

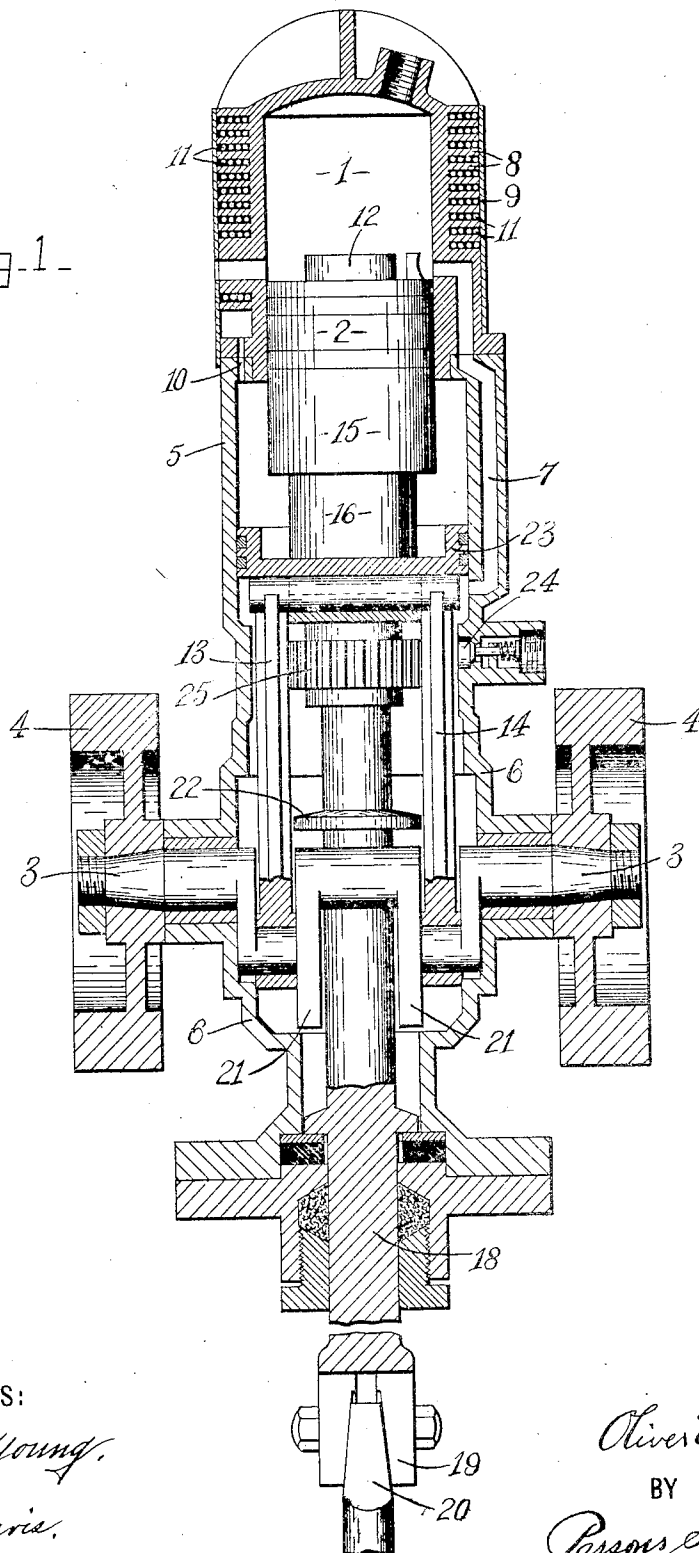
O. W. CURTIS.
INTERNAL COMBUSTION ENGINE.
APPLICATION FILED MAR. 27, 1908.

1,039,704.

Patented Oct. 1, 1912.

3 SHEETS—SHEET 1.

Fig. 1.



WITNESSES:

Chas. Young.

