Jan. 31, 1967 W. E. PASOWICZ 3,301,247

DRESSING GRINDING WHEELS, AND THE LIKE

Filed Sept. 10, 1964 3 Sheets-Sheet 1

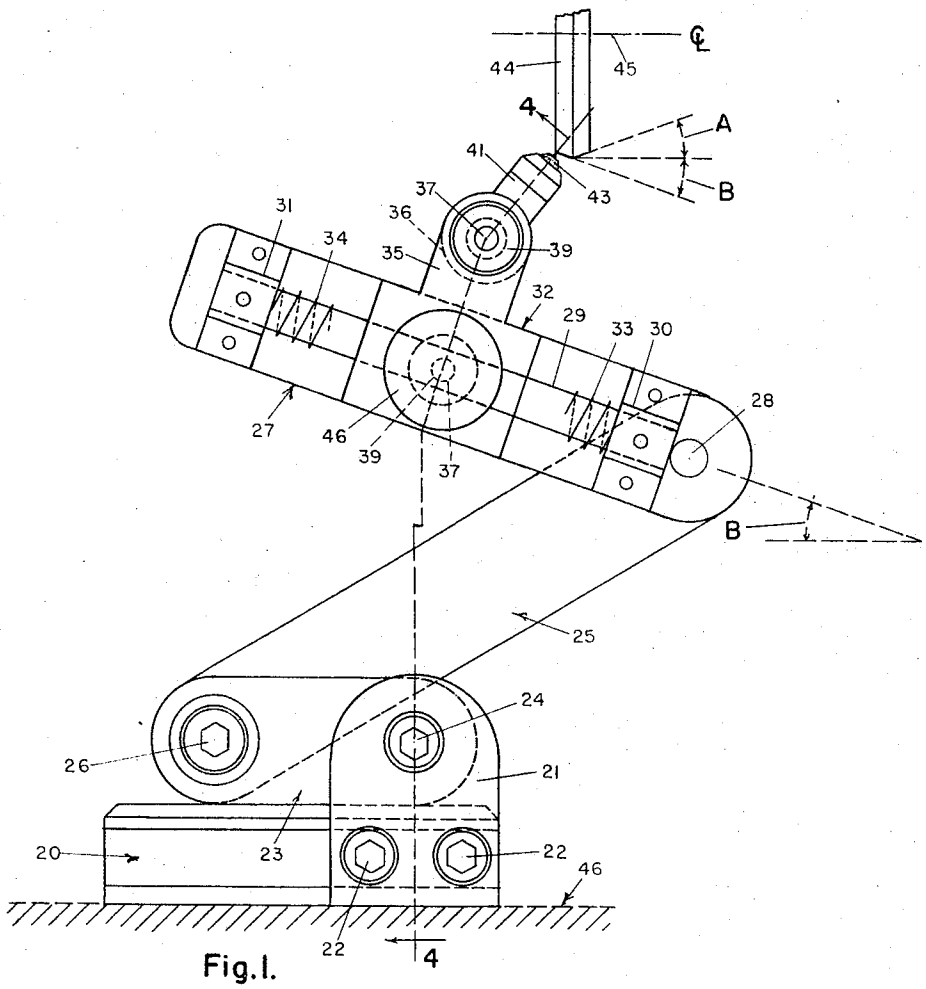


Fig. 1.

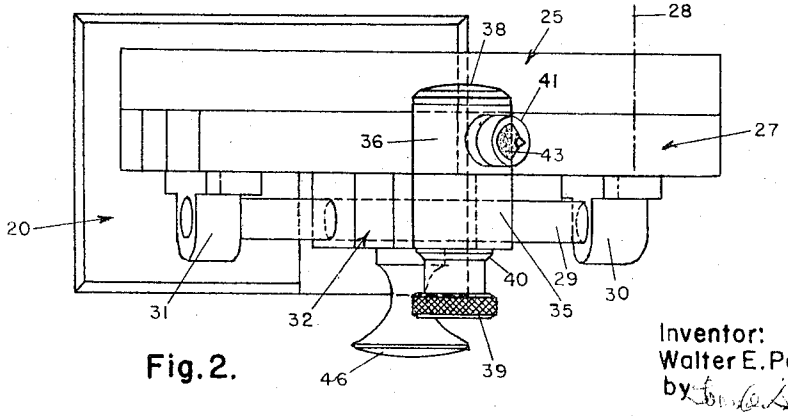


Fig. 2.

