Dec. 22, 1931. J. C. ERTEL, JR 1,837,419

MACHINE FOR DRILLING VALVE GUIDES

Filed May 24, 1929

FIG. 2

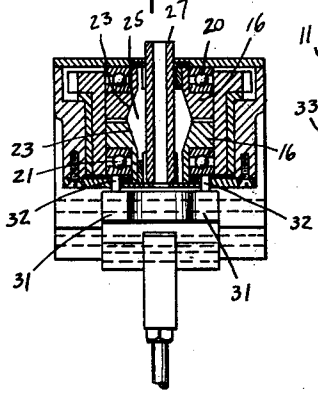


FIG. 1

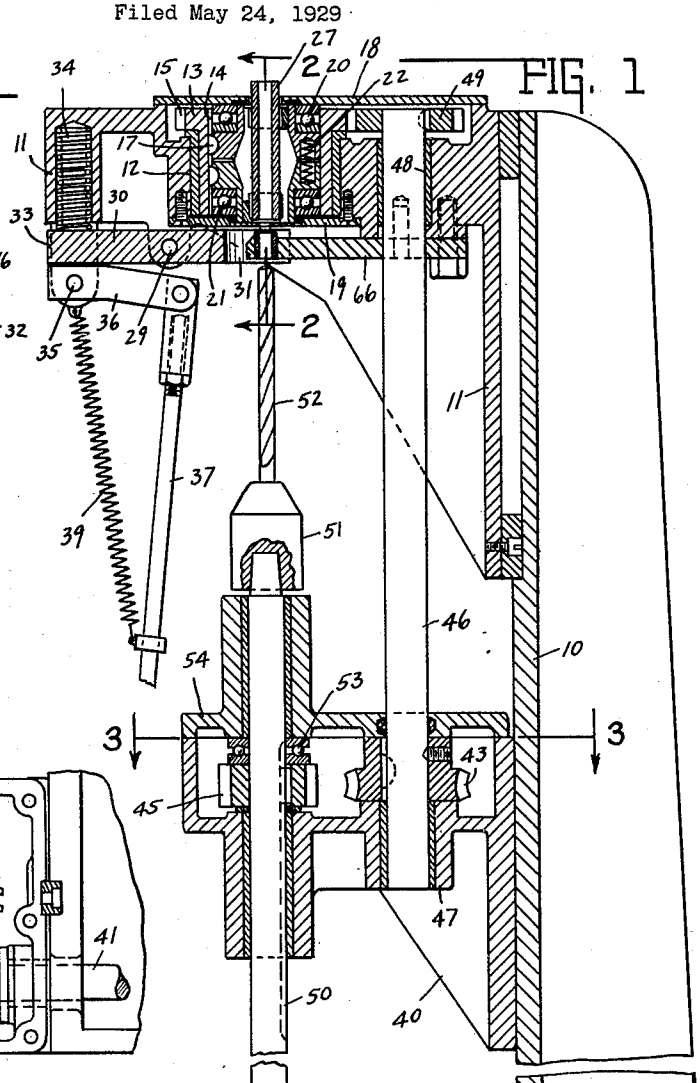


FIG. 3

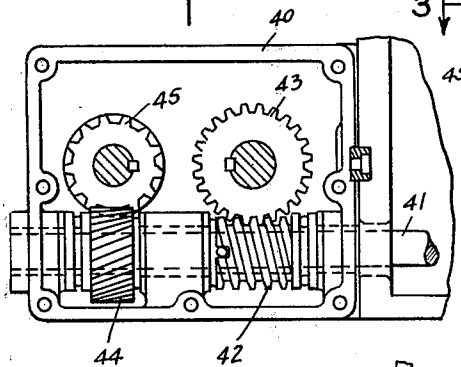
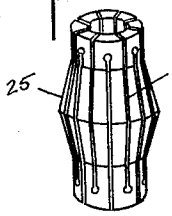
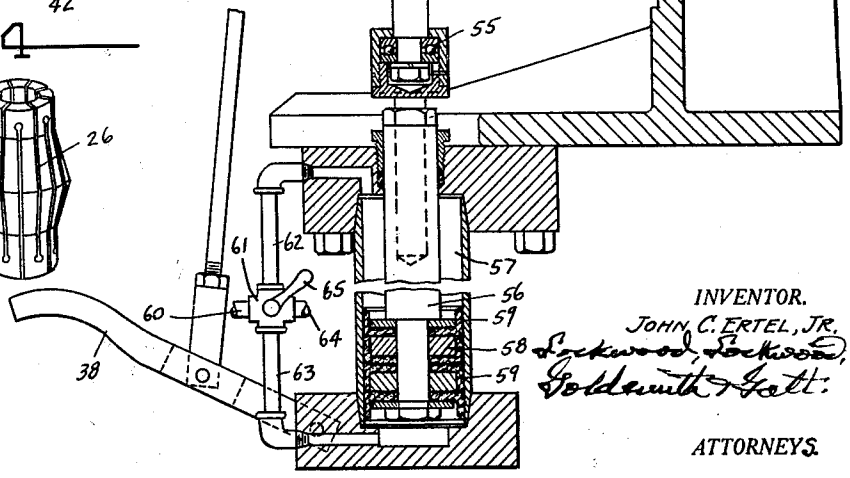


FIG. 4





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MACHINE FOR DRILLING VALVE GUIDES

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This invention relates to an apparatus for drilling a central hole in a cylindrical piece of material and particularly to an apparatus for drilling a central hole in a valve stem guide for automobile engines. In forming a valve stem guide it is important that the hole be exactly concentric with the outer surface of the guide. It is also extremely important that the work be done in the least possible time and with the least possible amount of the operator's attention.

Heretofore it has been common practice first to drill the hole and thereafter to turn the outer surface concentric with the hole, the whole operation being done in a lathe with the work chucked in the face plate and the drill fixedly carried on the tail stock. In this method and in other methods wherein the outer surface is made to conform with the hole it is necessary that considerable stock be taken from the outer surface in the turning thereof.

The principal object of the present invention is to provide a machine wherein the hole is drilled after the outer surface has been finished and wherein the hole is automatically placed concentric with the outer surface. With this method, castings may be used whose rough dimensions are an extremely small fraction of an inch greater than the finished dimension. The outer surface may then be finished on a grinder which obtains the final dimension without the necessity of centering the piece and therefore removes the smallest amount of material in the process. Such a grinder is a standard article of commerce but heretofore its use has not been extended to the finishing of cylindrical parts which require a concentric hole therein.

