May 20, 1952 O. S. COATES 2,597,292

POWER-DRIVEN JACKHAMMER

Filed April 30, 1949 2 SHEETS—SHEET 1

FIG. 1.

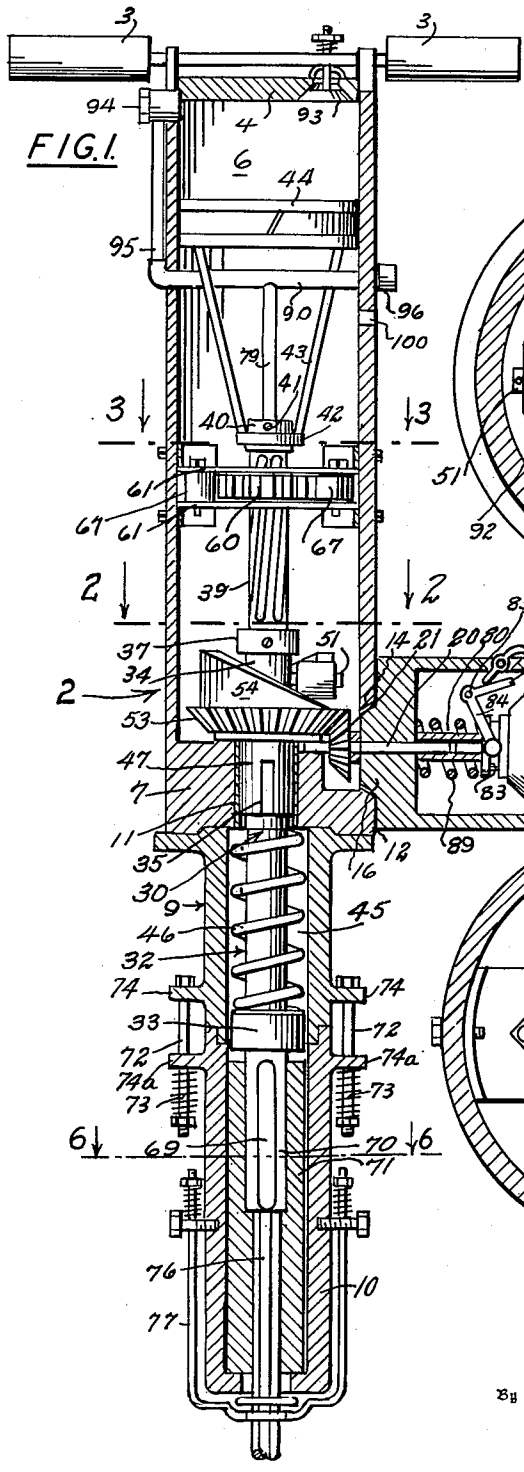


FIG. 2.

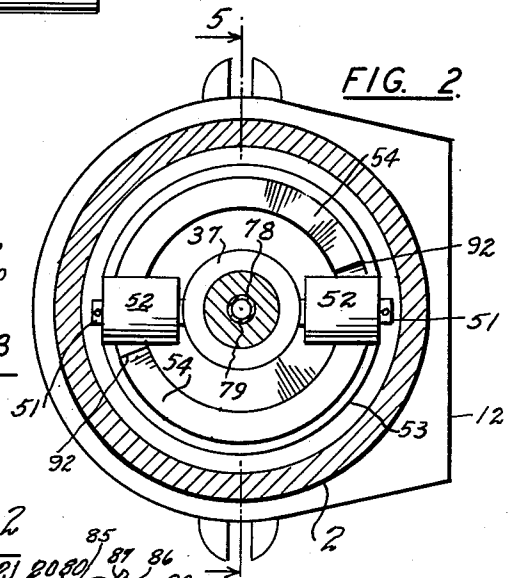
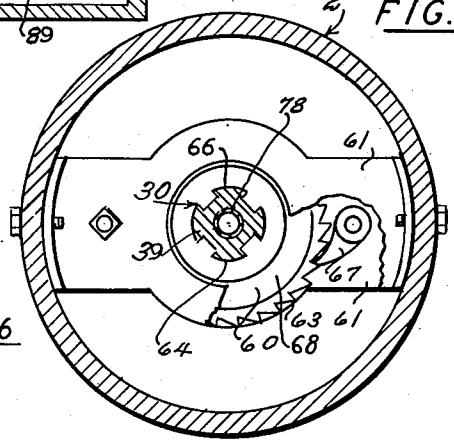


FIG. 3.



