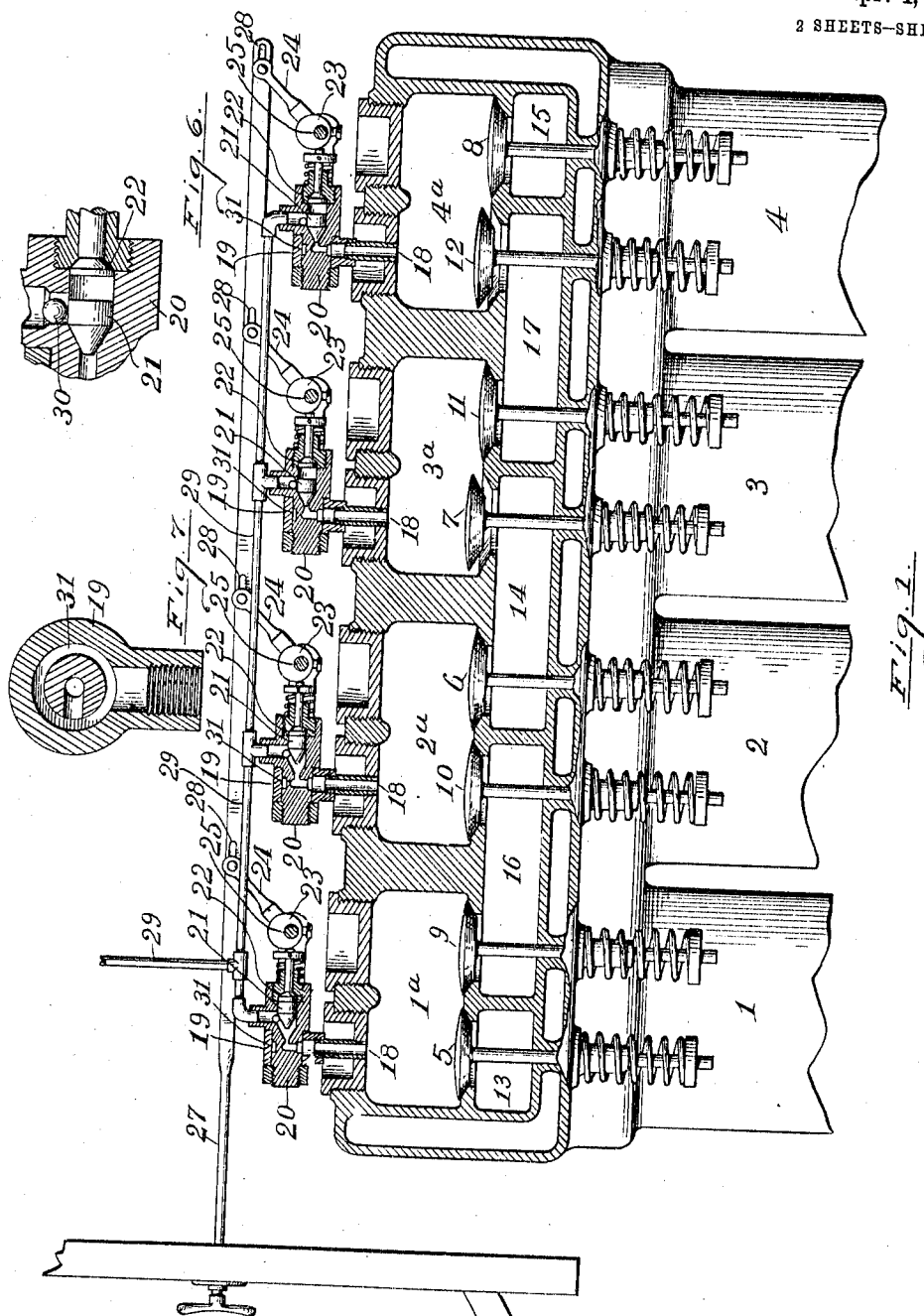


J. W. FITZ GERALD.
ENGINE STARTER.
APPLICATION FILED AUG. 26, 1910.

988,635.

Patented Apr. 4, 1911.
2 SHEETS-SHEET 1.



