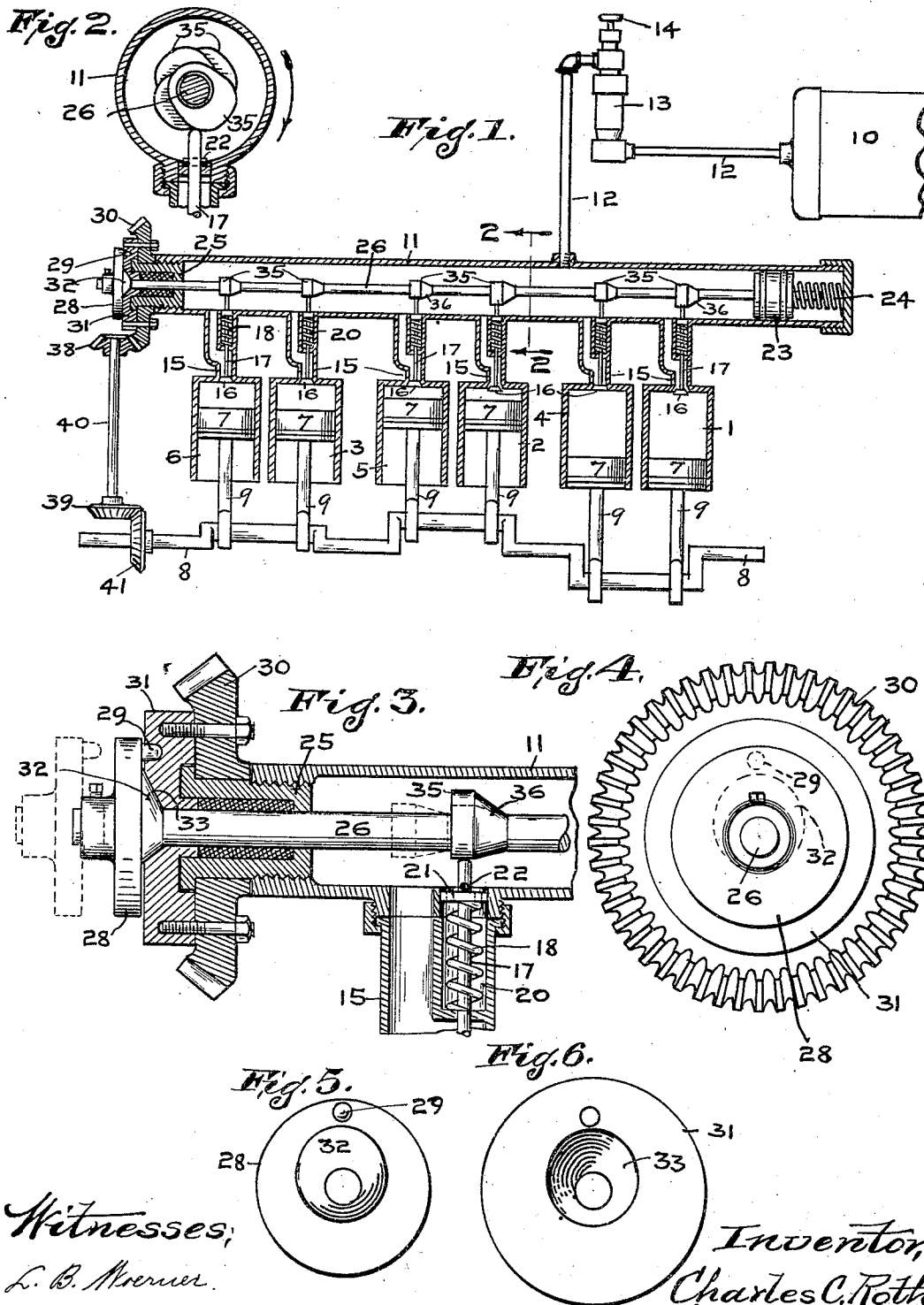


C. C. ROTH.
STARTING DEVICE FOR EXPLOSION ENGINES.
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Witnesses:
L. B. Moerner.
Wm L. Buehler.

Inventor,
Charles C. Roth
By Minturn & Mosner
Attorneys.

UNITED STATES PATENT OFFICE.

CHARLES C. ROTH, OF INDIANAPOLIS, INDIANA.

STARTING DEVICE FOR EXPLOSION-ENGINES.

1,024,103.

Specification of Letters Patent.

Patented Apr. 23, 1912.

Application filed September 25, 1911. Serial No. 651,142.

To all whom it may concern:

Be it known that I, CHARLES C. ROTH, a citizen of the United States, residing at Indianapolis, in the county of Marion and State of Indiana, have invented certain new and useful Improvements in Starting Devices for Explosion-Engines, of which the following is a specification.

My invention relates to improvements in starting devices for explosion engines with a plurality of cylinders whereby compressed air is admitted to each of the cylinders consecutively only during the explosion stroke of its piston.

