the resultant angle of dress if the tool is moved on a 45° angle with respect to the center line of the grinding wheel. In Figure 7 the line *x* represents the vertical radius of the wheel, and the line *y* forms an included angle therewith equal to the angle of compensation which will hereinafter be more fully described. In the formation of certain work such as high speed cutting tools, it is desirable to cut a groove in the tool to form the cutting edges therefor and diverting from Figure 7 for a second and referring to Figures 5 and 6, such a tool is illustrated as at 83. Let it be supposed that a groove is to be cut in one face of the cutting tool 83 so that the metal removed from a piece of work 84 will have a corresponding configuration or shape to the angularity of the cutting tool. In proceeding to form the groove 85 extending the length of the cutting tool 83, the piece of cutting tool steel 83 is placed upon a surface table beneath the grinding wheel 79 so that by moving the surface table longitudinally beneath the grinding wheel there will be cut a groove such as is shown in the tool steel 83 at 85 of the same shape and contour as the grinding wheel and with the same relative arrangement or angularity between the walls 82 thereof. After the H. S. tool steel has been thus formed along one wall with a 90 degree groove it is bevelled along the top edge as at 86 to provide a backing off and an acute point 87 adapted to be presented to the work 84. By reason of the heat generated during the cutting operation of the tool which partly passes into the work and into the tool steel, the cutter will stop cutting after a predetermined temperature is reached if operated above the surface speed of the particular metal. If the tool steel cutter 83 is slightly angled with respect to

a line tangent to the diameter of the work at an angle of approximately 7 degrees, the heat is reduced so that the cutting operation can be carried out at a much faster rate of speed and close to the speed of the metal employed. When the tool 83 is thus angled, the depth of the groove 85 as at 88 moves to the position shown at 89 so that instead of a 90 degree angular cut, one of approximately 84 degrees will result by reason of the projection from the points 88 to 89. In other words, when the tool 83 is tilted the required amount for efficiency in the cutting operation, the groove 85 is altered by a difference of approximately 7 degrees so that the work 84 instead of being cut with a 90 degree groove will be cut with a groove in which the walls are at an angle relative to one another of approximately 84 degrees.

Obviously, the angular walls 82 of the grinding wheel 79 must be ground or dressed so as to cut a groove such as is shown at 85 in a tool 83 at an angle greater than 90 degrees so that when the tool 83 is angled with respect to the work 84, the prescribed angle will be cut therein with the walls thereof angled exactly 90 degrees.

In order to compensate for the differences above, an angle is laid off on the grinding wheel 79 as indicated by the line *y* equal to the angle of inclination of the tool 83, and the radius to tangent dresser is angled as shown in Figure 3 to cause the cutter 71 to move along the line *z* which intersects the lines *x* and *y* in Figure 7 so that instead of the walls 82 thereof being at an angle of 90 degrees they will be cut on an angle greater than 90 degrees as shown by the dot and dash line 90 in the projected section in Figure 7. Hence, the included angle between the walls 90 indicated by the dot and dash line will be greater than 90 degrees so that the tool 83 will be cut with a groove having a corresponding angularity when on a flat surface. When the tool 83 is presented to the work 84 and tilted the required amount for most efficient operation, the difference of the tool tilt brings the groove to the exact amount of angularity such as 90 degrees which is the angle of the desired cut in the work 84.

The above examples are explanatory for all angular positions of the rotary head 29 and in setting the angle to tangent radius dresser the support 13 may be adjusted by manipulating the screw 15 so that the pointer 72 will register with a graduation 73 corresponding to the angle of tool tilt indicated in Figure 6. Of course, the rotary head 29 would be adjusted in the case of the above example to produce 90 degree related walls 82 so that the 45 degree marking on the graduations 37 would register with the zero marking on the graduated plate 39 whereby manipulation of the hand wheel 56 would cause the adjustable head 43 to slide at an angle of 45 degrees with respect to the horizontal. It is to be noted that the diamond point 71 of the tool 70 is positioned directly under the axis of the supporting shaft 80 so that the projected angular cut will be greater than 45 degrees by reason of the tilting of the grinding wheel dresser to a prescribed amount in accordance with the tilting or angularity with which the tool 83 is presented to the work 84. It is to be understood that the illustrations are exemplary of one particular angle, and if desired, grinding faces may be produced on the grinding wheel 79 which will form various other shapes and sizes of grooves with different angularly related cutting walls without necessitating complicated mathematical deductions computed