Inventor

Oscar S. Coates

By

Hall L. Norvell

Attorney

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POWER-DRIVEN JACKHAMMER

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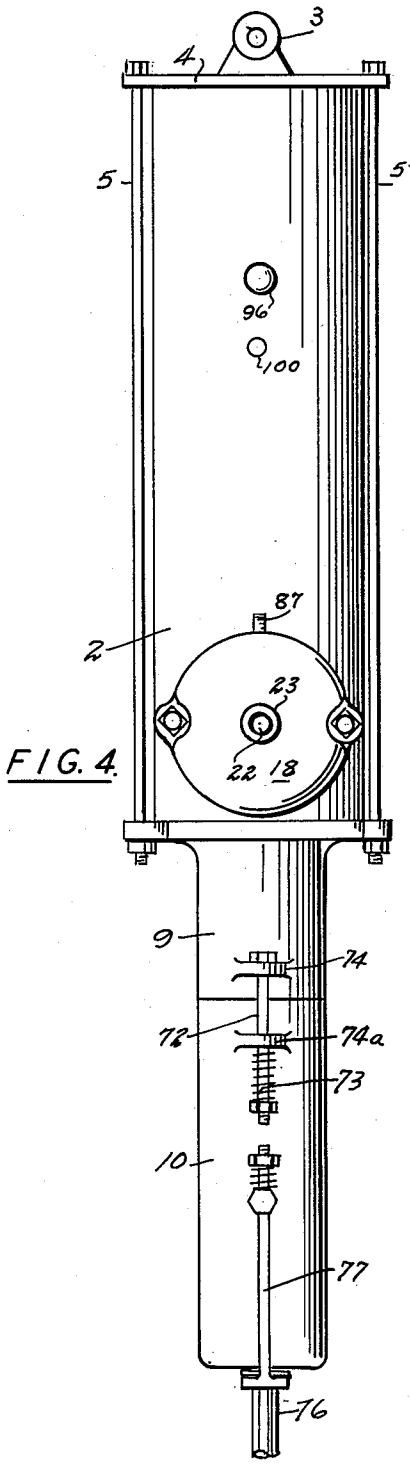


FIG. 4.

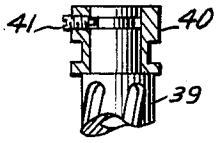


FIG. 7.

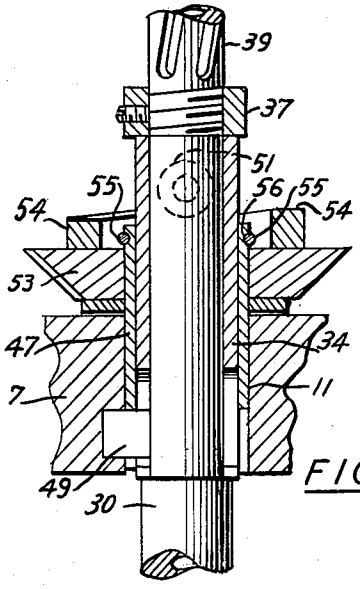


FIG. 5.

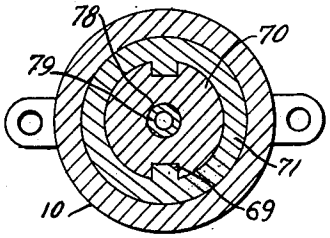


FIG. 6.

Inventor

Oscar S. Coates

By

Scott L. Norvel

Attorney

Patented May 20, 1952

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UNITED STATES PATENT OFFICE

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POWER-DRIVEN JACKHAMMER

Oscar S. Coates, Rock Springs, Ariz.

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4 Claims. (Cl. 255—42)

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This invention pertains to power driven jack hammers.

