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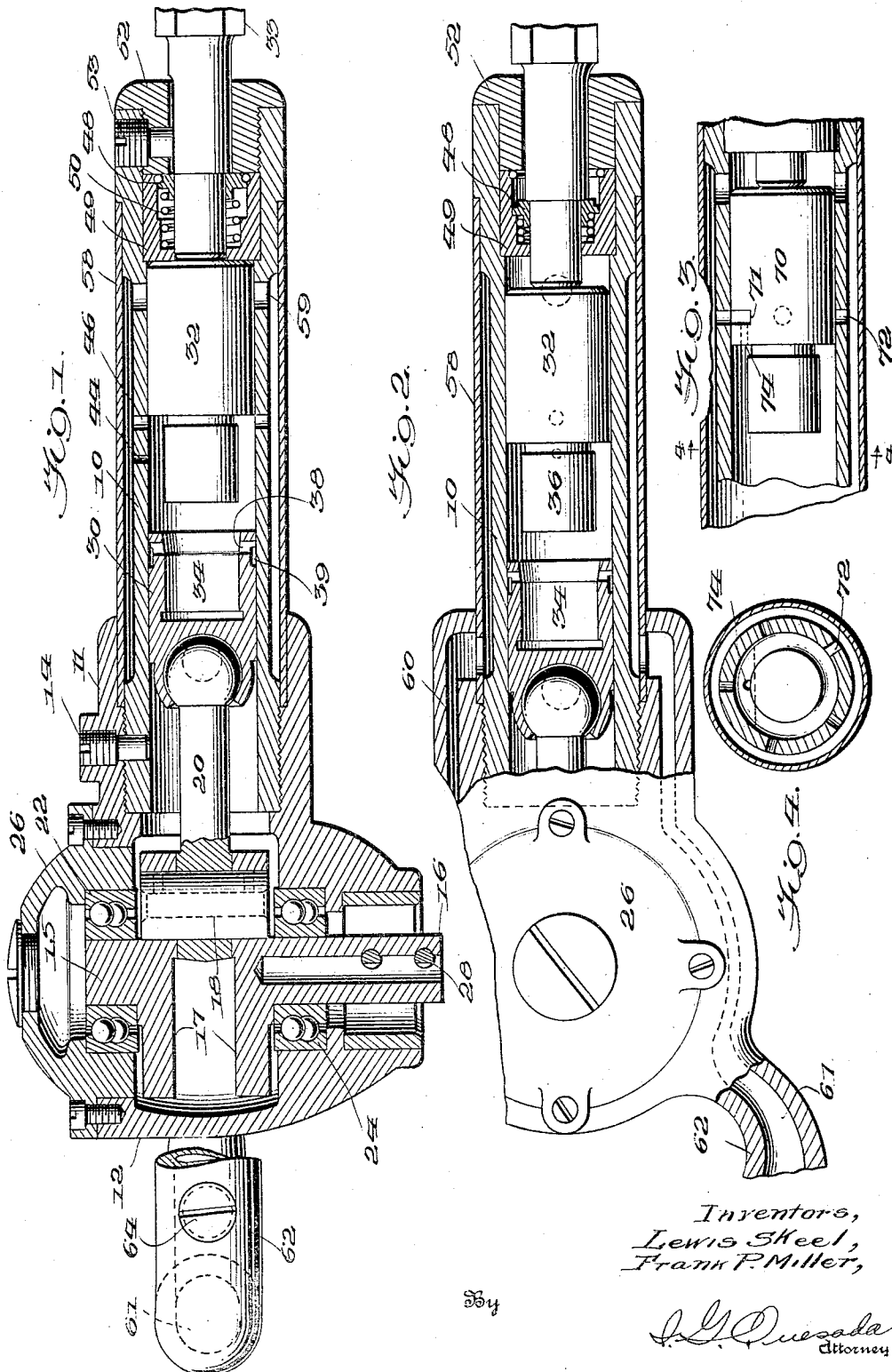
L. SKEEL ET AL