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DRESSING GRINDING WHEELS, AND THE LIKE

Filed Sept. 10, 1964 3 Sheets-Sheet 2

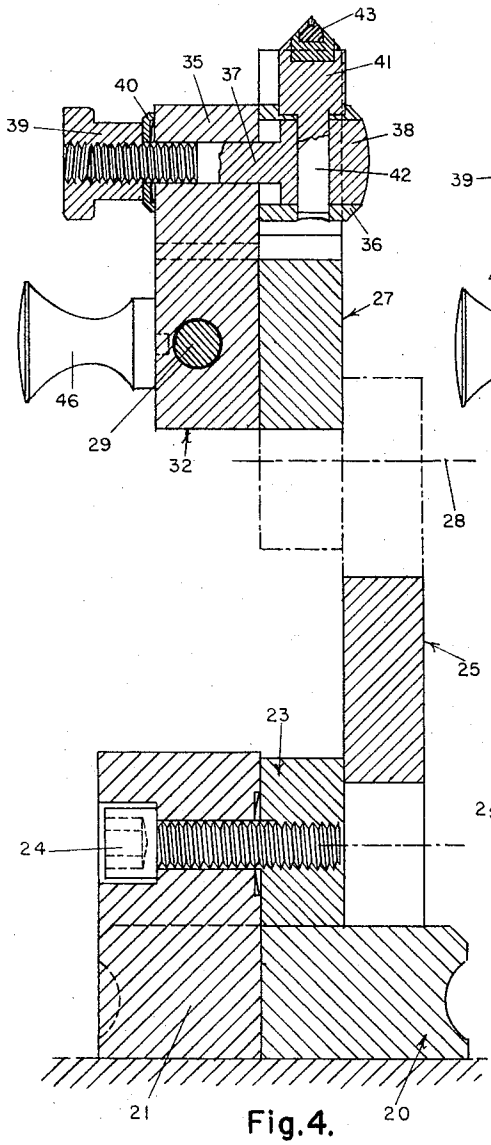


Fig.4.

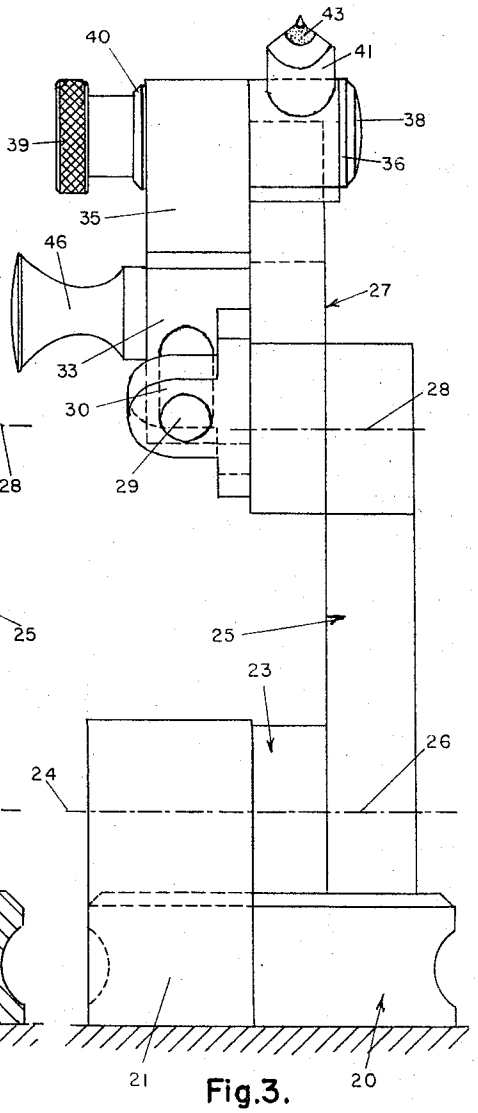


Fig.3.

