Oct. 26, 1943. M. SIMONS 2,332,609

APPARATUS FOR MANUFACTURING WIRE DRAWING DIES

Filed March 17, 1942 4 Sheets-Sheet 1

FIG. 1.

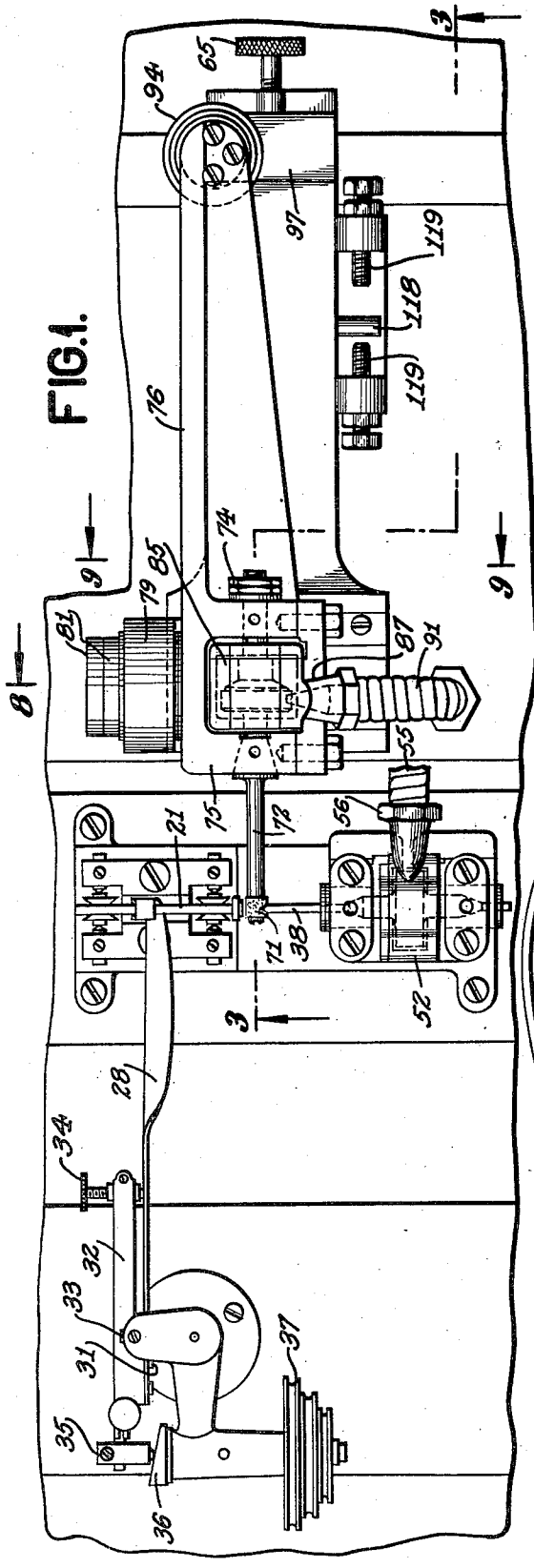
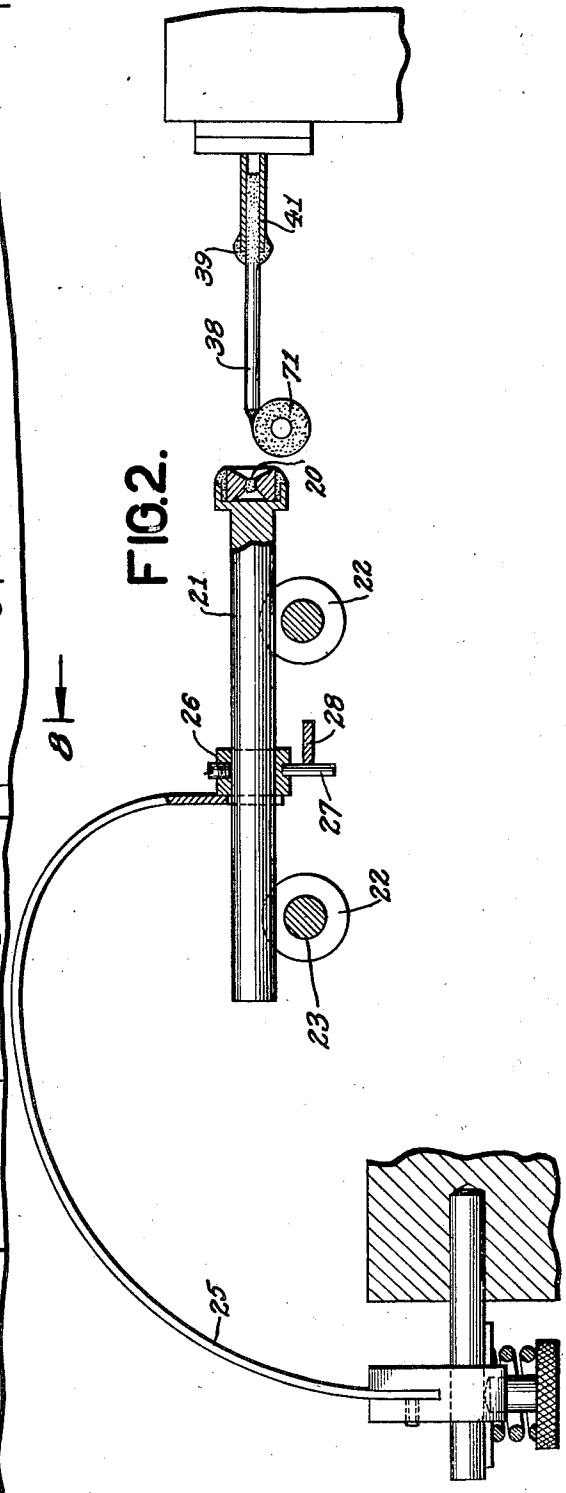


FIG. 2.