1,901,779

POWER HAMMER

Filed Sept. 19, 1928

2 Sheets-Sheet 1



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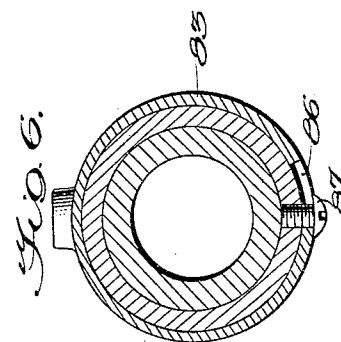
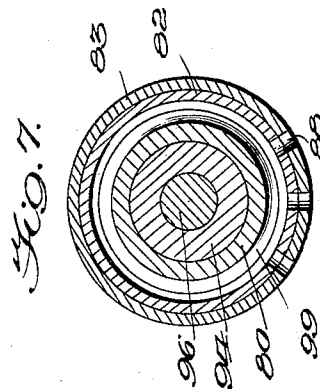
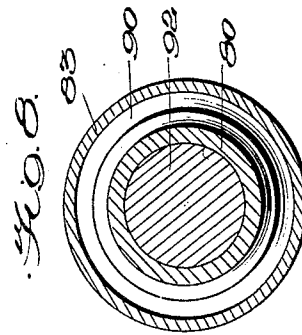
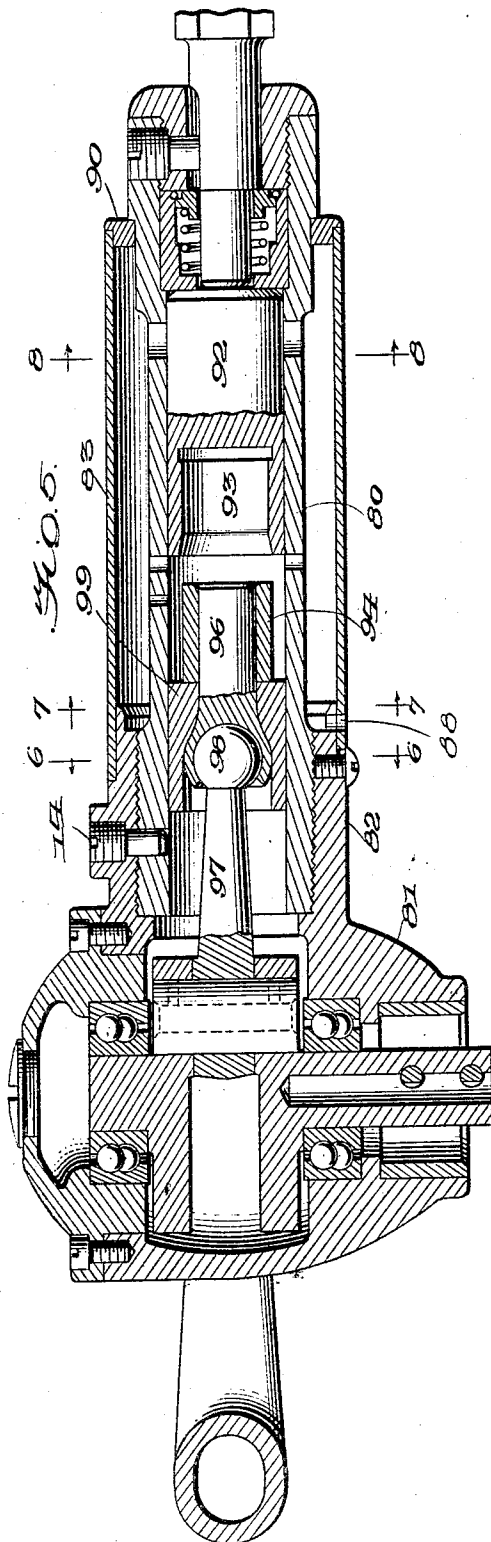
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POWER HAMMER

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2 Sheets-Sheet 2



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POWER HAMMER

Application filed September 19, 1928. Serial No. 306,955.

A hammer constructed in accordance with this invention will be found to embody means by which the reciprocation of a driving piston is imparted to a freely movable striking element through the alternate compression and rarefaction of the air between these two bodies and to provide for the automatic replenishment of such supply of air at regular intervals to maintain a constant and fully operative relation between the driving piston and the striking element whereby to utilize to the greatest advantage the power of the hammer except, of course, when the hammer is intentionally idled.

Another attribute of the invention resides in the means by which the air alternately admitted to and discharged from the cylinder of the hammer may be completely isolated to avoid contamination thereof by the surrounding dust laden air, in consequence of which the moving parts of the hammer are protected against excessive wear.