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DRESSING GRINDING WHEELS, AND THE LIKE

Filed Sept. 10, 1964 3 Sheets-Sheet 3

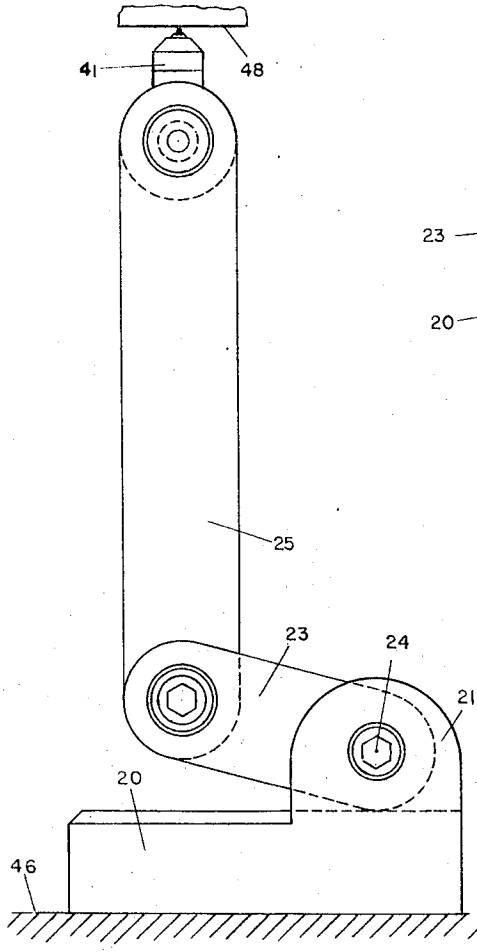


Fig.5.

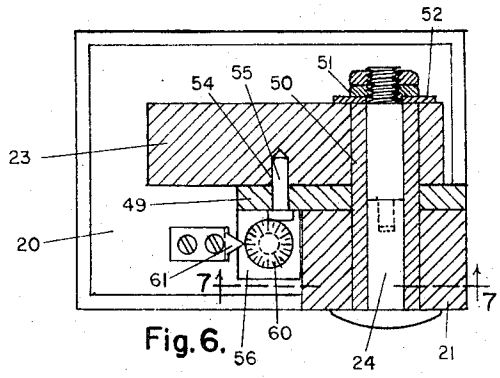


Fig.6.

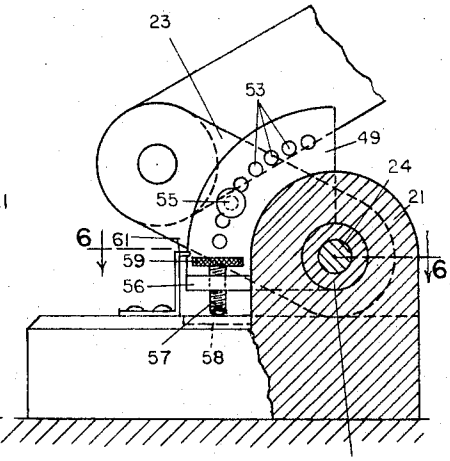


Fig.7.

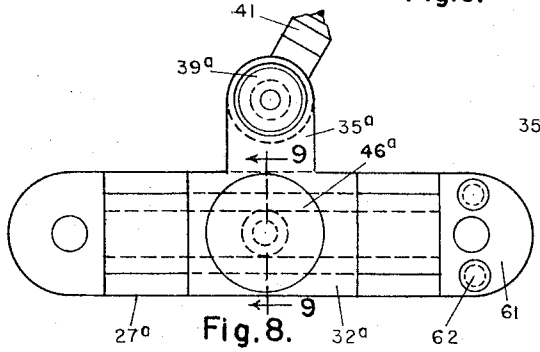


Fig.8.

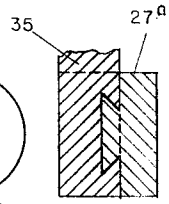


Fig.9.

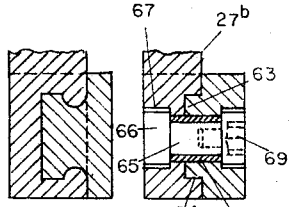


Fig.10. Fig.11.

