Jan. 17, 1956 D. J. WALLACE ET AL 2,730,848

FORM DRESSING TOOL

Filed June 18, 1953

Fig. 1

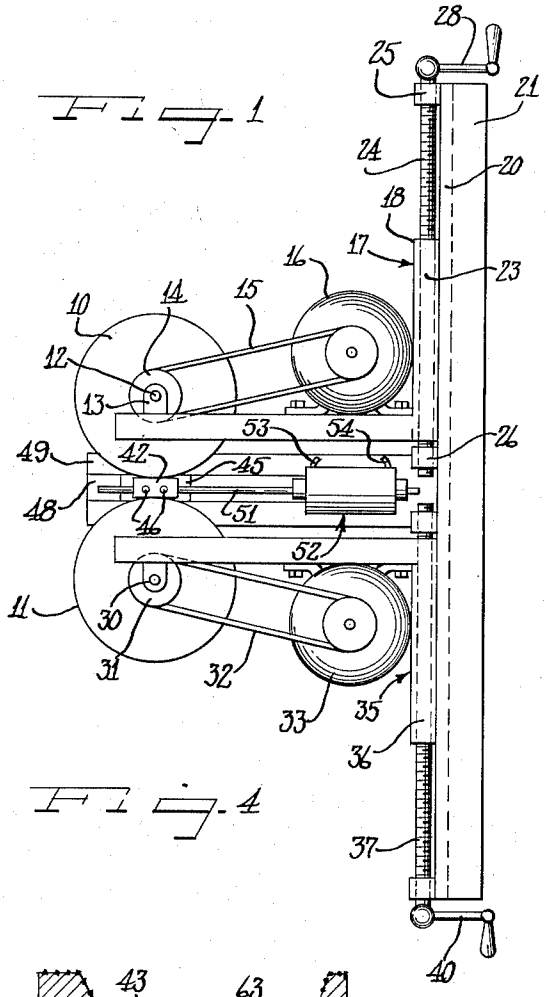


Fig. 2

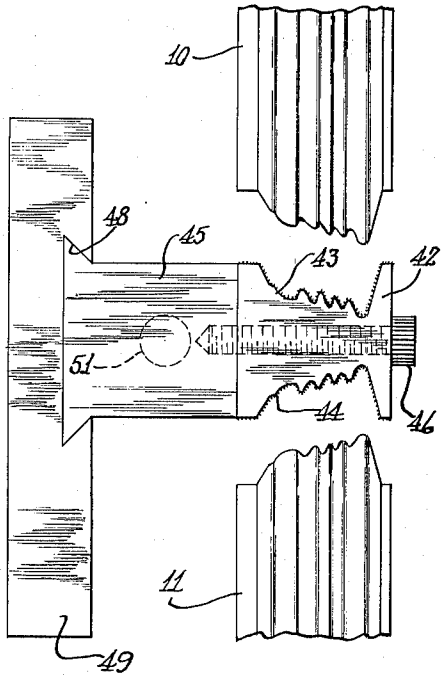


Fig. 4

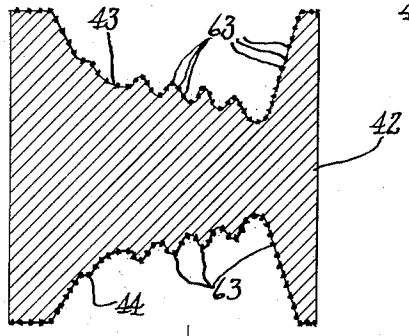


Fig. 5

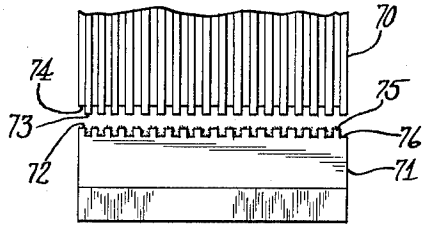


Fig. 6

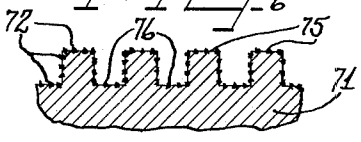
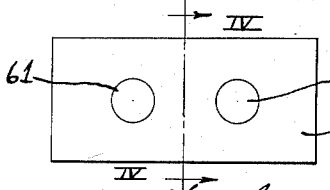


Fig. 3



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United States Patent Office 2,730,848 Patented Jan. 17, 1956

2,730,848

FORM DRESSING TOOL

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Application June 18, 1953, Serial No. 362,603

2 Claims. (Cl. 51—204)

The present invention relates to form dressing tools used for shaping peripheral surfaces of grinding wheels and the like to provide them with accurately contoured working surfaces. The invention specifically relates to form dressing tools having diamond imbedded contoured surfaces to be used in conjunction with apparatus for abrading a grinding wheel to impart to the working surface thereof a preselected peripheral contour of accurate dimensions.