Witnesses
Harold O. Van Antwerp
Max Ransom

Inventor
John Watson FitzGerald
By Luther V. Moulton
Attorney

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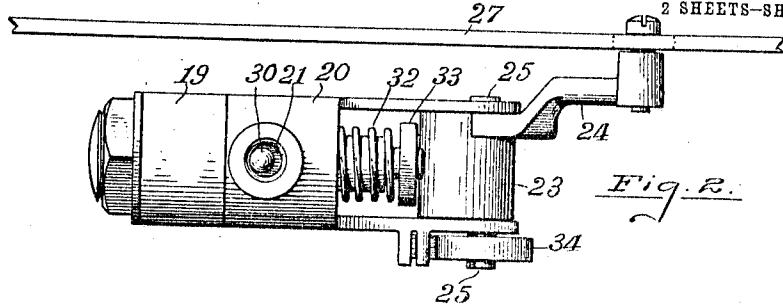


Fig. 2.

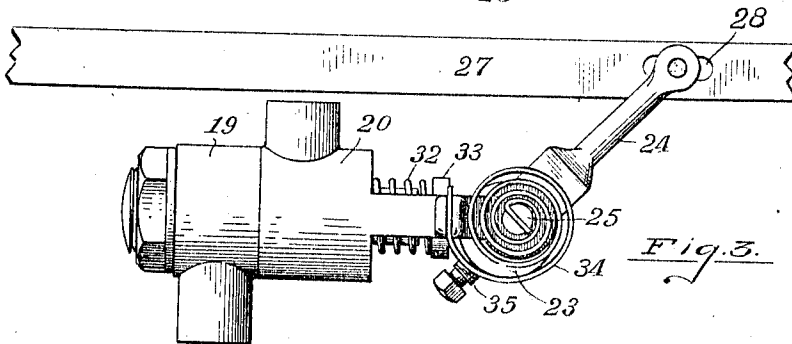


Fig. 3.

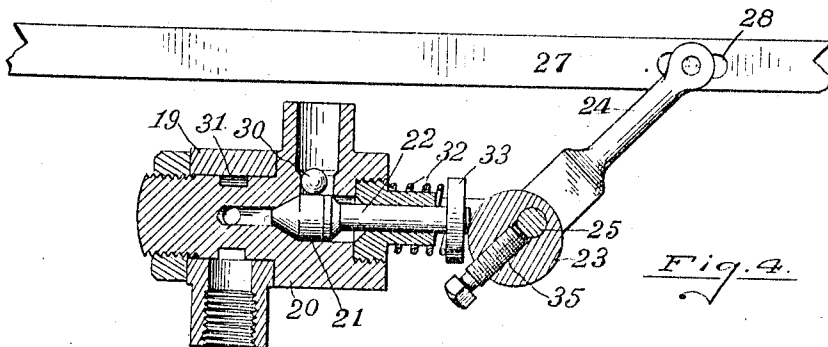


Fig. 4.

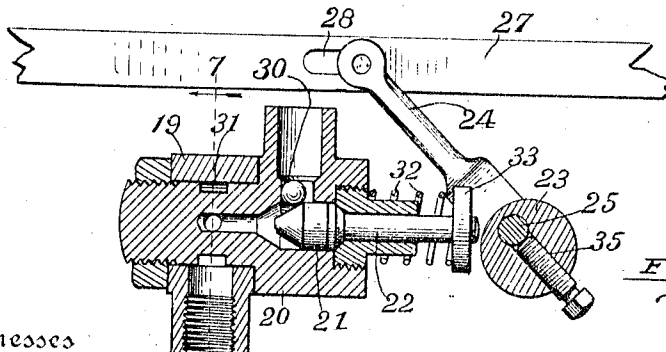


Fig. 5.

Witnesses

Harold O. Van Antwerp
Max Rauskin

Inventor

John Watson Fitz Gerald
By *Luther V. Moulton*
Attorney

UNITED STATES PATENT OFFICE.

JOHN WATSON FITZGERALD, OF GRAND RAPIDS, MICHIGAN.

ENGINE-STARTER.

988,635.

Specification of Letters Patent.

Patented Apr. 4, 1911.