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DRESSING GRINDING WHEELS, AND THE LIKE

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10 Claims. (Cl. 125—11)

This invention relates to improvements in dressing grinding wheels, and the like. More particularly, the presently to be disclosed improvements are intended for dressing the perimeters of grinding wheels composed of very hard abraded material, well known in the arts at this time. Such grinding wheels are formed of minute particles of the abradent cemented or otherwise bound together into the wheel form which may be thick or thin. Such wheels or disks rotate at high rotational speed, and, when their perimetral surfaces are well dressed, are capable of dependably grinding the surfaces of work bodies to very close tolerances, e.g., of the order of tenths of a mil. But to attain such high degrees of accuracy the perimetral surfaces of the grinding elements must be dressed with extreme accuracy, to ensure very close tolerances in wheel diameter, avoidance of minute irregularities in the wheel perimeters, such as minute pits, etc., and to ensure accurate production of the perimetral wheel surfaces, either as thin cylinders (all portions of the same radius), or edge shaped (such as produced by grinding opposite surface portions of the wheel perimeter to lie in truncated cones meeting in a sharp maximum diameter wheel edge, generally lying in the plane normal to the wheel axis of rotation, and midway of the thickness of the wheel).

Conventional practice in the dressing of such wheels at the present time involves the use of small cutting elements of very hard material, such as industrial diamond, mounted in and small cutter or carrier unit, and held in proper position with respect to the perimetral portion of the wheel while moved back and forth during the dressing operation, in manner to produce the desired dressed surface on the wheel. If such wheel perimetral surface is to be truly cylindrical such back and forth movement of the dressing unit must be produced in a path parallel to the axis of wheel rotation, and so controlled that the distance of the dressing unit from the axis of the rapidly rotating wheel does not vary; if such wheel surface is to be produced on a truncated conical surface, the dressing unit must be moved back and forth in a path lying in a plane which includes the axis of rotation of the wheel, and varies in distance from the wheel axis uniformly during the successive back and forth movements of the dressing unit to produce the dressing operation on the desired truncated conical surface. In any case, however, the dressing unit must be held very firmly during its movements, and such movements must be accurately controlled, without deviation from the intended path of movement, within extremely close tolerances, of the order of a tenth of a mil (one one-thousandth of an inch).

It is a prime object of the present invention to provide a dressing unit complying with all of the above stated objectives, as well as other objects hereinafter explained. In this connection the following further statement of operations performed in the use of such grinding wheel dressing units is pertinent:

The "setting up" of the dressing unit must be accurately performed to ensure accurate dressing of the wheel to the specifications desired. Such setting up of the dressing unit includes its adjustment to the exact elevation proper to ensure correct and accurate dressing of the subject wheel. Additionally, if the dressing is to be performed on a wheel having a truncated conical perimetral edge

contour, the dressing unit must be so supported that it may be moved back and forth with respect to the subject wheel (and parallel to the axis of such wheel), with varying distance from the wheel axis during the back and forth dressing unit movements, such varying distance complying with the varying diameter of the wheel edge surface at all times. The supporting elements by which the dressing unit is carried must be of such nature that the dressing unit shall at all times be supported with sufficient firmness to ensure known travel of the cutting edge along its intended path to ensure dressing the wheel accurately and of the intended contour. The present improvements are such as to obtain the foregoing objectives to a high degree of accuracy.

In connection with the foregoing, it is an important object of the invention to use simple elements in the construction of the supporting structure. To this end the presently to be disclosed structures are formed, to a large degree, from linkages of pivotally connected links. Provision is made for pivotally connecting such links together, and for changing their respective angles of connection together, to enable proper adjustments between the several links during the setting up operations. In this connection provision is also made for enabling variations to be made of the angular settings of the base link to enable changes or adjustments of the angle of that link, when necessary, to re-set or otherwise modify the path of movement of the cutting element during dressing operations. Provision is also made for reading the setting of that link prior to change of its setting, to enable re-setting thereof at a later time, and after some intervening operation has been made, such re-setting being thus possible to the originally set position and angle.

A further and important object of the invention is to produce a dressing unit of self-contained structure, and which can be readily used in connection with various forms of machine tools which include grinding wheels or with which such grinding wheels are operable. Many such machine tools are provided with flat smooth surfaced tables lying in planes parallel to the axis of the clutch shaft. The dressing units hereinafter to be described include base elements which may be set onto such smooth tables and shifted thereon during the dressing operations, the dressing units herein described being so constructed that they may be adjusted to ensure accurate dressing of the grinding wheel during such movements. Many of such presently installed machine tools also include magnetic clutches which are movable on suitable carrying elements, such as a smooth table aforesaid. Under such conditions, the base element of the present device may be magnetically gripped by such a magnetic clutch, and during the back and forth dressing operations, such clutch will travel with the present unit, moving on its own supports.

