June 9, 1931. F. L. CONE 1,809,402

RELIEVING DEVICE FOR HIGH SPEED DRILLS

Filed March 22, 1926 3 Sheets-Sheet 1

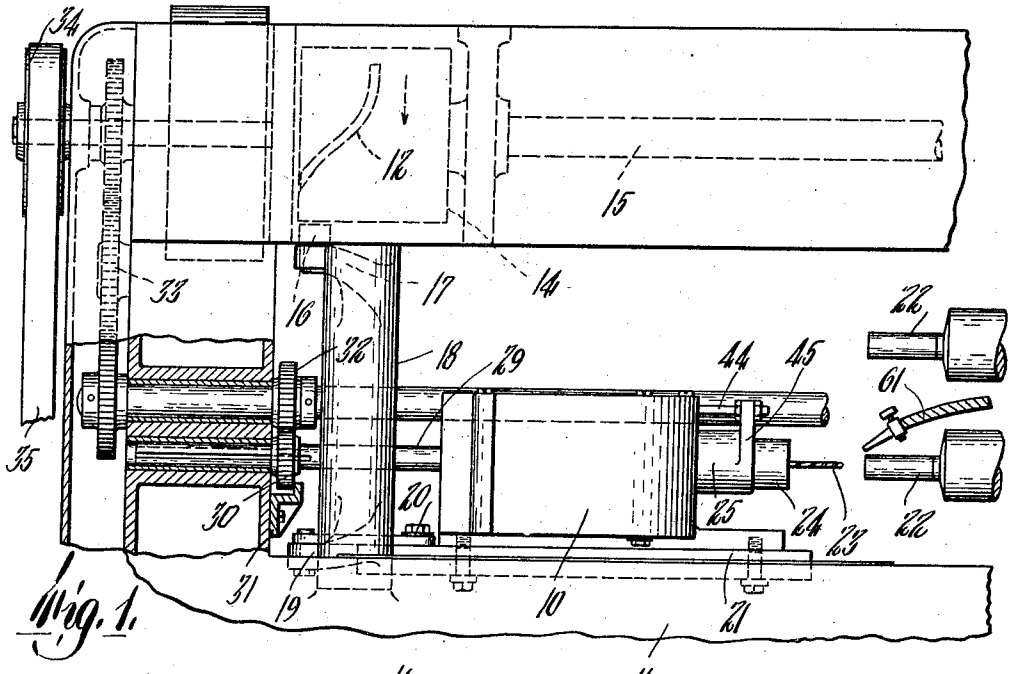


Fig. 1.

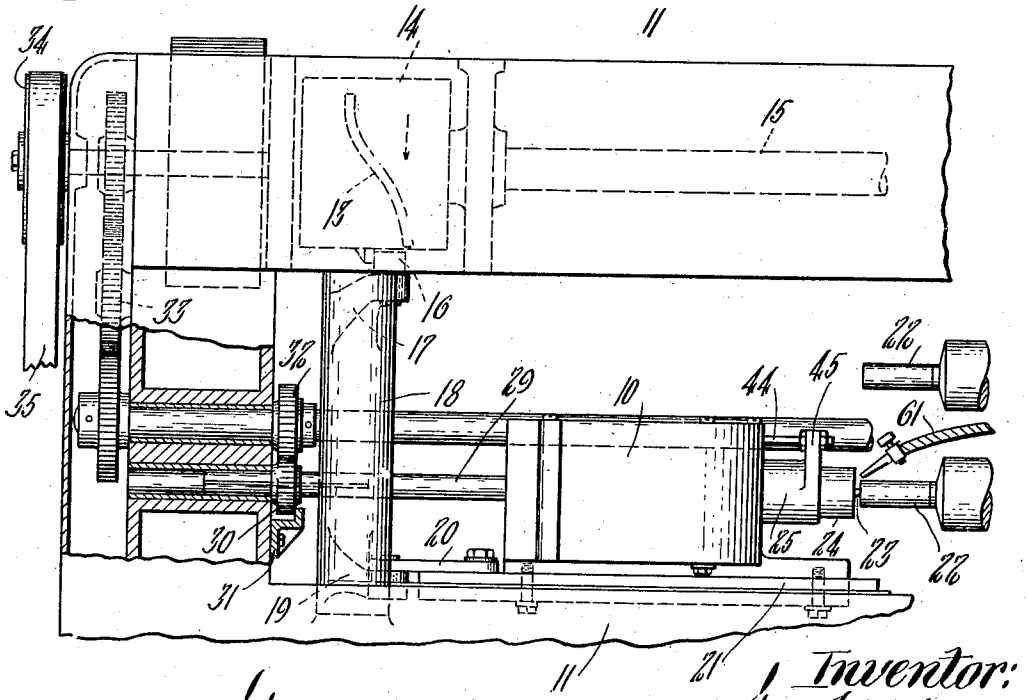


Fig. 2.

