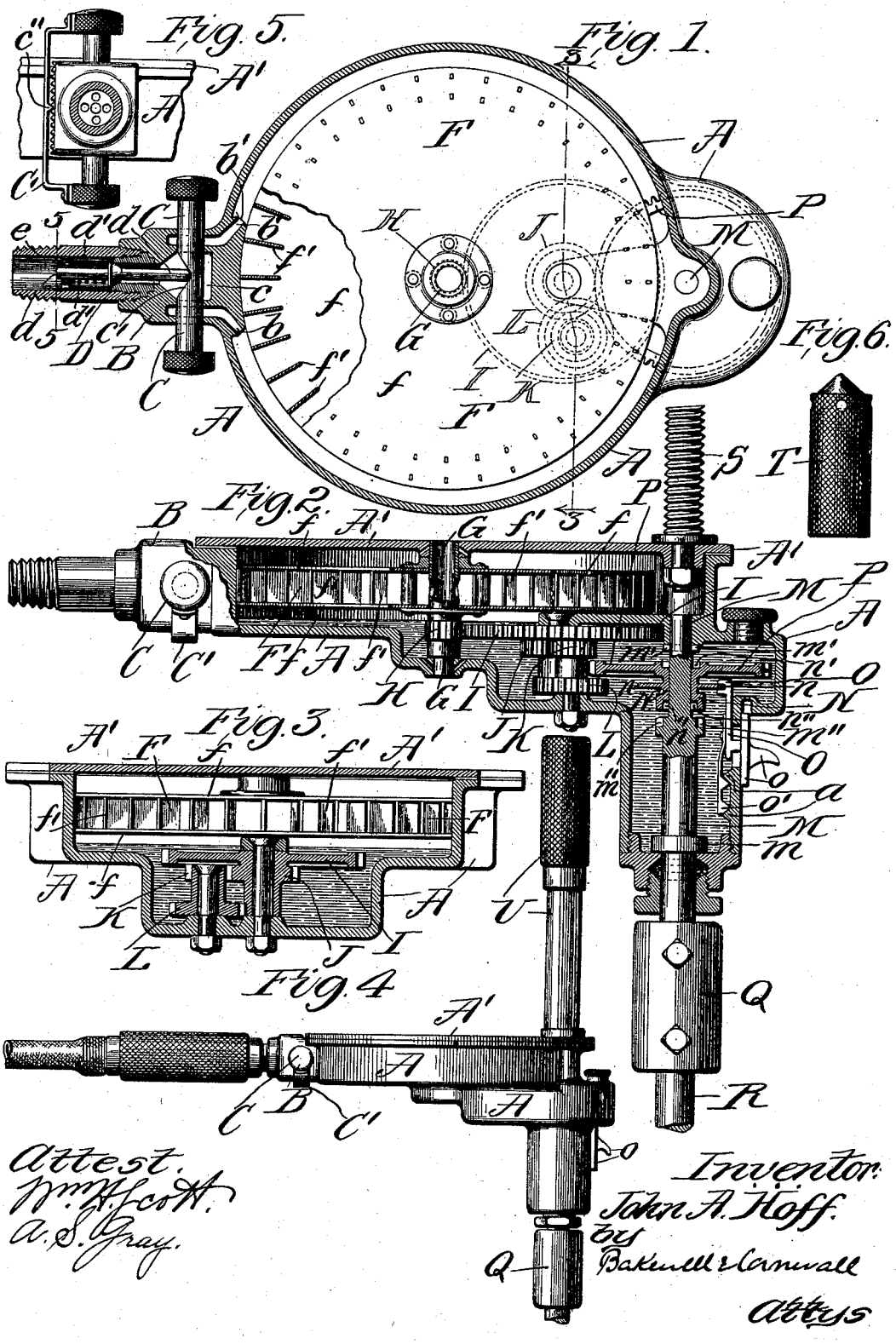
No. 647,265. Patented Apr. 10, 1900.

J. A. HOFF.

PNEUMATIC DRILL.

(No Model.) (Application filed Apr. 10, 1899.)



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UNITED STATES PATENT OFFICE.

JOHN A. HOFF, OF ST. LOUIS, MISSOURI, ASSIGNOR OF TWO-THIRDS TO EDMUND F. WICKHAM AND ALFRED BEVIS, OF SAME PLACE.

PNEUMATIC DRILL.

SPECIFICATION forming part of Letters Patent No. 647,265, dated April 10, 1900.

Application filed April 10, 1899. Serial No. 712,524. No model.

To all whom it may concern:

Be it known that I, JOHN A. HOFF, a citizen of the United States, residing at the city of St. Louis, State of Missouri, have invented a certain new and useful Improvement in Pneumatic Drills, 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 top plan view, partly in section, of my improved pneumatic drill. Fig. 2 is a vertical sectional view through the same. Fig. 3 is a cross-sectional view on line 3 3, Fig. 1. Fig. 4 is a side elevational view. Fig. 5 is a sectional view on line 5 5, Fig. 1; and Fig. 6 is a detail view of the nut for feeding the drill to its work.