It will be evident from the foregoing statement that it is a further object of the invention to provide a structure which will be usable in connection with many machine tools presently in use, to enable dressing the grinding wheels used from time to time in connection with such machine tools, and without need of providing special structural elements in such machine tools, to enable dressing of the grinding wheels used with them.

Other objects and uses of the invention will appear from a detailed description of the same, which consists in the features of construction and combinations of parts hereinafter described and claimed.

In the drawings:

FIGURE 1 shows a front face view of a typical wheel dressing unit embodying features of the present invention, with the dressing tool set into dressing engagement with the lower portion of the subject wheel; the setting

of the dressing tool being such as to enable dressing of one peripheral surface of a wheel whose perimeter is provided with a double truncated coned surface having the plane of joinder of the two truncated cones lying within a plane central of the thickness of the wheel;

FIGURE 2 is a plan view corresponding to FIGURE 1;

FIGURE 3 is a right-hand end view corresponding to FIGURES 1 and 2, but on enlarged scale as compared to the previous figures;

FIGURE 4 is a vertical transverse section taken substantially on the lines 4—4 of FIGURE 1, looking in the directions of the arrows, being an irregular section;

FIGURE 5 shows a modified elevational view of another embodiment of the present invention, in which a single element is provided, adjusted into a vertical position, and carrying the dressing tool at its upper end, the latter being set to dress the perimetral cylindrical surface of the grinding wheel;

FIGURE 6 shows a horizontal section through a modified embodiment of my present invention, which modification may also be incorporated in the embodiment shown in FIGURES 1, 2, 3 and 4, and others; such modification comprising the provision of means to adjust the angle of the lower or prime element to a nice degree, and means to indicate such setting and other settings, thus enabling re-setting to an original position after a changed setting of the parts;

FIGURE 7 shows a front elevational view corresponding to FIGURE 6, with showing of the sectioned part defined by the section line 7—7 of FIGURE 6, looking in the direction of the arrows; and FIGURE 7 also shows the section line 6—6 on which the horizontal section of FIGURE 6 is taken;

FIGURE 8 shows a front elevational view of a modified form of the head-link which directly carries the dressing tool therein shown; the support for the dressing tool including a two-part element whose two parts are connected together by a tongue and groove connection permitting later back and forth shift of the dressing tool proper, with limitation of such movement in each direction;

FIGURE 9 shows a cross-section taken on the line 9—9 of FIGURE 8, looking in the direction of the arrows;

FIGURE 10 shows a cross-section similar to that shown in FIGURE 9; but in the showing of FIGURE 10 a different form of tongue and groove is illustrated from that previously shown; and

FIGURE 11 shows another cross-section similar to that shown in FIGURES 9 and 10; but in the showing of FIGURE 11 one of the elements is provided on its back face with a channel into which extends a tongue carried by the other element; together with a slotted longitudinally extending opening in the front element through which slot extends a stud which also extends through the back element, with a spacer thimble limiting the tightening of the screw movement, to thus lock the two elements together against disengagement transversely of the unit, but without binding which would otherwise prevent lateral movements of the tool carrying element with respect to the front element of the pair.

Referring first to FIGURES 1, 2, 3 and 4, there is shown the base unit **20**, preferably made of magnetizable material, and of sufficient mass to stand firmly on a smooth surface, planar. This base block is provided with an upstanding lug **21**, shown in FIGURES 1, 3 and 4 as a separate element from the base, secured to such base by the screws **22**; but conveniently both the base element and such lug may be unitary, such as a forging. The primary arm element **23** is pivotally connected to such lug by the through stud **24**. Such stud **24** may be tightened sufficiently to resist all normal forces which may be expected to be transmitted to such primary arm element when, as shown in FIGURE 5 such primary arm element is swung upwardly from its original position of

rest against the top surface of the base element, as shown in FIGURES 1, 3 and 4. A secondary link element **25** has one end pivotally connected to the free end of the element **23** by the stud **26** (schematically shown by the dash-dot lines in FIGURES 3 and 4). By tightening such stud **26** the secondary link **25** may be locked to the primary arm element sufficiently to resist such forces as may be normally imposed on the parts when in use.

