

L. V. MOULTON.
 STARTER FOR INTERNAL COMBUSTION ENGINES.
 APPLICATION FILED JUNE 6, 1908. RENEWED DEC. 11, 1911.

1,060,355.

Patented Apr. 29, 1913.

2 SHEETS—SHEET 1.

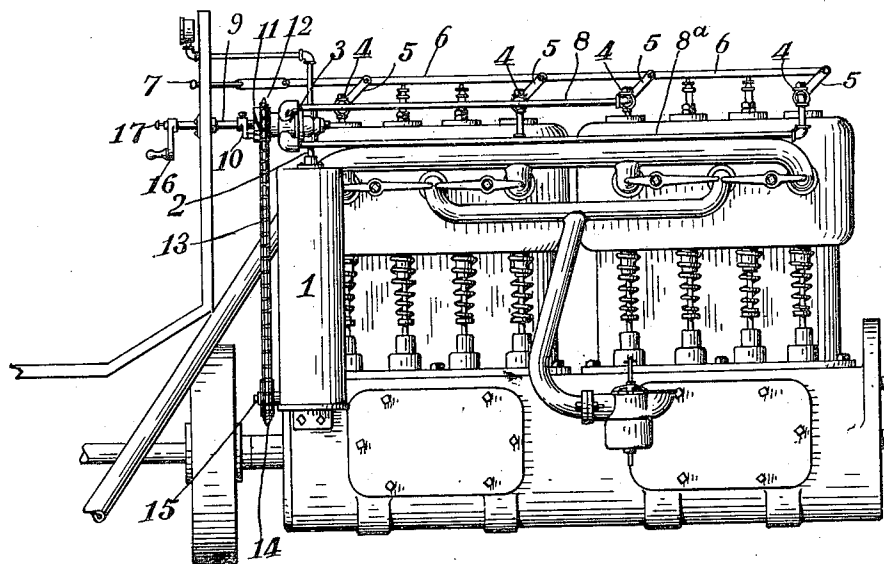


Fig. 1.

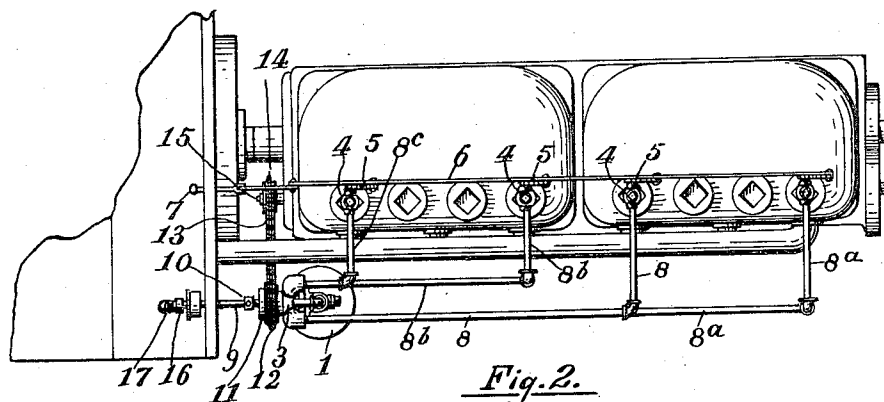


Fig. 2.

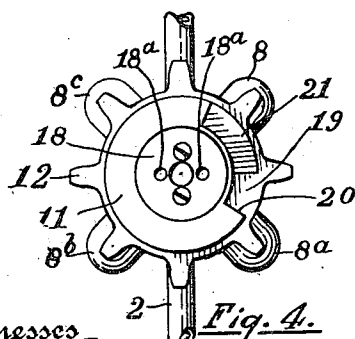


Fig. 4.

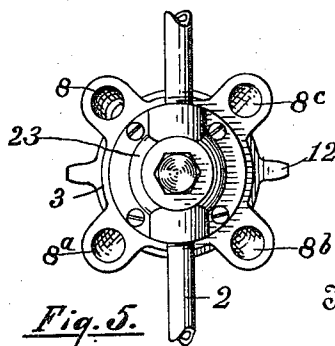


Fig. 5.