The herein described hammer further provides for the lubrication of the supplemental air chamber in one of the motion transmitting members, such as the driving piston, first, to reduce the friction incident to the movement of a piston-like extension of the other motion transmitting member into said chamber and the engagement of the extension with the wall of the chamber and second, to aid in the establishment of a substantially air tight seal between said extension and the wall of the chamber, the open end portion of said chamber being slightly flared to define a gradually restricted entrance opening by which said extension is guided accurately into the supplemental air chamber.

The invention further embodies a novel tool holder which may be detachably connected to the cylinder of the hammer and which is designed to hold the tool, such as a star drill, in proper position and to be freely removable.

Other objects and advantages will be apparent during the course of the following description.

In the accompanying drawings forming a part of this application and in which like

numerals are employed to designate like parts throughout the same,

Figure 1 is a vertical sectional view through the hammer in an idle or neutral position,

Figure 2 is a fragmentary longitudinal sectional view through the hammer in an operative position,

Figure 3 is a detail sectional view illustrating a slight modification of the invention,

Figure 4 is a sectional view taken on line 4—4 of Figure 3,

Figure 5 is a vertical sectional view through another modification of the invention,

Figure 6 is a transverse sectional view taken on line 6—6 of Figure 5.

Figure 7 is a transverse sectional view taken on line 7—7 of Figure 5,

Figure 8 is a transverse sectional view taken on line 8—8 of Figure 5.

In the drawings the numeral 10 designates a cylinder preferably of bronze and having the rear portion thereof threaded into what might be said to be the attaching portion 11 of a housing 12. The attaching portion 11 and the adjacent portion of the cylinder 10 are provided with radial openings adapted to be brought into registration for the reception of a fastening screw 14 by which the cylinder is held against turning with respect to the housing.

In carrying out the invention a more or less conventional motion transmitting mechanism is located within the housing 12 and comprises in part, spindles 15 and 16 having similar counterbalanced disks 17 to which the wrist pin 18 of a short connecting rod 20 is attached. Suitable anti-friction elements 22 and 24 rotatably support the spindles 15 and 16 respectively. The anti-friction element 22 is shown to be carried by the closure plate 26, while the anti-friction element 24 is carried by the housing 12. It will be seen that the axial bore of the spindle 16 is provided with transverse pins 28 with which the terminal link of a flexible driving chain or the like may be operatively engaged. Any suitable source of power, such as an electric

motor, may be employed to operate the hammer.

The connecting rod 20 is swiveled to a driving piston or element 30 having a rather close fit within the cylinder and adapted to bring about the reciprocation of a driven or striking element 32 also located within the cylinder.

An axial open ended chamber 34 is formed in one of the movable elements within the cylinder 10 and is adapted to snugly receive an axial piston-like extension 36 of the other movable element to compress the air therein so that when the piston 30 moves on its forward stroke the driven element 32 will be catapulted forward into striking engagement with the shank of the tool 33. The open end portion of the chamber 34 will be found to be slightly flared to define a gradually restricted entrance opening for the reception of the piston-like extension 36. To allow the driven or striking element 32 freedom of movement to respond to the various forces to which it is subjected the same has been made slightly less in diameter than the diameter of the piston 30, and thus the slight flare at the open end of the chamber 34 will guide the piston-like extension 36 into the chamber and at the same time avoid destructive contact of the members 30 and 36 with each other.

The fit of the piston-like extension 36 in the chamber 34 is a close one and the opposed walls of the chamber 34 and the extension 36 are furnished with a lubricant through radial apertures 38 and a circumferential oil collecting groove 39 in the peripheral portion of the driving piston. A portion of the lubricant supplied to the anti-friction elements and the motion transmitting mechanism within the housing 12 will find its way between the wall of the cylinder 10 and the piston 30 and will be received in the circumferential groove 39 for transfer into the chamber 34 to reduce friction incident to the entrance of the extension 36 into the chamber, and at the same time to aid in the establishment of an air tight seal between the extension and the wall of the chamber 34.

Thus, the extension 36 is allowed free entrance into the chamber 34 to compress the air therein so that on the subsequent forward stroke of the piston the air previously compressed within the chamber will be further compressed and caused to catapult the striking element 32 into engagement with the shank of the tool. The main body of air between the driving and driven elements 30 and 32 respectively will function very much the same as the air trapped within the chamber 34 and in addition will be rarefied to some extent on the rear stroke of the piston 30 to move the striking element 32 rearward or to act in concert with the rebound of the striking element in doing so.