The dressing unit carrier element **27** has one end pivotally connected to the free end of the link **25** by the stud **28**; and by tightening such stud sufficiently the dressing unit carrier will be retained against such forces as may be normally imposed on the device when in service. In the embodiment shown in FIGURES 1, 2, 3 and 4, such unit **27** includes the longitudinally extending track-rod **29** connected to the carrier proper by the lugs **30** and **31** which support the rod spaced in front of the carrier proper sufficiently to accommodate other elements as presently shown (see FIGURES 2, 3 and 4). The slide block **32** is slidingly mounted on the rod **29** with limitation of the longitudinal movements of such slide block by engagement with the lugs **30** and **31** or with the buffer springs located on the track rod at both sides of the slide block, such buffer springs being shown at **33** and **34** in FIGURE 1. The lug **35** extends upwardly from the slide block, and a cylindrical unit **36** extends rearwardly from such lug, being mounted on the stud **37** having its rear end enlarged into a head **38**. A nut **39** is threaded onto the front end of such stud, preferably with a washer **40** interposed between the nut and the front face of the lug **35**, a disk spring element being interposed between such washer and such lug front face. The enlarged head **38** terminates free of the rear face of the lug **35** as well shown in FIGURE 4, so that the stud and such enlarged head may be shifted forwardly by threading of the nut **39**.

The dressing tool unit **41** comprises a cylindrical block including at its lower end the stud portion **42** which sets down through companion openings through the enlarged head **38** and the cylindrical unit **36**. Accordingly, by threading the nut **39** sufficiently to draw the stud **37** forwardly, carrying with it the enlarged head **38**, the stud portion **42** of the unit **41** will be drawn leftwardly in FIGURE 4, to tighten the unit **36** against the rear face of the lug **35**, and at the same time tightening the stud **42** forwardly against the leftward surface of the opening through the enlarged head, and thus retaining the tool unit firmly in place on the stud **37** and cylindrical unit **36**. The upper end of the tool unit **41** is provided with a recess within which may be carried a block of material into which the cutting tool proper is seated, as shown at **43** in FIGURE 4.

By loosening the nut **39** sufficiently, the unit **36** may be released to permit the cutting tool to be rotated into such position as may be desired, according to the requirements of the surface to be dressed; whereupon such nut may be again tightened to securely retain the cutting tool in such adjustment. In FIGURE 1 the parts are shown in a position for engagement of the dressing tool with the left-hand surface of the perimeter of the grinding wheel **44**, which wheel is schematically shown with its axis **45** extending within a plane which also includes the carrier unit **27** and its rod **29** on which the slide block is mounted.

Study of the structure thus far described will show that by moving the slide block o nthe track-rod the dressing tool must follow such movement, so that the movements of such tool will be parallel to the adjusted angle and position of the track-rod. In FIGURE 1 the several parts have been adjusted and locked in position such that the tool must execute a path non-parallel to the wheel's axis of rotation. Thus, one truncated surface of the perimetral portion of the wheel will be dressed at an angle B with respect to such wheel axis. By turning the base block and the entire unit through 180 degrees

on the supporting surface 46, and without change of the adjustments of the several link elements of the unit, the right-hand perimetral portion of the wheel may be likewise dressed to produce the angle A which angle will be the same as, but complementary to the angle B, previously dressed. In the above statement it is assumed that the surface 46 is parallel to the wheel's axis. It is also noted that the unit 27 and its track-rod 29 determine the exact direction path in which the dressing tool will travel.

The hand-grip element 47 is provided on the slide-block 32 for convenience of operation of the dressing tool after the parts have been brought to the proper settings for the intended dressing operation.