Witnesses
H. O. Van Antwerp
Georgiana Chase

Inventor
Luther V. Moulton

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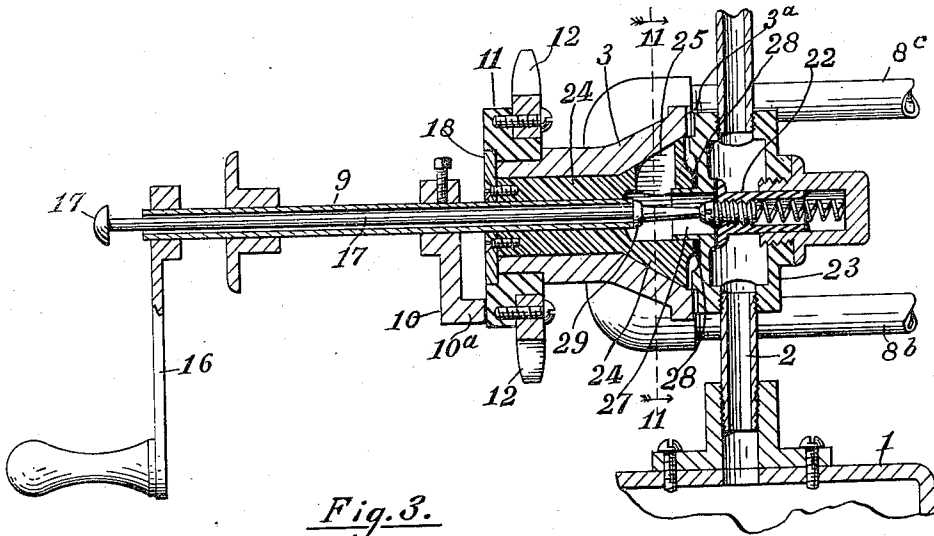


Fig. 3.

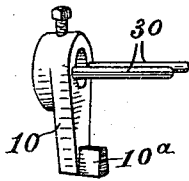


Fig. 6.

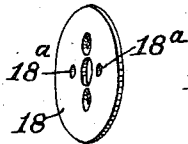


Fig. 7.

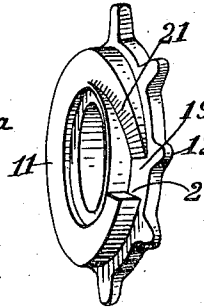


Fig. 8.

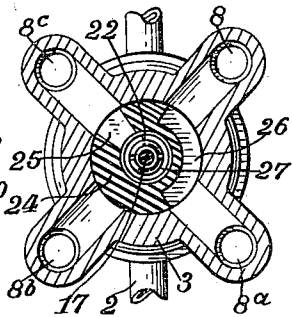


Fig. 11.

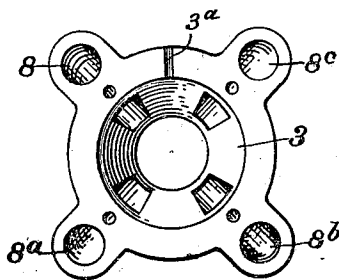


Fig. 9.

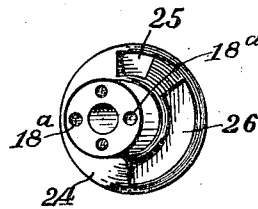


Fig. 10.

Witnesses
 H. O. Van Antwerp
 Georgiana Chase

Inventor

Luther V. Moulton

UNITED STATES PATENT OFFICE.

LUTHER V. MOULTON, OF GRAND RAPIDS, MICHIGAN.

STARTER FOR INTERNAL-COMBUSTION ENGINES.

1,060,355.

Specification of Letters Patent.

Patented Apr. 29, 1913.

Application filed June 6, 1908, Serial No. 437,133. Renewed December 11, 1911. Serial No. 665,151.

To all whom it may concern:

Be it known that I, LUTHER V. MOULTON, a citizen of the United States of America, residing at Grand Rapids, in the county of Kent and State of Michigan, have invented certain new and useful Improvements in Starters for Internal-Combustion Engines; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same.