This invention relates to a new and useful improvement in pneumatic drills, the object being to construct a device of the character described to be operated by compressed air fed thereto through a flexible supply-pipe, the drill being held in position by suitable braces or supports or by an operator, so that its power will be utilized in driving a bit or auger for wood-boring or a drill for boring metal.

With this object in view the invention consists in the novel construction of the throttle-valve and its coöperating or associate parts, whereby said valve when moved in one direction admits pressure to the engine and directs a blast of air to rotate the winged power-wheel in one direction, and when said valve is moved in the other direction it admits pressure to an oppositely-placed nozzle for driving said winged power-wheel in the opposite direction.

Another feature of the invention resides in the novel arrangement of the reducing-gear for transmitting the power from the power-wheel to the stock-spindle, such train of gearing being so arranged that said spindle may be driven at two speeds, according to the will of the operator, and, finally, the other features reside in the novel construction, arrangement, and combination of the several parts, all as will hereinafter be described, and afterward pointed out in the claims.

In the drawings, A indicates a casing, preferably in the form of a casting, which is preferably circular in shape, so far as its body portion is concerned, said casing being provided with a bearing for the reception of the shaft of the power-wheel, while the other end of said shaft finds a bearing in a cap or cover A′, secured to the casing A. The casing A is also formed or provided with a valve-casing B, having oppositely-disposed nozzles *b* and *b′* and a central chamber *c*.

C indicates a valve designed to be moved in opposite directions from its central position, said valve having suitable heads at each end by which it can be manipulated longitudinally its axis, the stem or body portion of the valve being formed about midway its length with a V-shaped groove *c′*, whose inclined faces act as cams to operate a valve D, whose stem *d* coöperates with said V-shaped groove. The valve-seat for valve D is preferably removable from the casing B and is held in position by the thimble or coupling-sleeve E. A spring *d′*, bearing at one end against a perforated follower *e* and at its other end against the valve D, tends at all times to hold said valve to its seat in a closed position. This spring is assisted by the pressure behind the valve.

As shown in Fig. 1, valves C and D are in a closed position and no pressure is being admitted to the engine. If valve C were moved downwardly, the upper inclined or cam face of its V-shaped groove would coöperate with the stem of valve D and force said valve away from its seat to admit pressure to the chamber *c*. This V-shaped groove would then establish communication between chamber *c* and the nozzle *b*, so that pressure would be admitted to the engine through said nozzle, the other nozzle *b′* being closed under such conditions. To reverse the engine, valve C would be moved in the opposite direction, which would operate first to close nozzle *b* against the introduction of pressure thereinto, then close valve D, and then by continued movement upwardly the lower inclined or cam face would raise valve D from its seat and establish communication between chamber *c* and nozzle *b′*. In order to hold valve C in an adjusted position, I preferably attach to the

heads thereof a piece of spring metal C′, having a tooth c'', coöperating with a notched face on the valve-casing B. As the valve C is moved longitudinally its axis the tooth c'' coöperates with the notches on the valve-casing B and tends to hold valve C in an adjusted position.

F indicates a winged power-wheel as an entirety, which consists of two disk plates f, between and at the peripheries of which are arranged a series of plates or wings f'. These wings are in line with the nozzles b and b', and when pressure is emitted from either of said nozzles it strikes against said wings and causes wheel F to rotate. The pressure is exhausted by passing inwardly between the disks and out through the hollow shaft G of the power-wheel, as shown in Fig. 2. Shaft G is preferably made hollow at its upper end only, said hollow part communicating with spaces between the disks, as before described, while its lower end carries a pinion H, meshing with a gear-wheel I, mounted in suitable bearings in casing A.

Conjoined to gear-wheel I is a pinion J, which meshes with a pinion K, arranged on one end of the sleeve, said sleeve carrying on its other end a gear-wheel L.

M indicates a shaft or spindle whose upper end finds a bearing in casing A, while its lower end is provided with a collar m, beyond which said spindle passes through an ordinary stuffing-box to the exterior. Spindle M carries clutch members m' and m'', between which is arranged a sliding collar N, carrying clutch members n' and n'', coöperating with the respective clutch members on the shaft or spindle. A disk or collar n is arranged on said sleeve, which coöperates with a notched finger O, which is connected to a sliding finger-piece o, arranged externally the casing, by means of which said sleeve may be slid longitudinally the spindle and thrown into engagement with either of the clutch members on the spindle. Sleeve N also carries a gear-wheel P, which is designed in one position (the upper) to mesh with the gear J when it is desired to run the shaft at a slow speed. When sleeve N is thrown to its other or lower position, gear P meshes with gear L, so that spindle M will rotate more rapidly. In the intermediate position, as shown in Fig. 2, gear P is arranged between gears J and L no motion will be imparted to spindle M and through the instrumentality of the gearing above described.

