G. J. SPOHRER.

ENGINE STARTING DEVICE.

APPLICATION FILED FEB. 11, 1911.

998,418.

Patented July 18, 1911

2 SHEETS—SHEET 1.

Fig. 1.

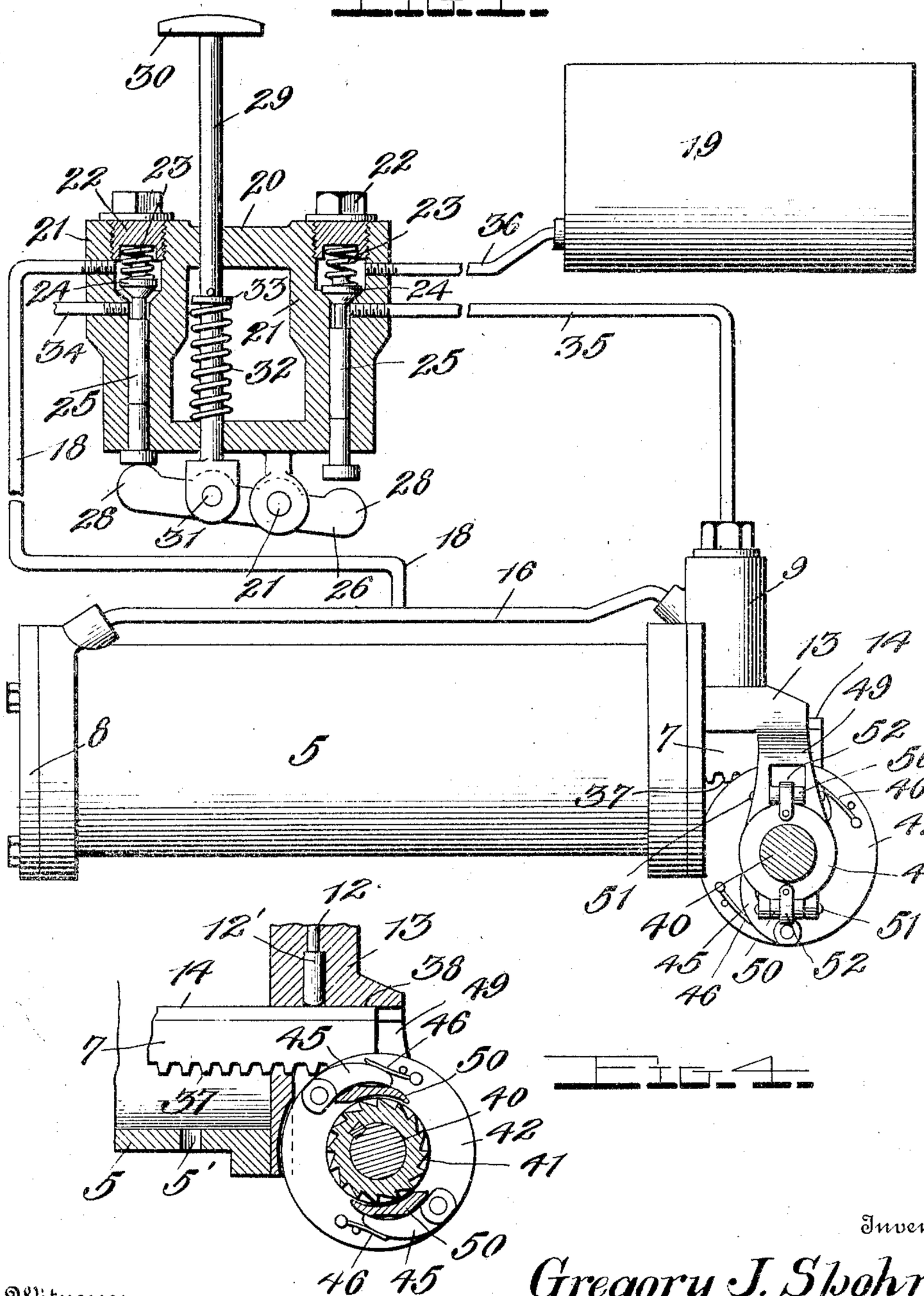

Fig. 4.

Witnesses

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2 SHEETS—SHEET 2.

Fig. 2.