Referring next to FIGURE 5, I have therein shown an embodiment comprising the base element and the upstanding lug 21, together with the primary arm element 23, pivoted to such lug 21 by the stud 24, as in the previously described embodiment. For illustration of the versatility of the units I have also, in FIGURE 5 shown such primary arm element as rocked into an upwardly slanting position, thus raising its free end above the base block, for the purpose of adjusting the elevation of its connection to the link 25. Thus such link 25 is shown in substantially vertical position. The unit 35 is then connected directly to the upper end of the link 25 by the stud 37 without interposition of the unit 27 and connected parts. Provision has thus been made for adjustment of the elevation of the dressing tool, but not for horizontal back and forth dressing movements. In the present case the base element 20 in slidably mounted on the supporting table 46, or, in case such table is itself horizontally movable, the necessary horizontal dressing movements may be effected by shift of such table 46 itself.

The work body, such as the perimetral cylindrical surface of a grinding wheel, is shown at 48 in FIGURE 5, it being evident that with the embodiment of that figure, the dressing tool must execute movements parallel to the surface 46.

In FIGURES 6 and 7 I have shown an alternate means for connecting the primary arm 23 to the upstanding lug 21 of the base block 20. In this alternate embodiment a circular segment 49 is mounted for swinging movement about the pivotal connection of the arm 23 to the lug 21, so that such segment may be rocked to various angular positions as needed corresponding to desired angular positions of the arm 23. To enable such swinging movement of the segment to occur, while at the same time providing for proper locking of the parts against disengagement from each other, I have included the sleeve 50, set onto the stud 24, as shown in FIGURE 6. This sleeve is of such length that when the nut 51 tightened against the washer 52, such washer is locked against the rear end of the sleeve without binding of the arm 23 against the segment 49. Thus the nut 51 may be tightened to lock the several parts into place without interfering with swing of either the arm 23 or the circular segment 49.

The segment 49 is provided with a series of holes 53 located at the same radius from the axis of swing of the segment about the stud, and a socket 54 is provided in the face of the arm 23 proximate to the segment, and located at the same radial distance from the pivoting stud 24 as the radial distance of the holes 53 from such stud 24. Accordingly, by swinging the arm to successively higher angular positions (measured from the base element 20), the hole or socket 54 of the arm will be brought successively into register with the several holes in the segment. A pin 55 may be set through the proper hole 53 and into the registering socket 54 of the arm, to lock the arm to the segment at corresponding angular relation of the arm and segment to each other.

A lug 56 extends from the lower edge of the segment towards the observer (looking at FIGURE 7), and an adjustment pin 57 is threaded through such lug, preferably with a rather fine threading so that fine adjustments, now to be explained, may be produced conveniently and accurately. The lower end of such pin 57 bears against the top surface of the base element 20 (or against a hard insert 58 set into the top portion of the base element). Accordingly, by turning such pin 57 while its lower end bears against the surface of the base element, or against such insert, the elevation of the lug 56 above the base element and thus also the position of support of the segment 49, may be adjusted to a high degree of accuracy. Also, since the successive holes 53 in the segment must necessarily be spaced apart angular amounts needed according to the diameters of such holes, it is possible, by use of such pin 57, to adjust the position of the arm to angles between successive holes 53. The pin 57 may be provided with the knurled head 59 for convenience of adjustment of such pin; and if desired, markings 60 may be placed on the top surface of such head to compare with the finger pointer 61 supported by the base element. By such arrangement, the adjusted position of the arm 23 may be recorded prior to changing the adjustment of such arm, for purposes of later adjusting operations, as in the case of desire to perform an operation of dressing a wheel surface between two other dressing operations.

In FIGURES 8 and 9 I have shown a modified form of the carrier element 27 (identified as 27^a in FIGURES 8 and 9, for ready identification). In this case the slide block 32^a and such element 27^a are provided with companion tongue and groove elements by which they are retained in working relationship, while at the same time allowing for back and forth dressing movements of the dressing tool carried by such element 32^a. In order to enable assembly of the slide block onto the unit 27^a, I have provided at one end of the unit the removable portion 61, removably connected to the unit 27^a by the screws 62.

In FIGURE 10 I have shown an embodiment similar to that shown in FIGURES 8 and 9; but the form of the tongue and groove structure in FIGURE 10 varies slightly from that previously shown.

