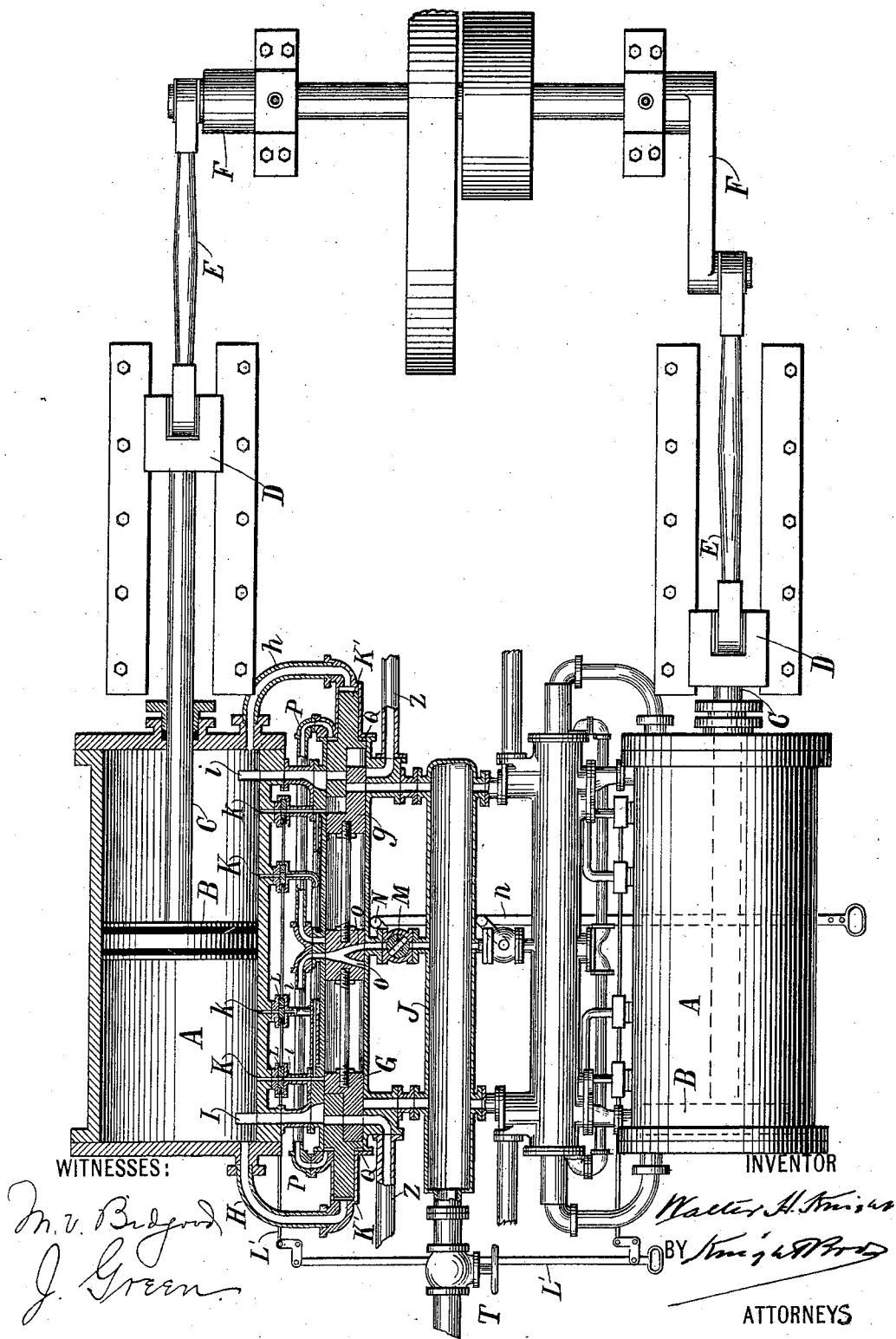


(No Model.)

W. H. KNIGHT.  
AIR MOTOR.

No. 568,354.

Patented Sept. 29, 1896.



# UNITED STATES PATENT OFFICE.

WALTER H. KNIGHT, OF NEW BRIGHTON, NEW YORK.

## AIR-MOTOR.

SPECIFICATION forming part of Letters Patent No. 568,354, dated September 29, 1896.

Application filed December 30, 1895. Serial No. 573,824. (No model.)

*To all whom it may concern:*

Be it known that I, WALTER H. KNIGHT, a citizen of the United States, residing at New Brighton, Richmond county, State of New York, have invented a new and useful Improvement in Air-Motors, of which the following is a specification.

My invention relates to reciprocating motors, and has for its object the provision of means for operating the valve mechanism of such motors with compressed fluid in lieu of eccentrics, cams, or the like.

My invention further relates to means for operating cut-off valves in connection with the main admission and exhaust valves by means of compressed fluid.

My invention further relates to means for reversing motors operated by fluid-actuated valves.

The accompanying drawing represents in partly-sectional plan view a double-acting duplex motor embodying my invention.

A A are cylinders; B B, pistons; C C, piston-rods; D D, cross-heads; E E, connecting-rods, and F F cranks of ordinary construction, the two cranks being set at an angular distance apart of ninety degrees.

G g is the main valve, which is of the piston type and is adapted to be operated by the air compressed by the main piston at each end of the stroke, operating through ports H h.

