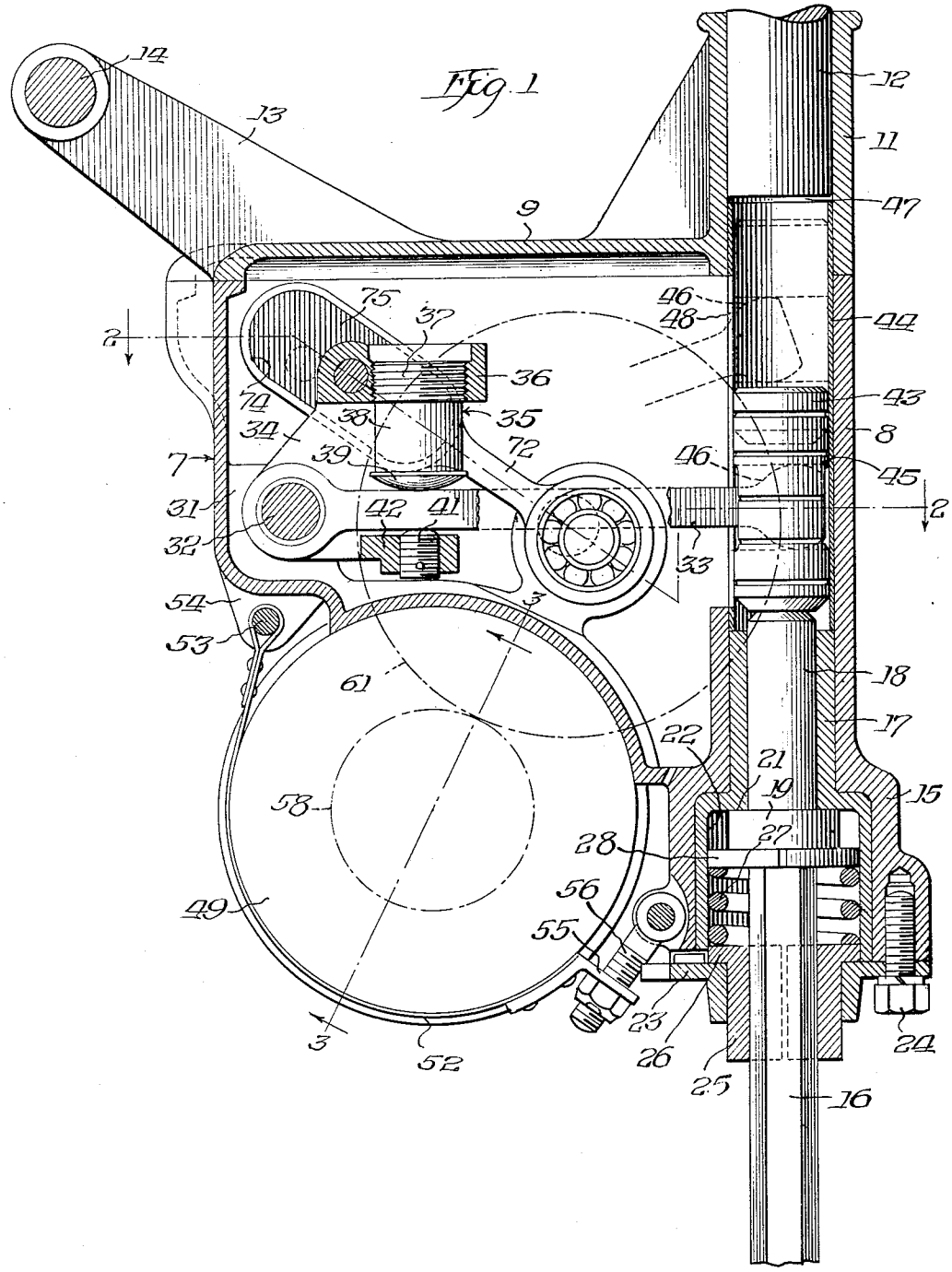
Oct. 31, 1933. H. S. BROWN 1,932,723

VIBRATORY TOOL

Filed Sept. 4, 1928 3 Sheets-Sheet 1

Fig. 1



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VIBRATORY TOOL

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Fig. 2.