The object is to reduce the amount of pipe fitting and otherwise to simplify the means for conducting the air to the cylinders in proper sequence; to place the operations under the control of the driver; to continue the movement of the pistons with compressed air by its consecutive admission to the cylinders until the normal operations by the use of hydrocarbon vapors properly exploded have been resumed, and to provide automatic timing and control which will be operated by the same compressed air which is subsequently used for moving the pistons in the cylinders.

I accomplish the above objects by the mechanism illustrated in the accompanying drawings, in which—

Figure 1 illustrates diagrammatically the cylinders of a six-cylinder engine equipped with the mechanism of my invention. Fig. 2 is a section on the line 2—2 of Fig. 1. Fig. 3 is a fragment in longitudinal section of the air distributing conduit on a larger scale than that of Fig. 1, showing the coupling and driving connections with the cam-shaft. Fig. 4, is a view in end elevation, of the mechanism illustrated in Fig. 3, and Figs. 5 and 6 illustrate the contacting faces of the coupling plates which connect the cam-shaft with its driving mechanism.

Like characters of reference indicate like parts throughout the several views of the drawings.

I have shown my invention as applied to a six-cylinder engine, but it is equally applicable to engines having a less number of cylinders, or to those having a still greater number, the six-cylinder engine being shown merely by way of illustration.

I have numbered the cylinders 1 to 6, inclusive, in the order in which a hydrocarbon charge will be fired or exploded in them in

the usual way, 7 are the pistons operating in said cylinders, 8 a crank-shaft and 9 the connecting-rods from the pistons to the crank shaft, all of usual and well known construction.

10 is a tank which is filled by any suitable means with compressed air, and 11 is a distributing tube or conduit to which the compressed air in tank 10 is delivered through a pipe 12, and located in the pipe 12 is a valve 13 for regulating the air discharge, through said pipe. The valve 13 has a push-rod terminating with the cap 14, whereby, by pressing the cap 14, as by the driver's foot, the valve 13 will be opened to allow the discharge of air from tank 10 into conduit 11 through pipe 12. The construction of the valve 13 is fully described and shown in my previous application for patent filed May 22, 1911, Serial Number 628839 and need not be described here in detail.

The conduit 11 has tubular discharges 15, one for each of the cylinders of the engine, from said conduit into each cylinder at the outer end of the latter, and valve seats are formed in the cylinders at the ends of said discharges, to receive the tapering valves 16 which, in opening, move inwardly of their respective cylinders. Each valve has a stem 17 which terminates within the conduit 11. A spring 18 is located in a chamber 20 formed in tube 15. It surrounds the stem 17 and bears at one end against the bottom of chamber 20 and at its other end against a disk 21 through which stem 17 passes and which is limited in its longitudinal movement on the stem by any suitable means such as a pin 22. The tube 15 has a lateral bend at the bottom of chamber 20 and extends thence to conduit 11 at the side of chamber 20 to provide an air passage independent of said chamber 20 and enables me to inclose the spring 18 in chamber 20 and protect it sufficiently from any hot discharge through tube 15 to prevent the overheating of spring 18 which would take the temper out of the latter and destroy its usefulness. If the several engine cylinders are located more or less remote from conduit 11 the tubes 15 will be suitably extended and bent to reach them in connecting the conduit 11 therewith.

Mounted within the conduit 11 is a piston 23 having a travel longitudinally of said conduit and provided with suitable packing rings to make an air-tight fit between the

piston and the inner wall of the conduit. This piston is located near one end of the conduit, as shown on Fig. 1, and is pressed normally away from the adjacent end by a
 5 spring 24. The opposite end of conduit 11 is closed in an air tight manner, here shown by means of a plug 25 which screws into the internally threaded end of said conduit. This plug 25 has a central opening through
 10 which a rod 26 of the piston 23 is passed and mounted on this end of the rod is a coupling disk 28, having a pin 29 on its inner side. Mounted loosely on the extended plug 25 is a bevel gear wheel 30, and bolted to the
 15 outer side of the wheel 30 is a coupling disk 31 having a socket in its outer face which is adapted to receive the pin 29 of the coupling disk 28 and to direct the pin into said socket immediately, upon the bringing of
 20 the adjacent sides of disks 28 and 31 together by a longitudinal movement of rod 26, I provide an eccentric cam extension 32 on the disk 28 and a correspondingly shaped socket 33 in the disk 31, which, by the seating of the cam in its socket, the two disks
 25 will be rotated to bring pin 29 into register with its socket.

Mounted upon the rod 26 are the cams 35, there being one cam for each of the valve-
 30 stems 17, and the ends of said stems are held in the paths of the cams by the action of their respective springs 18. The cams 35 have extensions 36 which taper down to the dimension of rod 26 to permit the cams to
 35 be moved into and out of contact with stems 17 by a longitudinal movement of the rod 26 carrying said cams. The movement of rod 26 in a direction to take its cams out of contact with said valve stems is accom-
 40 plished by the pressure of spring 24 against piston 23, and the reverse movement of rod 26 to bring the cams into action against the valve stems is accomplished by the pressure
 45 of the compressed air against piston 23 when admitted from tank 10 to conduit 11. This air pressure is sufficient to overcome the tension of spring 24.

