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PATENTED MAY 19, 1908.

G. ENRICO.

MEANS FOR STARTING INTERNAL COMBUSTION ENGINES.

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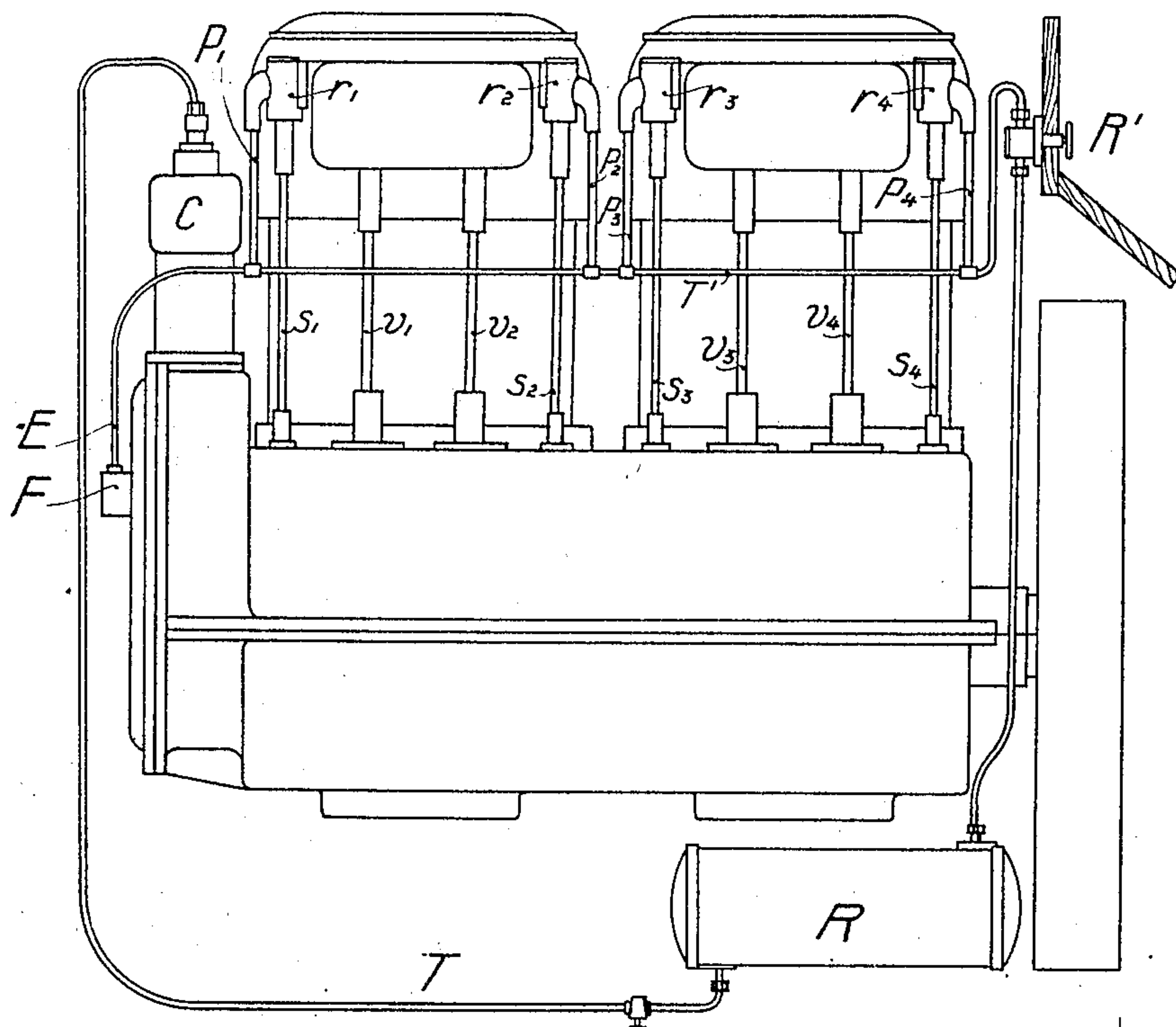


