July 10, 1923.

1,461,149

A. T. HUNT

APPARATUS FOR CUTTING DIAMONDS

Filed June 24, 1921

3 Sheets-Sheet 1

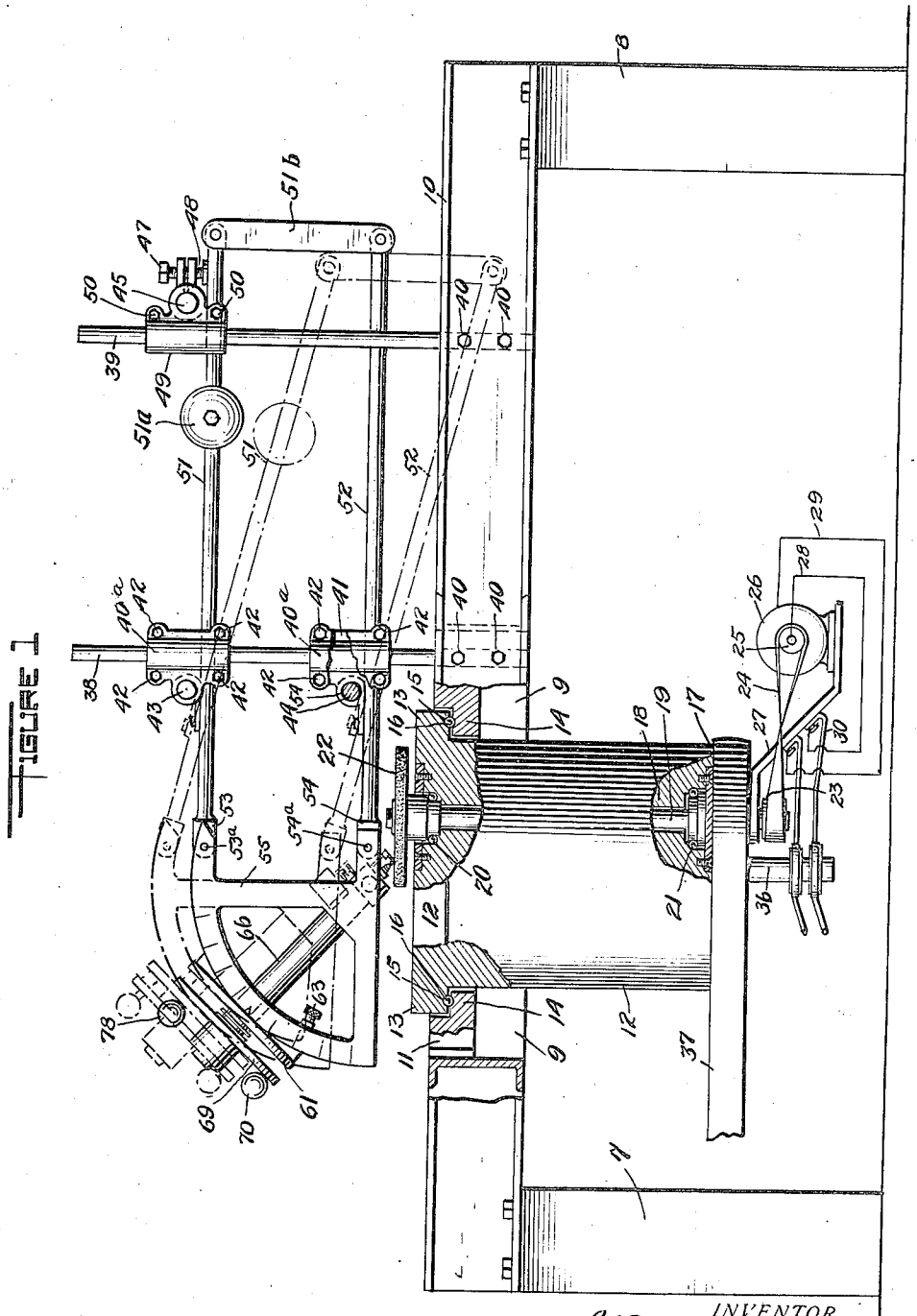


FIGURE 1

WITNESS
M. E. Lessin

INVENTOR
Alfred T. Hunt
BY
Walton Harrison,
ATTORNEY