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RELIEVING DEVICE FOR HIGH SPEED DRILLS

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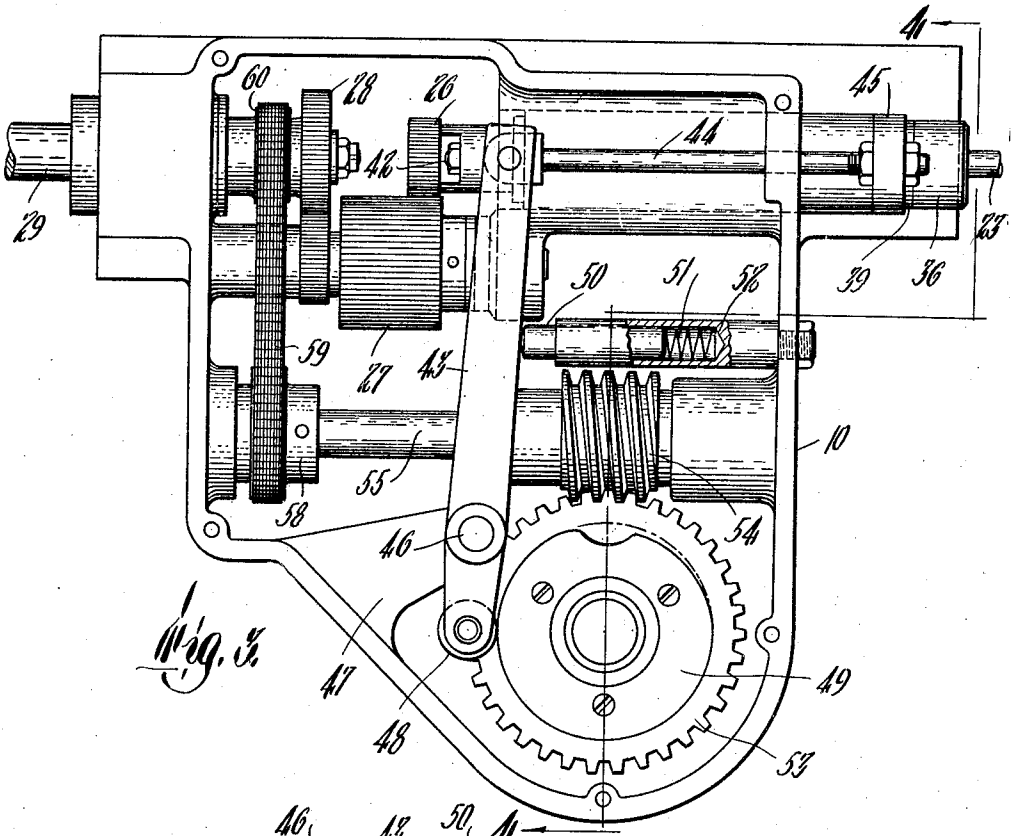


Fig. 3.

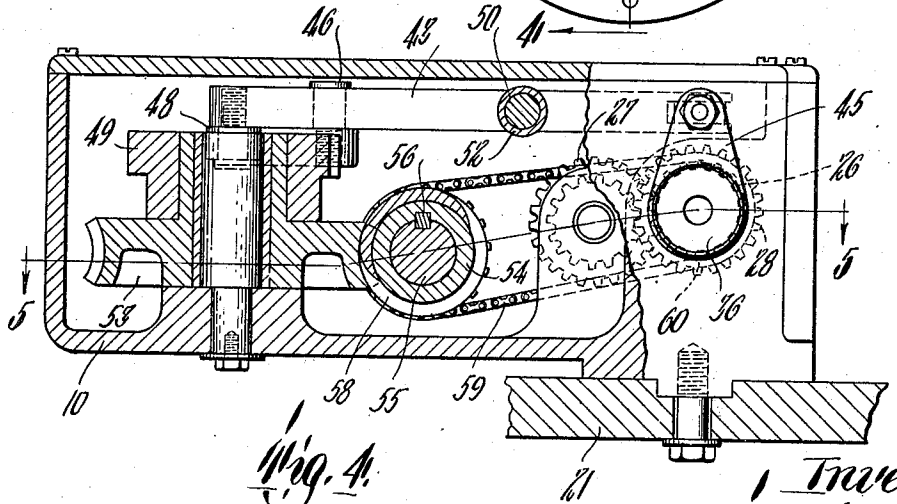


Fig. 4.