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To all whom it may concern:

Be it known that I, JOHN WATSON FITZGERALD, a citizen of the United States of America, residing at Grand Rapids, in the
5 county of Kent and State of Michigan, have invented certain new and useful Improvements in Engine-Starters; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as
10 will enable others skilled in the art to which it appertains to make and use the same,

My invention relates to improvement in starters for internal combustion engines, and more particularly to the class of devices in
15 which a combustible mixture is supplied to the proper cylinder or cylinders of the engine, and fired to furnish the initial or starting impulse or impulses, until the engine assumes the normal running process.

20 My invention resides mainly in the construction and operation of the valves attached to the cylinders, whereby said valves automatically determine the proper cylinder or cylinders to receive the initial charge
25 and close off the other cylinders, and in various details of construction and arrangement, as will more fully appear by reference to the accompanying drawings in which:

30 Figure 1 is a vertical section through the valves and combustion chambers of a four cylinder engine having my invention applied thereto. Fig. 2 is an enlarged detail
35 of one of the valves comprised in my invention shown in plan view. Fig. 3 a side elevation of the same. Fig. 4 a vertical section of the same shown in closed position, Fig. 5 the same in open position. Fig. 6 a portion of the same showing the valve
40 in position to stop off a cylinder that is not in condition to receive the initial charge. Fig. 7 a transverse section of one of the valves on the line of 7-7 of Fig. 5.

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

1 2 3 and 4 represent the cylinders of a four cylinder internal combustion engine, having the usual combustion chambers 1^a 2^a 3^a and 4^a and exhaust valves 5 6 7 and 8
50 communicating respectively with exhaust chambers 13 14 and 15, and intake valves 9 10 11 and 12 communicating with intake chambers 16 and 17 for supplying a combustible mixture to the engine, all operating in the usual manner of such engines.

So far, the device represents a common

form of internal combustion engine, and obviously is not limited to the specific form shown, and my invention obviously may be adapted to an engine with a different number of cylinders, as preferred.

Communicating with each combustion chamber is a small pipe or passage 18, mounted on which are annular sockets 19 each adapted to receive the shank of a valve
65 body 20, having a passage therethrough closed and opened by a valve 21, cylindrical in part and conical in part as shown, the conical part adapted to close said passage against the incoming initial charge of combustible mixture which latter is introduced
70 from any convenient sources of supply, (preferably a pump) by means of pipes 29 communicating with the interior of each valve body. For each valve 21 a detached
75 valve stem 22 is provided, terminating adjacent to the valve 21 in a piston end of the same diameter as the body of said valve, and movable in the chamber of the valve body independent of the valve 21 so that it will
80 separate therefrom, leaving a space therebetween to receive the combustible mixture from the pipe 29 and hold the valve closed, and when in contact with the valve as hereafter described will mechanically hold the
85 same closed, or will move away from the valve leaving the same closed, according to circumstances as hereinafter pointed out, in the operation of the device.

Engaging the end of the valve stem is a
90 reversible cam 23 provided with a lever 24 and fixed on a shaft 25 by a set screw 35; when this cam is turned with the thick side toward the stem 22 the stem will be moved inward in contact with the valve 21, mechanically closing the same, and when the
95 cam is turned with the thin side toward the same the stem is free to move outward and is so moved by a spring 32 engaging a collar 33 on the outer end of the stem, thus
100 leaving the valve 21 closed and opening a space between the valve and the piston end of the stem 22 into which space the combustible mixture from the pipe 29 will flow and thus hold the valve closed by the pressure of the same, which valve position is
105 illustrated in Figs. 1 and 6, and is the position which the valve will assume whenever any of the valves of the respective engine cylinders are open, as shown in Fig. 1. All
110 the levers 24 are coupled in common to a sliding rod 27 by connections movable in

slots 28 arranged longitudinally in the rod. The shaft 25 is provided with a spring 34 which spring rotates the cam in the direction to close the respective valve.

- 5 When a valve has been blown open it will be positioned as in Fig. 5 with its cylindrical portion closely surrounded by the case. The incoming fluid thus cannot get behind the valve to close the same, and the valve will usually stay open. To insure this result, however, I may provide special retaining means as follows. Above each valve 10 21 is a ball 30 smaller than the passage in which it is located, to permit the mixture to pass the ball which ball when the valve 15 21 is closed rests upon the cylindrical portion of the same, and when the valve is open, rests upon the conical portion of the same, and holds the valve in open position. 20 To permit of mounting this valve either in the top or the side of an engine, as occasion may require, the stem of the valve body is provided with an annular groove 31 communicating with the interior of the valve 25 body through a suitable opening whereby the valve body may be rotatively adjusted in the socket 19, so that the pipe 18 may be inserted vertical inclined or horizontal, as occasion may require and the valve remain 30 in upright position in any event.