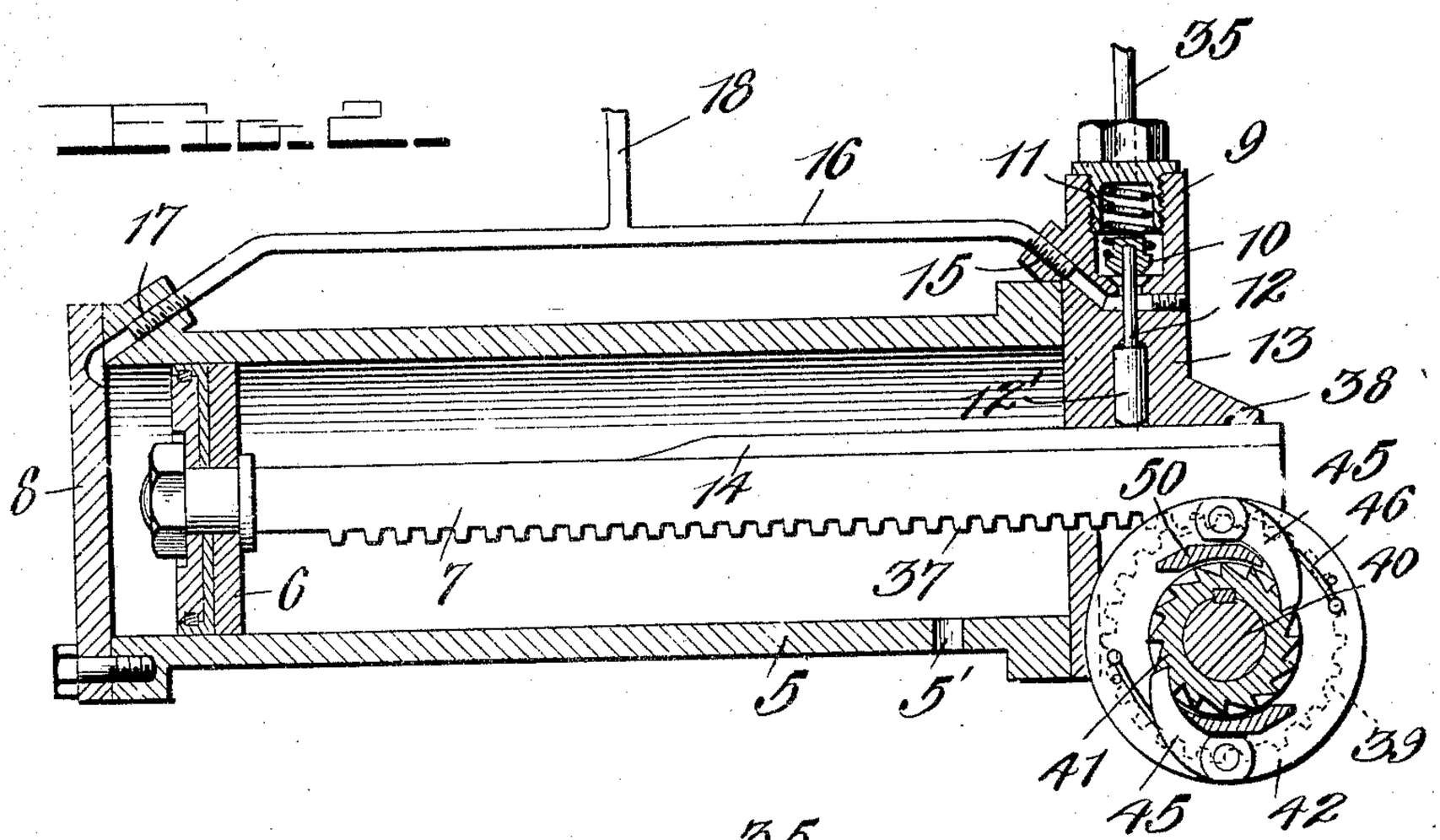
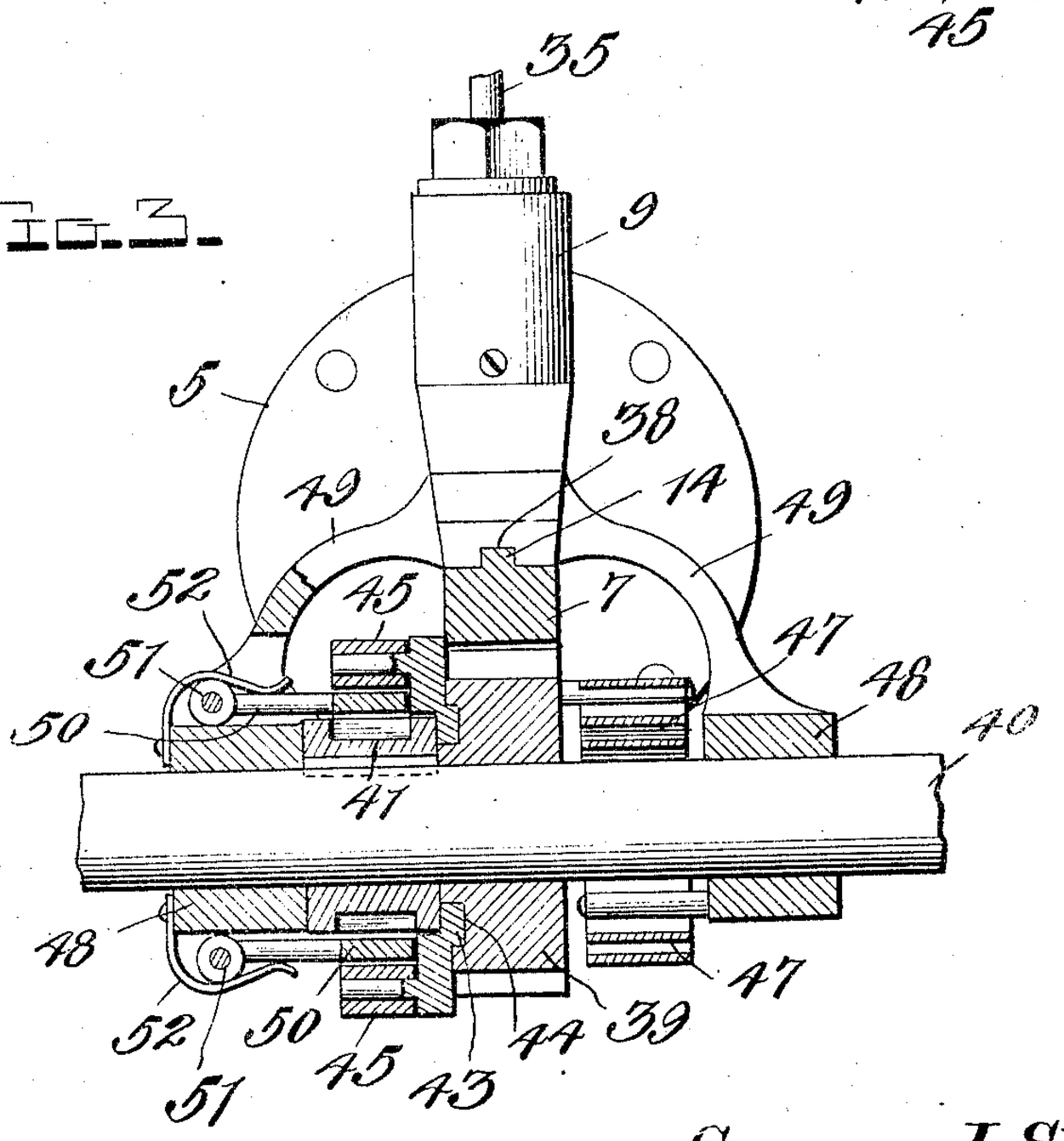


