

Feb. 5, 1935.

P. J. HELMSTADTER

1,990,074

DIE LAPPING MACHINE

Filed May 4, 1934

2 Sheets-Sheet 1

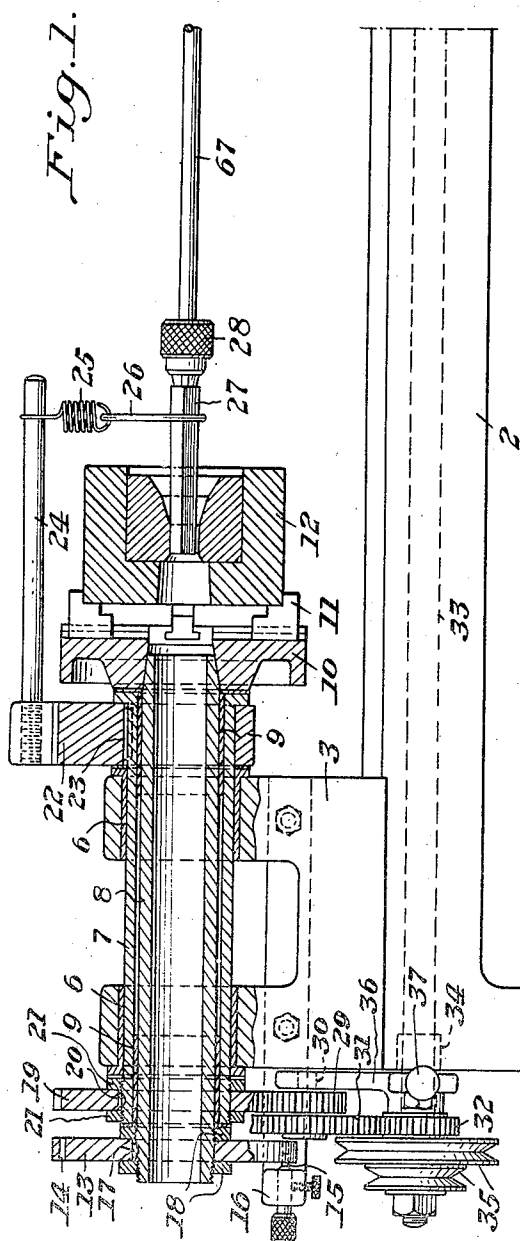
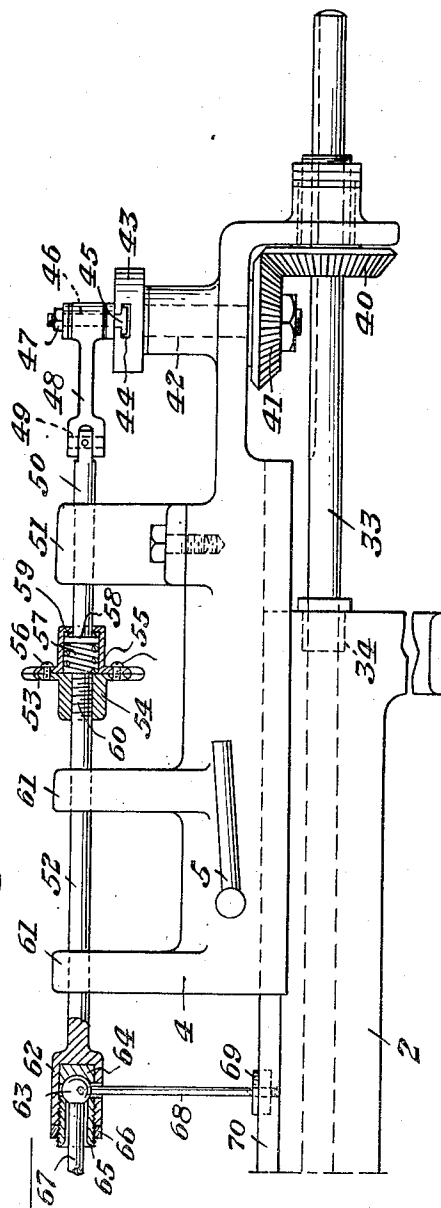


Fig. 2.



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2 Sheets-Sheet 2

Fig. 3.

