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DIAMOND DRESSING TOOL AND METHOD OF DRESSING GRINDING WHEELS

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FIG-1

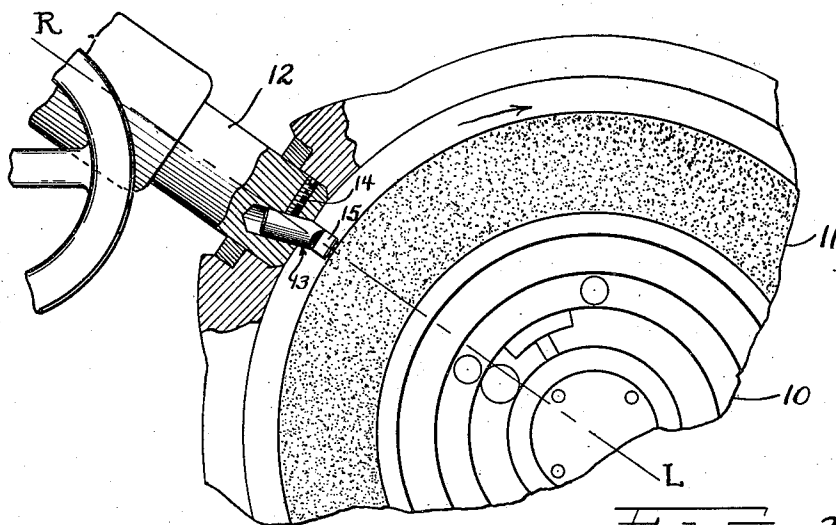


FIG-3

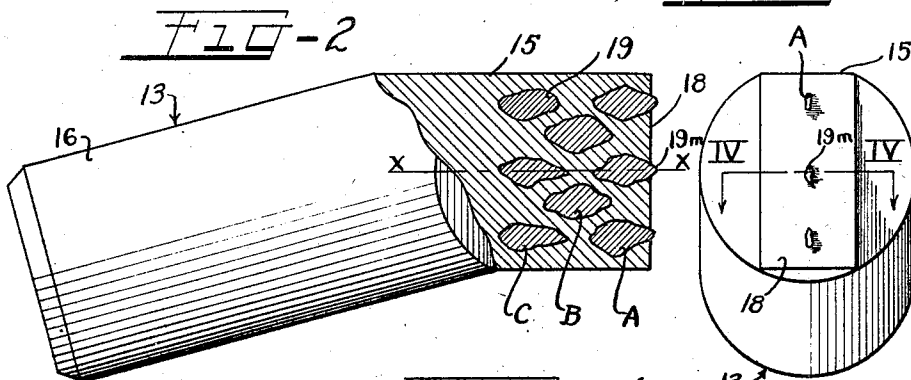
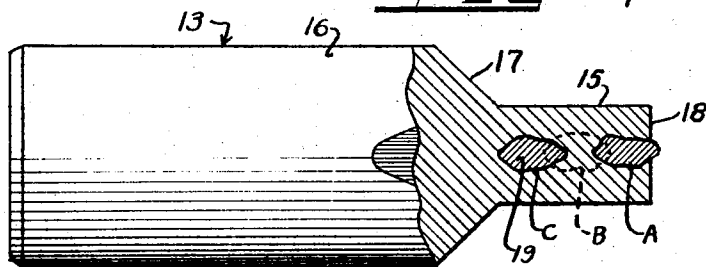


FIG-4



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DIAMOND DRESSING TOOL AND METHOD OF
DRESSING GRINDING WHEELSJohn L. Petrie, Detroit, Mich., assignor to Wheel
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9 Claims. (Cl. 125-11)

This invention relates to a diamond dressing tool and to a method of dressing grinding wheels and the like.

It has heretofore been considered necessary to use fairly large diamonds, such as diamonds weighing more than $\frac{1}{4}$ carat, in tools for dressing grinding wheels. The thought has apparently been that the larger diamonds would do a better job and stand up longer under the severe conditions of a wheel dressing operation.

Furthermore, in those instances where a plurality of diamonds set in a single row have been arranged in alignment across the cutting face of a tool, the tool has always been so held with respect to the wheel to be trued that the diamonds lie in a line parallel to the axis of the wheel and therefore cut in separate, side-by-side planes.

I have now found that superior results can be obtained by using diamonds of $\frac{1}{4}$ carat or less. The diamonds, in a given tool, should be fairly uniform in size and should be arranged in transverse rows or tiers, with the diamonds in each tier in substantial alignment and overlapping lengthwise of the tool the diamonds in the next adjacent tier, so that by the time the diamonds in the outermost tier have become worn out, the diamonds in the next tier are coming into cutting position.