One of the more common methods for providing the periphery of an abrasive wheel with a desired profile involves the operation known as crush dressing. In this type of wheel dressing the periphery of the abrasive wheel is brought into pressure contact with the tool having a contour which is the reverse of the configuration desired in the wheel periphery, the tool having a facing composed of hard metal or compounds such as silicon carbide, tungsten carbide and the like or appropriate softer materials. As the abrasive wheel is rotated, the hard surface of the tool presses into the periphery of the wheel, thereby crushing the vitrified binder matrix in which the abrasive particles are imbedded, as well as crushing to some extent the abrasive particles at the periphery of the wheel. Abrasive wheels bonded by resinoids, rubber and shellac do not lend themselves to crush dressing because of their resilient nature. A crush dressing operation frequently has to be followed by a finish dressing operation using a diamond dressing tool in order to bring the shape of the grinding wheel periphery within the dimensional tolerances required.

Furthermore, the pressures involved in crush dressing, usually being on the order of 400 to 500 pounds per square inch, put a substantial stress on the spindle of the abrasive wheel so that frequently, the abrasive wheel must be crush dressed on a spindle other than that which carries the wheel during the regular dressing operation. A new and improved method and apparatus for form dressing abrasive wheels forms part of the subject matter of our copending parent application, Serial No. 277,562, filed March 20, 1952, of which the present application is a continuation-in-part.

An object of the present invention is to provide a new and improved form dressing tool.

Another object of our invention is to provide a form dressing tool having surfaces complementary to the contour imparted to a grinding wheel or the like and having discrete abrasive particles imbedded in the surface of the tool.

Another object of the present invention is to provide a form dressing tool having a sintered matrix body formed with surfaces complementary to the contour to be imparted to a grinding wheel or the like with discrete diamond particles imbedded in said surfaces.

Still another object of the present invention is to provide a form dressing tool having a body of sintered refractory material such as any of the refractory metals or carbides of refractory metals, or mixtures of refractory metals and carbides of refractory metals, and having surfaces complementary to the contour to be imparted to a grinding wheel with discretely divided diamond particles or other abrasive particles imbedded in said surfaces of the dressing tool.

Still another object of the present invention is to provide a form dressing tool for form dressing a grinding wheel, or a pair of grinding wheels simultaneously, the form dressing tool having a surface that is rectilinear in one direction and in the transverse direction is complementary to the contour to be imparted to the grinding wheel, with finely divided diamond particles distributed over said surface and imbedded therein.

A still further object of the present invention is to provide a form dressing tool with abrasive particles so distributed over abroding surfaces of the tool that at least one particle appears in substantially any line along the said surface.

A still further object of the present invention is to provide a form dressing tool for abrading a pair of grinding wheels simultaneously to a preselected configuration, wherein the tool has a pair of substantially opposed surfaces contoured complementarily to the preselected contour to be imparted to the grinding wheel with discrete diamond particles so distributed over the abrading surfaces of the tool that at least one particle appears in substantially any line on said surfaces.

It is an additional object of the present invention to provide a form dressing tool having an abrading surface which is rectilinear in one direction and is contoured in a transverse direction complementary to the contour to be imparted to a grinding wheel or the like.

It is still an additional object of the present invention to provide a form dressing tool that preferably has an abrading layer of substantially single particle thickness provided by diamond particles imbedded therein.