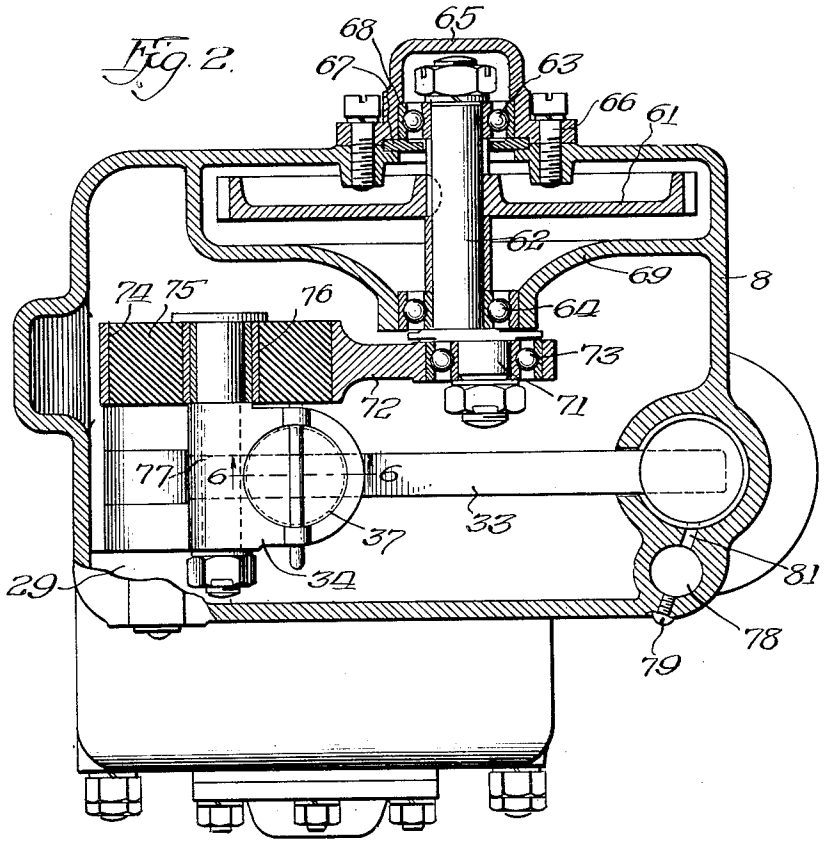


Fig. 4.

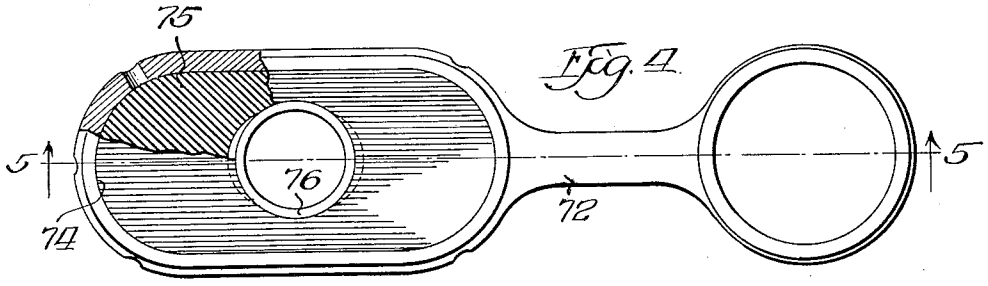
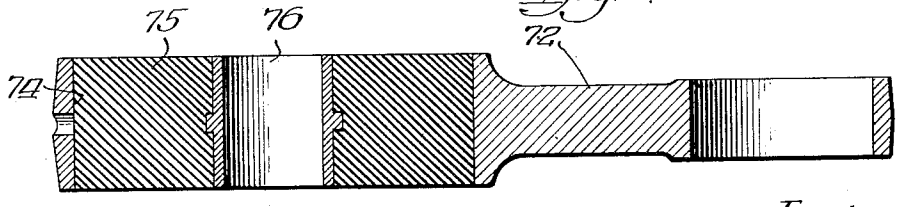


Fig. 5.