In order to hold the sleeve N and its carried gear P into proper engagement with either of the gears J or L, I provide spring-pressed lugs o' on the sliding thumb-piece to engage and coöperate with lug a on the interior of casing A, as best shown in Fig. 2. A suitable pocket or chamber is provided in the lower portion of casing A for the reception of this gearing and spindle M, which is designed to receive a lubricant, so that said parts will practically run in oil. As the engine is designed to run substantially in a vertical position at all times, there will be no danger of the oil escaping due to the stuffing-box around the lower end or spindle M and the tight connection of the sliding thumb-piece o. However, should the engine be tilted in its operation so that part of the power-wheel F would run in oil the high speed at which said power-wheel rotates would tend to throw said oil outwardly by centrifugal force, so as to prevent its entrance into the hollow shaft through which the exhaust passes. In fact, even when the engine is inverted the high speed at which the power-wheel rotates will be sufficient to throw the oil outwardly and prevent its exit through the exhaust-opening. Spindle M carries a clutch or socket Q at its lower end for receiving the shank R of a bit or drill, as is well understood.

S indicates a threaded standard secured in the cap A′ for receiving an extension collar or nut T, by which the drill may be fed when boring metal, or a handle U may be provided when the engine is manually applied to its work.

Having thus described my invention, what I claim, and desire to secure by Letters Patent, is—

1. The combination with a valve-casing having a central chamber and ports arranged on each side thereof, of a valve passing through said ports and chamber, a V-shaped groove in said valve which is wholly within the chamber when the valve is in its central position, and a valve for admitting pressure to said chamber which is actuated by the inclined faces of said groove; substantially as described.

2. The combination with a valve-casing provided with a chamber and a port, of a valve passing through said chamber and port, said valve being formed with a reduced portion having an inclined face, a valve for admitting pressure to said chamber, said valve being provided with means for engaging said inclined face, whereby said last-named valve is operated upon the movement of said first-mentioned valve, which movement of said first-mentioned valve likewise establishes communication between the chamber and said port; substantially as described.

3. The combination with a valve-casing provided with a chamber and a port, of a valve passing through said chamber and port, said valve being formed with a reduced portion having an inclined face, a valve for admitting pressure to said chamber, said valve being provided with means for engaging said inclined face, whereby said last-named valve is operated upon the movement of said first-mentioned valve, which movement of said first-mentioned valve likewise establishes communication between the chamber and said port, and means for locking said valve in an adjusted position for regulating the available area through which pressure passes into the port; substantially as described.

4. The combination with the valve-casing having suitable ports, of a valve C having a V-shaped reduced portion, which reduced portion likewise establishes communication between the central chamber and the ports on each side thereof, a spring-pressed tooth mounted on said valve C, and a notched face on the valve-casing, with which said spring-pressed tooth coöperates; substantially as described.

5. In an engine, the combination with a winged power-wheel, of a valve-casing provided with oppositely-disposed ports in juxtaposition to the periphery of said wheel, an adjustable valve in said valve-casing for admitting pressure to either of said ports, and a main throttle-valve bearing upon the adjustable valve and controlled by said first-mentioned valve; substantially as described.

6. The combination with a valve-casing provided with oppositely-disposed ports, of an adjustable slide-valve, and a throttle-valve bearing with spring-pressure upon the adjustable valve and adapted to be controlled thereby.

7. The combination with a valve-casing provided with oppositely-disposed ports, of an adjustable valve having a V-shaped notch therein for opening communication to either of the ports, and a spring-actuated throttle-valve normally held in contact with the adjustable valve and in the notch of the latter when closed.

8. The combination with a hollow winged power-wheel having an exhaust at its axis, of a valve-casing provided with oppositely-disposed ports, a valve for admitting pressure into either of said ports for operating said power-wheel in either direction, suitable gearing driven by said power-wheel, and a stock-spindle driven by said gearing; substantially as described.

9. The combination with a casing formed with a blast-nozzle arranged at an angle to a winged power-wheel mounted in the casing, said power-wheel comprising two disks with wings or plates arranged between at the periphery of said disks, and a hollow shaft on which said disks are mounted and which hollow shaft constitutes the exhaust-port; substantially as described.

10. The combination with a casing, of a power-wheel and gearing driven thereby, said casing containing a lubricant in which said gearing is designed to rotate, said power-wheel comprising two disks with interposed peripheral wings or plates, and a hollow shaft on which said power-wheel is mounted and through which the exhaust in the engine passes, whereby, should the lubricant contact with the said power-wheel, it will be thrown out by centrifugal force and prevented from passing outwardly through the hollow exhaust-shaft; substantially as described.

11. The combination with a casing, of a power-wheel and gearing driven thereby, said parts being mounted within the casing, and said casing containing a lubricant in which said parts are wholly or partly submerged, an exhaust-opening leading from the casing, and means for separating the lubricant from the exhaust before said lubricant reaches said exhaust-opening; substantially as described.

In testimony whereof I hereunto affix my signature, in the presence of two witnesses, this 4th day of April, 1899.

JOHN A. HOFF.

Witnesses:
F. R. CORNWALL,
A. S. GRAY.