by the usual formula for a projected angle on an xyz coordinate axis where the projected angle S equals the square root of x^2 plus y^2 plus z^2 .

It is to be understood that the form of the invention herewith shown and described is to be taken as a preferred embodiment thereof and that various changes in the shape, size and arrangement of parts may be resorted to without departing from the spirit of the invention or the scope of the subjoined claims.

What I claim is:

1. A radius to tangent angle grinding wheel dresser, comprising a base adapted to be positioned on the work table of a grinding machine, a support swiveled on said base to swing about a horizontal axis, said support being arranged in close relation to the grinding wheel of said grinding machine, a tubular control member journaled in said support and positioned in the same plane as said grinding wheel, a rotary tool supporting head on said tubular control member movable about the axis of said tubular control member at right angles to the axis of said support, a sliding head mounted on said rotary head, a grinding wheel dressing tool carried by said sliding head, and a control shaft extending through said tubular control member for imparting sliding movement to said sliding head whereby said dressing tool may be moved in an oblique plane on a compound angle when the support is swivelled on its base to a predetermined angular position.

2. A radius to tangent angle grinding wheel dresser, comprising a base adapted to be positioned on a grinding machine having a grinding wheel, a support swiveled on said base to move about a horizontal axis, a control sleeve mounted in a bore in said support, a tool carrying head secured to said sleeve to rotate about a tiltable and adjustable axis at right angles to said first-mentioned axis, position indicating markings on said head and base for registry with indicating markings on said support, a sliding head mounted on said rotary head movable diametrically across the axis thereof, and tool carried by said sliding head extending in the same plane as said grinding wheel and arranged so that tilting of said support to a predetermined angular position and sliding movement of said sliding head will impart movement to said tool along a compound angular path.

3. A radius to tangent angle grinding wheel dresser, comprising a base adapted to be positioned on the work table of a grinding machine, a support journaled on said base capable of being adjusted about a horizontal axis in close proximity to the grinding wheel of said grinding machine, a rotatable tool carrying head carried by said support for rotary movement on a tiltable axis at right angles to said first mentioned axis, a sliding head carried by said rotary head movable over said axis and on both sides thereof, individual control means for said heads to impart rotary and sliding movement thereto, a dressing tool carried by said slidable head extending in the same plane as said grinding wheel, and indicating markings on said support registrable with graduations on said base so that the axis of the rotatable tool carrying head can be tilted to a predetermined angular position to impart compound angular movement to said dressing tool upon operation of either of said control means.

4. A radius to tangent angle radius dresser for grinding wheels, comprising a base adapted to be supported on the work table of a grinding machine, an upright on said base having a bearing portion at its upper end in close proximity to the grinding wheel of said grinding machine, a tubular support journaled in said bearing portion for adjustment about a horizontal axis, a rotary head carried by said support to move about an adjustable tiltable axis at right angles to said first-mentioned axis, a sliding tool carrying head mounted on said rotary head, a dressing tool carried by said sliding head extending parallel with the last-mentioned axis and in the same plane as the grinding wheel individual control mechanism for said rotary and sliding heads, a pair of indicating markings on the tubular support for registry respectively with graduation markings on said rotary head and said bearing portion of the upright, and locking devices for holding said tubular support and rotary head in tilted predetermined angular positions whereby operation of said control mechanisms to impart sliding movement to said sliding head will cause said dressing tool to be moved in a resultant direction depending upon the component angular positions of said tubular support and rotary head.

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