

L. L. SCOTT.
INTERNAL COMBUSTION PERCUSSIVE ENGINE.
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1,058,268.

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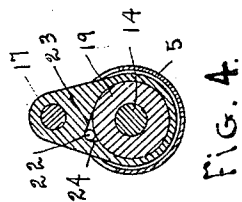


Fig. 4.

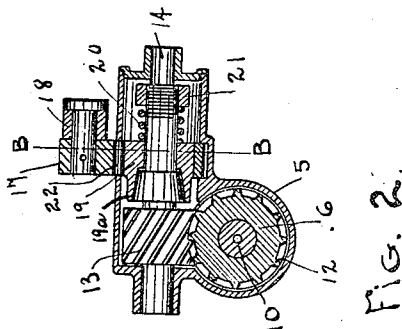


Fig. 2.

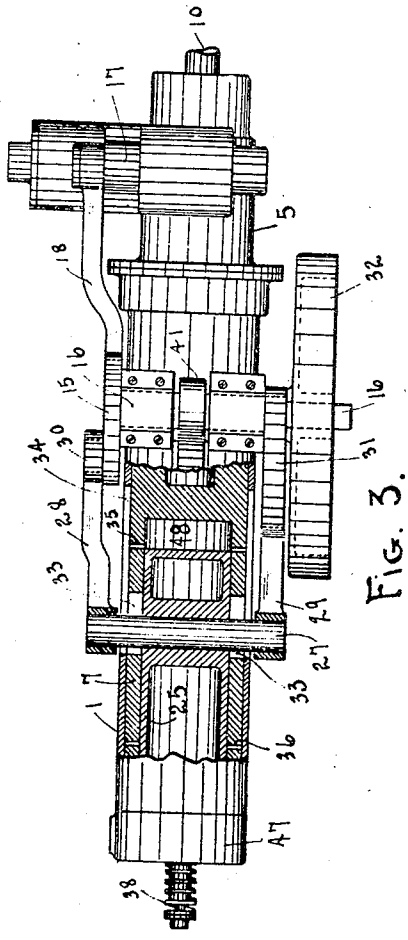


Fig. 3.

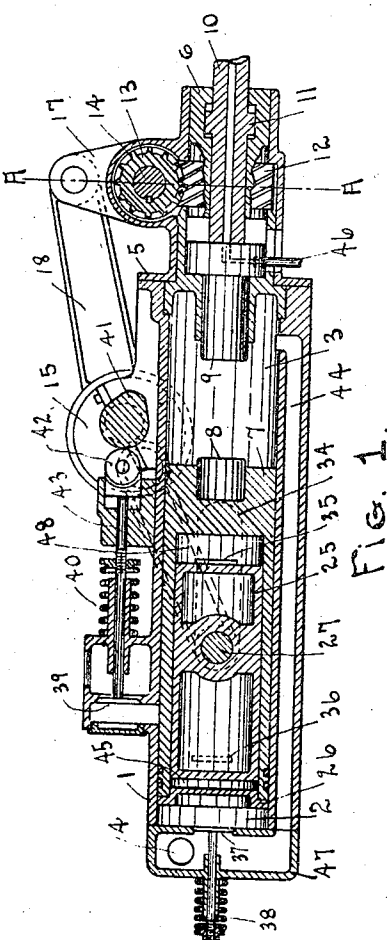


Fig. 1.

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INTERNAL-COMBUSTION PERCUSSIVE ENGINE.

1,058,268.

Specification of Letters Patent.

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To all whom it may concern:

Be it known that I, LEWIS L. SCOTT, a citizen of the United States, residing at St. Louis, Missouri, have invented a certain new and useful Improvement in Internal-Combustion Percussive Engines, of which the following is a full, clear, and exact description, such as will enable others skilled in the art to which it appertains to make and use the same, reference being had to the accompanying drawings, forming part of this specification, in which—

Figure 1 is a vertical longitudinal section of an engine constructed in accordance with my invention. Fig. 2 is a sectional view on line A—A of Fig. 1. Fig. 3 is a top plan view partly in horizontal section. Fig. 4 is a sectional view on line B—B of Fig. 2.

This invention relates to improvements in internal combustion percussive engines intended to be used particularly in connection with rock drills and the like.

The object of my present invention is to provide means for holding the explosive pressure within the firing chamber until the piston strikes the end of the block or drill so as to obtain the driving blow on the end of the same.

Another object is to provide improved means for cushioning the connection between the piston and crank-shaft, the hammer piston being free from the crank shaft when the blow is struck.

In the drawings, 1 indicates the cylinder and 2 the explosion chamber at the rear end thereof.

3 is the compression chamber which receives the charge of mixed air and gas through port 4 and channel 44.

5 is the head which closes the front end of the chamber in cylinder 1 and 47 is the head which closes the rear end of said cylinder, the latter head being ported and providing a mount for check valve 37 held to its seat by a spring 38 whereby the compressed charge of air and gas is admitted to the chamber 2. Head 5 affords a mount for means for rotating chuck 6.