My invention relates to improvements in starters for internal combustion engines, and more particularly to such devices as shown in the co-pending joint application of myself and Palmer A. Jones, filed September 19, 1907, Serial Number 393,671, which device consists essentially of a manually operated valve adapted to successively admit fluid under pressure to the respective cylinders of the engine in the order of the working strokes of their pistons, and means operated by the engine to control the manual adjustment and movement of the valve and the opening and closing of the throttle, and its object is to provide the device with means for reducing the friction of the manually rotated valve, to provide compression release when starting the engine, to provide means whereby the starting fluid may be admitted to any cylinder of the engine at pleasure, and to provide the device with various new and useful features hereinafter more fully described and particularly pointed out in the claims, reference being had to the accompanying drawings, in which:

Figure 1. is a side elevation of a four cylinder engine with my improved device attached thereto; Fig. 2. a plan view of the same; Fig. 3. an enlarged detail in longitudinal vertical section of the manually operated valve and mechanism connected therewith; Fig. 4. an end elevation showing the recessed wheel and sprocket wheel; Fig. 5. an end elevation of the valve casing; Fig. 6. perspective detail of the valve adjusting and controlling arm; Fig. 7. a detail of the retaining washer; Fig. 8. perspective detail of the wheel and sprocket wheel shown in Fig. 4; Fig. 9. an elevation of the valve case with the head removed; Fig. 10 a perspective of the manually operated valve; and, Fig. 11 a transverse vertical section on the line 11—11 of Fig. 3.

Like numbers refer to like parts in all of the figures.

1 represents a tank or any convenient closed receptacle charged with compressed fluid in any convenient manner, said fluid being adapted to be used for starting the engine. This tank communicates by a pipe 2 with the hollow head 23, which head communicates with a chamber in the axis of the rotary valve 24 through an opening 27, closed by a throttle valve 22, which valve is opened by the longitudinal movement of a rod 17 having one end engaging the valve. To enable the operator to open the valve 22 at pleasure, this rod extends through and beyond the tube 9 and is longitudinally movable therein, being provided with a collar 29 engaged by the end of the said tube to move the rod when the tube is moved. This tube 9 is longitudinally movable as well as rotative; is provided with a crank 16 for manually operating the same, and slidably connected to the valve 24 to adjust and rotate the same by pins 30 fixed in the arm 10 on the tube and slidable within openings 18^a in the washer 18 and valve 24. The tube thus slides freely in the axis of the valve and at the same time the valve is rotated therewith. Obviously the tube may be splined to the valve, but I prefer the construction shown as being cheaper and less likely to leak fluid around the tube. To prevent friction by pressure of the fluid on the valve 24, the opening 27 is surrounded by a packing 28 between the head 23 and the valve 24 to prevent escape of the fluid and any slight leakage escapes through a vent 3^a between the chest 23 and valve case 3, thus preventing any end pressure of fluid on the valve. From the chamber in the valve extends a lateral port 25, which as the valve is rotated successively connects the chamber with the various pipes 8, 8^a, 8^b and 8^c, which pipes communicate with the respective cylinders of the engine.

To relieve the compression and thus facilitate the starting of the engine, a segmental channel 26 is formed in the side of the valve 24, which successively connects the passages from the valve to the two cylinders next in advance of the cylinder receiving the fluid through the opening 25. Thus the compression is relieved, and instead of being exhausted, the charge is transferred to the cylinder, the piston in which is making

the inspiration stroke. The remaining cylinder having its exhaust valve open, the passage to this cylinder is closed. I also prefer to use a separate wheel 11 rotative on the valve case 3 and retained thereon by the washer 18, and attach to this wheel a detachable sprocket wheel 12, thus being able to use the ordinary rear sprocket wheel of a bicycle, and to more easily finish the wheel 11, which latter is provided with a recess 19 having a shoulder 20 at one side of the recess and an inclined or wedge surface 21 at the other side of the same. On the arm 10 is a lug or projection 10^a, which engages and traverses the face of the wheel 11 and is adapted to enter the recess 19 and engage the shoulder 20 at one side and the wedge 21 at its end. The sprocket wheel 12 is preferably connected to a like wheel 14 on the cam shaft 15 by means of a chain 13 whereby the wheel 11 rotates synchronously with the cam shaft (that is one revolution to each cycle of the engine). The wheel 11 is also adjusted relative to the operation of the engine that when the lug 10^a is in the recess 19, the valve 24 will be adjusted to a position which will connect the port 25 with the passage communicating with the cylinder in which the piston is making the working stroke. The next pipe in the series will be the one communicating with the cylinder in which the piston at the time is making the compression stroke, and the next pipe in series will communicate with the cylinder, the piston of which is at the time making the inspiration stroke. The fourth pipe will communicate with the cylinder, the piston of which is at the time on the exhaust stroke. Wherever in its cycle the engine stops, this recess 19 will always be so located that the valve 24 must be turned to the proper starting position before the lug 10^a can enter the recess 19 and the tube 9 can be thrust inward to open the throttle valve 22 and admit the compressed fluid to the engine.