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RELIEVING DEVICE FOR HIGH SPEED DRILLS

Filed March 22, 1926 3 Sheets-Sheet 3

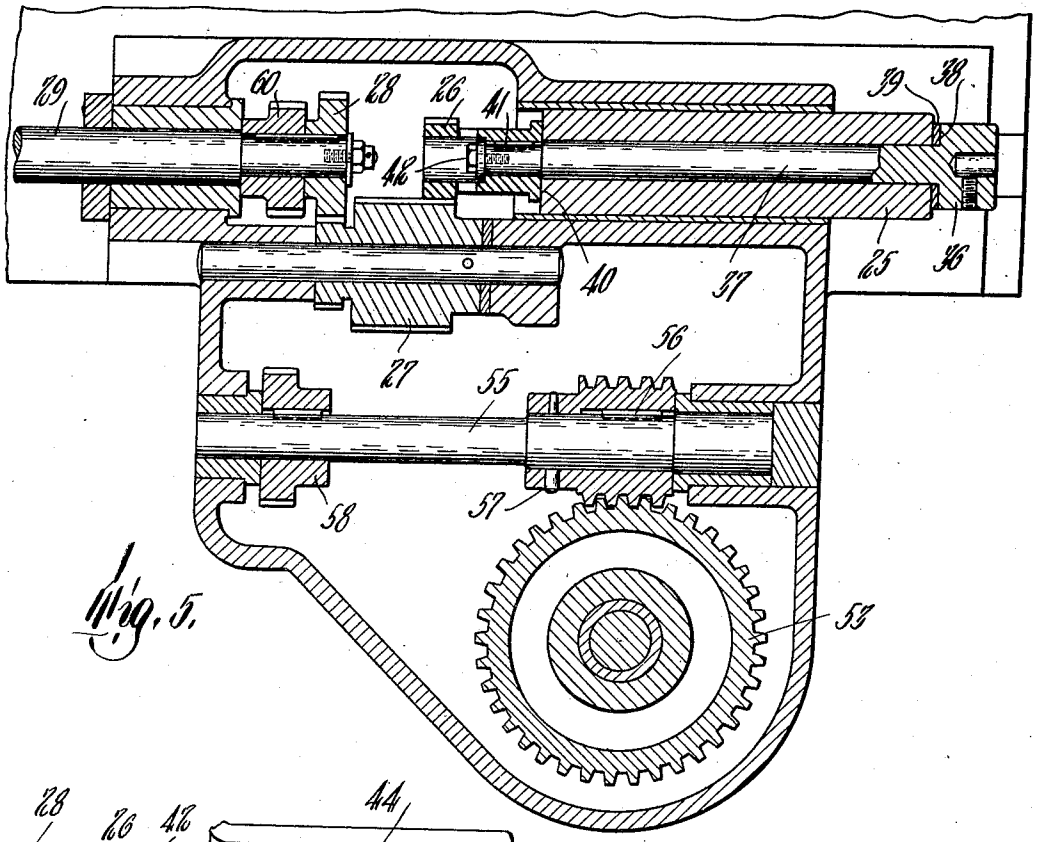


Fig. 5.

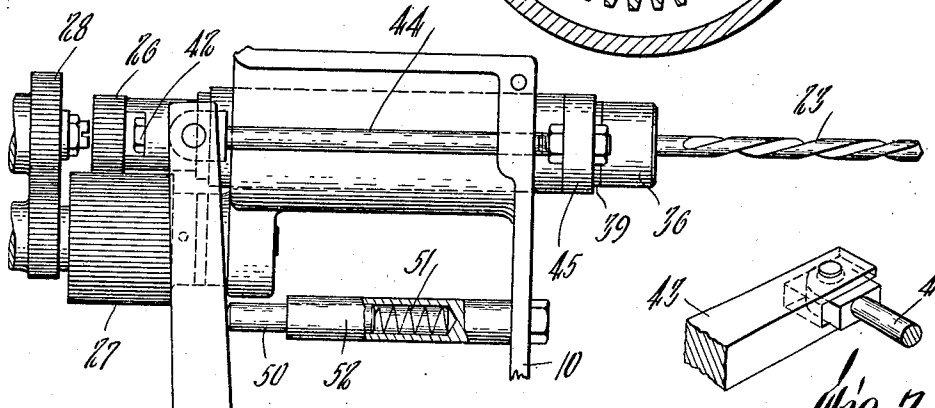
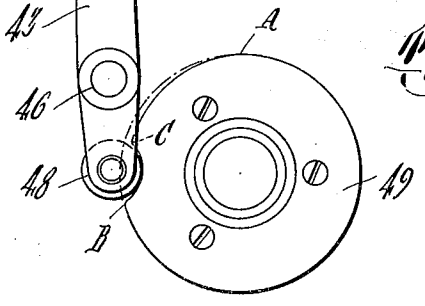


Fig. 6.