July 10, 1923. 1,461,149

A. T. HUNT

APPARATUS FOR CUTTING DIAMONDS

Filed June 24, 1921 3 Sheets-Sheet 2

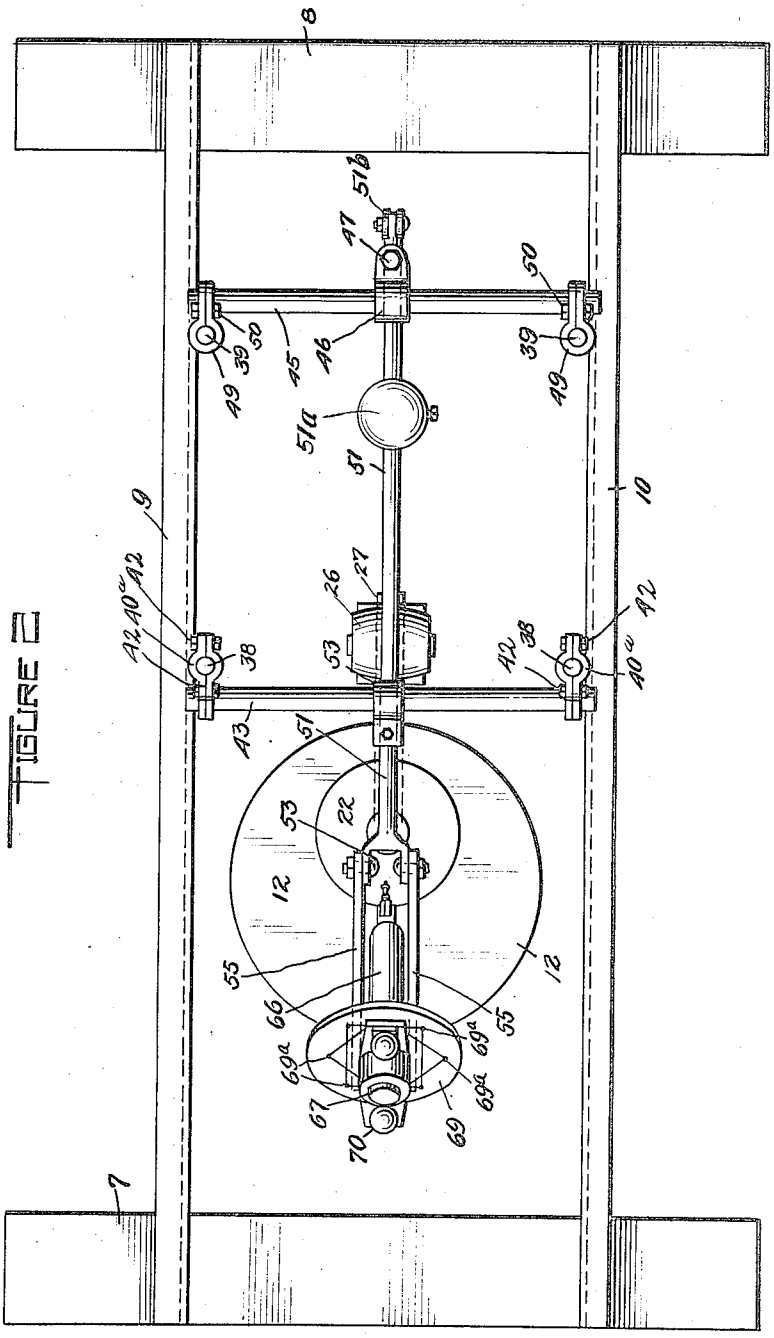


FIGURE 2

INVENTOR
Alfred T. Hunt
BY
Walton Harrison,
ATTORNEY

WITNESS
M. E. Lessin

July 10, 1923.