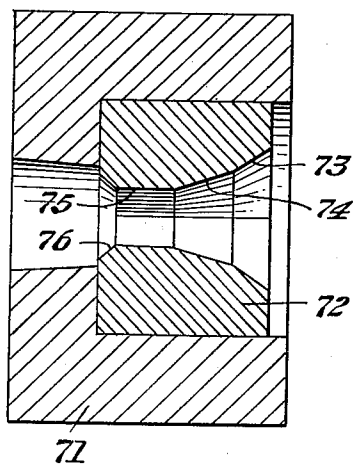


Fig. 4.

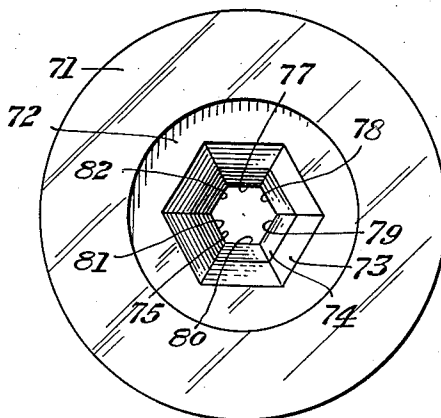


Fig. 5.

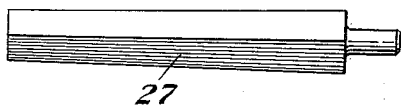


Fig. 6.

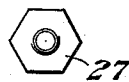


Fig. 7.

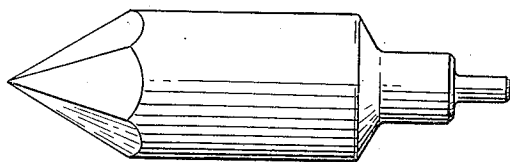
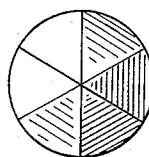


Fig. 8.



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DIE LAPPING MACHINE

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Application May 4, 1934, Serial No. 723,870

13 Claims. (Cl. 51—59)

This invention relates to a die lapping machine, and more particularly to such machine for lapping dies having non-circular openings therein. The invention is described more particularly herein as applied to the lapping of a die having a hexagonal opening, the die being formed of a tungsten carbide insert mounted in a die holder.

In the lapping of dies having circular openings, it has been customary to rotate the die while being lapped. Where the die has a non-circular opening, rotation is of course impossible, and it has been necessary to carry out the lapping operation by hand. The die lapping machine of the present invention enables dies having non-circular openings to be lapped more quickly and accurately than has been possible by the manual operations hitherto employed.

In the accompanying drawings which illustrate the present preferred embodiment of my invention—

Figure 1 is a front elevation of one end of the machine, parts being shown in section;

Figure 2 is a view similar to Figure 1, showing the other end of the machine;

Figure 3 is a section through a die which may be lapped in accordance with my invention;

Figure 4 is a front elevation of the die shown in Figure 3;

Figures 5 and 6 are, respectively, a side elevation and an end elevation of one form of lapping tool which may be used; and

Figures 7 and 8 are, respectively, a side elevation and an end elevation of another form of lapping tool.

Referring more particularly to the accompanying drawings, the lapping machine comprises a frame or base 2 on which is mounted at the front end a head stock 3 and at the other end a tail stock 4. The tail stock may be slid along the base and clamped in position in the usual manner by a clamp 5. Mounted in the head stock 3 in bearings 6 is a drive shaft 7. The drive shaft is hollow and an inner shaft 8 extends therethrough and is supported in bearings 9. The inner shaft 8 carries at the right hand end, as viewed in Figure 1, a chuck 10 having four jaws 11 for holding a die 12 which is to be lapped. Secured to the left hand end of the shaft 8 is an index plate 13 having openings 14 therein for receiving a pin 15 mounted in a support 16. The index plate is secured to the shaft 8 by a key 17 and is maintained in position by nuts 18 threaded onto the shaft 8.

A gear 19 is secured to the left hand end of the outer shaft 7 by means of a key 20. The gear is secured in position by nuts 21 threaded onto the

shaft. An arm 22 is secured by a key 23 to the right hand end of the outer shaft 7. This arm carries a rod 24 extending toward the opposite end of the machine. A spring 25 is connected at one end to the rod and on the other end carries a loop 26, which encircles a lapping tool 27 carried by a chuck 28. As will be described more fully hereinafter, the chuck is reciprocated back and forth in the lapping operation, the die remaining stationary. The spring 25 acts as a biasing means. The arm 24 and spring 25 rotate around the die, the spring acting as a biasing means for causing the tool to bear successively against different portions of the die surface which is being lapped.