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Filed March 17, 1942 4 Sheets-Sheet 2

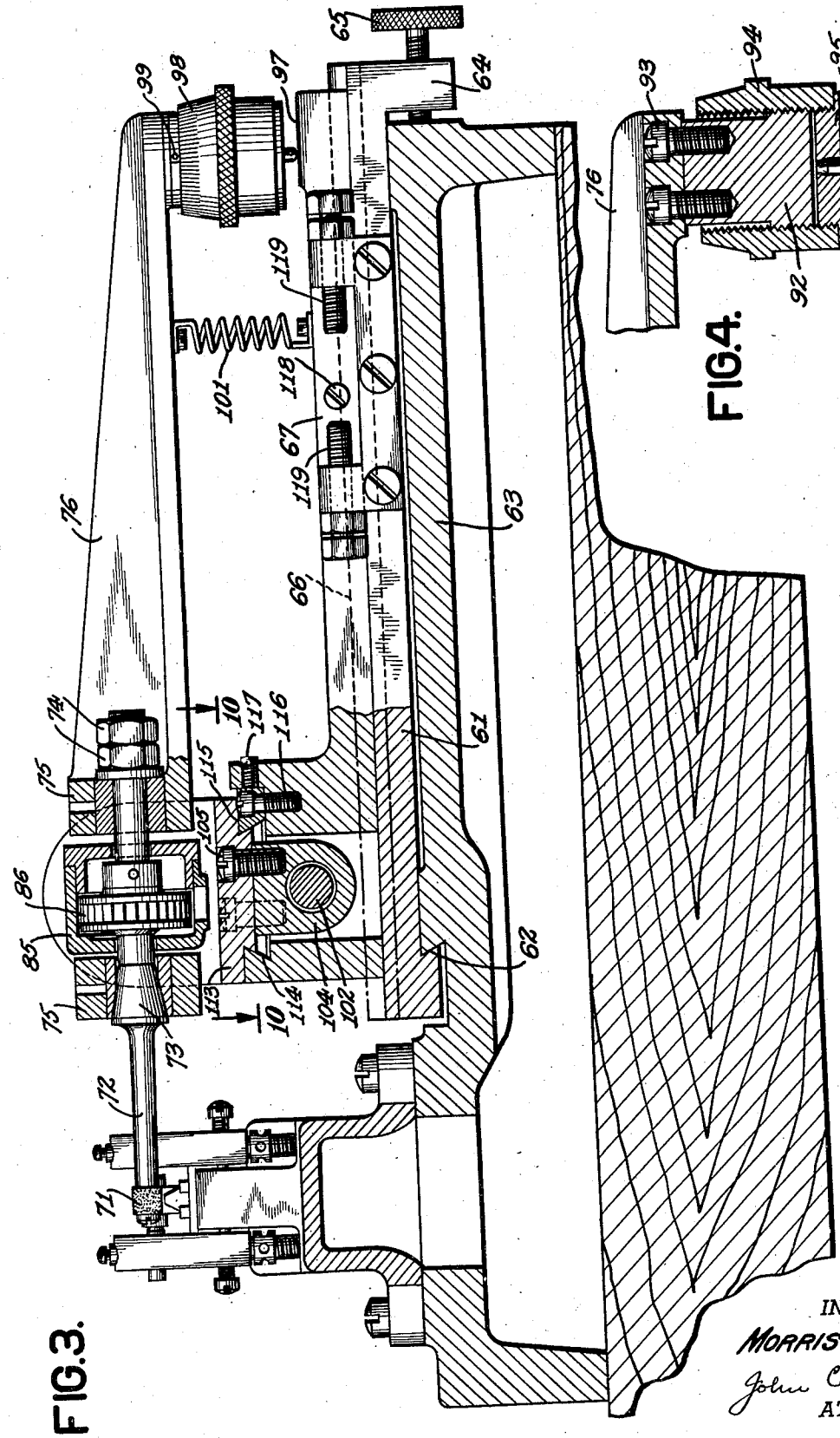


FIG.3.

FIG.4.