1,461,149

A. T. HUNT

APPARATUS FOR CUTTING DIAMONDS

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3 Sheets-Sheet 3

FIGURE 5

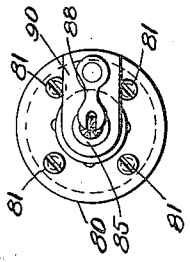


FIGURE 6

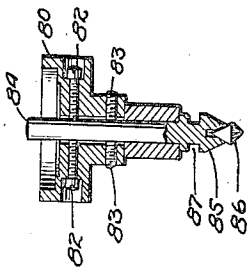


FIGURE 3

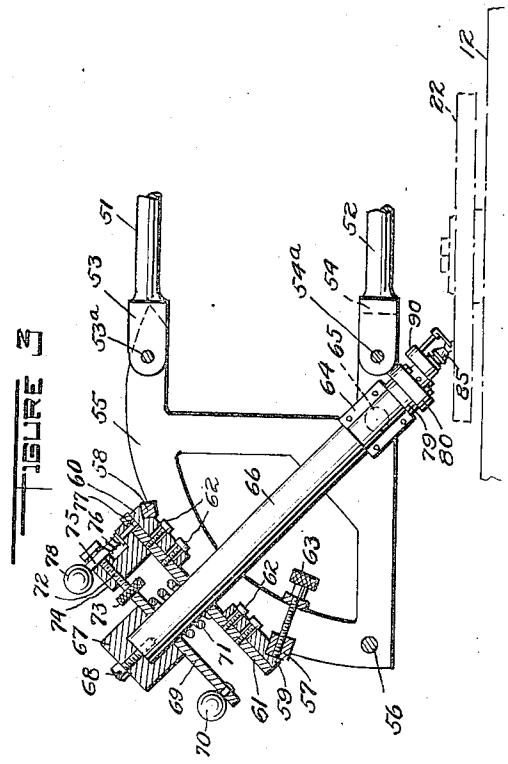
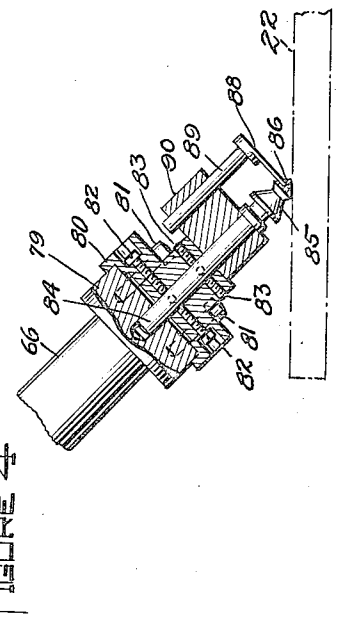


FIGURE 4



INVENTOR
Alfred T. Hunt
BY Walton Harrison,
ATTORNEY

WITNESS
Wm. E. Kosin

Patented July 10, 1923. 1,461,149

UNITED STATES PATENT OFFICE.

ALFRED T. HUNT, OF BROOKLYN, NEW YORK.

APPARATUS FOR CUTTING DIAMONDS.

Application filed June 24, 1921. Serial No. 480,149.

To all whom it may concern:

Be it known that I, ALFRED T. HUNT, a citizen of the United States, residing in Brooklyn, county of Kings, and State of New York, have invented certain new and useful Improvements in Apparatus for Cutting Diamonds, of which the following is a full, clear, and concise description.

My invention relates to diamond cutting, and has largely to do with overcoming specific difficulties which have heretofore arisen in practice, relative to the actual cutting of the stones, these difficulties apparently growing out of and being associated with the grain of the diamond.

My invention may perhaps be understood to better advantage in the light of my patent dated Nov. 5, 1918, No. 1,284,109.

The cutting of a diamond is a matter of some difficulty, due largely to the fact that the diamond is very hard, but mainly to the fact that a diamond has a grain; that this grain is invisible, and in the same individual diamond may run in many different directions; and that the diamond can not be properly cut by means of a cutting wheel, unless the direction of the cutting surface of the wheel, relatively to the position of the diamond, is such as to result in a peculiar working relation between the direction of travel of the cutting surface and the direction of the grain of the diamond.

