March 23, 1926. 1,577,665

R. E. B. WAKEFIELD

STARTING VALVE FOR ENGINES

Filed Oct. 30, 1920

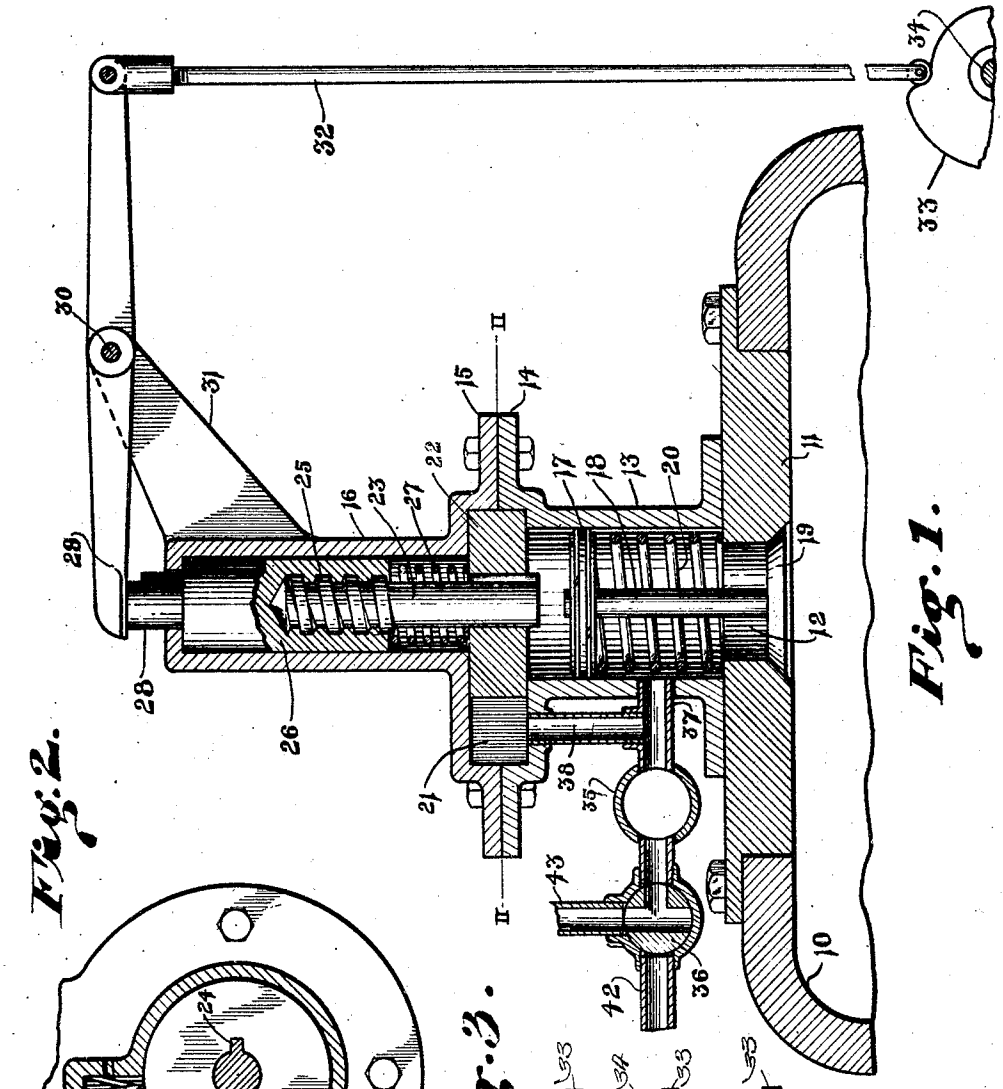

Fig. 1.

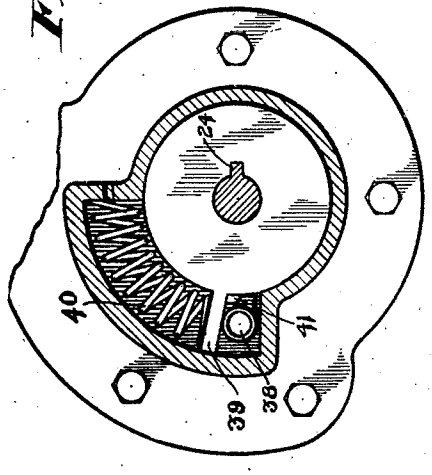

Fig. 2.

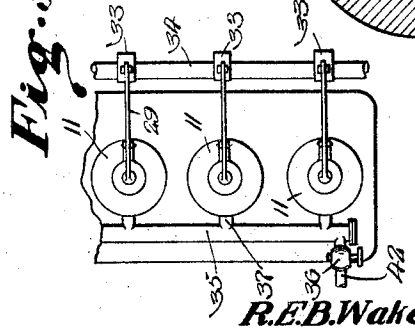

Fig. 3.