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VIBRATORY TOOL

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Fig. 3

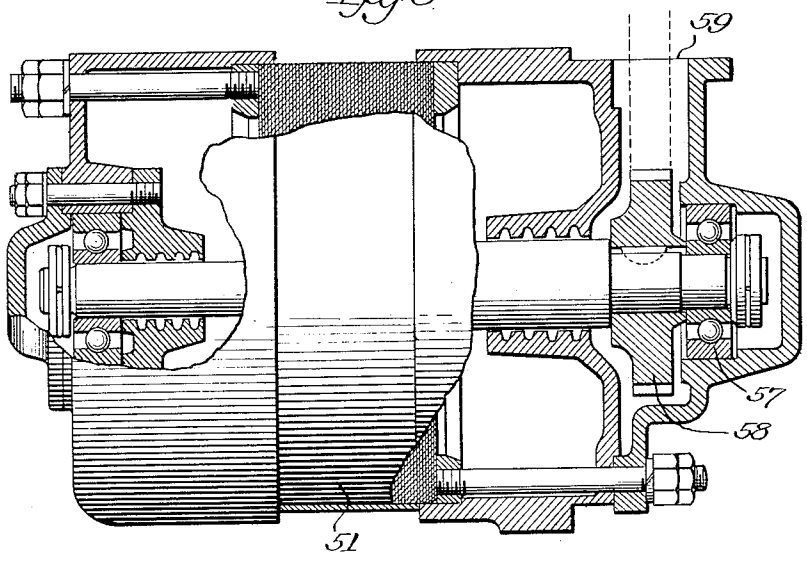
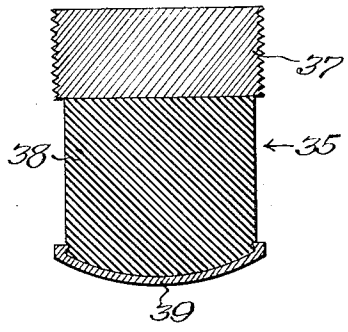


Fig. 6



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Patented Oct. 31, 1933 1,932,723

UNITED STATES PATENT OFFICE

1,932,723

VIBRATORY TOOL

Hugh S. Brown, Harvey, Ill.

Application September 4, 1928. Serial No. 303,703

1 Claim. (Cl. 125—33)

This invention relates to portable reciprocating tools, such, for example, as rock drills, tampers and other devices which can be handled and controlled in a convenient manner by a single operator.

It is highly desirable that devices of the above type be as light as possible and that the vibratory impulses, except those delivered to the tool itself, be reduced to a minimum in order that as little power as possible will be required to operate the tool and as little effort as possible will be required to control the same.

One of the primary objects of this invention is accordingly to provide a vibratory tool in which the vibration through the casing is reduced to a minimum.

Another object of this invention is to provide a vibratory type of tool which is light in weight, simple in construction and efficient in operation.

A further object of the invention is to provide a tool of the above type in which the operating parts of the tool, except for that part which is necessary to contact the work, are completely inclosed.

A further object of the invention is to provide a vibratory type of tool employing a hammer in which the extreme withdrawal movements of the hammer are retarded by means providing an air cushion, thus reducing the amount of vibration transmitted to the casing.

A further object of this invention is to provide a tool of the above character the operating parts of which are inclosed, but are readily accessible for inspection, renewal, or repair.

Other and further objects of this invention will be apparent as the same becomes better understood from an examination of the specification and claim in connection with the accompanying drawings, wherein

Fig. 1 represents a vertical fragmentary sectional view of a device embodying this invention.

Fig. 2 is a section taken on the line 2—2 of Fig. 1 showing parts in elevation.

Fig. 3 is a detail section with parts in elevation of the driving motor taken on the line 3—3 of Fig. 1.

Fig. 4 is an enlarged detail view partly in section of the connecting rod for connecting the crank shaft and rocker.

Fig. 5 is a section taken on the line 5—5 of Fig. 4, and

Fig. 6 is an enlarged detail vertical section of the adjustable plug by means of which a rocker drives the hammer on its downward stroke.