It may happen, and frequently does happen, that in an individual diamond to be cut, or even while a particular facet is being cut, the direction of the travel of the cutting surface of the wheel relatively to the surface being cut must be shifted several times in order to render the cutting effective. Indeed, it is apparently impossible, in many instances, to make any noticeable impression upon the diamond unless the direction of the cutting surface is repeatedly changed.

Heretofore in this art it has been customary to overcome the difficulty just stated in one of two distinct ways, namely (1) by having an expert diamond cutter determine the direction of the grain from time to time during the cutting operation, and repeatedly shift the direction of the cut accordingly, and (2) by using mechanical means, largely automatic, for shifting the direction of travel of the cutting surface relatively to the direction of the grain of the diamond, as for instance by giving the diamond a constant bodily movement relatively to the position of the cutting wheel.

It is found in practice to be much cheaper to employ the mechanical means just mentioned than to rely upon the talent of an expert diamond cutter for the purpose of overcoming the difficulty in question.

In my present invention I seek to hold the diamond in a predetermined fixed position while any one of its facets is being cut, and to bring the cutting wheel, which turns continuously, either constantly or periodically as the case may happen to be, into such position as to render its direction of travel relatively to the diamond such as to enable the diamond to be effectively cut.

Following this idea, I make provision for holding the diamond in a fixed position, and for causing the cutting wheel, while in engagement with the diamond surface to be cut, to not only rotate upon its own axis but also at the same time to revolve bodily around, so that the axis of rotation of the cutting wheel has a sort of planetary motion, relatively to the diamond as a center. By doing this I cause the grain of the diamond to be so positioned, at least once during each planetary movement of the cutting wheel, to be effectively cut by the rotation of the wheel.

In my arrangement the cutting of the diamond is rendered comparatively uniform, owing to the fact that the portion of the cutting wheel bearing upon the surface to be cut may be maintained at a constant distance from the center of rotation of the cutting wheel. Moreover, it enables the cutting to be done by the portion of the cutting wheel nearest the outer edge or periphery thereof. Because of this fact, each abrasive particle of the cutting surface, in crossing the facet which it is cutting, travels more nearly in a straight line than would ordinarily be the case. This appears to improve the character of the cutting.

In my new arrangement I find it practicable to greatly reduce the undesirable effects of accidental vibration, such as would ordinarily tend, momentarily or otherwise, to disturb the position of the diamond cutting wheel relatively to that of the diamond. That is to say, I find that by mounting the diamond cutting wheel in the manner I do, so that the wheel rotates and at the same time has a planetary motion relatively to

the position of the diamond, I render less objectionable all mechanical vibrations between the diamond cutting wheel and the diamond, and thus effectively prevent such vibration from seriously interfering with the proper cutting of the diamond. For this purpose I find it desirable to render the mounting for the cutting wheel comparatively massive and heavy.

My invention further comprehends an improved mechanical structure for supporting the diamond while being cut, this mechanical structure being adapted to facilitate the step of repeatedly shifting the diamond away from the cutting wheel, for the purpose of enabling the diamond to be examined.

Reference is made to the accompanying drawings forming a part of this specification, and in which like letters indicate like parts throughout the several figures.

Figure 1 is a side view, partly in elevation and partly in section, of my improved apparatus for cutting diamonds.

Figure 2 is a plan view of the structure shown in Figure 1.

Figure 3 is a detail, being a central vertical section through the mechanism immediately associated with the diamond dop and parts closely appertaining to the same.

Figure 4 is a fragmentary section showing the dop and the means for adjusting the same.

Figure 5 is an end elevation of the mechanism shown in Figure 4.

Figure 6 is a substantially vertical section through the dop and dop sleeve, as they appear alone.