I have found, furthermore, that best results are obtained if the diamonds are positioned in the tool in a predetermined arrangement as to the number of diamonds in the successive transverse tiers. My preferred arrangement is to position three diamonds in the outermost tier, viz., the tier which is first exposed, two diamonds in the second tier, and three diamonds again in the third tier. This is referred to as the 3-2-3 arrangement. Other advantageous arrangements are the 2-2-2, the 3-3-3, the 4-4-4, and the 4-3-4. Such arrangements have proved more efficient, resulting in less tendency to overheating and to glazing the surface of the grinding wheel than where the tool has but a single large stone or a larger number of closely spaced small stones.

Contrary to previous practice I have also found that in using the dressing tool of my invention superior results are obtained if the tool is so held against the surface of the grinding wheel that the diamonds lie substantially in a plane at right angles to the axis of the wheel, rather than parallel to the wheel axis. When in the position that I have indicated, the diamonds follow in practically the same track as that cut by the leading diamond. Therefore, each diamond does a proportionate amount of work much the same

as do the teeth of a saw. The result is that the tool leaves a much freer cutting grinding wheel. The free movement of the cooling and lubricating fluid past the diamonds, when in this novel position, tends to prevent overheating.

The positioning of the tool in accordance with my invention differs in still another respect from prior practice. Heretofore, in dressing a grinding wheel, it has been customary to position the dressing tool at a point below the axis of the wheel on the down moving side thereof so that the bearing pressure resultant is directed away from the wheel travel and there will therefore be less chance of damage to the diamond. In the use of my tool, however, the tool is positioned directly on a line with the axis, with the middle diamond, if three diamonds are presented toward the wheel surface, in line with a radius of the wheel, that is, with the line of pressure of the diamond normal to the circumference of the wheel at the point of contact therewith.

The use of my diamond dressing tool in the manner indicated leaves the surface of the grinding wheel in a more open, freer condition, instead of in a glazed condition such as is frequently the case when a single large dull diamond is used. A single large diamond tends to wear flat on its cutting surface and then to pack grit in between the grains of the grinding wheel, leaving the wheel in a dull condition. My method and tool leave the surface of the wheel in a free cutting condition. As a result, the effective life of a grinding wheel that has been properly dressed with my tool is much longer and more effective; a wheel is held to size more efficiently; and the operator can obtain more pieces of uniform finish between dressings, thereby increasing his production and reducing his manufacturing costs.

It is therefore an important object of this invention to provide a diamond dressing tool of novel construction, wherein small diamonds of relatively uniform size are employed instead of a single large diamond and the diamonds are arranged in tiers with preferably two, three or four diamonds in alignment in each of the successive tiers.

It is a further important object of this invention to provide a novel method of dressing a grinding wheel, in accordance with which a tool of my invention is positioned so that the diamonds line up one behind the other in substantially the same cutting track, instead of being aligned parallel to the axis of the wheel as formerly.

It is a further object of this invention to attain the superior results and advantages above enumerated by the use of a diamond dressing tool such as is hereinafter more fully described.

Other and further important objects of this invention will be apparent from the disclosures in the specification and the accompanying drawing.

This invention (in a preferred form) is illustrated in the drawing and hereinafter more fully described.

On the drawing:

Figure 1 is a fragmentary end elevational view of an assembly, illustrating the positioning of a dressing tool in a holder during the dressing operation, with parts broken away and in section.

Figure 2 is an enlarged elevational view of a diamond dressing tool embodying my invention, with parts broken away and in section to show the positioning of the diamonds.

Figure 3 is a top plan elevational view of my diamond dressing tool.

Figure 4 is a sectional view taken substantially along the line IV—IV of Fig. 3, with a part in elevation.

As shown on the drawing:

In Fig. 1 there is shown a conventional type of assembly comprising a mounting, indicated generally by the reference numeral 10 for holding a grinding wheel 11 for rotation during the dressing operation. A tool holder 12 serves to hold a tool in dressing relationship to the surface of the grinding wheel 11, with the usual adjustment for controlling the amount of the bearing pressure between the tool and the wheel surface. A dressing tool 13 of my invention is shown in the holder 12, retained therein by means of a set screw 14.

It will be understood that the showing of the assembled tool and holder in Fig. 1 is purely conventional and that for the purpose of illustrating the method of my invention, the tool 13 has been provided with an offset end 15 so as to adapt it to a conventional type of tool holder. The holder shown is intended for a tool having a straight axis so that it is necessary, in order to practice the method of my invention without changing the design of the tool holder, to provide my tool with an offset end, such as the end 15. By redesigning the tool holder 12, however, it would be possible to use a tool having a straight axis and still practice the method of my invention. It may be further noted that the assembly shown in Fig. 1 is that of a centerless type of mounting, necessitating the positioning of the tool holder above the axis of the grinding wheel. With other types of mounting, the position of the tool holder might be different, but Fig. 1 illustrates the principle involved, as will later more fully be explained.