R.E.B. Wakefield
INVENTOR

D.C. Davis
ATTORNEY

Patented Mar. 23, 1926. 1,577,665

UNITED STATES PATENT OFFICE.

RICHARD E. B. WAKEFIELD, OF PHILADELPHIA, PENNSYLVANIA, ASSIGNOR TO WESTINGHOUSE ELECTRIC AND MANUFACTURING COMPANY, A CORPORATION OF PENNSYLVANIA.

STARTING VALVE FOR ENGINES.

Application filed October 30, 1920. Serial No. 420,664.

To all whom it may concern:

Be it known that I, RICHARD E. B. WAKEFIELD, a citizen of the United States, and a resident of Philadelphia, in the county of Philadelphia and State of Pennsylvania, have invented a new and useful Improvement in Starting Valves for Engines, of which the following is a specification.

My invention relates to internal combustion engines and it has particular reference to air starting mechanisms for multi-cylinder internal combustion engines of the Diesel type.

An object of my invention is to provide an efficient starting mechanism for multi-cylinder internal combustion engines and more particularly for engines of the Diesel type in which air under pressure is used for starting the engine.

A further object of my invention is to provide an improved and efficient unit construction in an air starting mechanism so constructed that a multi-cylinder engine embodying any number of cylinders may be readily equipped with my improved starting device without modifying the design of the operating mechanism.

A further object of my invention is to produce an air starting valve simple in operation, durable in construction and automatic in action.

These and other objects which will be made aparent throughout the following description are attained by means of apparatus embodying the features of my invention herein described and illustrated in the accompanying drawing in which:

Figure 1 is a longitudinal sectional view of a valve structure applied to the head of an internal combustion engine and embodying a preferred form of my invention; Figure 2 is a detailed sectional view on the line II—II of Figure 1, and Figure 3 is a diagrammatic plan view, showing the application of my invention to a multi-cylinder engine.

In certain starting mechanisms commonly in use in multi-cylinder, internal-combustion engines, it is necessary, in order to place the starting mechanism in operation, to perform two or more manual operations. In other constructions now in use for supplying air to the cylinders of internal combustion engines, the design of the starting mechanism must be modified for any given number of engine cylinders. My improved device is constructed upon a unit plan and is designed in such a manner that a multi-cylinder engine of any number of cylinders may be equipped with my air starting device by associating a unit valve with each engine cylinder, supplying air to the unit valves of the several cylinders from a single manifold and operating the valve movements from a single cam shaft. The reciprocating portions of the air valve are constantly in motion but are held out of contact with the air admission valve stem until air under pressure is admitted to the valve. The air acting upon a reciprocable piston throws the reciprocating parts of the valve in contact with the air valve stem and permits the opening of the air valve to be controlled from the cam shaft. This provides an automatic operation of the air valves of a multi-cylinder engine which is controlled by the manipulation of a single valve supplying air to the air manifold.

Referring to the drawing, 10 designates a cylinder head to which is secured a closure plate 11 provided with a central opening 12. A cylindrical valve casing 13 is mounted upon and may be integral with the closure plate 11. The casing 13 has a flanged upper portion 14 which is secured to a co-operating flange 15 of an upper cylindrical plunger casing 16. Within the valve casing 13 a piston 17 is mounted to reciprocate. A valve stem 18 rigidly connects the piston 17 with a valve 19 which is arranged to open inwardly into the engine cylinder. The valve 19 is normally held closed by a spring 20 which is arranged to bear against the piston 17 and cover plate 11. The valve stem 18 projects through the piston 17 forming an abutment, the purpose of which will be hereinafter described.

An arcuate chamber 21 is formed between the flanged members 14 and 15, within which is mounted a disc 22. A stem 23 extends in slidable relation through the disc 22, and is splined to the disc 22 as by a key 24 to prevent relative rotation between the disc and the valve stem. The upper portion of the stem 23 is provided with a threaded portion 25 which operatively engages a threaded portion of a plunger 26. The plunger 26 and stem 23 are normally held

in an upper position by a spring 27, which bears against the disc 22 and plunger 26. The plunger 26 is provided at its uppermost end with a reduced portion 28 which extends through an opening in the top of the casing 16 and which is keyed thereto to prevent the rotation of the plunger 26 within the cylinder 16. The portion 28 is arranged to contact with a lever 29 pivoted at 30 to a bracket 31 which may be rigidly secured to the casing 16. The lever 29 may be actuated through a link 32 and cam 33, the latter being secured to a cam shaft 34. The cam shaft 34 may extend the length of the engine and serve to operate the starting valves in all the cylinders by means of individual cams 33 secured thereto and adjusted to actuate the operating mechanism of the respective starting valves in proper timed relation. It may be preferable, however, to provide a separate cam shaft 34 for each cylinder.