S. Davis.

INVENTOR

Oliver W. Curtis

BY

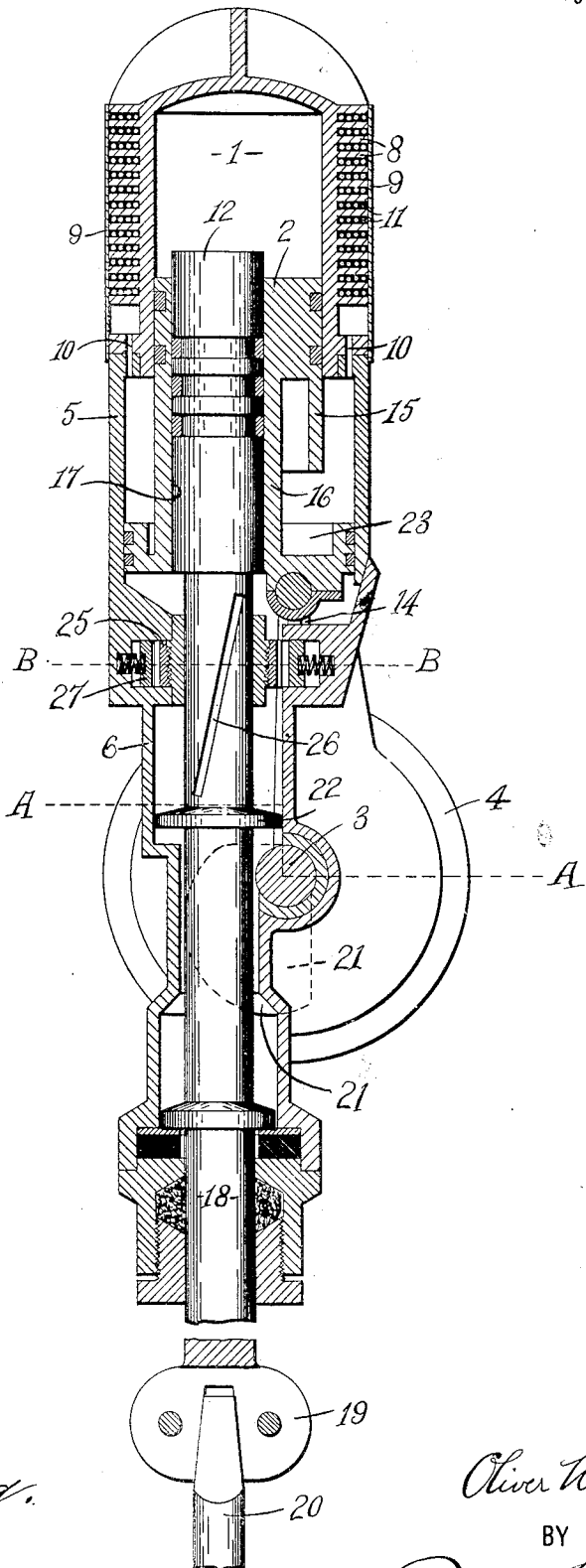
Parsons Hall & Bodell
ATTORNEYS

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 3 SHEETS—SHEET 2.

Fig. 2.



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3 SHEETS—SHEET 3.