One feature of the invention resides in the provision of means for simultaneously turning the work and the tool at different speeds. By this means an eccentricity of the work with respect to the tool is automatically overcome and the hole is automatically placed concentric with the outer surface of the work so long as the axis of rotation of the work is concentric with the outer surface thereof.

Another feature of the invention resides in the relative positioning of the work and the tool wherein the tool is placed below the work rather than horizontally therewith. This results in several advantages. First, the chips immediately fall out of the hole, thus allowing much faster operation of the drill without undue heating. Second, the work may be easily inserted by simply dropping the piece from above rather than inserting it in a horizontal opening. Third, the parts of the machine rotating at a high speed are all located beneath the operating table out of the operator's way. There is no danger, therefore, of the operator catching his clothing in a high speed revolving part.

Another feature of the invention resides in the form of chucking mechanism provided wherein the work is grasped by a collet whose sides have practically parallel motion and, therefore, contact with the surface of the work throughout the entire length of the collet rather than at one end only as with the usual form of collet.

Another feature resides in the particular mechanism used in operating the collet for grasping the work.

Other objects and features of the invention and the full nature thereof will be understood from the accompanying drawings and the following description and claims:

Fig. 1 is an elevational sectional view taken on the center line of the machine. Fig. 2 is an elevational sectional view of the chucking members taken on the line 2—2 of Fig. 1. Fig. 3 is a horizontal sectional view showing the drive gearing and taken on the line 3—3 of Fig. 1. Fig. 4 is a perspective view of the type of collet used.