Fig. 7.



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Patented June 9, 1931 1,809,402

UNITED STATES PATENT OFFICE

FRANK L. CONE, OF WINDSOR, VERMONT

RELIEVING DEVICE FOR HIGH SPEED DRILLS

Application filed March 22, 1926. Serial No. 96,655.

This invention relates to automatic high-speed machines for drilling holes in metal, such, for example, as oiling holes in machine castings. It frequently becomes necessary to bore relatively small holes through relatively thick metal in finishing machine castings. In such cases, it has been difficult to remove the metal chips and to keep the drill point properly lubricated. Consequently much trouble has been experienced with drills overheating from excessive friction, sticking, and breaking off, occasioning considerable loss of time and waste of material. In order to complete the boring of such holes, it has been necessary for an operator to retract the drill from the work at frequent intervals to remove chips, re-oil the drill tip and prevent overheating. This has necessitated the constant attention of an operator in spite of which breakages frequently occur.

By my invention, a drilling machine will operate with minimum attention on the part of the operator and will bore holes more rapidly than has previously been possible without excessive heating or sticking of the drill.

I attain these results by means of a device which periodically retracts the drill from the work and at once returns the drill to the work, the retraction and return being made by relatively quick motions. Between these periodic reciprocations of the drill from and back to the work, are relatively longer periods during which the tool is advanced at suitable boring speed into the work. The travel of the tool in its reciprocating motion is preferably arranged to be greater than the depth of the hole to be drilled, so that at all stages of the drilling, the reciprocation of the drill will bring the tip thereof clear of the hole. During the instant it is clear of the hole, the tip or boring end is covered with oil and then automatically inserted into the hole again to continue boring.

Further advantageous combinations and features of construction will be found in the drawings in which

Figure 1 represents in elevation a portion of an automatic drilling machine, showing my device mounted thereon, the carriage being in position to commence boring.

Figure 2 is similar to Figure 1 except that the carriage is in its position at the completion of the boring.

Figure 3 is a plan view of the device with the cover plate removed to show the working parts.

Figure 4 is a section on the line 4—4 of Figure 3.

Figure 5 is a horizontal section on the line 5—5 of Figure 4.

Figure 6 is a detached view of some of the essential parts of the device.

Figure 7 is a detail of the joint between the operating lever and the connecting rod.

Referring to the drawings, a tool carriage 10 is mounted to slide upon the frame 11 of a drill, its motion being caused by the cams 12, 13 mounted on a drum 14 which is rotated through a shaft 15 by any desired means. The cams 12, 13 successively engage a cam follower 16, which is mounted on an arm 17 extending from a rock shaft 18 near the lower end of which another arm 19 is connected by a link 20 with the sliding base 21 of the tool carriage. The cams 12, 13, as may be seen from Figures 1 and 2, cause the tool carriage to slide alternately toward and away from the work, indicated at 22, and thus impart to the carriage primary tool-feeding and retracting motions. The tool or drill 23 is carried by a tool holder 24, which is rotatably mounted in a sleeve 25. The tool holder 24 may be rotated in any desired way. As shown in Figures 3 and 5, a pinion 26 is secured to the inner end of the tool holder meshing with a long gear 27, on which it can slide axially. The gear 27 meshes with a pinion 28 keyed to a shaft 29 which extends through the casing of the tool carriage and is splined through a pinion 30 (Figure 1) which is kept from axial motion by a bracket 31 and a face of the machine frame 11. This permits a constant rotation of the shaft 29 and the other mechanisms connected with it during the motion of the tool carriage toward and from the work. The pinion 30 is driven by any suitable means. As shown, it meshes with a gear 32 which is driven by a train of

gears indicated generally as 33 connecting it with a pulley 34 which is connected as by a belt 35 with any suitable source of power.