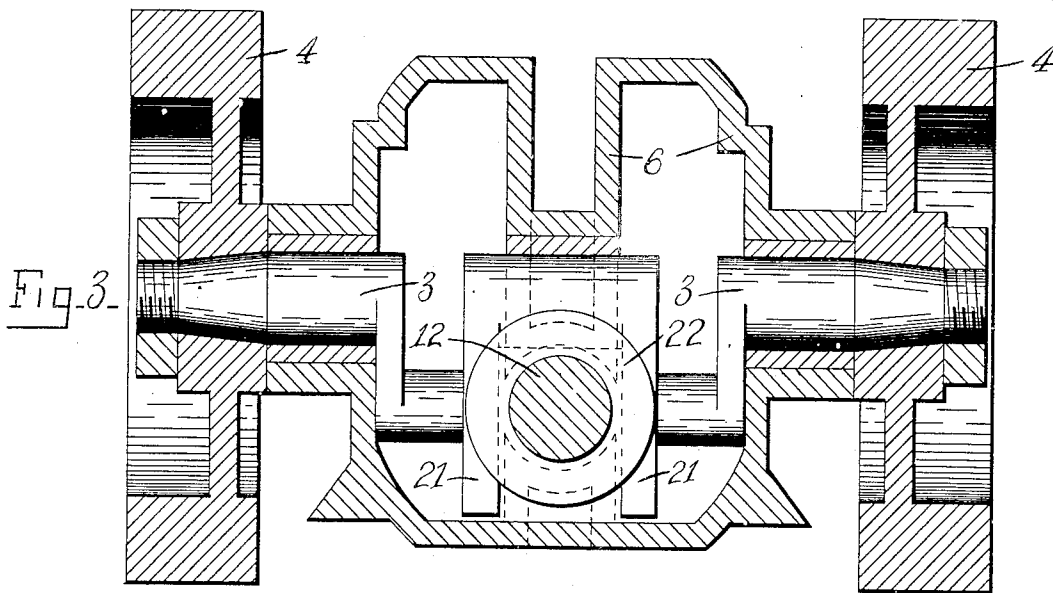


Fig. 4.

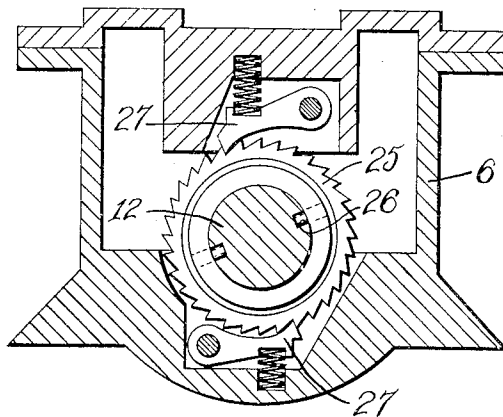
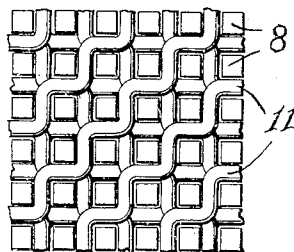


Fig. 5.



WITNESSES:

Chas. Young.
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UNITED STATES PATENT OFFICE.

OLIVER W. CURTIS, OF WATERTOWN, NEW YORK, ASSIGNOR OF ONE-THIRD TO LEVI CARPENTER, JR., AND ONE-THIRD TO HENRY W. BELL, OF WATERTOWN, NEW YORK.

INTERNAL-COMBUSTION ENGINE.

1,039,704.

Specification of Letters Patent.

Patented Oct. 1, 1912.

Application filed March 27, 1908. Serial No. 423,496.

To all whom it may concern:

Be it known that I, OLIVER W. CURTIS, of Watertown, in the county of Jefferson and State of New York, have invented a certain new and useful Internal-Combustion Engine, of which the following is a specification.

My invention has for its object the production of an internal-combustion engine, particularly applicable for operating rock-drills; and it consists in the combinations and constructions hereinafter set forth and claimed.

In describing this invention, reference is had to the accompanying drawing in which like characters designate corresponding parts in all the views.

Figures 1 and 2 are longitudinal sectional views of my engine taken at a right angle to each other. Figs. 3 and 4 are sectional views taken, respectively, on lines A—A, and B—B, Fig. 2. Fig. 5 is a view illustrating a portion of the outer surface of the wall of the cylinder, shown as disposed in a flat plane.

1 is the cylinder; 2 the piston movable therein, and 3 the crank-shaft of my engine; and 4, 4 are the fly-wheels thereof.

5 is a second cylinder of greater diameter than the cylinder 1, arranged end to end with said cylinder 1 and mounted thereon, the inner end of the cylinder 1 opening into the outer end of the cylinder 5, and the cylinder 5 communicating with the interior of the closed crank-case 6 which supports the cylinder 1. The engine illustrated is of the two-cycle type, and the crank-case, which serves as a motive-fluid supply-chamber, communicates with the cylinder 1 through a conduit 7.

