J. J. HENNESSY & E. A. CAPOCEFALO.

DRILLING APPARATUS.

APPLICATION FILED OCT. 12, 1908.

974,267. **Patented Nov. 1, 1910.**

Fig. 1.

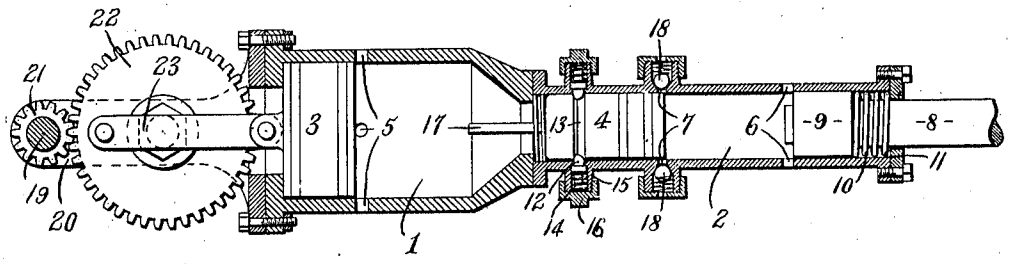
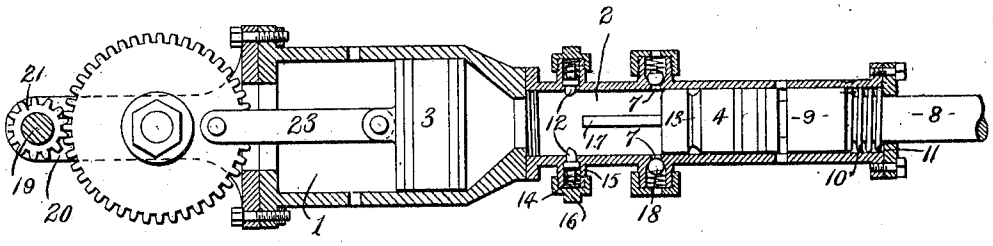


Fig. 2.



WITNESSES:

Chas. H. Young.

S. Davis.

INVENTORS

John J. Hennessy

Edward A. Capocefalo

BY

Parsons Hall & Brdlee

ATTORNEYS

THE NORRIS PETERS CO., WASHINGTON, D. C.

UNITED STATES PATENT OFFICE.

JOHN J. HENNESSY AND EDWARD A. CAPOCEFALO, OF SYRACUSE, NEW YORK.

DRILLING APPARATUS.

974,267. Specification of Letters Patent. Patented Nov. 1, 1910.

Application filed October 12, 1908. Serial No. 457,211.

To all whom it may concern:

Be it known that we, JOHN J. HENNESSY and EDWARD A. CAPOCEFALO, of Syracuse, in the county of Onondaga and State of New York, have invented a certain new and useful Drilling Apparatus, of which the following is a specification.

Our invention has for its object the production of a drilling apparatus which is particularly simple in construction and compact in its organization, and it consists in the combination and constructions hereinafter set forth and claimed.

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

Figures 1 and 2 are longitudinal sectional views of our drilling apparatus, illustrating the movable parts thereof in different positions.

This drilling apparatus comprises, generally, a case, a compressing piston movable in one end portion of the case, a hammer piston movable in the central portion of the case, the pistons being spaced apart and unconnected, a drill spindle supported at the other end of the case and arranged in the path of the hammer piston, and a catch for holding the hammer piston in its starting or retracted position during the compressing movement of the first mentioned piston, the case being formed with open passages for permitting air to enter in front of the compressing piston when said piston is at the end of its suction stroke and with open passages for permitting air to escape from in front of the hammer piston during the power stroke thereof and to enter the case in front of the hammer piston during the return stroke of the hammer piston effected by the suction stroke of the compressing piston.

As here illustrated the case is divided into two cylinders 1 and 2, in direct communication with each other, and the compressing piston 3 and hammer pistons 4 are, movable respectively in said cylinders.

As here illustrated the compressor and hammer cylinders 1 and 2 are arranged end to end in direct communication with each other and preferably in axial alinement, the hammer cylinder 2 being of less diameter than the compressor cylinder. Although the cylinders are here shown as formed of separate pieces which are bolted together, it is obvious that they may be formed integral.