In the drawings a main frame 10 fixedly supports a head casting 11 in turn supporting an annular anti-friction bushing 12. Carried within the bushing 12 is an annular member 13 having a keyway 14 and gear teeth 15 formed therein. Carried within the member 13 are a pair of annular members 16 each carrying a key 17 engaging the keyway 14 whereby rotation of the member 13 causes rotation of the annular members 16 leaving the members 16 free for axial movement with respect to the member 13. An upper plate 18 and a lower plate 19 are fastened to

the casting 11. A ball thrust bearing 20 is interposed between the upper annular member 16 and the upper plate and a similar ball thrust bearing 21 is interposed between the lower annular member 16 and the lower plate 19. A plurality of springs 22 are carried in recesses in the annular members 16 and normally tend to separate said members and to maintain the ball thrust bearings in contact with the upper and lower plate respectively.

The members 16 have inclined internal surfaces 23 contacting with mating surfaces carried by the collet 25. The collet is formed as shown in Fig. 4 with longitudinally-extending slots 26 therein extending alternately from each end to a point adjacent the other end. By this construction, when the annular members 16 are forced toward each other against the action of the springs 22 the collet is contracted to grasp the work 27 placed therein. Since the two ends of the collet are exactly alike such pressure will cause equal contraction at the two ends and the work will, therefore, be grasped equally at both ends of the collet. The opening 28 in the collet for reception of the work 27 is accurately formed concentric with the outer surface of the collet and the inner surface of the members 16 and 13 are accurately formed concentric with their outer surfaces. Therefore, the axis of the work will coincide with the axis of rotation of the member 13.

Pivotally attached to the casting 11 by a pin 29 is a clamping lever 30. The lever 30 has fork projections 31 extending to points beneath the ball thrust bearing 21. A pair of pins 32 contact with the portions 31 and extend through the lower plate 19 to contact with the lower race of the ball thrust bearing 21. The lever 30 has a rearwardly-extending portion 33 contacting with a plurality of springs 34 contained in a recess of the casting 11. By this means the pressure of the springs 34 upon the lever 30 tends to elevate the pins 32 thereby raising the lower member 16 toward its upper member and operating the collet to grasp the work. Rotation of the lever 30 against the action of spring 34, therefore, will allow the lower member 16 to drop and thereby operate the collet to release the work. Pivotally carried on a portion of the casting 11 by a pin 35 is a lever 36 contacting with the portion 33 of lever 30. Pivotally attached to the end of lever 36 is a rod 37 pivotally attached at its lower end to a foot pedal 38. A spring 39 is connected at one end to the rod 37 and at the other end to a portion of casting 11. The foot pedal 38 is pivotally attached to a portion of the frame 10. By this construction a downward pressure on the foot pedal 38 brings lever 36 in contact with lever 30 to release the work. The removal of the said downward pressure allows the spring 39 to elevate the foot pedal, thereby allowing the collet to grasp the work.

Fixedly carried on a portion of the frame 10 is a casting 40 supporting a drive shaft 41 which may be driven by any suitable power means. The shaft 41 carries a worm 42 meshing with a work wheel 43 and a spiral gear 44 meshing with a spiral gear 45. The worm wheel 43 is carried on a vertical shaft 46 supported in bearing 47 in casting 40 and bearing 48 in casting 11. A spur gear 49 is carried on the upper end of shaft 46 and meshes with the gear teeth 15 carried on the member 13. Thus, a drive is provided for rotating the work.