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APPARATUS FOR MANUFACTURING WIRE DRAWING DIES

Filed March 17, 1942 4 Sheets-Sheet 3

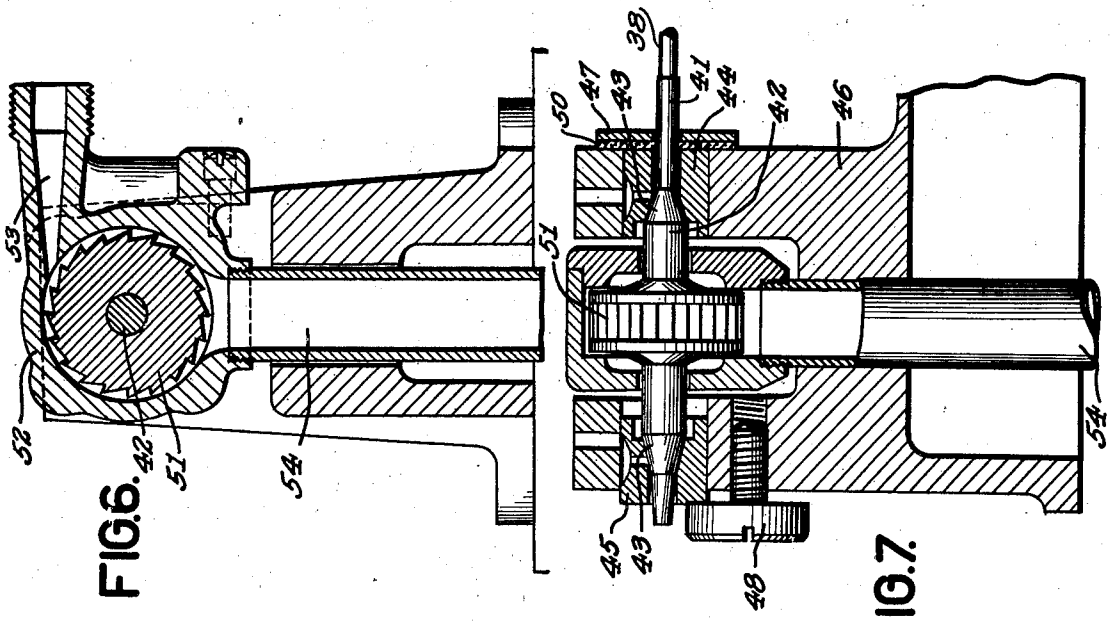


FIG.6.

FIG.7.

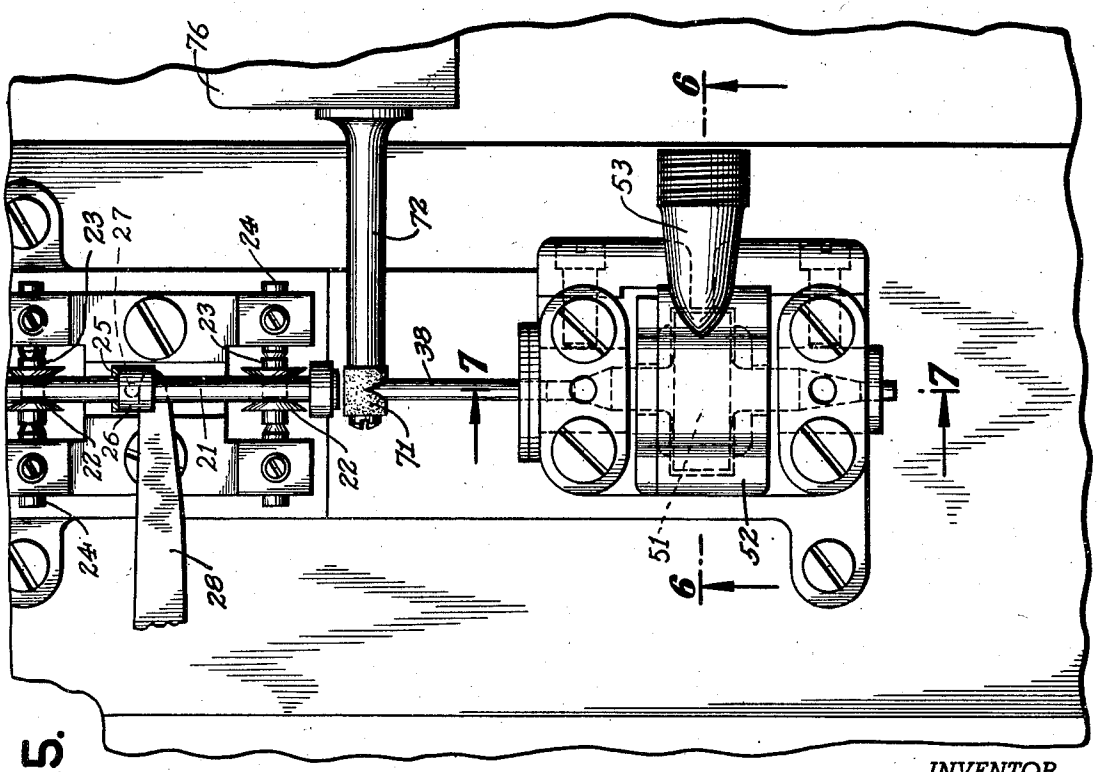


FIG.5.

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Filed March 17, 1942 4 Sheets-Sheet 4

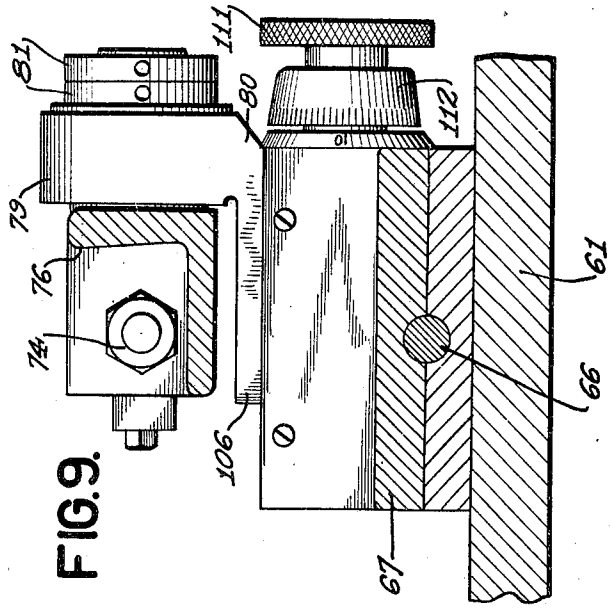


FIG.9.

