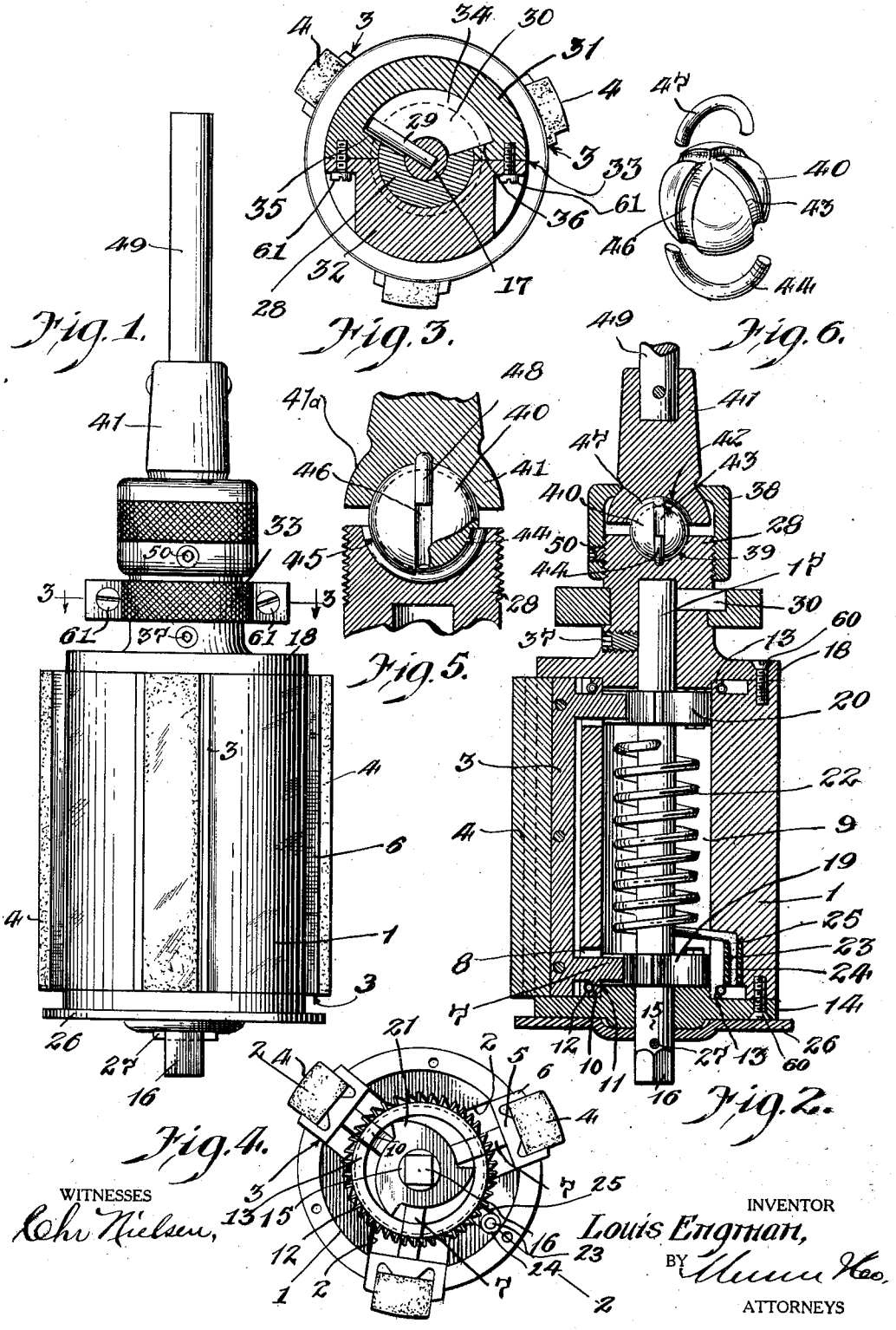
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L. ENGMAN

GRINDING TOOL

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WITNESSES

Chr. Nielsen,

INVENTOR

Louis Engman,

BY Munn & Co.

ATTORNEYS

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LOUIS ENGMAN, OF MOLINE, ILLINOIS.

GRINDING TOOL.

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This invention relates to grinding tools and has for its object the provision of a device having a plurality of radially movable grinding elements which are adapted to be controlled in their outward movement by a spring connected with a cam shaft which operates the grinding elements.

A further object of the invention is the provision of means which can be adjusted to prevent the radially movable grinding elements of the grinding tool from yielding in a radial inward direction from adjusted positions.

A further object of the invention is the provision of a universal joint for connecting the driving shaft to the grinding head of a grinding tool.

This invention will be best understood from a consideration of the following detailed description in view of the accompanying drawings, forming a part of this specification; nevertheless, it is to be understood that the invention is not confined to the disclosure, being susceptible of changes or modifications, but such changes or modifications shall mark no material departure from the salient features of the invention as expressed in the appended claim.

Figure 1 is a view in elevation of the grinding tool.