The spiral gear 45 is splined to a vertical shaft 50 which carries in its upper end a drill chuck 51, carrying the drill 52. The drill 52 is guided in a hardened bushing in a member 66 bolted to the casting 11. A ball thrust bearing 53 is interposed between spiral gear 45 and the cover plate 54 of the casting 40. The lower end of shaft 50 is provided with a ball thrust connection 55 connecting it with the plunger 56 of a double-acting hydraulic cylinder 57. The plunger 56 is fitted with the conventional piston 58 and cup leather packings 59. An inlet 60 connects a three-way valve 61 with a suitable supply of high pressure liquid such as a city water supply. Passages 62 and 63 connect the upper and lower portions of cylinder 57 respectively with the three-way valve 61, and outlet 64 is also provided in the three-way valve. The three-way valve may be operated by its handle 65 to connect the lower end of the cylinder 57 with the inlet 60 and to connect the upper end to the outlet 64 for raising the drill. Reverse operation of the valve serves to lower the drill. If desired, the valve handle 65 may be connected by a series of linkages to a lever located in a more convenient position for operation than shown herein.

Other means than the hydraulic cylinder here shown may also be used to raise and lower the drill without departing from the broader feature of the invention.

In the operation of the machine, the work and drill are both rotated. By the use of a worm gear in the mechanism for rotating the work and a spiral gear in the mechanism for rotating the drill, the work is rotated at a relatively slower speed than the drill. By this means a slight eccentricity of the drill with respect to the work does not operate to give an eccentric hole. In changing the work it is only necessary to operate the three-way valve 61 instantly lowering the drill, depress the foot pedal 38, lift out the finished work with a pair of pliers or other tool, drop a new piece in place, release the foot pedal and reverse the valve 61. This operation requires such an extremely short time compared to the time required to drill the hole that one oper-

ator can successively take care of a large number of machines.

The invention claimed is:

1. In an apparatus for drilling a concentric hole in a cylindrical object, the combination of a frame, a parallel motion collet adapted to grasp said object, a pair of collet-engaging members having surfaces adapted to engage said collet to contract the same for grasping when said members are moved relatively of each other, a pair of stationary members supported upon said frame, a ball thrust bearing interposed between each of said collet-engaging members and one of said stationary members, yielding means tending to maintain said collet-engaging members in a separated position, operating members projecting through one of said stationary members and contacting with a race of one of said thrust bearings, and means for moving said operating members to move said collet-engaging members for grasping and releasing the work.

2. In an apparatus for drilling a concentric hole in a cylindrical object, the combination of a frame, a parallel motion collet adapted to grasp said object, a pair of collet-engaging members having surfaces adapted to engage said collet to contract the same for grasping when said members are moved relatively of each other, a pair of stationary members supported upon said frame, a ball thrust bearing interposed between each of said collet engaging members and one of said stationary members, yielding means tending to maintain said collet-engaging members in a separated position, operating members projecting through one of said stationary members and contacting with a race of one of said ball thrust bearings, and pedal-operated means for moving said operating members to move said collet-engaging members for grasping and releasing the work.

3. In an apparatus having a drilling tool for drilling a concentric hole in a cylindrical object, the combination of a frame, a parallel motion collet adapted to grasp said object, a pair of collet-engaging members having surfaces adapted to engage said collet to contract the same for grasping when said members are moved relatively to each other, a pair of stationary members supported upon said frame and normally limiting the travel of said collet-engaging members, yielding means tending to maintain said collet-engaging members in a normally separated position, operating members projecting through one of said stationary members and adapted to move one of said collet-engaging members in opposition to said yielding means, a pivotal member having a forked portion straddling said drilling tool and contacting with said operating members, and means for moving said pivotal member.

4. In an apparatus having a drilling tool for drilling a concentric hole in a cylindrical object, the combination of a frame, a parallel motion collet adapted to grasp said object, a pair of collet-engaging members having surfaces adapted to engage said collet to contract the same for grasping when said members are moved relatively of each other, a pair of stationary members supported upon said frame and normally limiting the travel of said collet-engaging members, yielding means tending to maintain said collet-engaging members in a normally separated position, operating members projecting through one of said stationary members and adapted to move one of said collet-engaging members in opposition to said yielding means, a pivotal member having a forked portion straddling said drilling tool and contacting with said operating members, yielding means for moving said pivotal member in one direction, and pedal-operated means for moving said pivotal member in the opposite direction.

In witness whereof, I have hereunto affixed my signature.

JOHN C. ERTEL, JR.