Air is supplied to the casing 14 and chamber 21 from a manifold 35 which is disposed adjacent to the air valves of all of the engine cylinders and which is preferably provided with an air supply valve 36. The manifold 35 communicates with the valve casing 13 through a conduit 37 and with the arcuate chamber 21 through a conduit 38. Secured to the disc 22 and extending within the chamber 21 is a flange or piston 39 which forms an integral part of the disc 22. The flange 39 is constructed to oscillate in fluid-tight relation within the arcuate chamber 21 and is normally held near one end of the chamber 21 by means of a helical spring 40 which serves to press the flange 39 against a stop 41. Air may be supplied to the manifold 35 from any suitable source of compressed air through a conduit 42 and may be exhausted from the manifold 35 by turning the valve 36 to communicate with a conduit 43 which is open to the atmosphere.

Having described the arrangement of the device embodying my invention, the operation thereof is as follows: Air under pressure is admitted by the manipulation of the valve 36 to the manifold 35 and thence to the casing 13 and to the arcuate chamber 21. The air acting on one side of the flange 39 overcomes the force of the spring 40 and causes the disc 22 and with it the valve stem 23 to move through an angle determined by the length of the arcuate chamber 21. The angular movement of the stem 23 within the plunger 26 causes the stem 23 to be downwardly displaced to contact with the upper end of the stem 18 of the valve 19, in which position the reciprocating movements of the plunger are communicated to the air valve 19 so as to open and close the air valve in timed relation to the movement of the engine piston. It is to be understood that when the cam 33 is rotated a constant reciprocation of the lever 29, plunger 26 and stem 23 is effected. It follows that when the engine is at rest, the lever 29 retains the plunger 26 and stem 23 in one or more of the engine cylinders in their lower position. At the time air is admitted to the manifold, the stem 23 is still further lowered by the rotation of the disc 22 in a manner described above. This results in the opening of an air valve in the cylinder, or cylinders, in which the plunger 26 and stem 23 are at the time of starting held in a lowered position. Air is thus admitted to a cylinder in which the piston is in a position to be forced outwardly. As the engine turns over, other cylinders will in turn receive a charge of starting air in a similar manner. When the engine is in full operation, a turning of the single valve 36 to register with the exhaust 43 permits the spring 40 to return the flange 39 and disc 22 to their normal position as determined by the stop 41, thereby raising the plunger 26 and the stem 23 so that in their further reciprocation they will not contact with the valve stem 18. The spring 20 insures that the air valve 19 will be closed at all times, except during those periods in which air is supplied to manifold 35.

My improved starting valve is especially advantageous in that it may be applied to multi-cylinder engines of any type without the use of complicated operating mechanisms exterior to the valve structure. This is made possible by providing for each engine cylinder an individual and complete starting mechanism. It follows that the failure of one valve to operate in no way interfered with the operation of the valves in the remaining cylinders. This construction has the further advantage in the readiness with which any valve may be removed for repair or replacement, such exchange of valves being readily accomplished without interfering with the starting mechanism of the remaining engine cylinders.

While I have shown my invention in but one form, it will be obvious to those skilled in the art that it is not so limited, but is susceptible of various other changes and modifications, without departing from the spirit thereof and I desire, therefore, that only such limitations shall be placed thereupon as are imposed by the prior art or as specifically set forth in the appended claims.

What I claim is:

1. An automatically extensible push rod for air valves comprising a stem provided with a screw, a non-rotatable nut cooperating with the screw, an air motor adapted to rotate the stem in one direction, and spring means to return the stem to its initial position.

2. In an air starting mechanism for internal combustion engines, a reciprocating

plunger, means operatively connected to a moving engine part for reciprocating the plunger, an air valve arranged to be opened and closed by the reciprocation of the plunger, and means for changing the effective length of the plunger, the plunger being so disposed with relation to the valve that when the effective length of the plunger is increased the valve will be opened by the reciprocation of the plunger, and when the plunger is at its shortest effective length, the valve will not be opened by the reciprocation of the plunger.

3. In an air starting mechanism for internal combustion engines, a reciprocating plunger, means operatively connected to a moving engine part for reciprocating the plungers, an air valve arranged to be opened and closed by the reciprocation of the plunger, a casing for the valve, means for supplyng compressed air to the casing, and means for changing the effective length of the plunger, said means comprising a pressure responsive device so arranged that when air is admitted to the valve casing the effective length of the plunger will be greater, the plunger being so disposed with relation to the valve that when the effective length of the plunger is increased the valve will be opened by the reciprocation of the plunger, and when the plunger is at its shortest effective length, the valve will not be opened by the reciprocation of the plunger.

4. An automatically extensible push rod for air valves comprising a stem provided with a screw and adapted to open the valve, a non-rotatable nut cooperating with the screw, an air motor adapted to rotate the stem in one direction, spring means to return the stem to its initial position, and spring means opposing the valve-opening movement of said stem.

In testimony whereof, I have hereunto subscribed my name this 29th day of October, 1920.

RICHARD E. B. WAKEFIELD.