Referring to the drawings more particularly, numeral 7 designates a casing for the operating mechanism. This casing may be cast to provide a lower section 8 and an upper or cover section 9, which may be bolted thereto in a suitable manner as by bolts (not shown) extending into ears formed integrally with adjacent contacting portions of the section. The section 9 is provided with an upwardly extending sleeve 11 which is adapted to receive and have secured therein a pipe 12 the upper end of which is provided with a suitable handle (not shown). The housing member 9 is also provided with a laterally projecting bracket 13 which is provided with a handle 14. By means of these handles the tool may be conveniently controlled.

The lower end of the housing section 8 is provided with a downwardly extending sleeve 15. Supported with its upper end extending into this sleeve is a tool 16, such as a drill or tamping tool. A bushing 17 is provided within the sleeve 15 for the reciprocable tool 16. This bushing acts as a bearing for an upper portion 18 of the tool 16. A collar 19 integrally formed on the tool 16 beneath the portion 18 engages an annular shoulder 21 formed by an enlargement 22 of the lower portion of the bushing 17 to limit the upward movement of the tool 16. An annular flanged member 23 is removably secured to the open end of the sleeve 15 by means of studs 24. A bushing 25 provided with an annular flange 26 projecting radially over the inner edge of the member 23 is carried thereby and acts as a bearing for the lower portion of the tool 16. A spring 27 surrounding the tool 16 above the bushing 25 acts against a split collar or washer 28 beneath the collar 19 to yieldably hold the tool 16 in position to be engaged by the striking or operating mechanism which will presently be described.

Formed integrally with the casing section 8 are bosses 29 and 31 which support a pin 32. This pin serves to pivotally support a lever or helve portion 33 of a hammer and a rocker mem-

ber 34 concentric therewith. This rocker member is oscillated about its pivot by the driving motor through the medium of operating connections, which will presently be described. A yieldable connection is provided between the helve 33 and the rocker 34 at a position spaced from their common pivot whereby the helve may be driven with a minimum of vibration imparted to the casing. To this end I provide a yieldable plug, generally designated 35, adjustably threaded in an upper arm 36 of the rocker in a direction at right angles to the normal position of the helve.

As shown in Fig. 6, this plug 35 includes a metal portion 37 threaded on its outer periphery to cooperate with threads in the arm 36 and includes a cylindrical rubber portion 38 depending from the metal portion and formed by vulcanizing the rubber thereto. The lower end of the plug is provided with a downwardly rounded cap 39 for contacting the helve. This cap, like the metal portion of the plug is attached to the rubber during the vulcanizing process.

A screw plug 41 threaded in a lower arm 42 of the rocker 34 at right angles to the normal position of the helve acts to hold the same against the yieldable plug 35. By means of the yieldable connection provided by the plug 35, the force of the helve is not at its maximum at the end of a downward or striking stroke, but, on the other hand, considerable potential energy is built up within the rubber in the plug during the striking stroke and this energy is expended at the end of the stroke as the head of the helve strikes the upper end of the tool 16.

In order to further reduce the vibrations imparted to the casing, it is desirable to cushion the upper limits of travel of the helve. For this purpose the hammer head 43 is in the form of a piston which is slidable within a cylinder 44 supported between the sleeves 11 and 15. This head 43 is transversely apertured or recessed, as at 46, intermediate its ends, into which the free end of the helve 33 fits the free end being provided with an enlarged ball shaped portion 46 which extends into the recess 45 for connecting the helve to the head. The upper end of the cylinder 44 is blanked off by a disk 47 below the pipe 12 and the cylinder is provided with a longitudinal slot 48 for accommodating the helve throughout its travel. The travel of the head 43 extends for a considerable distance beyond the upper limit of the slot 48, whereas it does not extend an appreciable distance beyond the lower extremity of this slot. For this reason, a predetermined amount of air is compressed by the head 43 at its extreme upper limits of travel for cushioning the extreme withdrawal movements of the head and reducing the vibration imparted to the casing.