The cylinder 1 is preferably provided with heat-radiating projections 8, which are inclosed by a jacket 9 open at one end and forming substantially a continuation of the cylinder 5. Conduits 10 extend from the end of the cylinder 5 contiguous to the cylinder 1 and communicate with the interior of the jacket 9, said conduits being directed to discharge air about the outside of the cylinder 1 and about the projections 8. As best seen in Fig. 5, the projections 8 are spaced apart from each other and are arranged in a series of rows, and wires 11 are usually interwoven with the projections 8 for facilitating the conduction of heat from the wall

of the cylinder 1, said wires being here shown as extending in zigzag directions through the spaces between the projections 8.

12 is a second power piston here shown as movable in the cylinder 1 relatively to the piston 2, the pistons 2 and 12 being actuated by the same charge, the piston 2 being constantly connected to the crank-shaft 3, and the piston 12 being disconnected from the crank-shaft during the power-stroke of the piston, and the instroke of both pistons being effected by the crank-shaft.

In the illustrated embodiment of my invention, the crank-shaft 3 is offset and the piston 2 is connected thereto by two rods 13 and 14, and is formed with the usual trunk 15, and with an eccentric elongated body 16, and also with a lengthwise passage 17 extending through the face of the piston and the end of the body 16; and the piston 12 is movable in said passage 17 and is provided with a drill-spindle 18 fixed thereto and preferably integral therewith which extends crosswise of the crank-shaft through the crank-case, and is provided at its outer end with a chuck 19, or other suitable clamping means for rigidly attaching a drill 20, or other tool, thereto. Cams 21 actuated by, and as here shown, mounted on the crank-shaft 3, coact with an annular shoulder or collar 22 on the piston 12 for transmitting the motion of the crank shaft 3 to the piston 12 after the completion of the outstroke of the piston 12 to effect the instroke of said piston with the piston 2.

As best seen in Figs. 1 and 2, a pump-piston 23 is movable in the cylinder 5 for forcing air through the conduits 10 about the heat-radiating projections 8, and for drawing motive-fluid into the crank-case through a valve-controlled port 24 and forcing said fluid from the crank-case through the conduit 7 into the cylinder 1, the pressure area of the face of the pump-piston 23 presented toward the crank-case being substantially the same as that of the faces of the pistons 2 and 12. This pump-piston is connected to, and rigid with, the piston 2 and is preferably arranged at the outer end of the body 16, and as here shown, is formed integral therewith.

Means, as a ratchet-wheel 25, slidably mounted on the spindle 18 and operated in

one direction by spiral ribs 26 on the piston 12, and prevented from operation in the opposite direction by pawls 27, serves to effect the turning of the piston and drill attached thereto during each reciprocation of the piston.

In operation, upon the explosion of the charge in the cylinder 1, the piston to which the drill is attached is impelled outwardly unretarded, and after the completion of such movement is returned by the continued rotation of the crank-shaft effected by the fly-wheels.

What I claim, is:—

1. In an internal combustion rock-drill having a cylinder and a combustion chamber, the combination of an engine piston in said cylinder and having a central internal bore open to said combustion chamber, a drill piston in said bore, and a drill secured to said drill-piston.

2. In an internal combustion rock-drill, having a cylinder and a combustion chamber, an engine piston movable in said cylinder and having an internal bore open to said combustion chamber, and a drill piston within the engine piston, both pistons being acted upon by the same explosion and having variable movement relatively to each other.

3. In a rock-drill, the combination of a cylinder, an engine piston slidable in said cylinder and having a central bore open to the fluid pressure receiving face of the piston, a drill piston slidable in said bore and adapted to receive the full pressure of the fluid in the cylinder, and a piston rod secured to said drill piston.

4. In an internal combustion rock-drill, a cylinder having a combustion chamber; a piston of one diameter for drawing in and compressing air, a second piston of different diameter reciprocatory with the first piston, and a third piston within the second piston subjected to the same explosion with the second piston, but movable in respect to the second piston, permitting thereby the continued movement of the second piston and the standstill of the third piston, means for guiding compressed air to the combustion chamber, means for mixing it with a suitable fuel, and means for exploding against the second and third pistons the combustible mixture thus produced.