The compressor cylinder 1 is formed with inlet passages 5 for the air located in its central portion, in front of the position occupied by the piston 3 when said piston is at the end of its suction stroke. The hammer cylinder 2 is formed with passages 6 at its outer end and preferably with outlet passages 7 for the compressed air when the hammer piston 4 is at the limit of its power stroke, the passages 7 being preferably located just behind the position occupied by the hammer-piston 4 when said piston is at the end of its power stroke. The hammer-cylinder 2 also suitably holds a drill spindle 8, the head 9 of said spindle being located within the cylinder 2 in the path of the hammer piston and a buffer spring 10 being located between the head 9 and the outer end wall 11 of the hammer cylinder 2. Said hammer-cylinder 2 is also provided at its upper end with spring-pressed catches 12 for entering a peripheral groove 13 formed in the hammer piston 4 and holding said piston 4 in its retracted or starting position, during the compressing stroke of the piston 3 in the cylinder 1. These catches 12 and their springs 14 are here shown as movable in guides formed in threaded bosses 15 on which turn cap nuts 16 for tensioning the springs 14 between the catches 12 and the nuts 16.

As here shown the hammer piston 4 is formed with a rearwardly extending push arm 17 for being engaged and forced by the compressing piston 3 out of engagement with said catches 12, as the piston 3 is nearing the end of its compression stroke. However this arm may be omitted and the springs 14 of the catches so adjusted that they will be overcome when the piston 3 has compressed the air in the cylinder 1 to a predetermined degree. Preferably the air space between the pistons 3 and 4 when the pistons are in the positions shown in Fig. 1, is greater than the air space between the pistons when said pistons are in their position shown in Fig. 2, and the surplus air is discharged through the passages 7 when the hammer piston 4 is at the end of its power stroke. These spaces may however be substantially of the same, so that no outlet passages 7 are necessary. The passages 7 are preferably provided with check valves 18 for preventing the rush of air in the cylinder 2 behind the hammer 4, but such valves may be dispensed with if desired,

said passages 7 being then closed by the hammer piston upon its rebound from the head 9 of the spindle 8.

The compressing piston 3 may be actuated by any suitable means, here shown as a drive shaft 19 supported by a bracket 20 on the cylinder 1 and designed to be connected to a suitable motor, the shaft 19 having a gear 21 thereon meshing with the gear 22 which is also supported by the bracket 20 and connected to the piston 1 by a link or pitman 23.

The operation of our drilling apparatus is as follows: Air enters the compression cylinder through the passage 5 and is compressed during the out stroke of the piston 3 until the piston 3 engages the end of the push arm 17 and moves the hammer piston 4 out of engagement with the catches 12 (or in case the push arm is omitted, until the compression in front of the piston 3 overcomes the tension of the springs 12), whereupon the hammer piston 4 is impelled outwardly upon the head 9 of the drill spindle 8 pushing the air before it out through the vents of passages 6. When the hammer is at the end of its power stroke, the surplus air, if any, escapes through the passages 7. The compressor piston then begins its suction stroke, drawing the piston 4 backwardly until it is caught by the elements 12.

Our drill is particularly advantageous in that it has no mechanically actuated valves and is compact in its organization.

What we claim is—

1. A pneumatic apparatus comprising a case, an air compressing piston and a hammer piston movable in the case, the pistons being spaced apart therein and being unconnected, the spaces in the case behind the compressing piston and in front of the hammer piston being unconnected, and a catch extending through the case for holding the hammer piston in its retracted or starting position during the compression stroke of the first-mentioned piston, substantially as and for the purpose described.

2. A pneumatic apparatus comprising a case, an air compressing piston movable in one end portion of the case, a hammer piston movable in the other end portion of the case, the pistons being spaced apart and being unconnected, the case between the pistons being formed with an open passage located to permit the inlet of air in front of the compressing piston when at the end of its suction stroke, and with an open passage located to permit the air to escape from in front of the hammer piston during the power stroke thereof, the latter passage also permitting air to enter in front of the hammer piston during the return stroke thereof, in order that the hammer piston may be retracted by the suction of the compressing piston, and a catch extending through the case for holding the hammer piston in its retracted position, substantially as and for the purpose specified.

3. A pneumatic apparatus comprising a case, an air compressing piston movable in one end portion of the case, a hammer piston movable in the other end portion of the case, the pistons being spaced apart therein, and being unconnected, the spaces in the case behind the compressing piston and in front of the hammer piston being unconnected, and the case being formed with an open passage located to permit the inlet of air in front of the compressing piston when said piston is at the end of its suction stroke and with an open passage located to permit the escape of air from in front of the hammer piston during the power stroke thereof, the latter passage also permitting air to enter in front of the hammer piston during the return stroke thereof, in order that the hammer piston may be retracted by the suction produced by the compressing piston, a tool spindle supported at the hammer piston end of the case and having one end located in the path of the hammer piston, and a catch for holding the hammer piston in its retracted or starting position during the compression stroke of the first-mentioned piston, substantially as and for the purpose set forth.