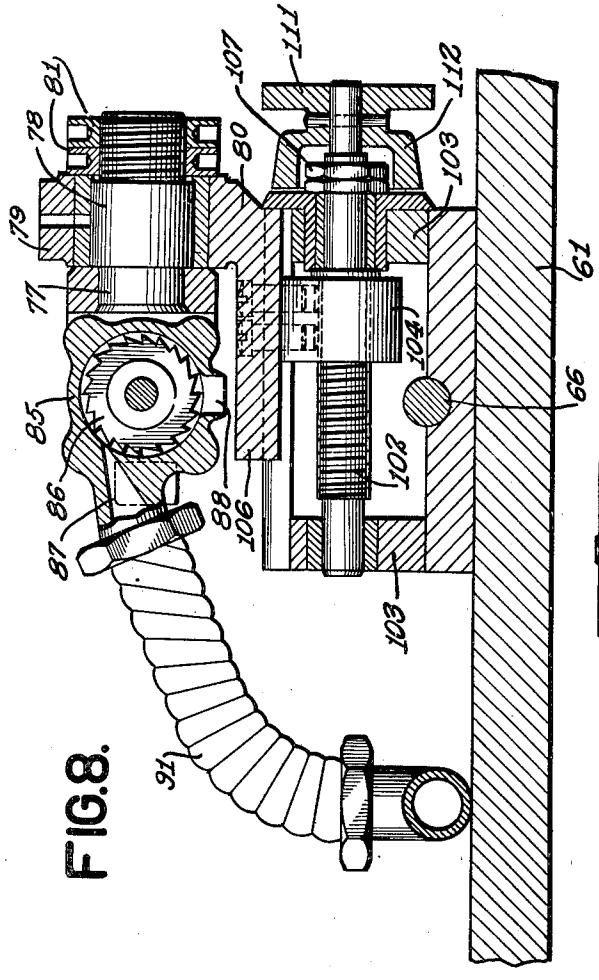


FIG.8.

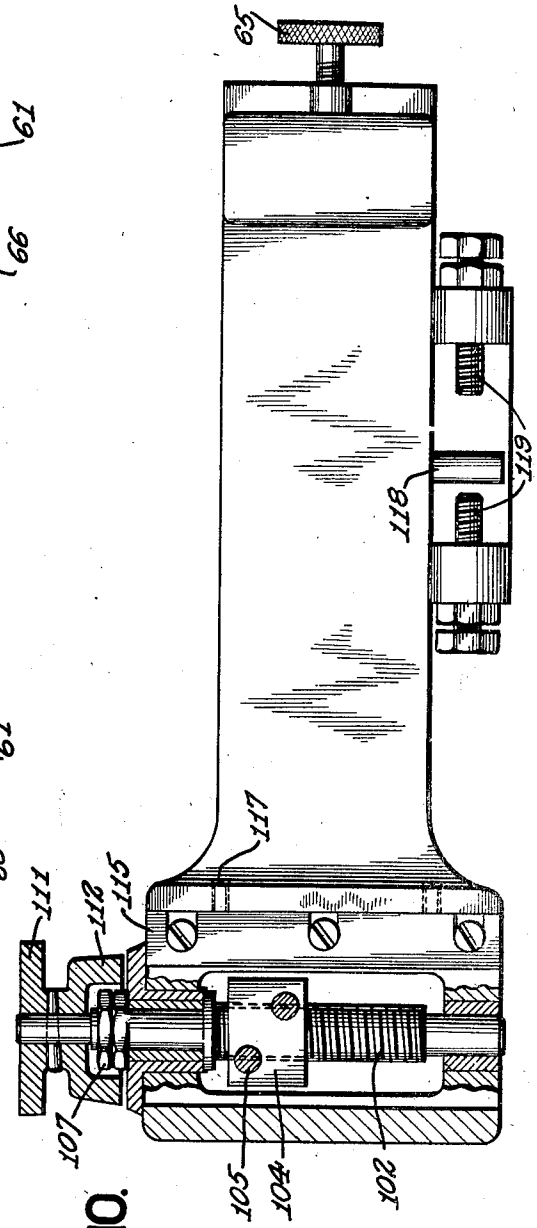


FIG.10.

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2,332,609

UNITED STATES PATENT OFFICE

2,332,609

APPARATUS FOR MANUFACTURING WIRE DRAWING DIES

Morris Simons, Ridgefield, Conn.

Application March 17, 1942, Serial No. 434,990

10 Claims. (Cl. 125—30)

This invention relates generally to improvements in the manufacture of dies for drawing wire and has for its broad purpose the production of wire drawing dies which are more uniform and less expensive than prior dies; and which will on an average last much longer in use than anything heretofore known in the art.