5. In an internal combustion rock-drill having a cylinder and a combustion chamber, the combination of an engine piston in said cylinder, and having an internal bore open to said combustion chamber, a drill piston in said bore, a compression cylinder, a compression piston connected with the engine piston and slidable in the compression cylinder, a crank shaft, fly-wheels on said shaft, and connecting rods connected to said shaft and to the compression piston.

6. In an internal-combustion engine, a

crank-shaft, a plurality of pistons movable relatively to each other, means in which the pistons are movable one piston being constantly connected to the crank-shaft and the other being disconnected from the crank-shaft during the power-strokes of the pistons and being provided with means for carrying a tool, and means for transmitting the motion of the crank-shaft to said other piston during the instrokes of the pistons, substantially as and for the purpose described.

7. In an internal-combustion engine, a cylinder, a crank-shaft, a plurality of power-pistons movable in the cylinder relatively to each other, one piston being connected to the crank-shaft and the other being disconnected from the crank-shaft during the power-strokes of the pistons and being provided with means for carrying a tool, and means for transmitting the motion of the crank-shaft to said other piston during the instrokes of said pistons, substantially as and for the purpose specified.

8. In an internal-combustion engine, a cylinder, a crank-shaft, a piston movable in the cylinder and formed with a lengthwise passage, a second piston movable in said passage, one of said pistons being constantly connected to the crank-shaft and the other being disconnected from the crank-shaft during the power-strokes of the pistons, and means for transmitting the motion of the crank-shaft to said other piston during the instrokes of said pistons, substantially as and for the purpose set forth.

9. In an internal-combustion engine, a cylinder, a crank-shaft, a piston movable in the cylinder and formed with a lengthwise passage a second piston movable in said passage, the first-named piston being constantly connected to the crank-shaft and the other being disconnected from the crank-shaft during the power strokes of the pistons; and means for transmitting the motion of the crank-shaft to the second-named piston during the instroke of the first-named piston, substantially as and for the purpose described.

10. In an internal combustion engine, a combustion chamber, a plurality of power pistons both having their faces exposed in the combustion chamber, the pistons being movable relatively to each other and in the same direction during their power strokes, and means operated by one of the pistons for effecting the instroke of the other piston, substantially as and for the purpose specified.

11. In an internal combustion engine, a cylinder, a plurality of pistons movable in the cylinder relatively to each other, said pistons being actuated on their out-strokes by the same charge, means operated by one of the pistons for effecting the instroke of

the other piston, and a tool connected to such other piston, substantially as and for the purpose set forth.

12. In an internal-combustion engine, a cylinder, a crank-shaft, a plurality of power-pistons movable in the cylinder relatively to each other, said pistons being actuated on their power-strokes by the same charge and one being constantly connected to the crank-shaft and the other being disconnected from said shaft during the power-strokes of the pistons, a tool connected to the piston which is disconnected from the crank shaft during its power stroke, and means on the crank-shaft for effecting the instroke of said other piston with said one piston, substantially as and for the purpose set forth.

13. In an internal-combustion engine, a cylinder, a crank-shaft, a plurality of power-pistons movable relatively to each other during their power-strokes, one being constantly connected to the crank-shaft and the other being disconnected from said shaft during the power-strokes of the pistons, a tool connected to the piston which is disconnected from the crank shaft during its power stroke, and a cam on the crank-shaft for effecting the instroke of the other piston, substantially as and for the purpose described.

14. In an internal-combustion engine, a cylinder, a crank-shaft, a plurality of power-pistons movable in the cylinder relatively to each other, said pistons being actuated on their power-strokes by the same charge, and one being constantly connected to the crank-shaft, and the other being provided with a rod formed with a shoulder, a tool connected to the rod, and a cam on the crank-shaft for coacting with said shoulder after the completion of the power-strokes of the pistons and effecting the instroke of the piston provided with the rod, substantially as and for the purpose specified.