Mounted upon a pair of frame members 7, 8, are a pair of I-beams 9, 10. Extending between these I-beams, and supported thereby, is a bearing plate 11. A circular block 12, having a general cylindrical form and being made of massive construction, is provided with an annular flange 13, integral with it. The bearing plate 11 is provided with an annular flange 14, mating the flange 13. The annular flanges are provided with a ball race 15, fitted with ball 16 and therewith constituting a ball bearing, as may be understood from Figure 1. The lower end portion 17 of the extension block 12 serves practically the purpose of a pulley.

The circular block 12 is provided with a hole 18 extending through it in a direction parallel with its general axis but displaced therefrom and constituting a shaftway.

A revoluble shaft 19 extends through this shaftway, and is therein supported by aid of ball bearings 20, 21 carried by the circular block 12. The shaft 19 carries the diamond cutting wheel, which is shown at 22, and secured detachably upon the upper end of the shaft.

The shaft 19 carries a pulley 23. Engaging this pulley is a driving belt 24, this belt also engaging a pulley 25 forming a part of an electric motor 26. The motor is mounted upon a step 27 which is secured rigidly upon the lower end of the circular block 12. Connected with the motor 26 for the purpose of energizing the same are wires 28, 29. These wires are connected with brushes 30, 31, which engage slip rings 32, 33, carried by the shaft 19. Other brushes 34, 35 engage the slip rings 32, 33, for the purpose of supplying current through these slip rings and the brushes 30, 31, to the motor. Thus the means for energizing the electric motor 26 are completely independent of those used for turning the circular block 12. The circular block 12 is turned by a belt 37, to which power is supplied from any convenient source, so that the circular block 12 is turned constantly and at uniform speed while the apparatus is in action.

Mounted upon the I-beams 9, 10 and extending upwardly therefrom are a pair of posts 38, located about the middle of the machine, and another pair of posts 39 located toward the right from the middle according to Figure 1. The posts are held in position by bolts 40^a. Mounted rigidly upon the posts 38 are a pair of collars 41, each being made in halves which are connected together by bolts 42. By loosening these bolts, then raising or lowering the collars and finally tightening the bolts, the collars 41 may be adjusted vertically in relation to the posts and to other parts of the frame work. Above the collars 41 are another pair of collars 40, in form like the collars 41, and similarly secured by bolts 42. The collars 41 are adjustable relatively to the posts 38, in the manner above described with reference to the collars 41.

The collars 40 together support a cross shaft 43 and the collars 41 similarly support another cross shaft 44. Still another cross shaft appears at 45. This shaft carries a collar 46, provided with a bolt 47 for loosening and tightening this collar. A nut 48 is mounted upon the bolt 47, as shown in Figure 1, and is used for locking the bolt when the latter is in its final position. The shaft 45 is mounted rigidly upon collar 49, two in number, these collars being mounted rigidly upon the posts 39. The collars are provided with bolts 50 whereby they may be loosened or tightened relatively to these posts. By loosening the bolts, shifting the collar 49 slightly and tightening the bolts the collar 49 may be adjusted relatively to the posts 39.

A pair of tilting bars are shown at 51, 52, and are connected by a link 51^b, as may be understood from Figure 1, full and broken lines indicating different positions of the