Figure 2 is a vertical section of the same through line 2—2 of Figure 4 and showing the tool revolved through 90° from its position in Figure 1.

Figure 3 is a horizontal section taken along the line 3—3 of Figure 1.

Figure 4 is an end view of the grinding tool with the end cover plate removed.

Figure 5 is an enlarged detail in section of the universal joint which connects the driving shaft with the grinding tool, showing the joint revolved through 90° from its position in Figure 2.

Figure 6 is a view in perspective of certain elements of the universal joint.

Referring more particularly to the drawings, 1 designates an open ended cylindrical body member having longitudinal grooves or slots 2 in which are adapted to be slidably mounted holders 3 which carry the grinding elements 4. Each of the holders is provided with a base member 5, side flanges 6 which embrace the grinding element 4 and rivets which are passed through the flanges of holders 3 for locking the grinding element 4 in position. Opposite end portions of the base 5 of each holder are provided with lugs 7 which extend radially inward from the base 5. These lugs project through openings 8 which connect the grooves 2 with a central bore 9 of the body 1 of the grinding head.

Upon the outer faces of the lugs 7 are ribs 10, which are provided on their outer faces with grooves 11 for the purpose of partially receiving annular coil springs 12. The coil springs confine the holders 3 in position in the grooves 2 in the body 1 by holding the lugs 7 in contact with cams 19 and 20. The body member 1 is provided at its opposite ends with outwardly projecting grooved ribs 13 which are located at the inner periphery of the body 1, each of the ribs 13 also being located between adjacent grooves 2. These grooved ribs 13 at each end of the body 1 are in line transversely of the body with the grooved ribs 10 on the adjacent end portions of the holders 3. The grooved ribs 13 at opposite ends of the body 1 also are adapted to partially receive the coil springs 12 so that the grooved ribs 10 and 13 at corresponding ends of the body 1 co-operate to retain the coil springs 12 in place on the end portions of the body 1 and the holders 3.

Secured to one end of the body member 1 is a closure 14 having a central opening which forms a bearing for one end of a cam shaft 15. This cam shaft is disposed centrally of the bore 9, projects through the closure 14, and has a square portion 16 adapted to be engaged by a tool for turning the same. The opposite end of the shaft 15 as shown at 17 is adapted to be received by a central passage in a closure 18 at the other end of the body member 1. Closures 14 and 18 are secured in any approved manner to the opposite ends of the grinding head as by screws 60. The closure 14 is provided with a boss adapted to be received within the outer end of the bore 9 and aiding materially in closing that end of said bore. Secured to the shaft 9 in spaced relation are the cam members 19 and 20. Each of these cam members is provided with three cam sections 21 adapted to engage the lugs 7 of the holders 3 so that as the shaft 15 is rotated the noses of said cams will progressively force the holders and the grinding elements 4 radially outward from the shaft 15. A coil spring 22 has one end se-

cured to the shaft 15, receives said shaft and has its other end 23 secured within a plug 24. This plug is received within a pocket 25 formed in the body member 1. The plug is sufficiently loose within the pocket 25 that when the shaft 15 is withdrawn from the body member 1 the spring and plug 24 will be readily removed from said body member. A dust cap 26 is made to conform to the shape of the outer face of the closure 14 and is maintained in close association with said closure by means of a pin 27 secured in a perforation in the cam shaft 15.

The closure 18 is provided with a hub 28 having the aforesaid central passage in which the end 17 of the cam shaft 15 is seated. The cam shaft is provided with a pin 29 adapted to be moved in a slot 30 that is formed in the hub 28. A ring 33 encircles the hub 28 of the closure 18 and comprises two semi-circular sections 31 and 32 secured together by means of the screws 61. The section 31 of the adjusting member is provided with an arcuately shaped slot 34 into which the outer end of the pin 29 protrudes from the slot 30 and is adapted to be moved, said pin being limited in its movements in opposite directions by shoulders 35 and 36, which respectively are located at opposite ends of the slot 34, when the shoulders 35 and 36 are in radial alinement with the end walls of the slot 30, as shown in Figure 3.

When the screws 61 are screwed fully home or tightened, the sections of the ring 33 will be clamped tightly to the hub 28, but when the screws 61 have been loosened slightly, the ring 33 can be turned on the hub 28 through a part of a revolution which will vary according to the position of the slot 34 with respect to the slot 30 at the beginning of the turning movement of the ring 33 on the hub 28. Therefore, it is obvious that the movements of the pin 29 in opposite directions in the slots 30—34 will be limited by one of the shoulders 35 or 36, and by the opposite end wall of the slot 30, when the ring 33 has been secured to the hub 28 with the shoulders 35 and 36 out of radial alinement with the corresponding end walls of the slot 30. The possible movement of the pin 29 in the slots 30—34 thus can be varied by adjusting the ring 33 on the hub 28 so that the slot 34 will be in complete or only partial register with the slot 30.

The outer surface of the ring 33 is knurled whereby the same may be gripped by hand and turned on the hub 28 through approximately 90° when the screws 61 have been loosened slightly. A set screw 37 having threaded engagement with a passage in the hub 28 is adapted to engage the shaft 15 and to lock the shaft 15 against turning in the hub 28 when desired.