The rod 24 and outer shaft 7 are rotated by the gearing shown in Figure 1. The gear 19 meshes with a gear 29 secured to a shaft 30. Also secured to the shaft 30 is a larger gear 31 which meshes with a gear 32 secured to a shaft 33, which in turn is mounted in bearings 34 supported in the frame 2. The shaft 33 carries two pulleys 35 of different size, either one of which may be used for varying the speed of rotation of the shaft 7. The shaft 30 to which are secured the gears 29 and 31 is supported in an arm 36 pivoted on the shaft 33 and provided with a handle 37 by means of which the arm may be oscillated to bring the gear 29 into or out of engagement with the gear 19. It is thus seen that when either of the driving pulleys 35 is rotated, the outer shaft 7, the arm 22 and the rod 24 will rotate about the die 12 which remains stationary.

A bevel gear 40 is secured to the right hand end of the shaft 33 and meshes with a bevel gear 41 secured to a vertical shaft 42. A disk 43 is secured to the vertical shaft and is provided with a slot 44. The slot receives the head 45 of a pin 46, the pin being secured in adjusted position in the slot by tightening the nut 47. The pin 46 is adjusted to a position which is eccentric to the shaft 42, and by varying the eccentricity of the pin, the oscillation of a pitman 48 which is connected at one end to the pin 46 may be varied. The other end of the pitman is connected by a wrist pin 49 to a connecting rod 50 which is supported in a bearing 51. The connecting rod 50 is joined to another connecting rod 52 by a coupling indicated generally by the reference numeral 53. This coupling consists of two parts 54 and 55 secured together by screws 56. A spring 57 inside the part 55 bears against the coupling part 54 at one end and at the opposite end bears against a head 58 formed on the connecting rod 50. A fibre washer 59 is arranged between the head 58 and the end of the coupling part 55.

The spring 57 acts as a shock absorber as the lapping tool is operated.

The end 60 of the connecting rod 52 is threaded into the coupling part 54, the connecting rod being carried in bearings 61. The left hand end of the connecting rod 52 is formed in a socket 62 for receiving a ball 63. The ball is supported by an end bearing 64 and a sleeve bearing 65 which is threaded into the socket and secured in position by a lock nut 66. The chuck 28 is carried by a stem 67 which is connected to the ball 63, the ball and socket forming a universal connection so that the lapping tool 27 can be made to bear successively against different portions of the surface being lapped. The lapping tool is guided while reciprocating by a guide consisting of a rod 68 connected at its upper end to the ball 63 and carrying a block 69 at its lower end. The block moves in a slot 70 formed in the base 2 of the machine.

In the operation of the machine, rotation of the gear 32 causes rotation of outer shaft 7, arm 22 and rod 24, the rod rotating about the die 12 which remains stationary. The lapping tool is reciprocated back and forth, the driving connection being from gear 32 through shaft 33, bevel gears 40 and 41, vertical shaft 42, disc 43, pitman 48 and connecting rods 50 and 52. As the lapping tool which is tapered is reciprocated, it is biased by the spring 25 so that it bears successively on different portions of the surface which is being lapped.

The die illustrated in Figures 3 and 4 consists of a holder 71 having a tungsten carbide insert 72. The opening in the die consists of a front angle 73, an entrance angle 74, a bearing angle 75 and a relief angle 76. In lapping each of these angles a different lapping tool is employed. The lapping tool 27 shown in Figures 5 and 6 is for lapping the bearing angle 75.

Figures 7 and 8 illustrate a lapping tool for lapping the front angle 73. It will be understood that other lapping tools in addition to those shown are used for lapping the entrance angle and the relief angle. Irrespective of the particular lapping tool which is employed, it is desirable to have the tool bear successively against different portions of the surface being lapped while the tool is reciprocating. This is accomplished in the embodiment shown by the spring 25, which causes the lapping tool 27 to bear successively against the surfaces 77, 78, 79, 80, 81 and 82, which surfaces taken together form the hexagonal bearing angle 75.