7 indicates a piston adapted to reciprocate in cylinder 1, said piston having a hammer head 8 designed to strike a block 9 mounted in head 5 through which the blow is transmitted to the drill 10.

Where it is desired to rotate the drill lugs

11 are provided on drill 10, which lugs fit in slots in the chuck 6 so that if the chuck is rotated the drill is rotated in unison therewith. Chuck 6 is provided with worm teeth 12, preferably at its inner end, and which operate in an internal or circumferential groove in the head 5 which worm teeth mesh with a worm 13 mounted on a shaft 14. Shaft 14 is intermittently rotated by means of an eccentric 15 carried by the main shaft 16 so as to oscillate the yoke or rock arm 17 (mounted on the end of shaft 14) by means of the connecting pitman rod 18. The oscillation of arm 17 intermittently rotates shaft 14 by means of a ratchet and pawl mechanism or by means of collar 19 mounted on the shaft 14 and held in frictional engagement with said shaft by a spring 20 bearing therebetween and a collar 21 threaded on the shaft. This collar 19 has a clutch face engaging a clutch member 19^a on shaft 14, as shown in Fig. 2. A roller 22 is mounted in the inclined slot 23 in the arm 17, as shown in Fig. 4, so that when the arm 17 is rocked in one direction, shaft 14 will be rotated, while the movement of the arm in the opposite direction permits the shaft to remain stationary, this recovering of arm 17 causing the roller to be moved against a shoulder 24 in the arm 17. The object of thus providing a friction drive for the drill is to prevent the breakage of parts in the event that the drill becomes wedged in the drill hole.

Piston 7, before referred to, is bored to receive a piston 25, preferably introduced through the open end of the bore, which rear end is closed by a removable head 26. A cross pin 27 is carried by piston 25, the ends of said pin extending through slots 33 in the walls of the piston 7 and slots 34 in the walls of cylinder 1 and are connected to pitman rods 28 and 29. Rod 28 is connected to crank pin 30 carried by main shaft 16, while the rod 29 is connected to an eccentric 31 whose throw is equal to that of the crank pin 30. A fly wheel 32 is mounted upon one end of shaft 16.

35 and 36 are ports cut in the side of piston 7 to permit air at atmospheric pressure to enter the spaces 45 and 48 between the ends of pistons 7 and 25. These ports are located a little distance from the end of the chamber in the piston 7 so as to provide a

cushion between the pistons 7 and 25, as will be explained later, although in practice it is not absolutely necessary to use the cushion chamber 48.

5 The charge of mixed air and gas enters chamber 2 of cylinder 1 through valve 37 which valve is normally held closed by spring 38, before referred to.

10 39 indicates an exhaust valve for the spent gases, said valve being normally held closed by means of a spring 40. This valve 39 may be dispensed with if desired.

15 41 indicates a cam secured to shaft 16 and which coöperates with the roller 42 on the end of the valve rod 43 which carries the valve 39. Any form of mixing valve may be attached to port 4.

20 The operation is as follows: The mixed air and gas is drawn into chamber 3 through port 4 and channel 44 on the retracting stroke of the piston. On the out stroke this charge is compressed in chamber 3 so that as soon as the exhaust valve 39 is opened by the cam 41 this compressed charge will pass check valve 37 and enter the explosion chamber 2. On the retracting stroke of the piston a new charge is drawn into chamber 3 and the charge in chamber 2 is compressed. As the piston reaches the limit of its retracting stroke the charge in chamber 2 is exploded by means of a spark arrangement commonly used in gasoline engines. Piston 7 will now be driven outward under the pressure of the explosion and will, through the hammer head 8, strike the block 9, the blow being transmitted to the drill 10. Hammer 8 strikes block 9 before crank 16 reaches its dead center and also before the pressure is relieved in chamber 2 by valve 39. The momentum of the fly wheel causes the crank to continue its movement so that piston 25 will move outward independently of the piston 7 and allow the crank shaft to pass its dead center without the end of piston 25 contacting with piston 7 and therefore without shock to its bearings as the air between the end of piston 25 and piston 27 forms a cushion. As the piston 25 moves outwardly it uncovers port 36 and lets air at atmospheric pressure enter space 45 between the two pistons, and thus an effective cushion between the pistons on the return stroke is provided which cushions the piston 25 against the shock of the explosion behind piston 7. The exhaust valve is opened and closed during the outward independent movement of piston 25, and as the crank passes its dead center and starts on the back stroke, piston 25 will compress the air in chamber 45 until the piston 7 is caused to move therewith. Port 35 is uncovered on the back stroke and air at atmospheric pressure will enter the chamber 48 so as to provide a cushion between the outer ends of the two pistons to absorb any shock due to a re-

bound of piston 7 in striking its blow. As these operations continue, it will be apparent that explosions occur in chamber 2 on every out stroke and when piston 7 approaches the end of its out stroke it will, through its energy, strike the block 9 and at the time of delivering such a blow be absolutely free from the crank shaft. At the time of striking its blow the explosive pressure is behind the piston 7, thereby making the blow very effective. The rotation of the drilling tool will occur, as before described and water or air may be run through the steel drill for the purpose of removing cuttings from the drill hole, connections for same being made at 46 (Fig. 1). In operation piston 7 practically becomes a floating piston entirely independent from the crank shaft and its bearings and has a differential stroke with respect to the internal piston 25. The stroke of piston 25 is determined by its connections to shaft 16 and may be said to be fixed.