Fig. 1

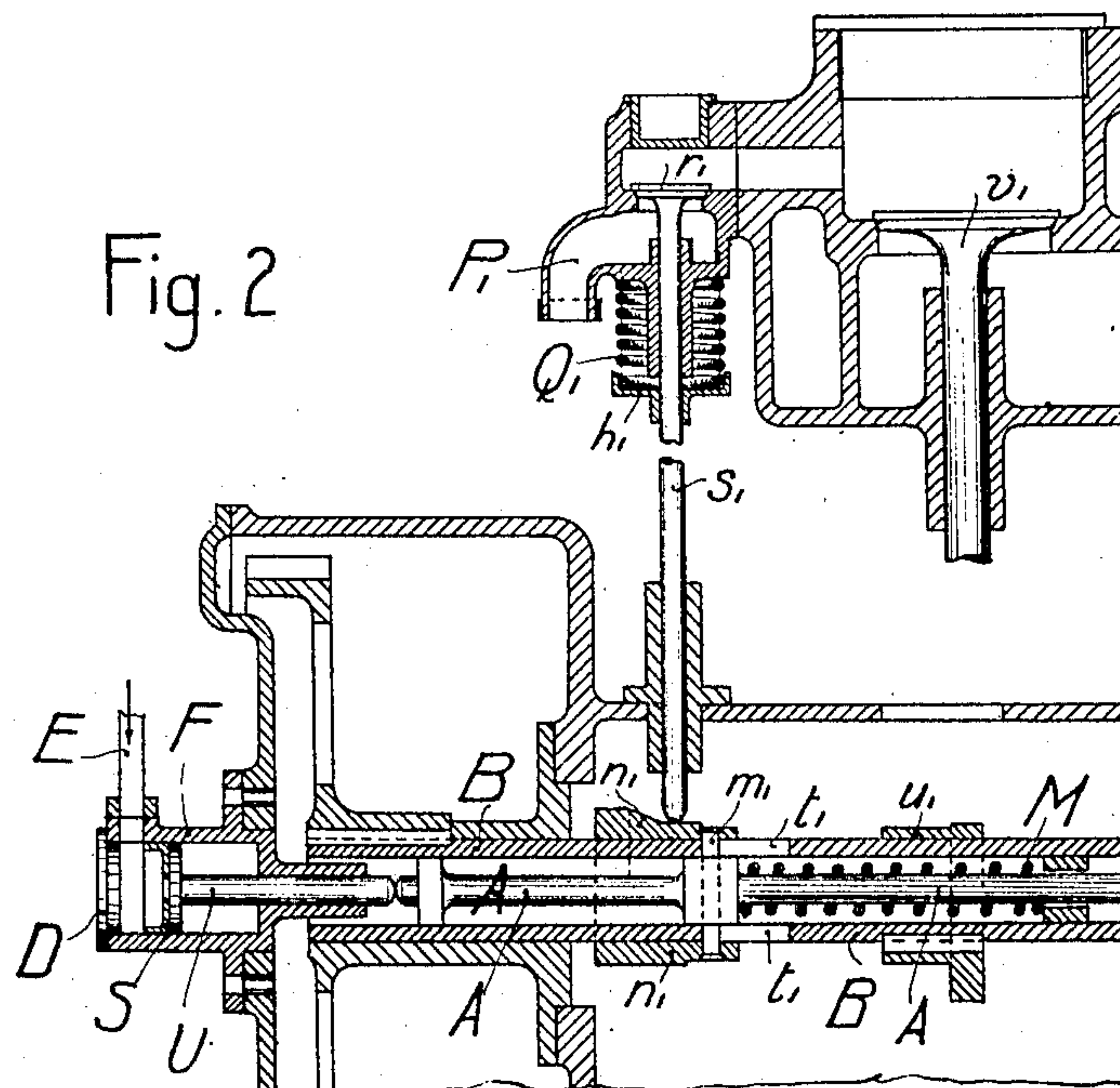


Fig. 2

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MEANS FOR STARTING INTERNAL-COMBUSTION ENGINES.

No. 888,074.

Specification of Letters Patent.

Patented May 19, 1908.

Application filed October 3, 1906. Serial No. 337,292.

To all whom it may concern:

Be it known that I, GIOVANNI ENRICO, engineer, residing at Turin, Italy, Corso Dante 35, a subject of the King of Italy, have invented certain new and useful Improvements in Means for Starting Internal-Combustion Engines, of which the following is a full, clear, and exact specification.

The object of this invention is to provide means for starting internal combustion engines by means of fluid under pressure such for example as compressed air, or gas. An arrangement according to this invention is illustrated in the accompanying drawing as applied to a four cylinder engine.

Figure 1 shows a general elevation and Fig. 2, a section, showing details and drawn to a larger scale.

Each cylinder is provided with inlet and outlet valves v^1, v^2, v^3, v^4 , operated in any known, or suitable manner, for example, by cams mounted on a shaft B only one of these cams (marked u^1) being shown in the drawing. Additional valves r^1, r^2, r^3, r^4 , open and close passages for the admission to the engine of compressed fluid from a reservoir R. The fluid may be compressed in the cylinder R in any suitable way, for example, by means of a pump C driven by the motor.

The following arrangement is applied to each of the additional valves r^1, r^2, r^3, r^4 . Through the shaft B, which is hollow runs a second shaft A provided with a pin m^1 projecting from the shaft A through grooves t^1 in the shaft B and fixed to this pin is a cam n^1 , (one opposite to each of the stems s^1, s^2, s^3, s^4 of the valves r^1, r^2, r^3, r^4) capable of sliding on the shaft B. Each of the cams n^1 is circular through a part (say a half) of its length so that this part (which is on the right hand in Fig. 2) imparts no motion of the stems s^1, s^2, s^3, s^4 , and consequently the corresponding additional valves remain at rest during the rotation of the cams. The other part (say a half) of each cam is shaped in a similar manner to the cams u^1 and the cams n^1 are so set on the shaft A that the opening of the valves r^1, r^2, r^3, r^4 takes place at the part of the stroke of the working pistons corresponding to that at which the explosion takes place in the respective cylinders. The shaft A is maintained by a coiled spring M, in a position such that each of the stems s^1, s^2, s^3, s^4 , is opposite the circular part of its respective cam n^1 , so that the valves r^1, r^2, r^3, r^4 are nor-

mally at rest and each is kept to its seat by the action of a spring Q^1 , the pressure of which is exerted on one side against a collar h^1 attached to each of the stems s^1, s^2, s^3, s^4 .