One of the objects of this invention is to provide a jack hammer having mechanism for converting rotary motion from a driving shaft to a series of mechanically produced blows adapted to drive drills, drill points or the like;

Another object is to provide a jack hammer having a cylindrical case with an air piston working with reciprocating hammer in said case to furnish air pressure for use in cleaning out drill holes;

Another object is to provide a jack hammer having a reciprocating striking head with means for coordinately rotating the striking and drill holding means a predetermined degree each time a blow is struck;

Another object is to provide a jack hammer as above described with means for supplying water to a hole being drilled.

A further object is to provide a light portable jack hammer which can be efficiently driven by a flexible shaft turned by a light motor of small horsepower;

A still further object is to provide a jack hammer, as above mentioned, with conveniently positioned handles and operating lever for controlling the application of power to the driving mechanism.

Other objects will appear hereinafter.

I attain the foregoing objects by means of the mechanism, and combination of parts shown in the accompanying drawings in which—

Figure 1 is an elevational sectional view of one form of jack hammer incorporating my improvements;

Figure 2 is a sectional plan view taken on line 2—2, Figure 1;

Figure 3 is a sectional plan view taken on lines 3—3, Figure 1;

Figure 4 is a vertical elevation of the jack hammer as viewed from the right side of the device as shown in Figure 1;

Figure 5 is a vertical sectional elevation of the column bar lifting mechanism, taken substantially on lines 5—5, Fig. 2; drawn on an enlarged scale;

Figure 6 is a section of the jack hammer case taken on lines 6—6 of Fig. 1; and

Figure 7 is a side elevation of the upper portion of the jack hammer column bar with the piston holding collar thereon shown in section.

Similar numerals refer to similar parts in the several views.

The mechanism of the jack hammer is enclosed

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within a forged or cast cylindrical case 2 to the top of which handles 3 are attached. The upper end of the case is closed by plate 4 and the interior portion of the case just below this constitutes an air cylinder 6. The bottom of the case is closed by a forged portion 7 to the bottom of which the hammer housing 9 is secured by rods 5. Drill chuck housing 10 is secured to hammer housing by bolts 12. The closure 7 has an axial bore 11.

A flattened face 12 is formed on the right side of case 2 and provided with a beveled hole 14 which receives beveled boss 16 on the inner portion of clutch housing 18.

Within the clutch housing is a drive shaft which extends radially relative to the axis of case 2 and carries bevel driving gear 21 on its inner end and a splined shaft receiving portion on its outer end. The inner portion of shaft 20 is journalled in the inner portion of housing 18 and the outer portion 22 in the outer wall 24. A sleeve 80 surrounds and is keyed to the inner portion of the drive shaft, while the inner end of outer portion 22 turns freely in the outer portion of this sleeve. A clutch cone 81 is keyed to the outer portion 22 of the drive shaft, and a mating clutch shell 82 is slidably keyed on sleeve 80 so that it will move from engaged position on cone 81 to a disengaged position, separated therefrom. Clutch shell 82 is provided with a hub 83 having an annular groove which receives clutch fork 84 pivoted at 85 and supporting a lever plate 86. Trigger 87 bears on this plate and is adapted to move it from the engaged position shown, to a disengaged position against the urge of clutch spring 89.

A threaded boss 23 on wall 24 surrounds the outer portion of shaft 20 to provide means for attaching a flexible shaft coupling (not shown).

Axially within case 2 is a reciprocating and rotating column bar 30. The lower portion of this bar is formed as a hammer 32. The lower enlarged cylindrical journal portion 33 bears in hammer housing 9 in which it slides and rotates. Above the hammer the column bar shaft is reduced in size and bears in the inner bore of cam roller lifting sleeve 34.

Above sleeve 34 the column bar shaft is reduced in size to provide a shoulder and is threaded to receive stop collar 37. Beyond this threaded portion the shaft is again reduced in size and machined to provide a plurality of spiral splines 39. The upper end is then reduced in size to form a journal to bear in bushing 40. This bushing is free to turn on the upper end of the column bar and is retained by screw 41 which has a dog point

engaging in an annular groove formed in the journal portion of the column bar near its upper end. Ring or plate 42 is forced onto bushing 40 and has two upwardly extending and diverging bars 43 which form a stirrup shaped structure to support piston 44 and attach it to the column bar. The upper ends of bars 43 are welded to the lower face of piston 44 at opposite points near its edge and the space between them is made adequate to admit the air and water pipe 90 which extends diametrically through cylinder 6. Piston 44 operates up and down within the upper part of cylinder 6 and above pipe 90, but does not rotate with the column bar.