The diamond dressing tool 13 comprises a cylindrical shank 16 from which extends an offset end 15 joined thereto by tapering shoulders 17. As shown, the end 15 has a rectangularly shaped flat end face 18, when new, but the particular form and shape of the tool is not critical.

The metal of the tool end 15 comprises a matrix in which are embedded a plurality of diamonds 19. The manner of forming the end 15 and mounting the diamonds therein is described in my copending application entitled "Method of making diamond tools," Patent No. 2,210,039, dated August 6, 1940.

In accordance with my present invention, the diamonds 19 are arranged in one or more tiers,

with the diamonds in each tier in substantial alignment. Preferably there are a number of such tiers, so that as the diamonds in one tier become worn, the diamonds in the next successive lower tier come into cutting or dressing position. As shown, there are three such tiers, identified by the reference characters A, B and C. In the outermost tier A I prefer to position three diamonds in substantial alignment with their longer axes preferably parallel to the axis X—X of the tool end 15. In the next successive tier B, I prefer to position two diamonds 19, also in substantial alignment and symmetrically spaced with respect to the axis X—X to lie between the diamonds of the tier A but overlapping the diamonds of tier A lengthwise of the tool. The diamonds in tier C are preferably spaced the same as the diamonds in tier A and overlap lengthwise of the tool the diamonds in the tier B.

The size and arrangement of the diamonds 19 are very important depending on grinding conditions. While it is not essential that the number of the diamonds in the successive tiers be as shown, namely, three, two and three, I have found that this arrangement gives most satisfactory results. However, it is possible to realize the advantages of my invention by employing a four-three-four combination, as well as the other combinations hereinbefore referred to, in place of the three-two-three combination shown.

In any given tool, diamonds of approximately the same size are used in each tier, or in a single tier if only one tier is employed. This tends toward uniformity in the results obtained using my tool. As to the size of the diamonds, they should be $\frac{1}{4}$ carat or smaller in weight, but not of such small size as to be capable of passing through a 200 mesh screen. For most practical purposes the diamonds should weigh between 0.01 and 0.1 carat, and preferably between 0.05 and 0.08 carat, with about 0.06 carat as the optimum weight per stone. This is quite a departure from former practices, since it has heretofore been customary to employ a single stone of greater weight than a quarter carat in dressing tools.

The spacing of the diamonds is also important. If the diamonds are about 0.05 to 0.08 carat each, the spacing at the closest point between adjacent diamonds in a tier should not be less than about $\frac{1}{16}$ of an inch. With the larger stones indicated to be permissible, namely those weighing somewhat less than a quarter carat each, the spacing between stones in a tier may be as much as $\frac{1}{4}$ of an inch, whereas with the finest stones indicated to be permissible, the spacing may be as little as 0.005 inch. The larger the stones, the greater may be the spacing between stones, and vice versa.

In using a diamond dressing tool such as described, the tool 13 is positioned within a holder 12 in the manner illustrated in Fig. 1, with the middle diamond, indicated by the reference numeral 19m, lying on a radius line R—L, passing through the axis of the grinding wheel mounting 10. The line of the tier A of the diamonds including the diamond 19m, is thus in a plane at right angles to the axis of the mounting 10, and the diamonds of said tier A follow in substantially the same track as the grinding wheel 11 is rotated in the direction of the arrow, much the same as would the teeth of a saw. Since the tool holder 12 is advanced slowly across the face of the grinding wheel 11, usually but once during the operation of dressing said wheel, the dia-

monds theoretically do not travel in exactly the same track, but for all practical purposes the diamonds may be said to follow in the same track. This arrangement brings about a cutting action rather than a crushing action, with the result that the surface of the grinding wheel after dressing is freer and more open and there is less fine grit packed in between the grains of the surface of the wheel. As previously stated, grinding wheels dressed in accordance with my method require less frequent dressing for this reason, and have a longer useful life than heretofore.

As the diamonds in the outermost tier A become worn away, the softer matrix surrounding them wears away even more deeply, until the points of the diamonds in the tier B are finally exposed and take up the cutting burden. One of the big advantages of using relatively small diamonds, such as herein described, is that the small diamonds retain their cutting effectiveness until they are practically used up, whereas a large diamond and also other tools where diamonds are set in surface multiples wear flat and require the tools to be turned and eventually reset. It is not necessary, when using the tool of my invention, to repeatedly turn the tool to present a new face of the diamond for its cutting action, as is generally the case when a single diamond and other types referred to are used for dressing a wheel. Also, the provision of a series of small diamonds, as in the case of my tool, renders the action of the cooling lubricant more effective in carrying away heat from the cutting zone.