To stop off the starting mechanism when the engine is running, cocks 4 are inserted in each pipe near the respective cylinders and each cock provided with a lever 5 to open and close the same, said levers being connected in common to a rod extending to a convenient point for manually operating the same and provided with a handle 7 to manually operate the rod 6, the valves being opened during the starting operation and closed when the engine is running. As soon as the engine starts, by manually turning the crank 16 and maintaining contact of the lug 10^a with the shoulder 20, the valve 24 will be controlled and operated to supply fluid to each cylinder in succession during the working stroke of the piston and the compression stroke of the preceding piston will force the compressed charge

through the channel 26 into the cylinder which is making the inspiration stroke. This compression release because of the limited size of this channel 26 will not be quite complete and thus a partial charge will be drawn through the carburetor of the engine, and a slightly compressed charge provided suitable for starting purposes, which being fired in the usual way will set up the regular operation of the engine. This will cause the wedge 21 of the wheel 11 to overtake the lug 10^a and thus move the tube 9 and permit the throttle valve to automatically close putting the starting mechanism out of action.

In the event that it is desired to scavenge out any of the cylinders, or to turn the engine backward for any reason, the valve 24 can be adjusted at pleasure to connect its interior with any one of the cylinders and the valve 22 opened by manual pressure on the outer end of the rod 17 thus admitting the fluid to any one or more of the cylinders at pleasure.

What I claim is:

1. Engine-starting apparatus having, in combination, a source of supply of motive-fluid and a selector for distributing the motive-fluid automatically among the cylinders of an engine to be started according to the positions of the respective pistons, the selector comprising a casing having a plurality of outlets adapted to be connected respectively, with the engine cylinders, and a rotary valve member provided with a port for discharging motive-fluid into said outlets in succession and a by-passage for interconnecting two of the outlets in advance of said port.
2. An engine starter, comprising a distributing valve adapted to admit fluid to the engine cylinders in succession, a throttle valve adapted to admit fluid to the distributing valve, a manually operated shaft adapted to simultaneously open the throttle valve and operate the distributing valve and independently operable means for manually opening the throttle valve.
3. An engine starter, comprising a rotative distributing valve to control the flow of fluid to the respective engine cylinders, a throttle valve to control the flow of fluid to the distributing valve, a manually operated shaft rotative to operate the distributing valve and longitudinally movable to open the throttle valve, and a longitudinally movable rod manually operated to independently open the throttle valve.
4. An engine starter, comprising a rotary distributing valve, a longitudinally movable throttle valve, a manually operated tubular shaft slidably connected to the distributing valve rotative to operate the distributing valve and longitudinally movable to open the throttle valve and a rod longitudinally

movable in the shaft to independently open the throttle valve.

5. An engine starter, comprising a manually operated tubular shaft having both rotary and longitudinal movement, a distributing valve slidably mounted on the shaft and rotative therewith, a rod longitudinally movable in the shaft, and a throttle valve independently opened by movement of either the shaft and rod together or by movement of the rod only.

6. An engine starter, comprising a tubular shaft both rotative and longitudinally movable, a rod slidable in the shaft and having a shoulder engaged by the end of the shaft, a throttle valve engaged by the end of the rod and opened thereby and a distributing valve slidably mounted on the shaft and rotated thereby.

7. An engine starter, comprising an admission valve, a throttle valve, means for manually and simultaneously opening the throttle valve and operating the admission valve, a controller adjusted and controlled by the engine and adapted to control the manual operation of said valves, and manually operated means for independently opening the throttle valve.

8. An engine starter, comprising a manually operated rotary tube, a rod longitudinally movable in the tube, a throttle valve engaged by the rod and opened thereby, an admission valve rotated by the tube, and means for controlling the manual operation of the tube, said means being in turn controlled by the engine.

9. An engine starter, comprising a manually operated rotative and longitudinally movable tube, a rod longitudinally movable in the tube and having a collar engaging the end of the same, a throttle valve opened by the rod, a rotary admission valve operated by the tube, and means for controlling the manual operation of the tube adjusted and controlled by the engine.