Still other and further objects of the present invention will be apparent and present themselves to those skilled in the art and others reading this specification and the claims appended thereto and viewing the drawings with numerals of reference marked thereon forming a part of this specification, in which like numerals referred to like parts and in which:

Figure 1 is a partial elevational view of apparatus employing a form dressing tool of the present invention;

Figure 2 is a fragmentary side view with parts in elevation of the assembly of Figure 1;

Figure 3 is a front elevational view of a preferred embodiment of our form dressing tool;

Figure 4 is an enlarged sectional view of the tool illustrated in Figure 3 and is taken along the line IV—IV of Figure 3;

Figure 5 illustrates another embodiment of our invention and a workpiece or grinding wheel abraded by the use of a dressing tool made in accordance with our invention; and

Figure 6 represents an enlarged view of the cutting section of the form of tool illustrated in Figure 5.

There is illustrated in Figures 1 and 2 a mechanism and system for facing two grinding wheels simultaneously and for employing a form dressing tool made in accordance with the present invention. Two grinding wheels 10, 11 have axes of rotation which are parallel to each other, and the wheels are mounted in the same plane of rotation. The wheels as shown are mounted in a vertical plane, but may lie in a horizontal or any other desired plane. The wheels 10, 11 may be composed of abrasive particles imbedded in any of the common materials including citrified compositions, resinoids, rubber, or shellac, as the method and the dressing tools of our invention accurately form dress all those types of wheels.

The upper grinding wheel 10 is supported on a spindle 12 journaled in a bearing 13. A pulley 14 carried

by the spindle **12** drives the wheel **10** by means of a belt **15** associated with a drive motor **16**. The grinding wheel structure, as well as the motor **16** are supported on an L-shaped bracket **17**. The shorter leg **18** of the L-shaped bracket has a tongue formed therein received in a channel **20** of a vertical support **21**. The leg **18** has an internally threaded bore **23** which receives a threaded rod **24**, the latter being supported from the support **21** by means of a pair of vertically spaced ears **25, 26**. A hand crank **28**, secured to the threaded rod **24**, is provided for rotating the rod **24**, and by virtue of the engagement of the threads of the rod **24** with the threaded bore **23** of the leg **18**, rotation of the hand crank **28** moves the L-shaped support bracket **17**, the grinding wheel **10** and the motor **16** in an adjusted vertical position.

The grinding wheel **11** is mounted in the same manner as that employed for mounting the grinding wheel **10**. A spindle **30** carrying the grinding wheel **11** is driven by means of a pulley **31**, a belt **32** and a motor **33** at a desired angular velocity. Preferably, the grinding wheels **10** and **11** are driven in opposite directions and at the same angular velocity. The motor **33** and the grinding wheel **11** are mounted on an L-shaped support bracket **35**, the latter having an internally threaded bore **36** in the shorter leg thereof which engages the threads of a threaded rod **37**. A hand crank **40** is provided to enable vertical adjustment of the L-shaped support bracket **35**, and hence, the vertical position of the grinding wheel **11**.

The mounting of the form dressing tools of the present invention is best illustrated in Figure 2. The tool, further described below, consists of a tool body **42** having oppositely contoured abrasive surfaces **43** and **44**, which are preferably rectilinear in one direction and contoured in a transverse direction. The configuration of the abrasive surfaces **43, 44** will be opposite from that desired in the profile of the grinding wheels to be dressed, that is, the contour of the abrading surfaces of the tool will be complementary to the contour to be imparted and abraded into the peripheries of the grinding wheels to be operated upon by the form dressing tool of the present invention. Many different types of cutting tools can be employed for the purposes of the present invention as for example, a tool formed, using powdered metallurgy technique, from a mixture of tungsten and tungsten carbide and having finely divided diamond particles imbedded in the surfaces **43, 44**. The size of the particles is quite small, being on the order of 50 to 500 particles per carat, or even much smaller where finish dressing is being done. A preferred range for particle size is on the order of 200 to 400 particles per carat where a substantially single diamond particle thickness of the diamond impregnated surface is to be provided.

If it is desired to form dress but one grinding wheel at a time, a form dressing tool in accordance with the present invention may be provided with only one abrading surface, as in the embodiment illustrated in Figure 5.