Within the annular space 45 above cylindrical hammer portion 33 is the hammer or striking spring 46. The lower end of this spring bears on the upper annular face of hammer portion 33 and the upper end bears on the lower face of case closure 7.

Lifting sleeve 34 is provided with key way grooves 35 and is fitted into gear bearing sleeve 41 to have a free sliding fit. Bearing sleeve 41 is, in turn, tightly pressed into bore 11 in the bottom closure 7 of case 2. Keys 49 are fitted into the annulus of closure 7 surrounding bore 11, and extend through slots in sleeve 41, into grooves 35 in lifting sleeve 34. Lifting sleeve 34 is free to slide up and down in bearing sleeve 41, but is restrained from rotation by keys 49. The mid-portion of column bar 30 journals in lifting sleeve 34 and is free to turn therein.

Bosses 51 extend radially from each side of lifting sleeve 34 and journal cam rollers 52. These rollers are positioned to roll on the upwardly disposed faces of arcuate cams 54 which are formed on the upper face of driven bevel gear 53. This gear is journalled on bearing sleeve 41 and is retained by a C ring 55 locked in groove 50 at the top of this sleeve. It meshes with driving gear 21.

In the upper portion of case 2 a ratchet wheel 60 is supported between plates 61 which restrains its upward and downward movement.

The hub 68 of ratchet wheel 60 is provided with a hole 66 to receive the splined portion 64 of column bar 30. This hole is provided with grooves and lands shaped to mate the spiral splines 39 and the grooves between them. Pawls 67 attached to the case engage teeth 63 on wheel 60 and detain it from counterclockwise rotation as viewed from above (Figure 3). On the up stroke column bar 30 tends to rotate counterclockwise through the hub of wheel 60, and wheel 60 tends to rotate clockwise. Column bar 30 has more resistance to rotation, due to its frictional support within parts of case 2, and its inertia, than wheel 60 and therefore wheel 60 turns clockwise and column bar 30 does not turn. On the down stroke column bar tends to turn clockwise (as viewed from above) and ratchet wheel 60 tends to turn counterclockwise. Since pawls 67 detain counterclockwise rotation of wheel 60 column bar is forced to rotate clockwise. The degree of rotation depends on the pitch of spiral splines 39, and the length of the stroke.

A cylindrical drill chuck 71 fits loosely within chuck housing 10. A striking bar 70 is formed at the lower end of column bar 30 below the hammer portion 33. This striking bar extends into an axial bore in the upper portion of drill chuck 71. The striking bar is provided with splines 69 which mate grooves in the drill chuck 71, and impart rotary motion from the striking bar 70 to the chuck 71. Chuck housing 10 is releasably attached to sleeve 9 by bolts 12 extending downward through lugs 74 on sleeves 9 and through similar lugs 14a on chuck housing 10. Springs 13 are between the nuts at the lower ends of bolts 12 and lugs on the chuck housing 10. Hexagon drill 76 is retained in an axially extending mating hexagonal hole in the lower end of drill chuck 71 by swing latch or bail 77. Retention of drill 76 in chuck 71 by these devices is well known to the art.

The column bar 30 is drilled axially as shown at 78, Figures 2 and 3, to receive air and water tube 79 which connects to diametrically disposed tube 90 at the top. Drill 76 is axially bored, and its bore hole mates with the bore hole in the bottom of column bar 30.

In use the drill 76 is inserted in the chuck in the usual manner. The outer end 22 of the drive shaft 20 is connected to a flexible shaft operated by a small gasoline engine or electric motor. If the hole is to be drilled dry no water connection is made to tube 90. Driving gear 21 is then turned by power transmitted through clutch members 81 and 82. Gear 53 rotates arcuate cams 54 which raise rollers 52, sleeve 34, stop collar 37 and column bar 30 against the urge of spring 46. When the lips 92 of the cams pass beneath the rollers 52, bar 30 is forced downward by spring 46. This causes hammer 32 to strike the upper end of drill 76. The number of blows struck is governed by the speed of the drive shaft and the ratio of gears 21 and 53.