I i are the supply and exhaust ports. Compression takes place immediately after the main piston has passed over and closed the exhaust-port in its passage toward the end of the cylinder. The air thus compressed, passing through ports H h, throws the main valve G g so as to open the port just covered by the piston to the live-air supply in the air-chest J, and throw the port at the other end of the cylinder in communication with the atmosphere through passages Z. The main valve remains in this position until the piston reaches the other end of the cylinder, when it is thrown backward by the compression taking place at that end.

K' K' are cut-off valves riding on the main valve and operated, together with the main valve, by the compressed air at the end of the stroke, as just described, but thrown back when the piston B has moved far enough

to uncover cut-off ports K k. These cut-off ports admit compressed air from the cylinder to the inner face of the cut-off valve, which is made larger than that face upon which the compression-pressure operated, the difference in area being sufficient to insure the movement of the cut-off. The cut-off ports are supposed to be located at that part of the stroke which will give the best average results.

There may be more than one set of cut-off ports to give different degrees of expansion, as, for instance, K k. In such case a manual valve L, operated by rods L', could be used to shut off one set of ports and simultaneously open the other set, the ports l in the valve L being placed at proper intervals to accomplish this result. The valve L can in one position close all of such cut-off passages, so as to prevent the valves K' K' from closing, thereby causing the engine to take pressure full stroke. By this means one cut-off may be used for giving maximum economy and the other cut-off may be used for starting or giving maximum capacity. It will be seen that after the cut-off valve is thrown back when the piston arrives at the cut-off point it remains in that position, and at the end of the stroke the main valve is thrown back against it, bringing both valves back to their starting position.

In order to reverse a motor of this kind, it is simply necessary to throw the valves into the opposite position from which they are standing. To do this, I provide a reversing-valve M operated by reversing-lever N, which, when thrown over by rod n, admits air from the air-chest J to a part o of the main valve that is provided with ports O, designed to allow the air to flow to that end of the valve, which will throw it in the opposite direction from which it is standing. Upon being so thrown over the ports O will arrange themselves in position to throw the valve back; but in the meantime the operator has by a further movement of the lever N thrown the valve M so as to shut off further admission of air to the ports O. The air flowing through valve M and ports O is led by passages P to chamber Q and operates therein upon a face of the cut-off valve, which is larger in area than the end faces upon which

the compression-pressure operates, this difference of area being such as to insure the throwing over of the valve irrespective of any pressure that may exist in the cylinder or in

5 ports II *h*.

The machine is started or stopped by means of throttle-valve T. The locating of the cranks ninety degrees apart insures the following of the piston to the end of the stroke, notwithstanding the compression which takes place at that point.

Having thus described my invention, the following is what I claim as new therein and desire to secure by Letters Patent:

15 1. The combination of the cylinder, and the piston adapted to compress fluid in the end of the cylinder, with the main valve, and cut-off valves controlling the main valve and operated by the fluid compressed in the end of

20 the cylinder.  
2. The combination of the cylinder and piston with ports so arranged as to compress contents of the cylinder at the end of the stroke with a valve controlling admission and

25 exhaust ports of such cylinder and operated by said pressure.  
3. The combination of two cylinders with their pistons, piston-rods, connecting-rods and cranks, with the cranks set substantially

30 at right angles with ports at each end of the cylinders so located as to give compression at the end of the stroke, and the valve for each cylinder controlling the admission and exhaust from the cylinders and passages leading from the ends of the cylinders to the valve-

35 chambers so that the said valves may operate solely by the pressure due to compression.  
4. The combination with the cylinder and piston of a valve operated by compression

40 caused at each end of the cylinder by the piston and a cut-off valve operated by the pressure in the cylinder and through a port exposed by the piston after it has traveled a predetermined part of the stroke.

45 5. In a fluid-pressure motor the combination of the cylinder and piston moving therein, a main valve controlling the admission and exhaust of the fluid to and from the cylinder and cut-off valve for each end, and

50 ports leading from the ends of the cylinder

to the cut-off-valve chambers so that such valves may be operated by compression of the fluid at the end of the stroke, the main valve being acted upon directly by the cut-off valve so as to be shifted simultaneously

55 with it.  
6. In a fluid-pressure motor the combination of the cylinder and piston with the main valve and cut-off valves actuated by the fluid that is compressed at the end of the stroke

60 and ports leading from one or more places from the cylinder to the cut-off-valve chambers through which cylinder pressure can be admitted to the said valve-chambers when the piston reaches a predetermined point or

65 points of its stroke to operate the cut-off valves and close the admission-ports.  
7. In a fluid-pressure motor the combination with the cylinder and piston of a fluid-actuated cut-off valve, and the main valve operated by the cut-off valve, of admission and exhaust ports opened and closed by said valves, passages leading from the ends of the cylinder to the face of the cut-off valves of a given

70 area, cut-off ports extending from cut-off points in the cylinder to the opposite ends of the cut-off valves which ends have greater area than the aforesaid ends of given area.

75 8. In a fluid-pressure motor the combination of the cylinder and piston with a main valve and cut-off valves actuated by the fluid-pressure, with cut-off passages leading from each cut-off-valve chamber to points in the cylinder corresponding to positions of maximum economy cut-off, and maximum capacity cut-off and means for closing one set of

80 such passages or both.  
9. In a fluid-pressure motor the combination of the cylinder and piston with fluid-actuated valves and reversing mechanism

85 consisting of a manual valve and automatic valve, the former admitting fluid under pressure and the latter directing the fluid so as to reverse the valves and consequently the direction of the machine.

WALTER H. KNIGHT.

Witnesses:

M. V. BIDGOOD,

H. E. KNIGHT.