15. In an internal-combustion engine, a cylinder, a crank-shaft, a piston movable in the cylinder and formed with a lengthwise passage, a second piston movable in the passage, the first-named piston being constantly connected to the crank-shaft and the second-mentioned piston being disconnected from the crank-shaft during the power-strokes of the pistons, and being provided with a rod formed with a shoulder, and a cam on the crank-shaft for engaging said shoulder and effecting the instroke of the second-mentioned piston, substantially as and for the purpose set forth.

16. In an internal-combustion engine, a motive-fluid supply-chamber, a cylinder, a second cylinder arranged end to end with the first-named cylinder and communicating with the supply chamber, a conduit for conducting the motive-fluid to the first-named cylinder from the supply chamber, a plurality of power-pistons movable in the same

direction in the first-named cylinder relatively to each other, and a pump-piston movable in the second-mentioned cylinder and connected to and rigid with one of the plurality of pistons, substantially as and for the purpose set forth.

17. In an internal-combustion engine, a motive-fluid supply-chamber, a cylinder, a second cylinder arranged end to end with the first-named cylinder and being of greater diameter than the same, the second-mentioned cylinder communicating with the supply-chamber, a conduit communicating with the supply-chamber and the first-named cylinder, a piston movable in the first-named cylinder and formed with a lengthwise passage, a second piston movable in said passage relatively to the first-named piston, and a pump-piston movable in the second-named cylinder and connected to and rigid with the first-named piston, substantially as and for the purpose described.

18. In an internal-combustion engine, a closed crank-case serving as a motive-fluid supply-chamber, a cylinder mounted on the crank-case, a second cylinder arranged end to end with the first-named cylinder and carried thereby, the first-named cylinder communicating with the crank-case, a conduit for communicating with the supply-chamber and the second-mentioned cylinder, a plurality of pistons movable in the same direction in the second-mentioned cylinder and movable at different speeds during their power-strokes, and a pump-piston movable in the first-named cylinder and connected to and rigid with one of said plurality of pistons, substantially as and for the purpose specified.

19. In an internal-combustion engine, a motive-fluid supply-chamber, a cylinder, a second cylinder arranged end to end with the first-named cylinder and being of greater diameter than the same, the second-mentioned cylinder communicating with the supply-chamber, a conduit communicating with the supply-chamber and the first-named cylinder, a crank-shaft, a piston movable in the first-named cylinder and formed with a lengthwise passage, a second piston movable in said passage relatively to the first-named piston, the first-named piston being constantly connected to the crank-shaft and the second-mentioned piston being disconnected from the crank-shaft during the power-strokes of the pistons, means actuated by the crank-shaft for effecting the instroke of the second-mentioned piston, and a pump-piston movable in the second-mentioned cylinder and connected to and rigid with the first-named piston, substantially as and for the purpose set forth.

20. In an internal-combustion engine, a crank-case serving as a motive-fluid supply-chamber, a cylinder mounted on the crank-

case, a second cylinder arranged end to end with the first-named cylinder and carried thereby, the first-named cylinder being of greater diameter than the second-mentioned cylinder and communicating with the crank-case, a conduit communicating with the crank-case and the second-mentioned cylinder, a crank-shaft, a piston movable in the second-mentioned cylinder and formed with a lengthwise passage, a second piston movable in said passage relatively to the first-named piston, the first-named piston being constantly connected to the crank-shaft, the second-mentioned piston being disconnected from the crank-shaft during the power-strokes of the pistons, means rigid with the piston and formed with a shoulder, a cam on the crank-shaft for engaging said shoulder and effecting the instroke of the second-mentioned piston, and a pump-piston movable in the first-named cylinder and connected to and rigid with the first-named piston, substantially as and for the purpose described.