It will be seen that the supply of air be-

tween the driving and driven elements is subject to depletion by leakage incident to compression thereof and to provide for the intermittent replenishment of this supply of air the cylinder 10 has a port 44 that is uncovered during only a short portion of the stroke of the striking element. Actual use of a hammer constructed in accordance with this invention has demonstrated the fact that the volume of air admitted to the space between the elements 30 and 32 by way of the port 44 is merely sufficient to provide for the efficient operation of the hammer and does not interfere with the initial phase of the rear stroke of the striking element. Of course, after the port 44 is closed on the rear stroke of the striking element it remains inoperative until the striking element again approaches the limit of forward movement thereof.

From the foregoing, it will be seen that the air supplied to the cylinder 10 by way of the port 44 compensates for the partial loss of air resulting from the compression of the same and thereby maintains a constant operative relation between the driving and driven elements as distinguished from previously known hammers in which a forceful blow was impossible because of the reduced supply of air available for compression after the hammer has been in use a short period.

The cylinder 10 is shown to be provided in advance of the port 44 with a separate series of ports 46 by which air may be admitted to the space between the driving and driven elements to intentionally idle the hammer. That is to say, when the striking element 32 is in its foremost or idle position as shown in Figure 1 the ports 46 are uncovered to allow a fully neutralizing supply of air to be admitted to and discharged from the cylinder during the reciprocation of the driving piston 30. During the reciprocation of the element 32 the ports 46 remain entirely closed.

By moving the striking element 32 back across the idling ports 46 the full power of the hammer is brought into play. This may be accomplished by moving the hammer forward until the tool 33 connected thereto has pressure engagement with the work and the tool in turn, caused to move the striking element backward.

The shank of the tool is extended through and is shouldered against a bushing 48 movably mounted within a casing 49 and urged to an extreme forward position by a spring 50. The rear end of the casing 49 is flanged inward to form a stop for the spring and at the same time to guide the shank of the tool. It will be seen that the resistance of the spring 50 must be overcome to bring about the rearward movement of the striking element across the ports 46. Also, the spring 50 makes it possible to graduate the force of the blow.

The casing 49 is detachably mounted within the cylinder 10 and is held in place against a shouldered portion of the cylinder by a tool holding nib 52 threaded into the cylinder and locked in place by a fastening screw 53. The forward terminal of the screw 53 may be extended into the bore of the nib 52 to cooperate with an adjacent flat on the shank of the tool in holding the tool against turning. As previously stated, the cylinder 10 is preferably of bronze, while the tool holding parts are of hardened steel and are freely removable for inspection and repair and for gaining ready access to the striking element.

As illustrated in Figures 1 and 2, a jacket 58 is mounted on the cylinder in spaced relation to a substantial portion of the same and cooperates therewith in the formation of an annular reservoir in constant communication with the ports 44, 46 and the ports 59 so that the air alternately admitted to and discharged from the spaces between the driving and driven elements and immediately in advance of the striking element is substantially isolated to avoid contamination thereof by the surrounding air. The rear portion of the jacket 58 is in constant communication with passages or ducts 60 in opposite sides of the housing 12 and the ducts in turn communicate with the opposite ends of a chamber or passage 61 extending through the handle 62. It will be seen that the passages 60 and 61 greatly augment the capacity of the reservoir and that the air which travels through the handle has a cooling effect thereon.

If the particular use to which the hammer is put does not create dust the closure 64 of the passage 61 may be removed to open the reservoir to the atmosphere.

In the form of invention illustrated in Figures 3 and 4 the cylinder is provided with an annular series of combination replenishing and idling ports 72 designed to be uncovered, in whole or in part, by the striking or driven element 70. In explaining this it is pointed out that when the striking element 70 is in its foremost or idle position all of the ports 72 will be uncovered to admit air in sufficient volume to the space between the driving and driven elements to idle the hammer.

On the other hand, when it is desired to forcefully reciprocate the element 70 the same is moved rearward to cut off the idling supply of air. The driven element 70 is formed with transverse and longitudinal connected passages, the transverse passage 71 being adapted for random communication with one of the ports 72 for a short portion of each stroke of the driven element so that the supply of air between the driving and driven elements is replenished in the proper volume at each stroke of the hammer. The

ports 72 are sufficiently close together to assure registration of the passage 71 with one of them at each stroke of the element 70.

Thus, when all the ports 72 are uncovered the hammer will be idled and when only one of them is intermittently uncovered the supply of air will merely be replenished.