tilting bars. The tilting bar 51 carries a counterweight 51ª and a fork 53, and the tilting bar 52 carries a similar fork 54. A pair of sectors 55 are by means of pins 53ª, 54ª connected with the forks 53, 54, and thus journalled upon the two tilting bars 51 and 52. The sectors 55 are held in proper relation to each other by aid of a pin 56, shown more particularly in Figure 3. The sectors 55 carry two bars 57, 58, and two blocks 59, 60 engaging these bars. Mounted upon the blocks 59, 60 is a plate 61, secured in position by fastening screws 62. By means of a clamping screw 63 the plate 61 may be adjusted to slightly different angles relative to the sectors 55. A bearing 64 is by aid of a pivot pin 65 journalled relatively to the sectors 55. A shank 66 extends through a hole in the plate 61, and is also journalled in the bearing 64. A massive cap 67 fits over the upper end of the shank 66, and is secured thereto by a screw 68. Fitting against the lower face of the cap 67 is a plate 69, secured rigidly to the shank 66. The plate 69 carries a knob 70, serving as a handle for enabling the operator to turn the plate 69. A spring 71 encircles the shank 66, and bears against the plate 61 and 69. The plate 69 carries a screw 72, provided with a milled head 73 whereby it may be turned by hand. The plate 69 also carries a block 74 through which the screw 72 extends. The block 74 is so arranged as to be shifted in position relatively to the plate 69 when the screw 72 is turned by the milled head 73. The block 74 carries a locking pin 75 and a spring 76. The locking pin 75 is provided with a knob 78 serving as a handle and is further provided with a portion 77 of reduced diameter. This portion is adapted to be thrust into any one of a number of holes 69ª, with which the plate 69 is provided. The operator by grasping the knob 78 a pulling upon the locking pin 75 can withdraw the portion 77 of the pin from the hole 69ª in which it happens to be, and by turning the plate 69 relatively to the plate 61 and placing the portion 77 of the locking pin in a different hole 69ª, and thus turn the shank 66 into a different angular position, and lock it in such position.

The shank 66 is at its lower end provided with an annular head 79. This head is used in supporting the dop sleeve 80, the form of which may be understood from Figures 4, 5 and 6. The dop sleeve 80 is detachably mounted upon the annular head 79 by means of fastening screws 81. The dop sleeve 80 carries a number of screws 82, 83, used for adjusting the dop spindle, which appears at 84. The dop spindle carries a dop 85, and the dop detachably supports the diamond 86, which is to be cut.

The dop is provided with a groove 87, to be used in connection with a clamp (not shown) for holding the diamond in the conventional manner relatively to the dop, in instances where the dop is to be removed from the dop sleeve. A fork 88 mounted upon a stem 89, is therewith carried by a block 90, the latter being mounted upon the dop spindle, and adapted to be shifted by hand, step by step, relatively to the same.

The plates 61 and 69 and parts immediately associated therewith, shown more particularly in Figures 3 to 6 inclusive and above described briefly, are identical with parts disclosed in my patent above mentioned. These parts do not relate directly to my present invention, and are here shown and described merely for the purpose of showing how they may be mounted and adapted for use in connection with my present invention. For this purpose, it may be sufficient to say that the operator, by shifting the plate 69 step by step relatively to the plate 61, and shifting the block 90 relatively to the dop spindle 84, can bring the diamond into different angular positions relatively to the cutting wheel. That is to say, no matter whether the culet or the table of the diamond is being cut, it is of course being cut facet after facet, and for the operator to turn the diamond so as to disengage one facet from the cutting wheel and bring another facet into engagement therewith, he merely turns the plate 69 and shifts the block 90 in the manner set forth in my aforesaid patent, now forming a part of the prior art.

The shank 66, carrying with it the dop sleeve, the dop and various other parts, may be raised and lowered at the will of the operator. For this purpose he merely raises or lowers the sectors 55 so as to shift the tilting bars 51, 52, as indicated by broken and full lines in Figure 1. That is to say, to raise the diamond out of engagement with the cutting wheel 22, the tilting bars 51, 52 are inclined as indicated by the broken lines in Figure 1. To bring the diamond back into engagement with the cutting wheel, the tilting bars are each brought into horizontal position, as indicated in this figure. When the tilting bars are thus in horizontal position, the collar 46, carried by the shaft 45, is engaged by the adjacent end portion of the tilting bar 51. Thus the collar 46 serves as a limiting stop for the tilting bar 51, and consequently for the various movable parts connected with this tilting bar, including the shank 56, the dop holding sleeve, and the dop carrying the diamond.

It will be noted that in raising and lowering the sectors 55 for the purpose of lifting the diamond out of engagement with the cutting wheel and lowering into contact therewith, the sectors are not tilted angularly with reference to the plane of the cut-

ting wheel, although the tilting bars are each inclined every time the sectors are raised. Because of this fact the operator, after raising the sectors, can examine the diamond without the necessity for changing the angle of the facet being cut relatively to the plane of the cutting wheel. Moreover, by this arrangement the diamond is less apt to be displaced relatively to the position of the dop, the dop holding sleeve, or the shank 66, than would be the case if the axis of the diamond had to be tilted each time the diamond was moved into or out of engagement with the cutting wheel.