10. An engine starter, comprising a manually operated longitudinally movable and rotative tube, an admission valve rotated by the tube, a throttle valve opened by the longitudinal movement of the tube, an adjusting and controlling member rotated by the engine, a member connected to the tube engaging the engine rotated member and controlled thereby, and a rod longitudinally movable in the tube and engaging the throttle valve to independently open the same.

11. An engine starter, comprising a manually operated rotative and longitudinally movable tube, an admission valve rotated by the tube and slidably connected thereto, a rod slidable in the tube, a throttle valve engaged by the end of the rod, a collar on the rod engaging the end of the tube, a wheel rotated by the engine, and interlocking members on the wheel and tube whereby the

wheel determines the adjustment of the admission valve and the opening of the throttle valve, and the rod independently opens the throttle valve.

12. An engine starter, comprising a manually operated and longitudinally movable tube, an admission valve operated by the tube and slidably connected therewith, a rod longitudinally movable in the tube and projecting therefrom at each end, a collar on the rod engaging one end of the tube, a throttle valve engaged by the rod and opened by longitudinal movement thereof, and means operated by the engine for controlling the movement of the tube.

13. In combination with a multiple cylinder internal combustion engine, a starter, comprising a distributing valve successively communicating with the respective cylinders of the engine, means for supplying a starting fluid to said valve, and means operating in connection with said valve to permit fluid to pass from a cylinder during compression therein to another cylinder during inspiration therein.

14. An engine starter, comprising a valve case having a series of openings communicating with the respective cylinders of an internal combustion engine, a rotary valve in the case having an axial opening and a radial port to successively connect the axial opening with the openings in the case, said valve also having a segmental channel to successively connect two other of said openings and means for rotating said valve.

15. An engine starter, comprising a valve case having a series of openings to communicate with the respective cylinders of an internal combustion engine, a rotary valve in the case having an axial opening and a radial port to successively connect the axial opening with the openings in the case and also having a segmental channel to successively connect two of said openings, and means for adjusting and controlling the movement of said valve adapted to be adjusted and controlled by an engine.

16. An engine starter, comprising a valve case having a series of openings to communicate with the respective cylinders of an engine, a valve having an axial chamber and a radial port successively communicating with said openings, a head having an opening communicating with the chamber of the valve, a packing between the head and valve and surrounding said opening, a valve to close said opening, means for manually operating the valves and means for controlling said operation controlled by the engine.

17. An engine starter, comprising a valve case having a series of openings to communicate with the respective cylinders of an engine, a valve having an axial chamber and a radial port successively communicating with said openings, a head having an open-

ing communicating with the chamber of the valve, a valve to close said opening, a packing surrounding said opening, a vent to the space between the head and valve, means
5 for manually operating the valves and means for controlling said operation actuated by the engine.

18. An engine starter, comprising a valve case having a series of openings to communicate with the respective cylinders of an engine, a valve having an axial chamber, and also having a radial port to communicate with said openings in succession, and a segmental channel to successively connect two
10 of said openings, means for supplying fluid to said valve, means for manually operating said valve, and means for controlling said operation actuated by the engine.

19. An engine starter comprising a valve case having openings to communicate with the respective cylinders of an engine, a valve having an axial chamber, and also having a lateral port, and a segmental channel, means
20 for supplying fluid to said valve, means for manually operating the valve, and means for controlling said operation actuated by the engine.

20. An engine starter comprising a valve case having openings to communicate with the respective cylinders of an engine, a valve having an axial chamber and also hav-
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ing a lateral port and a segmental channel, a hollow head attached to the case and having an opening communicating with the chamber in the valve, a packing between the head and valve, a vent for the space between the valve and head and means for operating the valve. 35

21. An engine starter comprising a valve case having openings to communicate with the respective cylinders of an engine, an admission valve having an axial chamber and also having a radial port to successively communicate with the said openings, and a segmental channel to successively connect two of said openings, a hollow head attached to the case and having an opening communicating with the chamber in the valve, a throttle valve to close said opening, a packing between the head and valve, a rotative and longitudinally movable tube connected to the admission valve, a rod engaging the throttle valve and longitudinally movable in the tube, and means for controlling the movement of the tube operated by the engine. 40 45 50 55

In testimony whereof I affix my signature in presence of two witnesses.

LUTHER V. MOULTON.

Witnesses:

H. O. VAN ANTWERP,
GEORGIANA CHACE.