4. A pneumatic apparatus comprising a case, an air compressing piston movable in one end portion of the case, a hammer piston movable in the other end portion of the case, the pistons being spaced apart and being unconnected, the spaces in the case behind the compressing piston and in front of the hammer piston being unconnected, and the case being formed with an open passage located in front of the position occupied by the head of the compressing piston when at the end of its suction stroke, and with a passage opening directly into the outer air and located near the position occupied by the head of the hammer piston when at the end of its power stroke, and a catch extending through the case and engaging the hammer piston for holding the hammer piston in its retracted or starting position during the compression stroke of the first-mentioned piston, substantially as and for the purpose described.

5. A pneumatic apparatus comprising a case, a compressing piston and a power piston reciprocally movable in the case, one in advance of the other, the pistons being spaced apart therein and being unconnected, a catch for holding the power piston in its retracted or starting position during the compression stroke of the compressing piston, and means fixed to one piston and extending toward the other piston in order to engage said other piston during the compression stroke of the first-mentioned piston and thereby force the power piston from the catch, substantially as and for the purpose set forth.

6. A pneumatic apparatus comprising a case, a compressing piston and a power-piston reciprocally movable in the case one in advance of the other, the pistons being spaced apart therein and being unconnected, a catch for holding the power piston in its retracted or starting position during the compression stroke of the compressing piston, and a push arm fixed to one piston and extending toward the other piston in order to engage said other piston during the compression stroke of the compressing piston and thereby force the power piston from the catch, substantially as and for the purpose set forth.

7. An air operated apparatus comprising a case, an air compressing piston movable in one end portion of the case, a hammer piston movable in the other end portion of the case, the pistons being spaced apart and being unconnected, the spaces in the case behind the compressing piston and in front of the power piston being unconnected, and the case being formed with an open inlet passage located in front of the position occupied by the head of the compressing piston when at the end of its suction stroke, a passage opening directly into the outer air and located near the position occupied by the head of its power piston when at the end of its power stroke and with an outlet passage opening into the space between the pistons and located just behind the position occupied by the hammer piston when the hammer piston is at the limit of its power-stroke, a check valve in said passage, and means fixed to one piston and extending toward the other piston, in order to engage the other piston during the compression stroke of the first-mentioned piston and thereby force the hammer piston from the catch and start it on its power stroke, substantially as and for the purpose specified.

8. A drilling apparatus comprising an air compressor cylinder, a second cylinder in direct communication with the compressor cylinder, a piston movable in the compressor cylinder, a hammer piston movable in the second cylinder, and having a peripheral depression and a spring-pressed catch for entering said depression and holding the hammer piston at the inner end of the second cylinder during the compression stroke of the first-mentioned piston, substantially as and for the purpose described.

9. A pneumatic apparatus comprising a case, an air compressing piston, and a power piston movable in the case, the pistons being spaced apart therein and being unconnected and the hammer piston being formed with a peripheral depression, the spaces in the case behind the compressing piston and in front of the power piston being unconnected, and a spring-pressed catch supported by the case and extending through the case in position to enter the peripheral depression of the hammer piston when the hammer piston is in its retracted or starting position, substantially as and for the purpose set forth.

10. A pneumatic apparatus comprising a case, an air compressing piston and a hammer piston movable in the case, the pistons being spaced apart therein and being unconnected, and the hammer piston being formed with a peripheral depression, the spaces in the case behind the compressing piston and in front of the hammer piston being unconnected, a spring-pressed catch supported by the case in position to enter the peripheral depression of the power piston when the power piston is in its retracted or starting position, and means fixed to one piston and projecting toward the other piston in order to engage said other piston during the compression stroke of the first-mentioned piston and thereby force the power piston from the catch and start the same on its power stroke, substantially as and for the purpose described.

In testimony whereof, we have hereunto signed our names in the presence of two attesting witnesses, at Syracuse, in the county of Onondaga, in the State of New York, this 9th day of October, 1908.

JOHN J. HENNESSY.
EDWARD A. CAPOCEFALO.

Witnesses:
S. DAVIS,
E. K. SEEMILLER.