The tool holder 24 comprises a chuck 36 and a reduced portion 37 extending through the sleeve 25. A shoulder 38 formed on the chuck bears against a friction washer 39 at one end of the sleeve and a shoulder 40 formed by an extended portion of the pinion 26 bears against the other end of the sleeve 25, thus constraining the tool holder to move axially with the sleeve, but to be freely rotatable therein. The pinion 26 is secured to the tool holder 24 as by a key 41 and a screw 42. As shown in Figures 3 and 6, reciprocation of the sleeve and the tool holder carried therewith with respect to the carriage is effected through a lever 43, one arm of which is connected to a rod 44 which is secured to a lateral extension 45 formed at the outer end of the sleeve 25. This reciprocatory motion of the tool holder is superimposed on or compounded with the continuous feeding motion of the carriage itself. The lever 43 is preferably mounted for rocking on a pivot 46 formed on a boss 47 extending inwardly from the casing of the carriage 10. The other arm of the lever 43 carries a cam follower which may be in the form of a roller 48 and bars against the peripheral surface of an edge cam 49. The cam follower 48 is constantly held against the cam edge by a plunger 50 pressed by a spring 51, which is enclosed in a suitable socket 52 mounted on the casing of the carriage 10. The cam disc 49 is preferably secured concentrically with a suitable gear 53 which meshes with a worm 54 secured to a shaft 55 as by a key 56 and a pin 57. Keyed to the shaft 55 is also a sprocket 58, which is connected by a chain 59 to a sprocket 60, which is keyed to the shaft 29, so that both the tool holder 24 and the cam 49 are rotated from the shaft 29.

The shape of the cam surface on the disc 49 is clearly indicated in Figure 6. The major portion of the periphery of the disc is in the form of an arc of a circle concentric with the axis of rotation of the disc. As shown in Figure 6, this arc extends clockwise from A to B. This is followed by a short reentrant arc extending from B to C. The further end of this arc at the point C is nearer to the axis of the disc than is the point B. Thus the cam follower 48 upon reaching the point B will thereafter move toward the axis of the disc and will at once move away therefrom but not at once to its original distance. From C to A the cam surface comprises an arc which gradually increases in radial distance from the axis until at A it merges into the major circular arc.

While the follower 48 is in contact with the portion A—B of the cam surface, the tool holder 24 will be held fixed in its normal position with reference to the tool carriage, and as the tool carriage is advanced through the action of the cam 12, the tool progresses steadily into the work at a suitable drilling speed. When the cam follower passes the point B, the reentrant portion B—C of the cam allows the spring-pressed plunger 50 to retract the tool quickly from the hole at a greater than drilling speed. The tool in leaving the hole draws with it the chips which have been cut and receives oil or other lubricant on its tip from a suitable supply means, such as the pipe 61, before entering the hole again. During the retraction and return of the tool, the carriage as a whole has meanwhile moved a short distance in the direction of the work and has carried the tool that same distance with it. The tool is therefore returned by quick motion not to its normal position relative to the carriage, but to the point in the work from which it was retracted, the motion of the carriage during the reciprocation of the tool being compensated for by locating the point C of the cam slightly nearer to the axis of the cam than is the point B, so that the quick travel of the tool toward the work is a little less than its previous quick travel away. This prevents the rapid return travel of the tool at a greater than drilling speed from extending into the work beyond the point to which the tool has previously bored, and obviates the possibility of destructive shock of the tool against the bottom of the boring and a too rapid working feed. The arc C—A is shaped to return the tool gradually while it is boring to its normal position with respect to the carriage. This frequent periodical retraction of the tool from the hole which is being drilled, resulting in a frequent cleaning out of the chips from the hole and the re-oiling of the tip of the drill, permits rapid automatic drilling of holes at a far greater speed and with less difficulty due to breakage and necessary attention than has heretofore been possible.

Having thus described an embodiment of this invention, it should be evident to those skilled in the art that various changes and modifications may be made therein without departing from its spirit or scope as defined by the appended claims.

I claim:

1. In a device of the class described, a tool carriage having a tool-holder thereon, means for positively advancing the carriage continuously at a relatively slow speed through its range of travel toward the work, and means on said carriage for supporting said tool holder for advance substantially with the carriage, said last-named means operating periodically during the advance of the carriage for retracting said tool-holder from the work and returning the tool-holder at a relatively fast speed as far only as the position with respect to the work from which it was retracted.

2. In a device of the class described, a tool

carriage having a tool-holder thereon, means for positively advancing the carriage continuously through its range of travel toward the work, and means operating periodically during the advance of the carriage to retract the tool-holder by a relatively rapid motion from its normal position relative to the carriage, to advance the tool-holder by another rapid motion part of the way back to its normal position, and then to restore the tool-holder to its normal position relative to the carriage by a relatively slow motion.

In testimony whereof I have affixed my signature.

FRANK L. CONE.