In the form of invention illustrated in Figures 5 to 8 inclusive, the cylinder 80 is connected to the housing 81 by an attaching member 82 to which a jacket 83 is connected for limited rotation. The rear portion of the jacket 83 is provided with a circumferential slot 86 receiving a fastening screw 87 by which the jacket may be held in a fixed position. As shown in Figure 7, the attaching portion 82 and the jacket 83 are provided with ports 88 adaptable for mutual registration so that the reservoir defined between jacket 83 and the cylinder 80 may be opened to the atmosphere. On the other hand, the sleeve 83 may be rotated slightly to close the ports 88 and may be secured in this position by the fastening device 87. The forward portion of the jacket is mounted on a supporting annulus 90 carried by the adjacent portion of the cylinder 80.

The driven element 92 shown in Figure 5 is provided with a chamber 93 adapted to snugly receive the liner 94 of the driving piston.

The stem 96 of the driving piston has the rear portion thereof connected to the rod 97 by a ball and socket joint 98 positioned within the body 99 of the piston approximately midway of the ends thereof to provide for the efficient transmission of power. The stem 96 of the piston is extended through the liner 94 and has the forward portion thereof upset so that the members 94, 96 and 99 have the effect of one single body.

Having thus described the invention, what is claimed is:

1. In a hammer, a cylinder, a driven element in the cylinder, a reciprocating driving piston in said cylinder and serving to alternately compress and rarefy the air between the same and the driven element whereby the reciprocation of the driving piston is imparted to the driven element, said cylinder being provided with means spaced from the driving piston and uncovered by the driven element only upon reaching the forward portion of the forward stroke of the driving piston and as a preliminary to the rear stroke of the driving piston by which the supply of air between the driving piston and said driven element is replenished during a short portion only of the strokes of the driving piston and the driven element.

2. In a hammer, a cylinder, a driven element in the cylinder, a driving piston in the cylinder and serving to compress the air between the same and the driven element whereby the forward movement of the driving piston is imparted to the driven element, said

cylinder being provided at a point adjacent to one end of the stroke of the driven element and at a point spaced from said driving piston with a port adapted to be uncovered by the driven element only during the completion of the forward stroke thereof and as a preliminary to the rear stroke of the driven element to replenish the supply of air between the driven element and the driving piston, the aforesaid supply of air being otherwise isolated during actual use of the hammer.

3. In a hammer, a cylinder, a driven element in the cylinder, a driving piston in the cylinder and serving to intermittently compress the air between the same and the driven element whereby movement of the driving piston is imparted to the driven element, said cylinder being provided at a point adjacent to one end of the stroke of the driven element and at a point spaced from said driving piston with a port adapted to be uncovered by the driven element during a short portion only of the stroke of the driven element, and as a preliminary to the rear stroke of the driven element to replenish the supply of air between the driven element and the driving piston, the aforesaid supply of air being otherwise isolated during actual use of the hammer, said cylinder being provided with a second port spaced from the first named port and adapted to be uncovered by said driven element to admit and discharge a substantial volume of air to neutralize the action of the driving piston and thereby idle the hammer.

4. In a hammer, a cylinder, driving and driven elements mounted for reciprocation in the cylinder, the movement of the driving element serving to intermittently compress the air between said elements and actuate the driven element, and a jacket surrounding said cylinder in spaced relation thereto to cooperate therewith in the formation of a closed chamber, said cylinder being provided with a port communicating with said closed chamber and adapted to be uncovered by the driven element during the completion of the forward stroke of the driven element and as a preliminary to the rear stroke of the driven element to allow the supply of air between said elements to be replenished at each stroke of the same.

5. In a hammer, a cylinder, a driving piston in the cylinder, a driven element freely movable in the cylinder and being slightly lessened in diameter than the driving piston, said driving piston being provided with an open ended axial chamber and with a peripheral oil collecting groove in constant communication with the chamber to supply oil thereto, said driven element being provided with an axial extension adapted to be snugly received in said chamber.

6. In a hammer, a cylinder, a driving piston in the cylinder, a driven element of cylindrical form freely movable in the cylinder and having a diameter slightly less than that of the piston and being provided with a reduced axial extension, the driving piston being provided with an open-ended chamber slightly enlarged at one end to guide said extension into the chamber, said driving piston also being provided with an annular oil collecting groove and radial ports establishing constant communication between said groove and said chamber to furnish a lubricant to the chamber.

In testimony whereof we affix our signatures.

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FRANK P. MILLER.

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