The outer end portion of the hub is threaded for engagement with the internal screw threads of a nut 38. The outer free end of the hub 28 is provided with a semi-spherical socket 39 adapted to partially receive a ball 40. A link or coupling member 41 likewise has a semi-spherical socket 42 wihch cooperates with the socket 39 to completely embrace the ball 40. The ball is provided with a circular groove 43 adapted to partially receive a semi-circular pin 44. A grove 45 in socket 39 is adapted to aline with the groove 43 in the ball 40 and also is adapted to partially receive the semi-circular pin 44. The ball is also provided with a circular groove 46 which is disposed at right angles with the groove 43, and the socket 42 of the coupling member 41 is also provided with a semi-circular groove 47 cooperating with the grove 46 to receive a semi-circular pin 48. The coupling member 41 is provided with a rounded shoulder 41^a adapted to be engaged by an inturned flange at the outer end of the nut 38, the inner end portion of the coupling member being loosely received in the bore of the nut 38. Said nut thus can be adjusted on the threaded end portion of the hub 28 to position to maintain the coupling member 41 in close association with the end of the hub 28. An operating shaft 49 is rigidly secured to the coupling member 41. A set screw 50 in a threaded passage in the nut 38 is adapted to engage the hub 28 and to lock the nut against movement from adjusted position on the hub 28.

It will be seen that by reason of the universal joint, the body member 1 may be moved in a plurality of different directions and yet be revolved by the shaft 49 since the arcuately shaped keys 48 and 44 permit various positions of the body member relative to the axis of the shaft 49 but nevertheless cause the body member to be rotated by said shaft irrespective of the angular relation of the axis of the body member to the axis of the shaft 49.

From the foregoing description of the various parts of the device, the operation thereof may be readily understood. A wrench or other suitable tool may be engaged with the squared portion 16 of the cam shaft and manipulated to turn the cam shaft in a counter-clockwise direction when the grinding elements are in expanded positions to wind the spring 22 and to permit retraction of the grinding elements toward the positions shown in Figure 2. The set screw 37 then is tightened to lock the cam shaft against turning from the position shown in Figure 2 in response to the actuation of the spring 22. The ring 33 then may be adjusted on the hub 28 and secured to the hub 28 in position to limit as desired the possible movement of the cam shaft in a clockwise direction from the position shown in Figure

2, whereby the outward movements of the holders 3 in the grooves 4 will be limited. The body member 1 then is inserted in the cylinder that is to be ground and as soon as the set screw 37 has been loosened, the spring 22 will function to turn the cam shaft clockwise to force the grinding elements outward against the wall of the cylinder that is to be ground and to maintain the grinding elements in contact with the wall of the cylinder, assuming of course that the adjustment of the ring 33 on the hub 28 is such that the grinding elements are permitted to move outward against the wall of the cylinder that is to be ground before the pin 29 strikes the shoulder 36. However, the ring 33 will co-operate with the pin 29 to prevent the grinding elements from moving outward under the actuation of the spring 22 sufficiently to permit undue enlargement or grinding of the bore of the cylinder that is to be ground. It is obvious that the grinding elements may be positively prevented from moving radially inward in the grooves 4 from any expanded position by tightening the set screw 37 and the device then used as a rigid tool. Moreover, it also is obvious that the grinding elements will be held against yielding accidentally in a radially inward direction from an expanded position even when the set screw 37 has been loosened since the holders of the grinding elements bear directly on cams which are, of course, unyielding in a radial inward direction.

I claim:

A tool for grinding cylinders comprising a tubular body having a central bore and spaced grooves in its periphery, said body having radial openings connecting said grooves and said bore, holders for grinding elements slidable radially in said grooves and having lugs extending through said radial openings into said bore, end members covering the opposite ends of said tubular body and having portions retaining said holders against longitudinal movement in said grooves, one of said end members having an axial hub extension outside of said tubular body, said end members having alined central bores, said hub having an arcuate slot extending from the bore of the associated end member through the outer wall of the hub, a rotary cam shaft extending through the bore of the tubular body and having end portions journalled in the bores of said end members, said cam shaft having spaced cams in contact with the inner ends of the lugs of said holders, a coil spring encircling said cam shaft and having one end secured to the cam shaft and its opposite end secured to said tubular body, a radial pin extending through said slot in said hub and secured to the adjacent end of said cam shaft, a set screw threaded through a radial opening in said hub and adjustable to and from position to lock said cam shaft against turning in said hub, and a ring adjustable circumferentially on the hub and having a pair of shoulders adapted to be engaged by the outer end portion of said radial pin to limit the turning movement of said cam shaft in opposite directions about its axis when said set screw has been loosened, said coil spring being adapted to be placed under tension when said cam shaft is turned in the direction required to permit inward movement of said holders in the grooves of said body and then tending to turn said cam shaft in the opposite direction about its axis.

LOUIS ENGMAN.