While the invention is not limited to making dies of any particular size it has its greatest utility in making dies from .002" down to .0004". The dies in the sizes mentioned have heretofore been produced only by highly skilled and experienced men who ground the die drilling needles by hand. Grinding by hand does not mean removing the drilling needle from the machine and grinding it and then replacing it, as in actual practice the needle is left in fixed position in the machine and the grinding was done by holding the grinder by hand and applying it to the needle. The shape of the drilling end of the needle depended entirely upon the skill of the operator in applying the grinder. While a skilled man could drill a hole small enough for fine wire he could not uniformly make dies having the proper shapes. This resulted in great variation in the productivity of dies, as one of the dies would draw 5000 meters of wire and the next 25,000 meters. However, the user of the dies had to accept them as they were the best obtainable.

Study of the product of manufacturers of fine dies by die makers disclosed that only about seven dies out of twenty produced by the prior practice could be put into work as drawing dies having sizes from .002" down to .0004". The rest of the twenty ran over-size and were finished at sizes larger than they were originally intended to have. This made the cost of the finer dies much greater than was desirable and in addition, involved drilling a much greater number of dies than would otherwise be necessary in order to get the number of fine dies required.

These defects and disadvantages of prior practice are overcome by the present invention and as a result in the making of 100 dies of triples naught sizes, such as, for example, .0005" or .0006", the yield is from 90 to 100 perfect dies. The benefits in the way of lowered cost and accuracy of the dies, as well as the greater amount of wire which can be drawn, are obvious. These advantages are obtained by providing a mechanism for grinding the drills or drilling needles which will maintain the drilling portion of the drill or drilling needle in proper shape to give the desired results. This is done in such a way that fewer drills are needed and stoppages of drilling operations to replace drills are reduced to a minimum.

In addition to the matters above stated, an important object of the invention is to provide a means whereby the operator of a die drilling machine can drill the die which will have the correct internal contour at the completion of the drilling operation.

Another object is to reduce drill replacements to a minimum as above stated, an incidental result being that the reduction in drill replacements contributes to the accuracy of the drilling operation as no matter how much care is used in replacing worn drills it is very seldom that the new drill will have precisely the same relation to the work as the old one.

A further object is to provide a die drilling mechanism and a grinding mechanism, both of which run with almost a total absence of vibration, thereby greatly facilitating both the drilling and the grinding operations.

Another object is to provide a grinding or sharpening mechanism for the drills which can be set up according to a predetermined shape of the drilling point or end so as to yield the desired outside flare, entrance, drawing angle and wire diameter, and after these characteristics have been determined and set up on the apparatus it will accurately produce all of them on the drilling element at each sharpening operation.

With the foregoing and incidental objects in view which will become more apparent later on, the invention consists in a novel construction and relation of parts, the preferred embodiment of which is hereinafter described with reference to the drawings accompanying and forming a part of this specification, the novel features being pointed out in claims appended hereto.

In the drawings:

Fig. 1 is a top plan view of substantially the complete apparatus.

Fig. 2 is a detail on a larger scale of the mechanism for engaging the drill needles with the object to be drilled and shows a grinding wheel in grinding relation with the drill.

Fig. 3 is a section on the line 3—3 of Fig. 1.

Fig. 4 shows in section and on a larger scale, some of the details of the construction shown in the right hand side of Fig. 3.

Fig. 5 is a top plan view on a scale larger than employed in Fig. 1 of the drilling apparatus and the drive for the drill.

Fig. 6 is a section on the line 6—6 of Fig. 5.

Fig. 7 is a section on the line 7—7 of Fig. 5.

Fig. 8 is a section on the line 8—8 of Fig. 1.

Fig. 9 is a section on the line 9—9 of Fig. 1.

Fig. 10 is a section along the line of line 10—10 of Fig. 3 with related parts at the right shown in top plan view.

In the illustrative embodiment shown in the drawings the various features of the invention are in the form they would take when applied to a French horizontal machine for drilling diamonds for subsequent use in wire drawing dies. The diamond is represented at 20, Fig. 2 of the drawings. It is mounted in any suitable or usual way in the head of a member 21 which is mounted for endwise or reciprocatory movement in the grooves of rollers 22 having trunnions 23, Fig. 5, rotatably supported on the ends of screws 24. These screws are tapered at their ends to afford a satisfactory bearing for the trunnions of the rollers 22. The member 21 is reciprocated by a spring 25, Fig. 2, and a member 28, Fig. 1. Spring 25 is secured at its lower end in a stationary fixture and has its forward end forked to span the member 21. The fork on the spring engages a block 26 held on the member 21 by a set screw, said block having a downwardly projecting pin 27. This pin engages the end of a member 28 which is preferably of spring material and is secured at 31, Fig. 1, to a member 32 which is pivoted at 33. The member 32 is provided at one end with an adjusting screw 34 and at the other end with a member 35 carrying a ball or other projection resting upon the face of an eccentric 36. This eccentric is connected with a set of change speed pulleys 37 driven by a belt which is driven by a motor or other suitable devices. When the eccentric 36 is rotated it will oscillate the members 32 and 28 in a horizontal plane, thereby first relieving the spring 25 to allow it to engage the diamond 20 with the drill 38, whereupon the movement of the member 28 is reversed causing it to act against the pin 27 to withdraw the diamond from engagement with the drill. The adjusting screw 34 is to permit changing the relation between the members 28 and 32 to regulate the movement of the member 21; for example, to accommodate for wear on the drill.