In FIGURE 11 I have shown still another embodiment of the unit 27 (now 27^b) wherein the slide block 32^b is engaged with the unit 27^b by seating of the projection 63 into a longitudinally extending groove 64 of the unit 27^b, so that during back and forth dressing operations of the slide block, such projection 63 will ride along the groove. To retain the parts in engagement with each other during such operations, I have provided the stud 65 extending through the slide block, and carrying the head 66 at its back end, such head riding along another groove 67 provided along the back face portion of the unit 27^b. The sleeve 68 is set onto the stud between the head 66 and the nut 69 to prevent jamming of the slide block against the unit 27^b when the nut 69 is tightened onto the stud.

I claim:

1. A self-contained unit for dressing the circular surfaces of grinding wheels, comprising in combination a base block having a smooth planar mounting surface for support on a table-like element, a primary arm pivotally mounted to said base block for rocking movement about a first defined axis lying in a plane which intersects the mounting surface of the base block, means to lock the primary arm and the base block together in angularly adjusted position, a secondary link element pivotally connected to the free end of the primary arm for angular movement with respect to the primary arm about a second defined axis substantially parallel to the first defined axis, means to lock the secondary link and the primary arm in angularly adjusted position, a dressing unit carrier pivotally connected to the free end of the secondary link element for rocking movement about a third defined axis substantially parallel to the first defined axis and the second defined axis, means to lock the dressing unit carrier and the secondary link in angularly adjusted position, a dressing unit holder, a dressing unit and cutting element, means to pivotally connect the dressing unit to the dress-

ing unit holder for angular adjustment about an axis which intersects the plane which includes the dressing unit holder, means to lock the dressing unit in angularly adjusted position with respect to the dressing unit holder, and means to connect the dressing unit holder to the dressing unit carrier comprising means constituted to support the dressing unit holder to the carrier for back and forth movement of the dressing unit holder within a plane which intersects the first defined axis, and the second defined axis, and the third defined axis.

2. A dressing unit as defined in claim 1, wherein the means which connects the dressing unit holder to the dressing unit carrier comprises a track-rod, and means to support said rod to the carrier, with the dressing unit holder in sliding engagement with the rod.

3. A dressing unit as defined in claim 2, wherein the means to support the rod to the carrier comprises means to connect each end of the rod ot the carrier with the dressing unit holder located between the rod supporting means for the two ends of the rod.

4. A dressing unit as defined in claim 3, together with buffing springs located on the rod between the dressing unit holder and each of the means which connects an end of the rod to the carrier.

5. A dressing unit as defined in claim 1, wherein the means which connects the dressing unit holder to the dressing unit carrier, comprises a tongue and groove connection extending lengthwise of the carrier.

6. A dressing unit as defined in claim 1, wherein the means which connects the dressing unit holder to the dressing unit carrier comprises a slot extending lengthwise of the carrier, a pin carried by the holder and extending through such slot, and means to retain the pin against withdrawal from the slot.

7. A self-contained unit for dressing the circular surfaces of grinding wheels, comprising in combination a base block having a smooth planar mounting surface for support on a table-like element, a primary arm pivotally mounted to said base block for rocking movement about a first defined axis lying in a plane which intersects the mounting surface of the base block, a dressing unit carrier, means to connect such carrier to the free end of the primary arm, including a pivotal axis permitting rocking movement in a plane which intersects the mounting surface of the base block, together with means to

adjust the elevation of the last named pivotal axis above the base block; said adjusting means comprising an element mounted to the base block for rocking movement about the pivotal mounting of the primary arm to the base block, means to connect the primary arm to said last named element at different angular positions between said parts, and means to adjust the angular position of said last named element with respect to the base block; wherein the element which is mounted to the base block for rocking movement about the pivotal mounting of the primary arm to the base block, comprises an arcuate segment, and wherein the means to connect the primary arm to said segment at different angular positions between said parts, comprises a plurality of holes located at successive angular positions around the segment and at equal radii from the axis of rocking movement of the segment, together with at least one recess in the face of the primary arm proximate to the segment and located at the same radius from the pivotal mounting of the primary arm and the segment, with respect to the base block, and a removable pin insertable through a selected hole of the segment and into the recess of the primary arm.

8. A dressing unit as defined in claim 7, together with means to limit rocking movement of the segment towards the base block.

9. A dressing unit as defined in claim 8, wherein said segment rocking limiting means is adjustable for limit of the segment movement to adjusted positions with respect to the base block.

10. A dressing unit as defined in claim 9, together with means to indicate the limited position of movement of the segment towards the base block.

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