For starting the shaft A is moved longitudinally against the action of the spring M, so that each of the cams n^1 is moved into the position wherein its eccentric portion comes under its respective stem s^1, s^2, s^3, s^4 .

In four-cylinder internal combustion engines during normal work one of the cylinders is always performing its working stroke so that if at the corresponding time the additional valve (r^1, r^2, r^3 , or r^4) is raised it allows the admission to that cylinder, of compressed fluid through the passage P^1 , and successively compressed fluid is admitted to the other cylinder and the cams and additional valves come successively into operation. After a sufficient number of revolutions the motor is sufficiently started and the shaft A is returned to its normal position and the valves r^1, r^2, r^3, r^4 , remain closed, and the engine operates normally.

The longitudinal motion of the shaft A may be effected by means of any suitable arrangement, but it is preferred to use the following arrangement in accordance with this invention in connection with the shaft A. A piston S works in a cylinder F so arranged that the rod U of the piston S is in line with the shaft A and bears against the end thereof. The cylinder F communicates, at its front end, by means of a tube E, with the compressed fluid reservoir through the medium of a cock R^1 which, in automobiles, may be arranged in any convenient position within the reach of the driver. The tubes P^1, P^2, P^3, P^4 , branch off the pipe T^1 beyond the cock R^1 so that, when this cock is closed the admission of compressed fluid to the cylinder F and valves r^1, r^2, r^3, r^4 , is prevented. To start the motor the cock R^1 is opened and as soon as the motor is started, the cock R^1 is closed and the valves r^1, r^2, r^3, r^4 , remain closed excepting that at first they may continue to move for a few moments on account of the rotation of the cams n^1 while the compressed fluid escapes from the cylinder F through small holes D or if preferred through a passage provided in the cock R^1 . The shaft A then returns to its normal position under the action of the spring M and the valves r^1, r^2, r^3, r^4 remain closed during the normal working of the engine.

Having now particularly described the nature of my said invention and in what manner the same is to be performed I declare that what I claim is:

5 1. In an internal combustion engine, the combination with the cylinder of inlet and outlet valves, cams for operating such valves, a hollow cam shaft carrying such cams, an additional valve adapted to admit compressed
10 fluid to the engine for starting purposes, a cam for operating said additional valve, said cam being independent of the outlet and inlet valve cams, and being adapted to slide on said cam shaft, and a second shaft for oper-
15 ating the cam for the additional valve, said shaft extending within the cam shaft and being connected to its cam through slots formed in the cam shaft.

2. In an internal combustion engine, the
20 combination with the cylinder of inlet and outlet valves, cams for operating such valves, a hollow cam shaft carrying such cams, an additional valve adapted to admit compressed fluid to the engine for starting pur-
25 poses, a cam for operating said additional valve, said cam being independent of the outlet and inlet valve cams, and being adapted to slide on said cam shaft, a second shaft for operating the cam for the additional valve,
30 said shaft extending within the cam shaft and being connected to its cam through slots formed in the cam shaft, and a piston for operating said second shaft, said piston being connected on one side with a source of com-
35 pressed fluid, and said shaft being provided with a spring to oppose the movements of said piston.

3. In an internal combustion engine, the combination with the cylinder of an addi-

tional valve for admitting compressed air to
40 the engine for starting purposes, a cam adapted to be moved into and out of position for operating said valve, a yielding means for normally holding said cam in its inoperative
45 position, and a piston connected on one side with a source of compressed fluid and adapted to move said cam to its operative position and to hold it in such position against the pressure of said spring.

4. In an internal combustion engine, the
50 combination with the cylinder of an additional valve for admitting compressed air to the engine for starting purposes, a cam adapted to be moved into and out of position for operating said valve, a yielding means
55 for normally holding said cam in its inoperative position, and a piston connected on one side with a source of compressed fluid and adapted to move said cam to its operative position and to hold it in such position
60 against the pressure of said spring, and a valve for controlling the supply of fluid to said piston and to said additional valve, whereby when said valve is opened said piston is actu-
65 ated to move the cam to its operative position so as to admit compressed fluid to the cylinder, and when said valve is closed the supply of compressed fluid is cut off from said cylinder and said piston automatically moves to throw said cam out of its operative posi-
70 tion.

In witness whereof, I have hereunto signed my name in the presence of two subscribing witnesses.

GIOVANNI ENRICO.

Witnesses:

MARIO CAPUCCIO,
GEOTT. C. PIRONI.