For purposes distinguished in the following claims I shall designate piston 25 as an internal piston and floating piston 7 as an external piston.

What I claim is:

1. In an internal combustion percussive engine, the combination of a cylinder having valved ports for the admission of air and gas and the exhaustion of the spent gases, a floating piston operating in said cylinder and an internal fixed-stroke piston operating within the floating piston, said pistons being moved in a forward direction by the expansion of exploded gas within the cylinder, and a crank shaft connected with the fixed stroke piston and operable to move the pistons on the rearward stroke.

2. In an explosive engine of the character described, the combination of a cylinder, a floating piston therein, an internal fixed stroke piston, said pistons having differential movement, said cylinder being adapted for the explosion of gas therein to move said pistons, means for providing cushions between the ends of said pistons, a shaft rotated by the fixed stroke piston on the forward movement of the pistons and operating to return the pistons on the rearward stroke, and means for controlling the admission and exhaust of gas to and from the cylinder.

3. In an explosive engine of the character described, the combination of a cylinder, a floating piston therein adapted to coöperate with a drilling device, an internal piston, a drilling device for receiving a blow from the external piston, a shaft rotated by the internal piston, an exhaust valve, and means operable by said shaft for opening the exhaust valve after the external piston has delivered its blow upon the drilling device.

4. In an explosive engine of the character described, the combination of a cylinder, an external floating piston and an internal

fixed-stroke piston, a drilling device with which the floating piston coöperates, a shaft connected to the internal piston, and means operated by said shaft for rotating said drilling device.

5. In an explosive engine of the character described, the combination of a cylinder, an external floating piston and an internal fixed-stroke piston, a hammer block with which the floating piston coöperates, a shaft connected to the internal piston, a drill which is designed to be struck with the hammer block, and means operated by said shaft for rotating said drill.

6. In an internal combination percussive engine of the character described, the combination with a drilling device of a slotted cylinder, a floating piston operating in said cylinder and adapted to deliver impact upon the drilling device, said floating piston being slotted, its slots being alined with the slots in the cylinder, an internal piston arranged within the floating piston, a pin carried by said internal piston, and having an end projecting through said alined slots, a shaft, and connections between said pin and shaft for driving the latter.

7. In an explosive engine of the character described, the combination of a cylinder, a drilling device mounted at one end of the cylinder, two pistons mounted within the cylinder, one of said pistons being arranged within the other, one of said pistons being in the nature of a floating piston and designed to operate the drilling device, the other of said pistons having a fixed stroke, a crank shaft operated by the last mentioned piston and adapted to move said pistons away from the drilling device, and means for providing a cushion between said pistons.

8. In an explosive engine of the character described, the combination of a slotted cylinder, a drilling device mounted in one end of said cylinder, two pistons arranged within the cylinder, one of said pistons being contained by the other, one of said pistons being in the nature of a floating piston adapted to strike the drilling device, and the other of said pistons having a fixed stroke, a crank shaft adapted to receive energy from said pistons on their forward stroke for the purpose of moving them on their rearward stroke, and a pin carried by said fixed stroke piston and projecting through the slotted

cylinder, and connected to said shaft to operate the same.

9. In a device of the class described, the combination, of a cylinder provided with an explosion chamber, a floating piston in said cylinder in operative relation to said explosion chamber, an anvil with which said floating piston coöperates, an inner piston slidably mounted in said floating piston, a crank shaft for moving said pistons toward the explosion chamber, and means for operating said shaft from said inner piston.

10. In a percussive engine of the character described, the combination of a cylinder having an explosion chamber and a charge receiving chamber, means for introducing an explosive fluid into the charge receiving chamber and transmitting said fluid to said explosion chamber, means for exploding the fluid in the explosion chamber, two pistons arranged within the cylinder, one of said pistons being mounted within the other, said pistons having relatively differential movement, one of said pistons being in the nature of a floating piston and adapted to deliver impact, and the other having a fixed stroke, a drilling device for receiving a blow from the floating piston, and a crank shaft operated by the fixed stroke piston for moving the pistons on the rearward stroke.

11. In a percussive engine of the character described, in combination, a cylinder provided with an explosion chamber and a charge receiving chamber, said chambers being provided with a means of communication whereby a charge may be conveyed from the latter to the former, a floating piston operating within said cylinder and adapted to deliver blows under the influence of charges exploded in the explosion chamber, a drilling device with which said floating piston coöperates, a fixed stroke piston adapted to move with said floating piston, and a crank shaft operatively connected with said fixed stroke piston whereby said pistons are retracted on their rearward stroke.

In testimony whereof I hereunto affix my signature in the presence of two witnesses, this 7th day of March, 1912.

LEWIS L. SCOTT.

Witnesses:

M. P. SMITH,
C. S. BUTLER.