The form dressing tool body **42** may be secured to a carrier **45** by means of spaced securing bolts **46**. The carrier **45** is also provided with a tongue which is slidably received within a channel **48** of a guideway **49**. In order to distribute the abrading action over the full length of the abrasive surfaces **43, 44** in the rectilinear direction, the carrier **45** is reciprocated tangentially to the peripheries of the wheels **10, 11** during rotation of the wheels, as illustrated in Figure 1. The carrier **45** is secured to a rod **51** associated with a hydraulic cylinder **52**, preferably a double acting type. A plurality of fluid inlet means **53, 54** are provided in the cylinder **52** for periodically reciprocating a piston (not shown) secured to the end of the rod **51** opposite the carrier **45**, and reciprocable within the cylinder **52**.

In the form dressing of the grinding wheel **10, 11**

the wheels are preferably rotated in opposite directions by means of their associated motors **16, 33** and preferably at the same angular velocity. As the grinding wheels **10** and **11** are rotated, pressurized fluid is introduced into the fluid inlet means **53, 54** associated with the hydraulic cylinder **52**, thereby causing reciprocation of the carrier **45** and the tool **42** associated therewith. The spacing of the wheels **10** and **11** is sufficient to engage the abrasive covered surfaces **43, 44** of the dressing tool **42** to afford abrading contact between the peripheries of the grinding wheels and the abrasive surfaces of the tool due to differential speeds, the pressure contact between the wheels and tool being less than crushing pressure. The tool **42** is reciprocated back and forth in the direction tangential to the peripheries of the wheels **10** and **11** in as many passes as necessary to abrade the periphery of the rapidly rotating grinding wheels **10** and **11** into a configuration which is complementary to and opposite to the configuration of the abrading surfaces **43, 44**.

The abrading action tool, in contrast to the crushing action of crush dressing tools, provides an accurate form dressing tool for form dressing the periphery of the grinding wheels within close dimensional and contour tolerances. The tools of the present invention also provide for form dressing time substantially less than heretofore customary, and have the further advantage that the useful life of the dressing is substantially longer than other types of form dressing tools.

With specific regard to the form dressing tool of the present invention and particularly as it is illustrated in Figures 3, 4, 5 and 6, it can be seen that the dressing tool **42** can be provided with either one, two or more contoured dressing surfaces as desired. The body of the tool may be formed in any desired manner. It may be formed of rolled tool steel stock which is cut precisely in conformity with the contour preselected, or it may be cast of some hard material, or it may be molded and finished to have the preselected desired contour for its abrading surfaces. One preferred method of forming the body of the tool is to precut mold faces to substantially precisely the configuration desired for the grinding wheels that are to be abraded by the tool, and then cover these precut faces with the abrading material such as diamond dust, or diamond particles. Following this, the mold is filled with a refractory powder which is substantially sintered so that it conforms substantially to the form of the mold and has the abrasive particles imbedded in its abrading surfaces and substantially only in those surfaces and not throughout the body of the tool.

It is particularly desirable in making form dressing tools of the present invention, to have the diamond particle layer providing the abrading surface a layer of single particle thickness. It is a waste of expensive material to imbed the diamond particles to a thickness greater than that of a single particle or at most a few particles if the particles are very fine, since the form of the tool and hence its utility as a form dressing tool are lost once the superficial surface diamonds become worn excessively or dislodged.

A preferred method for forming form dressing tools of the present invention is fully described in our copending application Serial No. 280,464, filed April 4, 1952, of which this application is also a continuation-in-part.

As we have pointed out above, the form dressing tool of the present invention is preferably made of hard or refractory materials for the body portion of the tool. Satisfactory refractory material includes the substantially pure metals or alloys thereof such as the high carbon and/or high silicon alloys, but preferably we use refractory metals based on the metals of Group VI–A and their carbides or mixtures of the same.

The metals of Group VI–A, i. e., molybdenum, tungsten and chromium and their carbides, are preferable, and

we have found that a particularly preferred species to be employed in form dressing tools of the character of the present invention is that formed of a mixture of tungsten and tungsten carbide. It should be noted, however, that other hard and/or refractory materials are available for use in constructing form dressing tools in accordance with the present invention and we do not intend to limit ourselves to the material disclosed hereinabove.