As column bar shaft 30 reciprocates spiral splines 39 traveling axially on the hub hole or ratchet wheel 60 rotate it a predetermined distance as above explained. The mechanism including ratchet wheel 60, pawls 67, and the splined portion 39 of striking bar 30, constitutes a means for rotating drill 76. This rotary movement is imparted to drill 76 through chuck 71 to keep it from binding in the hole.

Coincidentally piston 44 operates in cylinder 6. Air is drawn in through intake valve 93 and forced out through outlet valve 94 to transverse pipe 90, and thence down through tube 79 which slides in the axial bore 78 of column bar 30. This air is in turn forced through the bore of drill 76. Normally the outer end of pipe 90 is closed by cap 96.

When water is required for drilling rather than air, cap 96 is removed from pipe 90, and a water hose connected. Water may then be forced through tube 79 and air forced along with it. Valve 94 keeps water out of cylinder 6, and air pumping action may be stopped by holding inlet valve 93 open. Breather hole 100 is drilled in case 2 to relieve pressure below piston 44.

Summarizing operational use of the drill: shaft 22 is driven by a motor; operation is controlled by trigger 87 which controls the clutch; the gears and rotary cams raise the column bar shaft 30 and its attached parts against tension of spring 46; the column bar shaft turns as it reciprocates, and either air or water may be forced down the shaft and drill. In normal use the drill may be held by handles 3, and drill 76 chucked in the conventional manner.

I claim:

1. A power driven jack hammer, including, in combination, a cylindrical case body; an axially bored column bar axially operative therein; a hammer portion on the lower end of said column bar having a striking bar at its lower end; a drill chuck adapted to receive said striking bar at its upper end having means for retaining a drill in its lower end, a drill having an axial opening

secured in said chuck, a spring within said case surrounding said column bar extending between said column bar and said case normally urging said column bar downward to striking position; means for raising said column bar against the urge of said spring and quickly releasing it, including horizontal cam rollers journalled radially relative to said column bar, and operatively associated therewith to communicate axial motion thereto, arcuate cams operative around said column bar beneath said cam rollers, gears adapted to drive said cams, a drive shaft, and a manually operatable clutch to control rotation from said drive shaft to said gears, and means for clearing the hole drilled by said drill comprising a cylinder formed within the upper end of said cylindrical body, a piston attached to the upper end of said column bar, operative in said cylinder, an air inlet valve opening into said cylinder, an air outlet valve and a pipe leading from said outlet valve to the axial bore of said column bar and extending therein in slidable air tight relation thereto.

2. A power driven jack hammer comprising in combination a cylindrical case having radially extending handles at the top, an air cylinder formed within its top portion, a bottom closure having an axial bore, an axially bored sleeve secured to the lower end of said case forming a hammer housing on its lower end, and an axially bored drill chuck housing detachably secured to said sleeve; a column bar axially operable in said case and having an axial bore, a hammer portion adjacent its lower end having an enlarged journal portion bearing in said hammer housing, a striking bar below said enlarged journal portion, a portion above said enlarged journal portion adapted to receive a striking spring, and spiral splines formed on the upper portion of said column bar; a striking spring surrounding said hammer portion engaging between said enlarged bearing portion at its bottom and said case bottom closure at its top normally urging said column bar downward; mechanism for axially reciprocating said column bar including a lifting sleeve secured to said column bar journalled for axial sliding motion within the axial bore in the bottom closure of said case having sliding key slots; keys within the bore of said case closure slidably engaging in said slots in said lifting sleeve to restrain it from rotation, radially extending cam rollers attached to the upper portion of said lifting sleeve, a driven bevel gear journalled on said lifting sleeve having cams on its upper surface cooperative with said cam rollers and shaped to produce a slow lift and a quick release therefrom; a driving bevel gear meshing with said driven bevel gear keyed to a radially extending shaft journalled in said case; mechanism including a clutch for rotating said radially extending shaft; a drill chuck operative in said drill chuck housing adapted to receive said striking bar at its upper end keyed to rotate therewith and adapted to receive a hexagon shaped axially bored drill at its lower end; mechanism for forcing air through the bore in said column bar to the drill in said chuck including a piston secured to the upper end of said column bar and operative in the air cylinder of said case, an inlet valve in the top of said cylinder, an outlet valve in the top of said cylinder connected to a pipe axially positioned in said case and fitted into the axial bore of said column bar in air tight relation therewith; and mechanism for rotating said column bar including a ratchet wheel journalled within said case