The lever 24 is detachable from the cam 23, and by removing and replacing the shaft 25 the cam may be reversed relative to the lever which permits reversing the valve 35 body end for end as occasion may require. These features of adjustability enable me to adapt the device to a great variety of engines as occasion may arise.

- In operation, when the engine is running 40 the rod 27 is moved so as to permit the springs 34 to turn the cams 23 to close the valves, and as each valve comes to closed position, the slots 28 permit the rod 27 to move independent of the levers 24 and thus 45 permit each spring 34 to independently close the respective valve; I am thus able to insure accurate closing of these valves. The engine will normally stop with the piston of one cylinder on the working stroke, 50 and the piston of another cylinder on the compression stroke, which as illustrated herein are the cylinders 1 and 2; these cylinders will also have the valves 5 6 9 and 10 closed and thus there will be pressure of 55 fluid in the chambers 1^a and 2^a; the other two cylinders will have respectively the exhaust valve and the intake valve open, and thus there would be no pressure in the chambers 3^a and 4^a. The rod 27 being shifted to 60 turn the cams and release the valves the stem 22 of each will be moved outward by the springs 32, the pressure in the chambers 1^a and 2^a will now blow the respective valves open to the position shown in Figs. 65 1 and 5, the valves remaining in this posi-

tion until again closed by the movement of the rod 27, there being no pressure in the chambers 3^a and 4^a, the valves 21 will remain 70 closed as in Fig. 6 and cut off communication of the pipes 29 with these two cylinders of the engine. The next step is to inject through the pipes 29 a combustible mixture, by means of any convenient device, which 75 mixture will pass into the chambers 1^a and 2^a. The valves are now all closed by releasing the rod 27 and by shifting the spark lever or by otherwise closing the spark circuit, as the case may be; the charge of combustible mixture will be ignited in the cylinder 80 having the piston on the working stroke, this will start the engine and the next cylinder in order will also have received a combustible mixture so that two explosions of these initial charges will occur thus effectually starting the engine in the 85 regular performance of the usual process.

What I claim is:

1. In an engine starter, a freely movable valve, moved to open position by pressure of fluid from the engine cylinder, means for 90 preventing the valve from closing while injecting a starting fluid past the same and means for positively closing the valve against said pressure when the engine is 95 running.

2. In an engine starter, a freely movable valve, a detached and independently movable stem, means for forcing the stem against the valve to positively close the same, means 100 for moving the stem away from the valve to permit the latter to be blown open by fluid pressure from the engine cylinder and means for holding the valve open to permit a starting fluid to pass the same toward the 105 engine.

3. In an engine starter, a selecting valve adapted to be blown open by fluid pressure from the engine cylinder, means for holding the valve open to admit a starting fluid to 110 the engine cylinder and means for restoring the valve to closed position.

4. In an engine starter, a valve freely movable and opened solely by fluid pressure from the engine cylinder, automatic means 115 for yieldably holding the valve open and manually operated means for positively closing said valve against the said pressure.

5. In an engine starter, a freely movable valve opened solely by fluid pressure, manually operated means for positively closing 120 said valve, and automatic means for yieldingly holding said valve in open position.

6. In an engine starter, a freely movable valve opened solely by fluid pressure, a ball 125 resting on said valve and adapted to yieldingly hold the valve open, and manually operated means for positively closing the valve.

7. In an engine starter, a valve case having a conical seat and a lateral opening, a 130

freely movable valve having a conical portion to engage the seat and a cylindrical portion below said opening, a ball in said opening of less diameter than the same and resting on the cylindrical portion of the valve when the valve is closed, and engaging the conical portion of the valve to yieldingly hold the same when open, and means for positively closing the valve.