The bevel wheel 30 is in constant drive from the crank shaft 8 of the engine through
 50 pinions 38 and 39 on shaft 40 and pinion 41 on said crank shaft 8, and by the coupling together of disks 29 and 31 by the longitudinal movement of piston rod 26 when the piston is moved by the admission of com-
 55 pressed air to conduit 11 as above described, the rod 26 will be rotated and the cams 35 will all be rotated with it.

The cams 35 are shaped substantially as shown in Fig. 2 with enlargements to lower
 60 the valve stems 17 and hold the valve 16 open during a little less than one fourth of each revolution of the rod 26. The rod 26 in a six cylinder engine is made to travel one revolution for each two revolutions of
 65 the crank shaft 8 in order to properly time

the opening of the valves 16. The cams 35 are arranged on rod 26 in a manner as illustrated in Fig. 2 to correspond with the proper movements of the piston of the cylinder with which it is designed to operate, the purpose being to always admit the compressed air to a cylinder during the explosion stroke of its piston at the beginning of that stroke. By so doing, when the engine is quiet, the force of the compressed air admitted to a cylinder operates its piston; this starts the entire engine, rotates the rod 26 closing the air valve which had just discharged, and opening the compressed air discharge into another cylinder at the beginning of its expansion stroke and so on until the engine is operating normally by the explosion of hydrocarbon charges in the usual way. The supply of air from tank 10 to conduit 11, continues as long as the valve 13 is held open by the driver and the valve 13 will be closed by him as soon as the engine is running with gasoline.

The operation of my device in brief is as follows: The engine being quiet the driver presses his foot against cap 14 opening valve 13 and admitting compressed air from tank 10. Compressed air is admitted to conduit 11, and thereupon piston 23 is pressed against spring 24 compressing the spring and moving the cams 35 into contact with stems 17 and also coupling the rods 26 through disks 28 and 31 to the bevel wheel 30. One of the 6 cams 35 will be in right position to open a valve 16 into a cylinder having its piston at the beginning of its expansion stroke. This piston will be driven by the force of compressed air, thereby starting the engine in the manner previously described, and as soon as the normal hydrocarbon operations have been resumed the compressed air will be dispensed with by the driver relieving cap 14 of valve 13.

Having thus fully described my invention, what I claim as new and wish to secure by Letters Patent is—

1. In a starter for explosion engines having a plurality of cylinders, the combination with spring-closed inlet valves, one for each cylinder, of a conduit, a separate tubular discharge from the conduit to each valve, a rod mounted to rotate in said conduit and having cams, means operated by the rotation of said cams for consecutively opening each valve, and means for supplying compressed air to the conduit.

2. In a starter for explosion engines having a plurality of cylinders, the combination of spring-closed inlet valves, one for each cylinder, of a conduit, a separate tubular discharge from the conduit to each valve, a rod mounted to rotate in said conduit and having cams, a wheel operatively connected with the crank-shaft of the engine, means for supplying compressed air to the conduit,

means for operatively coupling the rod to said wheel, means for normally uncoupling the rod and wheel, means operated by the pressure of air in the conduit for operatively coupling the rod and wheel, and for starting the engine, and means operated by the rotation of the cams on said rod for consecutively opening each valve.

3. In a starter for explosion engines having a plurality of cylinders, the combination with spring-closed inlet valves, one for each cylinder, of a conduit, a separate tubular discharge from the conduit to each valve, a rod mounted to rotate in said conduit and having cams, said rod having longitudinal adjustment, a piston mounted on said rod and making an air tight fit with the inner walls of the conduit, a wheel operatively connected with the crank-shaft of the engine, means for operatively coupling the rod to said wheel, a spring to move the rod longitudinally and uncouple it from the wheel, means for supplying compressed air to the conduit to remove the piston and couple the rod to the wheel and to start the engine thereby causing said rod and its cams to rotate; and means operated by the rota-

tion of the cams for consecutively opening each valve.

4. In a starter for explosion engines having a plurality of cylinders, the combination with spring-closed inlet valves, one for each cylinder, of a conduit, a separate tubular discharge from the conduit to each valve, a rod mounted to rotate in said conduit, and having cams, said rod having longitudinal adjustment, a disk operatively connected with the crank-shaft of the engine, a second disk mounted on said rod and having a pin to enter a hole in the other disk, means for directing the pin into its hole when the two disks are brought together, means operated by the rotation of said rod and cams for consecutively opening each valve, and means for supplying compressed air to the conduit.

In witness whereof, I, have hereunto set my hand and seal at Indianapolis, Indiana, this, 18th day of September, A. D. one thousand nine hundred and eleven.

CHARLES C. ROTH. [L. S.]

Witnesses:

J. A. MINTURN,
F. W. WOERNER.

Copies of this patent may be obtained for five cents each, by addressing the "Commissioner of Patents, Washington, D. C."