The drill 38 is secured as by solder 39 in a tubular end provided on a shaft 41, Figs. 2 and 7, this shaft forming a part or extension from a member 42 having tapered portions 43, the assembly being supported in removable cone bearings 44 and 45 mounted in recesses in the sides of a frame member 46. A plate 47 secured to the frame 46 holds a piece 50 of felt or the like in sealing relation to the bearing 44. The bearing 45 cooperates with the head of an adjusting screw 48 which can be turned to regulate the cone bearing support for the shaft 41. Rigid with the member 42 and, of course, with the drill 38, is the rotor 51 of a turbine. This rotor is surrounded by a housing 52 which is provided with an air inlet 53 and outlet 54, Figs. 6 and 7. The inlet is in the form of a flat nozzle through which a current of air is forced against the teeth or blades of the rotor. This construction provides a means for rotating the drill 38 without vibration, this effect being contributed to not only by the fact that the drive is in the nature of a turbine but also because of the form of mounting of the assembly including the rotor.

The speed of the drive and consequent rate of rotation of the drill 38 may be regulated by a valve (not shown) in the air supply line. Air pressure is conducted from the source of supply to the turbine through a flexible tube 55 which is joined to the nozzle and the source of air supplied by one or more unions 56.

The mechanism for supporting the reciprocating diamond carrier 21 and for effecting the reciprocations are well known in the art as are also various adjustments, which are shown but need not be described, for obtaining correct axial alinement between the member 21 and the drill 38.

The grinding part of the mechanism comprises a member 61, Fig. 3, which is provided with gib 62 engaging a corresponding gib surface on the base 63 for the mechanism, the member 61 also having a lug or shoulder 64 in which is mounted a set screw 65. The set screw may be loosened and the member 61 adjusted laterally of the machine, i. e. lengthwise of the drill 38, in setting up the mechanism after which the set screw 65 may be tightened to maintain the adjustment. The member 61 carries substantially all of the grinding mechanism. The member 61 is provided with a groove lengthwise of the member in which is a rod 66, Figs. 8 and 9. In sliding engagement with the upper face of the member 61 is a member 67 which also is provided with a groove fitting the rod 66. This guides the member 67 and all of the parts supported thereby for endwise movement in a direction laterally of the axis of drill 38, and if occasion requires it, the plate 67 and all of the parts carried thereby may be lifted off as a unit after an air tube, mentioned more in detail later on, is disconnected.

The grinding wheel 71 is carried on the end of a shaft 72, Fig. 3, provided with a tapered portion 73 working in a suitable bearing. The other end of the shaft is provided with nuts 74 for adjusting the longitudinal position of the shaft 72 and locking it in adjusted position. The bearings for the shaft 72 are carried in the side arms of a yoke 75 forming a part of a member 76, Figs. 1 and 3. This member, as best shown in Figs. 1 and 8, is pivoted upon a boss 77 forming a part of a member 78 which is journalled in an upstanding portion 79 of an adjustment member 80. The boss 77 is headed to engage a correspondingly shaped part of the recess in the yoke portion of the member 76 and the frictional relation between the member 76 and the boss is controlled by a pair of nuts 81 on a threaded extension of the member 78.

Mounted between the side arms 75 of the yoke is a turbine housing 85 containing a turbine rotor 86. Air is delivered within the housing 85 to the teeth or blades of the rotor through a flat nozzle 87, the air escaping through an outlet 88. The nozzle 87 is connected to a source of supply by a flexible tube 91 which will transmit air to the nozzle 87 and rotor 86 in all positions of the grinding mechanism. The amount of air delivered to the rotor and the consequent speed of the shaft 72 and grinding wheel 71 are regulated by a valve (not shown) in the compressed air line.

The purpose of pivoting the member 76 as previously described, is to permit changing the angle of the shaft 72 and grinding wheel with respect to the drilling needle in setting up operations. This permits determining the depth or shape of the cut made by the grinding wheel on the working end of the drilling needle and affords a means of compensating for changes in the sizes of the grinding wheels. The mechanism for making such adjustments is best shown in Figs. 3 and 4. The pivoted member 76 is provided at

its end with a micrometer adjusting device. This device comprises a cylindrical member 92 secured by screws 93 on the underside of the extension or arm of the member 76. The lower periphery of the member 92 is threaded to cooperate with the threads on the interior of a tubular shell 94. Secured in the lower end of the tubular shell as by means of threads is a member 95 carrying a rounded pin 96 resting upon a flat surface or plate 97 forming a part of the upper face of the plate member 67. The tubular shell 94 is provided with markings or indicia on the surface 98 which cooperate with a stationary marker 99 to provide a way of making adjustments, preferably by ten thousandths of an inch to raise and lower that end of the member 76 with consequent raising and lowering of the shaft 72 and grinding wheel 71. The tension spring 101 between the member 76 and the plate member 67 serves to yieldingly hold the member 76 in adjusted position.

In grinding operations the unit comprising the sliding plate member 67 and the parts supported thereon are given a reciprocating movement at right angles to the length of the drilling needle thereby engaging the grinding wheel with the needle. In order to prevent the corner of the grinding wheel from striking the needle and causing possible damage to the needle, the arm 76 may be lifted against the tension of the spring 101 so that the grinding wheel will clear the needle after which release of the member will permit the spring 101 to engage the grinding wheel with the needle.