If the operator wishes to cause the shank 66 to tilt, he grasps the clamping screw 63, and by turning it loosens the plate 61 relatively to the sectors 65. This done he shifts the plate 61 bodily a little distance relatively to the sectors, and then secures the plate in position by turning the clamping screw 63. Thus any desired degree of inclination can be given to the shank 66 and consequently to the axis of the diamond. The various adjustments of the shank 66 and parts immediately associated therewith, for the purpose just indicated, do not interfere in the slightest degree with the bodily movements of the sectors, for the purpose of bringing the diamond into and out of engagement with the cutting wheel.

The operation of my device may in the light of the foregoing explanation be readily understood.

Supposing a particular diamond is to be cut, and that the particular conventional form for the diamond has been determined. The diamond is next mounted upon the dop in the usual or any desired manner, and the dop spindle is adjusted, by aid of the screws 82, 83, so as to bring the axis of the diamond as nearly as practicable into alinement with the axis of the shank 66. The inclination of the shank 66 relatively to the plane of the cutting wheel 22 is next arranged, by adjusting the plate 61 relatively to the sectors 55, as above described.

Various other adjustments are made, so that the cutting operation is ready to be performed. The cutting wheel, carrying diamond dust and oil, being in motion, the diamond is brought into engagement with the cutting wheel and a facet of the diamond is cut. Next the shank 66 is turned, by an adjustment of the plate 69, and the next facet is cut. This is repeated for each of the facets to be cut.

The circular block 12 turns upon a vertical axis which extends through the center of the annular flange 13. The cutting wheel 22, however, turns upon the axis of the shaft 19 as a center, so that the cutting wheel has an orbital or planetary motion around the axis of rotation of the circular block 12, as above described. The diamnd rests upon the cutting wheel 22 as the latter turns upon its own axis and at the same time describes its planetary movement. Thus the diamond is concentric to the circular block 12 as a whole, and in fact is located in the geometrical axis thereof, which coincides with the axis of rotation of the circular block. Yet the diamond, in engaging the cutting wheel, is always located at a point relatively near the outer edge of the cutting wheel. This gives some advantages in cutting, as above set forth.

The principal advantage, however, is that the cutting wheel is bound to be brought into proper working relation to the grain of the diamond to render the cutting effective.

No matter whether the grain of the diamond be straight or curved, no matter in what direction it may run or in how many directions, or how close the grain in one direction may lie to the grain in another direction, or how some parts of the grain may be interwoven with other parts thereof, it necessarily follows that the cutting wheel is bound to operate upon the diamond in such manner that, at intervals at least, the direction of the cut will have the proper relation to the direction of the grain to render the cutting effective. It is the universal belief among diamond cutting experts that without exception there is always some direction or directions in which a diamond cutting wheel, operating upon the diamond, must necessarily be effective for purposes of cutting. With my method and apparatus, the diamond cutting wheel virtually hunts in all directions for the critical direction or directions in which the cutting can be done effectively and easily. Thus while a particular point, located somewhere upon a facet of a diamond, cannot be cut by the wheel so long as the wheel surface engaging the facet is traveling in one direction, the point in question may be cut if the cutting surface of the wheel is caused to travel in a different direction. Hence, by causing the wheel to revolve bodily around in an orbit and at the same time to rotate upon its own axis, every conceivable direction of travel will be given to the cutting surface, the inevitable effect being that the diamond is effectively cut. Moreover the cutting is done by a surface located comparatively near the outer edge of the cutting wheel, where the speed of the wheel is comparatively high, and where the speed of travel of the cutting surface is nearly uniform for different parts of the facet upon which the cutting wheel is operated.