8. In an engine starter, a valve casing having an interior chamber communicating with a cylinder of the engine, a freely movable valve in said chamber, a separately movable stem to engage said valve and positively close the same, and movable away from the valve to permit the same to open by fluid pressure, a spring to move the stem away from the valve, a cam to move the stem against the valve, and means for manually rotating the cam.

9. In an engine starter, a valve case having an inner chamber and a passage communicating with an engine cylinder, a freely movable valve to close said passage and opened solely by fluid pressure from the engine, a ball resting on said valve to yieldingly hold the same open, a separately movable stem to engage the valve and positively close the same, a cam engaging the stem to move the same inward, a spring to rotate the cam and close the valve, and a lever to manually rotate the cam and hold the same against the action of the spring.

10. In an engine starter, a valve case having an inner chamber communicating with the engine cylinder and a lateral opening to receive a combustible mixture, a valve freely movable in said chamber to open and close said communication, a separately movable stem to engage and positively close the valve, and incapable of opening the same, a spring to move the stem away from the valve, a cam to move the stem against the valve and means for manually rotating the cam.

11. In an engine starter, a valve case having an inner cylindrical chamber provided at one end with a conical valve seat and a passage communicating with the engine cylinder and also having a lateral opening to receive a combustible mixture, a detached valve having a cylindrical portion opposite said lateral opening and a conical end to close said passage, a separately movable stem having a piston end opposite said lateral opening, a spring to move the stem away from the valve, and open a space between the valve and piston end to receive fluid from the lateral opening, and means for moving the piston end against the valve to positively close the same.

12. In an engine starter, a valve case having a cylindrical chamber, a passage communicating with the engine cylinder and a lateral opening to receive the fluid; a valve

freely movable in said chamber having a cylindrical portion opposite the said opening and adapted to close and open said passage, a ball resting on said valve to yieldingly hold the same open, a stem independently movable against the valve to close the same and movable away from the valve to leave the same closed and permit it to be blown open by fluid pressure from the engine, and means for manually moving the stem to close the valve.

13. In an engine starter, a pipe communicating with the engine cylinder and terminating in a socket, a valve case having an inner chamber and a stem rotatively adjustable in the socket and provided with an annular recess, and also having a passage connecting the recess and chamber, a valve in the chamber opened solely by fluid pressure from the engine, and means for positively closing the valve when the engine is running.

14. In an engine starter, a selecting valve opened by fluid pressure from the engine, a rotative cam to close the valve reversibly mounted on a shaft, and a manually operated lever detachably and reversibly connected to the cam to rotate the same.

15. In an engine starter, a selecting valve opened solely by fluid pressure from the engine, a separately movable stem to engage and positively close the valve, a spring to move the stem away from the valve, a cam to move the stem against the valve and reversibly mounted on a shaft, a spring to rotate the shaft to close the valve, and a lever detachably and reversibly connected to the cam to manually rotate the same against the action of the spring.

16. The combination of a multiple cylinder internal combustion engine, a valve case communicating with each cylinder and each case adapted to receive combustible fluid, a valve in each case freely movable and opened solely by fluid pressure from the respective engine cylinder, a separately movable stem for each valve to positively close the same, means for forcing each stem toward the respective valve, levers to operate said means, a longitudinally movable rod to simultaneously operate said levers, slotted connections between said levers and the rod, and a spring to separately move each valve independently of the rod.

17. In combination with a multiple cylinder internal combustion engine, a valve case communicating with each cylinder, a valve in each case opened solely by fluid pressure from the respective engine cylinder, means for positively closing each valve, a spring to operate each closing means, and means for manually operating each closing means to overcome the springs and release the valves.

18. In combination with a multiple cyl-

inder internal combustion engine, a valve
case communicating with each cylinder and
rotatively adjustable about its axis, a valve
in the case opened solely by fluid pressure
5 from the respective cylinder, a separately
movable stem in each case to positively close
the respective valves, reversible cams to en-
gage the stems and close the valves, a lever
reversibly attached to each cam, and a longi-
10 tudinally movable rod having a slotted con-

nection with each lever to simultaneously
move the levers to release the valves, and
a spring connected to each cam to inde-
pendently close each valve.

In testimony whereof I affix my signa- 15
ture in presence of two witnesses.

JOHN WATSON FITZGERALD.

Witnesses:

PALMER A. JONES,
MAE RANKIN.