The grinding wheel shaft 72 and the turbine 86 for driving it may also be adjusted laterally; that is, crosswise of the machine, to engage the grinding wheel with the end of the drilling needle. This may be done in setting up the machine ready for a grinding operation or it may be done as a part of the grinding operation. The mechanism for effecting this lateral movement is shown to the best advantage in Figs. 8 and 10. It comprises a threaded rod 102 mounted in lugs 103 extending upward from the plate 67. The threads 102 work in threads in a member 104, Figs. 8 and 10, which is secured by screws 105 to the underside of a horizontal extension 106 of the member 79 to which the member 76 is pivoted as before described. One end of the threaded member 102 is provided with a pair of locknuts 107 for limiting the endwise movement of the threaded member 102 but these nuts may be omitted or left loose if desired. The threaded member 102 projects beyond the lug 103 and has pinned to it a thumb wheel 111 which is integral with an indicating dial 112 suitably marked and cooperating with a stationary marking point to indicate the extent of adjustment. The indicia on the dial 112 may be according to any desired scale, preferably in tens of thousandths of an inch. By turning the thumb wheel 111 the grinding wheel shaft and grinding wheel, as well as the turbine for driving them, can be moved to and fro so as to carry the grinding wheel back and forth in a direction parallel to the length of the drilling needle.

This lateral movement is permitted and controlled by gibs 113 on the horizontal portion 106 of the member 79 cooperating with correspondingly shaped gibs 114 and 115 on the member 67. The gib 115 is preferably on a bar which is held in place by screws 116 so as to permit ready removal of the gib 115 in disassembling the apparatus. The frictional relation between the member 115 and the corresponding gib on the part 106 may be adjusted by means of a screw 117.

As previously indicated, after the apparatus has been set up to grind the drill or needle, the plate 67 is slid endwise to carry all of the grinding mechanism to and fro to engage the grinding wheel 71 with the needle. This reciprocating movement is limited in both directions by a pin or screw 118, Figs. 1 and 3, projecting from the edge of the plate 67 and cooperating with adjustable stops 119 mounted in lugs extending from the edge of the plate 61. Before this movement is started the air is turned on for the turbine 86 and preferably the air also is turned on for the turbine 51 for rotating the needle. After the proper adjustments have been made of the thumb wheel 111 and micrometer sleeve 94, a hand reciprocation of the plate 67 and the grinding mechanism supported thereby will engage the grinding wheel with the drill or needle and effect the desired grinding operation. The grinding wheel shaft will, because of the turbine drive for it, run without vibration and this, coupled with the fact that the needle also has a turbine drive which results in absence of vibration, will permit of doing the grinding with extreme accuracy.

When the grinding mechanism is to be used to sharpen the end of the drilling needle it is advisable to stop the reciprocations of the member 21. This may be done in several ways, the most convenient way being to disengage the forked end of the spring 25, Fig. 2, from the member 21 and block 26 and leave the member 21 resting upon the rollers 22. This prevents the work carrying end of the member 21 from being moved into engagement with the grinding wheel 71 while the wheel is in contact with the drilling needle 38.

In explaining the construction and operation of the respective embodiments, the parts and their operations have been referred to in considerable detail. However, it will be obvious to those skilled in the art that many changes may be made and it is not the desire to be limited by anything hereinabove contained, except to the extent indicated by the claims which follow.

What is claimed is:

1. In a machine of the character described having a diamond drilling needle, and means for supporting the needle for rotation on a fixed axis, a grinding wheel shaft on which grinding wheels of different diameters may be secured, a machine frame member having a substantially flat top, a member adjustable on said top in directions parallel to the axis of the needle and means for securing said adjustable member to the frame member in various adjusted positions, a sliding member slidable on the adjustable member toward and away from the needle, a pivoted member, means on the sliding member pivotally supporting said pivoted member, the pivot being parallel to the axis of the needle, means for adjusting said member on its pivot according to the diameter of the grinding wheel on the grinding wheel shaft, supporting devices for the grinding wheel shaft, said supporting devices being mounted on the pivoted member, and means for adjusting the shaft and grinding wheel parallel to the axis of the needle, the adjustments herein specified predetermining the contour which will be given to the needle point by the grinding wheel when the aforesaid sliding

member is operated to engage the grinding wheel with the needle.

2. In apparatus of the character described having a drilling needle and means supporting the needle for rotation on a fixed axis, the combination comprising a grinding wheel shaft and supporting devices for supporting said grinding wheel shaft in a predeterminable relationship to said needle, said supporting devices including bearings for the grinding wheel shaft extending laterally to the drilling needle and carried by a plurality of slides having guides arranged at right angles to each other so that one of said slides may be slid in a direction crosswise of the axis of said grinding wheel shaft and another of said slides may be slid lengthwise of the shaft in a direction crosswise of the axis of the needle to effect the grinding of a predetermined shape of the drilling point of the needle.

3. In apparatus of the character described having a drilling needle and means supporting the needle for rotation on a fixed axis, the combination comprising a grinding wheel carried by a shaft extending laterally to the axis of said drilling needle and supporting devices for supporting said shaft in a predeterminable relationship to said needle during a grinding operation, said supporting devices including a plurality of slides having guides arranged at right angles to each other so that one of said slides may be moved in a direction crosswise of the axis of said grinding wheel shaft and another of said slides may be moved to cause lengthwise movement of the shaft in a direction crosswise of the axis of the needle, a pivoted member carried by a pivot on the upper of said slides, said pivot being disposed substantially parallel to the needle, bearings for said grinding wheel, said bearings being mounted on said pivoted member and disposed at right angles to said pivot, means for adjusting the pivotal position of said member with respect to the upper of said slides, and means for holding said pivotal member in adjusted position.