For the reasons above stated, the cutting of the diamond is greatly simplified and rendered much cheaper. The apparatus is in great measure automatic, and by its aid the diamond cutting can be done by operators having no special skill such as is or-

dinarily required of diamond cutting experts.

I do not limit myself to the precise mechanism shown, as variations may be made therein without departing from my invention, the scope of which is commensurate with my claims.

Having thus described my invention, what I claim as new and desire to secure by Letters Patent is as follows:

1. In a machine for cutting diamonds, the combination of a diamond dop for holding a diamond, a cutting wheel for engaging said diamond, means for causing said cutting wheel to rotate upon its own axis, means for causing said wheel to revolve bodily around an axis different from the axis of rotation of said cutting wheel, mechanism for supporting said diamond dop so as to maintain the diamond in a predetermined bodily position, and mechanism controllable at the will of the operator for adjusting said diamond dop to different degrees of inclination relatively to said diamond cutting wheel, without disturbing the general fixed position occupied by said diamond while being cut.

2. In a diamond cutting machine, the combination, with a dop for holding the diamond, a shank for supporting the dop, and sector mechanism for supporting said shank in different positions of inclination, of a pair of tilting bars pivotally connected with said sector mechanism, and means for pivotally supporting each of said tilting bars.

3. In a diamond cutting machine the combination, with a dop for holding the diamond, a shank for supporting the dop, a cutting wheel for engaging the diamond and sector mechanism carrying said shank and provided with means for inclining said shank and said dop into different positions relatively to said cutting wheel, of mechanism connected with said sector mechanism and controllable at the will of the operator for shifting said sector mechanism into and out of proximity to said cutting wheel.

4. In a diamond cutting machine the combination, with a pair of sectors and mechanism carried thereby and adjustable relatively thereto for supporting a diamond dop in different positions of inclination relatively to said sectors, of a pair of tilting bars connected with said sectors and disposed parallel with each other, each of said tilting bars being supported in such manner as to enable both of said tilting bars to be together tilted, each to the same extent.

5. In a machine for cutting diamonds the combination, with a dop for holding the diamond, a shank for supporting the dop, a cutting wheel for engaging the diamond and a pair of sectors for supporting the shank, of a pair of tilting bars each pivotally connected with a different portion of said parallel sectors, a shaft connected with each tilting bar for supporting the same, and bearings for supporting the shafts.

6. In a machine for cutting diamonds the combination, with a dop for holding the diamond, a shank for supporting the dop, a cutting wheel for engaging the diamond, and a pair of sectors upon which said shank is revolubly mounted, of mechanism connected with said sector and controllable at the will of the operator for shifting said sectors bodily into and out of proximity to said cutting wheel, said mechanism for shifting said sectors including means for preventing the sectors from tilting relatively to the plane of the cutting wheel.

7. In a diamond cutting machine the combination, with a cutting wheel and a dop for holding a diamond thereupon, of a shank for supporting said dop, sectors for supporting said shank, said shank being revolubly mounted upon said sectors in order to enable the dop to be turned slightly from time to time, means controllable at the will of the operator for shifting the general position of the shank relatively to the sectors in order to vary the degree of inclination of the shank relatively to the plane of the cutting wheel, a pair of tilting bars disposed parallel to each other and pivotally connected with different portions of said sectors, bearings for supporting said tilting bars so as to allow them to be tilted together while remaining parallel with each other, and a limiting stop located within the path of travel of one of said tilting bars, to prevent excessive movement of the same.

8. In a diamond cutting machine the combination, with a cutting wheel and a dop for holding a diamond thereupon, of a shank for supporting the dop, sectors for supporting said shank, means controllable at the will of the operator for shifting the general position of the shank relatively to the sectors in order to vary the inclination of the shank relatively to the plane of the cutting wheel, a pair of tilting bars disposed parallel with each other and pivotally connected with different portions of the sectors, and mechanism for the double purpose of supporting said tilting bars and allowing them freedom of tilting movement, in order to allow the sectors to be moved into and out of proximity to said cutting wheel.

ALFRED T. HUNT.