The biasing of the lapping tool against the various surfaces is possible due to the universal connection of the chuck 28, and the shock which otherwise would occur during reciprocation of the lapping tool in the die as the tool is driven home in the die, is absorbed by the spring 57. After the lapping tool has been reciprocated in contact with the die a sufficient length of time, during which time the tool has been forced successively against different surfaces of the die, the die is rotated to a new position by manually rotating the index plate 13 and the lapping operation is continued.

In lapping a die having a hexagonal opening, the index plate is rotated 60° between each lapping operation. The lapping tool of course is withdrawn from the die during the time that the die is being rotated to its new position, it being a characteristic of the present invention that the die is stationary during the time that the lap-

ping tool is reciprocating in contact with the die.

I have illustrated and described the present preferred embodiment of my invention. It is to be understood, however, that the invention may be otherwise embodied within the scope of the following claims.

I claim:

1. A die lapping machine, comprising means for reciprocating a lapping tool in contact with a surface of the die, and means operably connected to said lapping tool to move it bodily substantially in a circle and cause it to bear successively against different portions of said surface while said surface remains stationary.

2. A die lapping machine, comprising means for reciprocating a lapping tool in contact with a surface of the die, and biasing means operably connected to said lapping tool to move it bodily substantially in a circle and cause it to bear successively against different portions of said surface while said surface remains stationary.

3. A die lapping machine, comprising means for holding a die, means for reciprocating a lapping tool in contact with a surface of the die, biasing means bodily rotatable around said die and operably connected to said lapping tool for causing said tool to move bodily substantially in a circle and bear successively against different portions of said surface while said surface remains stationary.

4. A die lapping machine, comprising means for holding a die, means for reciprocating a lapping tool in contact with a surface of the die, an arm rotatable relative to said die, means for rotating said arm relative to said die, and biasing means operably connecting said arm and said lapping tool for causing said tool to bear successively against different portions of said surface.

5. A die lapping machine, comprising means for holding a die, means for reciprocating a lapping tool in contact with a surface of the die, an arm rotatable relative to said die, means for rotating said arm relative to said die, a spring connecting said arm and lapping tool for causing the tool to bear successively against different portions of said surface.

6. A die lapping machine, comprising a chuck for holding a die, a shaft connected to said chuck, a second shaft surrounding the shaft which is connected to said chuck and rotatable relative thereto, an arm secured to said second shaft, and biasing means operably connecting said arm and said lapping tool for causing the tool to bear successively against different portions of said surface.

7. In a die lapping machine, a device for reciprocating a lapping tool in contact with a surface of the die, said device comprising a chuck for a lapping tool, a connecting rod, a universal connection between said connecting rod and said chuck, means for reciprocating said connecting rod, and a guide for said chuck.

8. In a die lapping machine, a device for reciprocating a lapping tool in contact with a surface of the die, said device comprising a chuck for a lapping tool, a connecting rod, a universal connection between said connecting rod and said chuck, means for reciprocating said connecting rod, and a guide connected to said universal connection and movable in a slot in a stationary part of the machine for guiding said lapping tool while reciprocating.

9. In a die lapping machine, a device for reciprocating a lapping tool in contact with a sur-

face of the die, said device comprising a chuck for a lapping tool, a connecting rod, a universal connection between said connecting rod and said chuck, said connecting rod being provided with a shock absorber, and means for reciprocating said connecting rod.

10. In a die lapping machine, a device for reciprocating a lapping tool in contact with a surface of the die, said device comprising a chuck for a lapping tool, a crank, a connecting rod connecting said crank and said chuck, said connecting rod including a shock absorber, and a universal coupling between said connecting rod and said chuck.

11. In a die lapping machine, a device for reciprocating a lapping tool in contact with a surface of the die, said device comprising a chuck for a lapping tool, a connecting rod, a ball and socket connection between said connecting rod and said chuck, and means for reciprocating said connecting rod.

12. A die lapping machine, comprising means for reciprocating a lapping tool in contact with a surface of the die, and means rotatable around said lapping tool and operably connected thereto for causing it to bear successively against different portions of said surface while said surface remains stationary.

13. A die lapping machine, comprising a lapping tool, a chuck for said lapping tool, a connecting rod, a universal connection between said connecting rod and said chuck, means for reciprocating said connecting rod to reciprocate the lapping tool in contact with a surface of a die, and means rotatable around said lapping tool and operably connected thereto for causing it to bear successively against different portions of said surface while said surface remains stationary.

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