21. In an air-cooled internal-combustion engine, a motive-fluid supply-chamber, a cylinder, a second cylinder arranged end to end with the first-named cylinder and being in direct communication therewith and communicating with the supply-chamber, a conduit opening from the end of the second-mentioned cylinder contiguous to the first-named cylinder, the conduit being directed to discharge air about the outside of the first-named cylinder, a conduit communicating with the supply-chamber and the first-named cylinder, a crank-shaft, a piston movable in the first-named cylinder and having a lengthwise passage, a second-piston movable in said passage relatively to the first-named piston, the first-mentioned piston being constantly connected to the crank-shaft, and the second-named piston being disconnected from the crank-shaft during the power-strokes of the pistons, means actuated by the crank-shaft for effecting the instroke of the second-mentioned piston, and a pump-piston movable in the second-mentioned cylinder, substantially as and for the purpose specified.

22. In an air-cooled internal-combustion engine, a crank-case serving as a motive-fluid supply-chamber, a cylinder mounted on the crank-case, a second cylinder arranged end to end with the first-named cylinder and carried thereby, the cylinders being in direct communication with each other and the first-mentioned cylinder communicating with the crank-case and being of greater diameter than the second-named cylinder, a conduit opening from the end of the first-mentioned cylinder contiguous to the second-named cylinder, the conduit being directed to discharge air about the outside of the second-named cylinder, a conduit com-

municating with the crank-case and the second-named cylinder, a crank-shaft, a piston movable in the first-named cylinder and having a lengthwise passage, a second piston movable in said passage relatively to the first-named piston, the second-mentioned piston being disconnected from the crank-shaft during the power-strokes of the pistons, means for transmitting the motion of the crank-shaft to the second-mentioned piston after the completion of the power-strokes of the pistons, and a pump-piston movable in the first-mentioned cylinder, substantially as and for the purpose set forth.

23. In combination, in an internal-combustion engine, a cylinder, a crank-shaft, a piston movable in the cylinder and formed with a lengthwise passage, a second piston movable in said passage, one of said pistons being constantly connected to the crank-shaft and the other being disconnected from the crank-shaft during the power-strokes of the pistons, means for transmitting the motion of the crank-shaft to said other piston during the instroke of said pistons, and a drill spindle fixed to said other piston, substantially as and for the purpose set forth.

24. In an internal-combustion engine, a cylinder, a crank-shaft, a piston movable in the cylinder and formed with a lengthwise passage, and a second piston movable in said passage, the first-named piston being constantly connected to the crank-shaft and the other being disconnected from the crank-shaft during the power-strokes of the pistons, means for transmitting the motion of the crank-shaft to the second-named piston during the instroke of the first-named piston, and a drill spindle fixed to said second piston, substantially as and for the purpose described.

25. In combination, an internal-combustion engine comprising a crank-case serving as a motive-fluid supply-chamber, a cylinder mounted on the crank-case, a second cylinder arranged end to end with the first-named cylinder and carried thereby, the cylinders being in direct communication with each other and the first-mentioned cylinder communicating with the crank-case and being of greater diameter than the second-named cylinder, a conduit opening from the end of the first-mentioned cylinder contiguous to the second-named cylinder, the conduit being directed to discharge air about the outside of the second-named cylinder, a conduit communicating with the crank-case and the second-named cylinder, a crank-shaft, a piston movable in the second-named cylinder and having a lengthwise passage, a second piston movable in said passage relatively to the first-named piston, the first-named piston being constantly connected to the crank-shaft and the second-mentioned piston being disconnected from the crank-shaft, means

for transmitting the motion of the crank-
shaft to the second-mentioned piston after
the completion of the power-strokes of the
pistons, a pump-piston movable in the first-
5 mentioned cylinder, and a drill spindle fixed
to the second-mentioned piston, substantially
as and for the purpose specified.

In testimony whereof, I have hereunto

signed my name in the presence of two at-
testing witnesses, at Watertown, in the 10
county of Jefferson, in the State of New
York, this 23rd day of March, 1908.

OLIVER W. CURTIS.

Witnesses:

PATRICK J. MULLIN,
CYRIL CARPENTER.