4. In apparatus of the character described having a drilling needle and means supporting the needle for rotation on a fixed axis, the combination comprising a grinding wheel carried by a shaft extending laterally to the axis of said drilling needle and supporting devices for supporting said shaft in a predeterminable relationship to said needle during a grinding operation, said supporting devices including a plurality of slides having guides arranged at right angles to each other so that one of said slides may be moved in a direction crosswise of the axis of said gringing wheel shaft and another of said slides may be moved to cause lengthwise movement of the shaft in a direction crosswise of the axis of the needle, a pivoted member carried by a pivot on the upper of said slides, said pivot being disposed substantially parallel to the needle, bearings for said grinding wheel mounted on said pivoted member, and adjustable means for determining and fixing the angular position of said pivoted member to provide for the use of grinding wheels of different diameters.

5. In apparatus of the character described having a drilling needle and means supporting the needle for rotation on a fixed axis, the combination comprising a grinding wheel carried by a shaft extending laterally to the axis of said drilling needle and supporting devices for supporting said shaft in a predeterminable relationship to said needle during a grinding operation, said supporting devices including bearings for the grinding wheel shaft, a plurality of slides having guides arranged at right angles to each other so that one of said slides may be moved in a direction crosswise of the axis of said grinding wheel shaft and another of said slides may be moved to cause lengthwise movement of the shaft in a direction crosswise of the axis of the needle, means for adjustably moving said supporting devices for accurately determining the desired grinding position of the grinding wheel with respect to the end of said needle, means pivotally supporting said bearings on the upper of said slides, and means for adjusting the angularity of the bearings of said grinding wheel shaft with respect to the needle so as to determine the location of the grinding wheel opposite the end of the needle in accordance with the diameter of the grinding wheel.

6. In apparatus of the character described having a drilling needle and means supporting the needle for rotation on a fixed axis, the combination comprising a grinding wheel carried by a shaft extending laterally to the axis of said drilling needle and supporting devices for supporting said shaft in a predeterminable relationship to said needle during a grinding operation, said supporting devices including a plurality of slides having guides arranged at right angles to each other so that one of said slides may be moved in a direction crosswise of the axis of said grinding wheel shaft and another of said slides may be moved to cause lengthwise movement of the shaft in a direction crosswise of the axis of the needle, a member pivotally mounted on the upper of said slides, bearings in said member for supporting said grinding wheel shaft, a turbine mounted upon said shaft and including a housing mounted upon said member, and means for maintaining said pivoted member and shaft in a fixed angular position with respect to the guides of said slides.

7. In apparatus of the character described having a drilling needle and means supporting the needle for rotation on a fixed axis, the combination comprising a grinding wheel carried by a shaft extending laterally to the axis of said drilling needle and supporting devices for supporting said shaft in a predeterminable relationship to said needle during a grinding operation, said supporting devices including a pivoted member on which said grinding wheel shaft is mounted for rotation in a plane parallel to the plane of the axis of the needle, supporting means on which said pivoted member is mounted, said supporting means being slidable to carry the grinding wheel into and out of engagement with the needle, means for maintaining the pivoted member in a fixed angular position with respect to said supporting means, and means for adjusting the pivoted member on its pivot to predetermine the amount of material to be ground from the needle during a needle sharpening operation.

8. In apparatus of the character described having a drilling needle and means supporting the needle for rotation on a fixed axis, the combination comprising a grinding wheel carried by a shaft extending laterally to the axis of said drilling needle and supporting devices for supporting said shaft in a predeterminable relationship to said needle during a grinding operation, said supporting devices including a pivoted member, bearings for said grinding wheel shaft, said bearings being carried by said pivoted mem-

ber and disposed at a right angle to the length of the needle, supporting means on which said pivoted member is mounted, said supporting means including a slide vertically separable from its supporting guide and slidable to carry the grinding wheel into and out of engagement with the needle, and means for maintaining the pivoted member in a fixed angular position with respect to said supporting means.

9. In apparatus of the character described having a drilling needle and means supporting the needle for rotation on a fixed axis, the combination comprising a grinding wheel carried by a shaft extending laterally to the axis of said drilling needle and supporting devices for supporting said shaft in a predeterminable relationship to said needle with the axis of said needle intersecting the surface of said grinding wheel during a grinding operation, said supporting devices including a pivoted member on which said grinding wheel is mounted, means pivotally supporting said member, carriage devices for the grinding wheel supporting member and its pivot means, said carriage devices being operable to move the grinding wheel lengthwise of its axis and laterally of the needle to engage the needle with the grinding wheel, and turbine means for rotating the grinding wheel, said turbine means being operable to rotate said grinding wheel in any position of the pivot means and carriage devices.

10. In apparatus of the character described having a drilling needle and means supporting the needle for rotation on a fixed axis, the combination comprising a grinding wheel carried by a shaft extending laterally to the axis of said drilling needle and supporting devices for supporting said shaft in a predeterminable relationship to said needle with the axis of said needle intersecting the surface of said grinding wheel during a grinding operation, said supporting devices being slidably movable lengthwise of the grinding wheel shaft to engage the grinding wheel with the needle and slidably movable in another direction to locate the grinding-back position of the grinding wheel with respect to the point of the needle, and turbine means for rotating the grinding wheel shaft in all positions of the supporting devices.

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