having a hub bored and provided with grooves and lands bearing on and cooperative with the spiral splined portion of said column bar, pawls within said case engaging said ratchet wheel to permit its rotation in one direction and detain its rotation in the opposite direction, whereby said column bar will be rotated by axial movement of said splined portion therethrough.

3. In a power driven jack hammer, having a cylindrical case with a drill chuck housing at its lower end, an axially operative column bar therein having a hammer portion at its lower end, and mechanism for axially reciprocating said column bar and for holding a drill in operative contact with said hammer portion, the combination therewith of mechanism for rotating said column bar and a drill held in operative contact with the hammer portion thereon, coincidental to its axial striking motion, including spiral splines formed on the upper portion of said column bar, a ratchet wheel journalled within said case having a hub provided with lands and grooves adapted to operatively receive said splined portion of said column bar; pawls attached to said case adapted to engage said ratchet wheel and detain it from rotation in one direction, a striking bar formed on the lower end of said column bar hammer portion; a drill chuck operative in the drill chuck housing of said case having an axial opening adapted to receive said striking bar at its upper end in axially slidable relation thereto and to receive a drill in fixed rotational relation at its lower end, and splines operative between said striking bar and said opening in the upper end of said chuck so that rotary movement of said column bar is communicated to said chuck.

4. A power driven jack hammer comprising, in combination, a cylindrical case having radially extending handles at the top, an air cylinder formed within its top portion, a bottom closure having an axial bore, an axially bored sleeve secured to the lower end of said case forming a hammer housing on its lower end, and an axially bored drill chuck housing detachably secured to said sleeve; a column bar axially operating in said case, having an axial bore, a striking bar at its lower end, an enlarged hammer portion thereabove, a journal portion above said enlarged hammer portion, and a portion of reduced size thereabove having spiral splines and terminating in a collar journal; a striking spring surrounding the said hammer portion of said column bar, engaging between the enlargement thereof and said case bottom and normally urging said column bar downward, a lifting sleeve bearing on said journal portion of said column bar and secured thereto to communicate lifting motion to said column bar against the urge of said spring; said lifting sleeve having longitudinal key slots; keys fitted into the axial bore in the bottom of said case and slidably engaging the key slots in said lifting sleeve to restrain it from rotation; radially extending cam rollers attached to said lifting sleeve; a driven bevel gear journalled on said lifting sleeve below said cam rollers and journalled on said case bottom closure to resist downward thrust, having cams on its upper surface cooperative with said cam rollers to produce a slow lift and quick release therefrom; a driving bevel gear meshing with said driven gear operating on a radially extending shaft journalled in said case; a drill chuck operative in said drill chuck housing adapted to slidably receive said striking bar at its upper end, keyed to rotate

therewith, and having an axially disposed hexagonal hole within its bottom portion; a hexagon drill bar having an axial bore fitted into the lower end of said drill chuck; a resiliently supported latching bail securing said drill bar in said chuck; a piston secured to the upper end of said column bar on a bearing collar, and operating in said air cylinder; valves operating in said cylinder to draw air therein and expel it therefrom, and a tube connected to said cylinder through one of said valves adapted to carry air therefrom to the axial bore of said column bar; and a ratchet wheel journalled within said case having a hub formed with a centrally positioned opening having grooves and lands adapted to slidably receive the splined portion of said column bar; pawls on said case cooperative with said ratchet wheel to restrain its rotation in one direction whereby

said column bar will be rotated by axial movement of its said splined portion through the hub of said wheel.

OSCAR S. COATES.

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