The mechanism for oscillating the rocker 34 will now be described. The outer lower surface of the casing secton 8 is shaped cylindrically to form a cradle for a driving motor 49 and casing therefor. The casing for this motor 49 is provided with a central circumferential groove 51 for accommodating a strap 52 by means of which the motor is attached to the casing section 8. One end of the strap 52 is pivotally attached to the latter casing section by means of a pin 53 extending between a pair of lugs 54 integrally formed on said section. The other end of said strap is provided with a lug 55 adapted to cooperate with a screw dog 56 pivotally attached to the sleeve 15.

In order that none of the moving parts of the motor or its connections to the vibratory mechanisms may be exposed, the motor is so constructed that the bearings 57 for the armature shaft are supported by the motor casing at the respective ends thereof, the ends of the shaft being entirely enclosed and the driving pinion 58 of the motor mounted on the shaft inside of one of these bearings instead of outside the motor on an outer end of the armature shaft as in the usual practice. The motor casing is provided with an opening 59 and the casing section 8 for the vibratory or operating mechanism is provided with a corresponding opening for permitting a large gear 61 mounted within the casing section 8 to mesh with the pinion 58. The gear 61 is rigidly mounted upon a crank shaft 62 mounted in the casing section 8 on spaced ball bearings 63 and 64. The ball bearing 63 is carried in a cap 65 inclosing the outer end of the shaft 62 and bolted to the casing section 8 by means of bolts 66. An annular disk 67 fitting within cooperating recesses in the contacting surfaces of the cap 65 and casing section 8 surrounds the shaft 62 and acts to hold the ball bearing unit against an annular shoulder 68 on the interior of said cap when the bolts 66 are tightened. The ball bearing unit 64 is centrally carried in a partition 69 integrally formed within the section 8 in a manner to segregate the gear 61 from the rest of the interior of said section.

The inner end of the shaft 62 extends into the interior of the section 8 beyond the partition 69 and is in the form of a crank 71. A connecting rod 72 is connected at one end to the crank 71 through the intermediary of a ball bearing unit 73. The other end of the connecting rod 72 is enlarged and provided with a longitudinally extending opening 74 in which is vulcanized under pressure a body of rubber 75 for floating a bushing 76. This bushing acts as a bearing for a transverse pin 77 extending through the rocker member 34.

In the operation the motor may be controlled by means of a suitable switch in proximity to either one of the handles of the device. When the motor is driven it will act through the pinion 58 and gear 61 to drife the shaft 62. This shaft through the intermediary of the crank 71 and connecting rod 72 will oscillate the rocker 34. The rocker 34 acts, as previously described, to reciprocate the helve 33 and head 43 to strike the tool 16.

It will be seen that by reason of the provision of the air cushion for retarding the extreme withdrawal movements of the head 43 considerable vibratory impulses, which would otherwise be imparted to the casing, are avoided. The yieldable connection between the rocker 34 and the helve afforded by the yieldable plug 35, and the floating bearing 76 of the connecting rod 72 also reduce the vibratory impulses imparted to the casing.

An oil well 78 is formed within the wall of the casing section 8 and runs longitudinally with respect to the cylinder 44. This well is provided with inlets 79, whereby it may be filled from without, and ducts 81 communicating with the interior of said cylinder for lubricating the head 43.

It will also be apparent that the aforedescribed construction is rugged and that it is sim-

ple to manufacture and convenient to operate. The parts are readily accessible for inspection, renewal or repair.

I am aware that many changes may be made without departing from the principles of this invention and I therefore do not wish to be limited to the details described.

I claim:

In a portable self-contained vibratory tool, a portable casing having a cylinder therein closed at one end and slotted at one side for a portion of its length, said slot terminating short of said closed end to form a sealed cylinder portion, a hammer having a head snugly fitting within said cylinder for reciprocable movements toward and from the sealed end of the cylinder, one end of the hammer head on its working stroke uncovering the end of the slot adjacent said sealed cylinder portion, a helve pivotally mounted in said casing and operatively connected to said hammer, said helve extending through the slotted portion of said cylinder, and means for reciprocating said helve including a motor secured to said casing and connections from the motor to the helve.

HUGH S. BROWN.