Referring again to Figures 3 and 4, the form dressing tool **42** may take any particular desired shape but when used in conjunction with apparatus such as that of Figures 1 and 2, preferably has a front elevational contour which is substantially rectangular and a pair of holes **61**, **62** bored therein for the reception of such securing means as the bolts **46** (Figures 1 and 2). The diamond imbedded surfaces **43**, **44** preferably are rectilinear in one direction and should conform substantially precisely, and be complementary to the contour to be imparted to the grinding wheels in a transverse direction. The diamond particles **63** should preferably be so distributed over the surfaces of the tool so that a diamond particle will appear substantially in every line that may be drawn on the surfaces so that the contour of the grinding wheels will be substantially smooth and all points on the grinding wheel subjected to the action of the tool will be of the proper height with respect to the remainder of the contoured surface of the workpiece or grinding wheel. This is to say that preferably the diamond particles should be so distributed over the surfaces of the tool that whenever a grinding wheel is abraded by the tool, the grinding wheel will be cut or abraded to a substantially precise configuration according to the preselected contour to be imparted thereto.

Form dressing tools according to the present invention may take most any desired contour and impart that contour quite precisely to a grinding wheel or other workpiece. Form dressing tools of the present invention are not limited in their configuration to substantially rounded contours such as that shown in Figure 4, but they may take that form if such form is desired. They may also take the form such as that shown in Figures 5 and 6 wherein substantially rectangular lands and grooves **73**, **74**, respectively, are abraded or cut in a grinding wheel, such as **70**, to provide such a configuration and abrade the same in a workpiece or grinding wheel **70**. A tool **71** is provided with a substantially precisely complementary contour of lands **75** and grooves **76** which are coated with diamond particles **72** in much the same way as the diamond particles **63** were provided on the surfaces **43** and **44** of the form dressing tool **42** illustrated in Figures 1, 2, 3 and 4.

Comparing Figures 3 and 4 with Figures 5 and 6, it will be noted that form dressing tools in accordance with our invention need not have two abrading surfaces, one on each of two opposite sides of the tool, but may be formed that way, if desired, to be employed with apparatus such as that described and illustrated with respect to Figures 1 and 2 to abrade two grinding wheels simultaneously, but tools in accordance with our invention may

also be made with a single abrading surface such as that shown in Figures 5 and 6 if so desired. Additionally, of course, tools in accordance with our invention may also be provided with more than two abrading surfaces if so desired to be used with apparatus where more than two grinding wheels are to be form dressed substantially simultaneously.

It will be understood that modifications and variations in our invention may be effected without departing from the scope of the novel concepts of the present invention.

We claim as our invention:

1. A form dressing tool for imparting a preselected contour simultaneously to a pair of grinding wheels, comprising a rigid tool body symmetrical about a longitudinally extending median plane and having on either side of said plane oppositely facing abrading work surfaces, each of an identical configuration that is rectilinear in longitudinally extending planes parallel to said median plane and non-rectilinear in all planes transverse to said median plane, and discrete abrasive particles forming a layer of substantially a single particle thickness embedded in said oppositely facing surfaces and exposed thereon, said particles being so distributed over said work surfaces that at least one of said particles lies in any straight line extending in the rectilinear direction of said surfaces.

2. A form dressing tool for imparting a preselected contour to a grinding wheel, comprising a rigid tool body having a working surface composed of longitudinal extending rectilinear elements and having other than a continuously rectilinear contour in all planes transverse to said rectilinear elements, and discrete diamond particles of 50 particles per carat and finer embedded in said surface and exposed thereon, said particles being distributed over said entire surface so that at least one of said particles lies exposed for abrading action in every one of said rectilinear elements, whereby said tool is effective in use to form dress a wheel to substantially the exact contour of said working surface.

References Cited in the file of this patent

UNITED STATES PATENTS

122,573	Daniels	Jan. 9, 1872
2,100,954	Gould et al.	Nov. 30, 1937
2,197,655	Boyer	Apr. 16, 1940
2,281,420	Drader	Apr. 28, 1942
2,359,920	Keeleric	Oct. 10, 1944
2,367,286	Keeleric	Jan. 16, 1945
2,396,015	Liden	Mar. 5, 1946
2,443,370	Bakker	June 15, 1948
2,662,519	Metzger	Dec. 15, 1953
2,675,654	Harris	Apr. 20, 1954

FOREIGN PATENTS

382,626	Great Britain	Oct. 20, 1932
556,668	Great Britain	Oct. 15, 1943
570,767	Great Britain	July 20, 1945
576,452	Great Britain	Apr. 4, 1946