According to previous standards, it has been thought necessary in the trueing of grinding wheels that the size of the diamond should bear some fixed ratio to the diameter of the wheels to be trueed. For instance, with a wheel of six inches and under in diameter, a $\frac{1}{2}$ carat diamond would generally be considered necessary, while with wheels as large as 36 and 42 inches in diameter, it would be thought necessary to use a diamond of 6 or 8 carats, respectively. Such previous theories are entirely overthrown by the actual operation of the tools of my invention, since my diamond dressing tools have thoroughly demonstrated the superior advantages flowing from the use of relatively small diamonds arranged in the manner above described.

Although my tool has been described as a diamond dressing tool, it will be understood that the tool can be used for other purposes than merely in the dressing of grinding wheels, as for instance in the cutting of the grinding wheel to a given radius, and for other purposes.

It will, of course, be understood that various details of construction may be varied through a wide range without departing from the principles of this invention and it is, therefore, not the purpose to limit the patent granted hereon otherwise than necessitated by the scope of the appended claims.

I claim as my invention:

1. In the method of dressing a wheel with a diamond tool having a plurality of relatively small diamonds all in substantial alignment across the face of the tool, the steps of so positioning the tool with respect to the wheel that the line of said diamonds lies in a plane transverse of the axis of said wheel, whereby the diamonds line up one behind the other in substantially the same cutting track, and effecting

relative movement between the tool and wheel to dress the wheel.

2. In a wheel dressing assembly, a diamond tool having a plurality of diamonds all set in substantial alignment across the face of said tool, and a holder for said tool for positioning said diamonds in dressing relationship to said wheel with the line of said diamonds lying in a plane at right angles to the axis of said wheel, whereby the diamonds line up one behind the other in substantially the same cutting track.

3. A diamond dressing tool comprising a matrix and a plurality of diamonds of comparatively uniform size embedded therein, all of said diamonds being arranged in practically a single plane and in substantial alignment in tiers with at least three but not more than four diamonds in one tier and at least two diamonds but not more than four in an adjacent tier, the diamonds in adjacent tiers overlapping lengthwise of the tool and each diamond being of not greater than 0.25 carat but of greater size than 200 mesh.

4. A diamond dressing tool comprising a matrix and a plurality of diamonds of comparatively uniform size embedded therein, all of said diamonds being arranged in substantial alignment in tiers with three diamonds in one tier and two diamonds in an adjacent tier, the diamonds in each tier being spaced apart by not more than $\frac{1}{4}$ inch nor less than 0.005 inch, the spacing being greater the larger the diamonds and being less the smaller the diamonds, the diamonds in adjacent tiers overlapping lengthwise of the tool and each diamond being of not greater than 0.25 carat but of greater size than 200 mesh.

5. In the method of dressing a wheel using a diamond dressing tool having a plurality of diamonds weighing between 0.01 and 0.25 carat all arranged in substantially the same plane, the steps of positioning the tool with the line of the diamonds lying in a plane transverse of the axis of said wheel and with the line of pressure of the diamonds extending along a radius of the wheel, whereby the diamonds line up one behind the other in substantially the same cutting track, and effecting relative movement between the tool and wheel to dress the wheel.

6. A diamond dressing tool which comprises a shank adapted for mounting in a standard holder, said shank having an end portion at an angle to the shank predetermined for presenting the end face thereof in a plane normal to the radius of the wheel being ground, and a plurality of diamonds set in said end face lying in a plane at right angles to the axis of the wheel whereby the diamonds line up one behind the other in substantially the same cutting track.

7. A diamond dressing tool adapted for mounting in a holder to dress a wheel comprising a tool body and a plurality of diamonds set in an end thereof in such a manner that all of said diamonds lie in practically a single plane transverse to the axis of the wheel with at least two of said diamonds disposed in a line across the end of the tool body, whereby the diamonds line up one behind the other in substantially the same cutting track, said diamonds in said line being spaced apart not more than $\frac{1}{4}$ inch nor less than 0.005 inch, and the diamonds weighing not more than 0.25 carat nor being so small as to pass a 200 mesh screen, the spacing being greater for the larger-sized diamonds and less for the smaller-sized diamonds.

8. A diamond dressing tool adapted for mounting in a holder to dress a wheel comprising a

ool body, a plurality of diamonds set in an end thereof in such manner that all of said diamonds lie in practically a single plane substantially transverse of the axis of the wheel and with at least two diamonds disposed in a line across the end of the tool body, whereby the diamonds line up one behind the other in substantially the same cutting track.

9. A diamond dressing tool adapted for mounting in a holder to dress a wheel comprising a 10

tool body and a plurality of diamonds imbedded therein all lying in practically a single plane substantially transverse to the axis of the wheel, said diamonds being arranged in tiers with a plurality of diamonds in each tier to produce a line of diamonds across the end of the tool body whereby the diamonds line up one behind the other in substantially the same cutting track.

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