Fig. 3.



Witnesses

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UNITED STATES PATENT OFFICE.

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ENGINE-STARTING DEVICE.

998,418. Specification of Letters Patent. Patented July 18, 1911.

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To all whom it may concern:

Be it known that I, GREGORY J. SPOHRER, a citizen of the United States, residing at Franklin, in the county of Venango and State of Pennsylvania, have invented certain new and useful Improvements in Engine-Starting Devices, of which the following is a specification, reference being had to the accompanying drawings.

This invention relates to improvements in engine starting devices and more particularly to a device adapted to be operated by means of compressed air and constructed and arranged upon a motor vehicle to impart the initial movement to the engine shaft.

Another object resides in the provision of a device of the above character which is extremely simple, positive in its operation and may be actuated with a minimum expenditure of power.

A still further object of the invention resides in the provision of a double acting foot operated valve connected to and cooperating with a valve arranged upon the piston cylinder to control the admission and exhaust of the actuating fluid to said cylinder.

A still further object of the invention is to provide a reciprocating piston geared to the motor shaft, and means automatically operating to eliminate possible breakage of the parts after the completion of the effective stroke of the piston, in the event that the shaft should "back kick" or retrograde.

With the above and other objects in view, the invention consists of the novel features of construction, combination and arrangement of parts hereinafter fully described and claimed, and illustrated in the accompanying drawings, in which—

Figure 1 is a side elevation of a device constructed in accordance with the present invention; Fig. 2 is an enlarged longitudinal section through the piston cylinder; Fig. 3 is an end elevation thereof; and Fig. 4 is a detail fragmentary elevation showing the ratchet engaging dogs for locking the gear on the engine shaft in their elevated or inoperative positions at the end of the inward or reverse stroke of the piston.

The present invention is more particularly related to engine starting devices of that character employing a movable rack which co-acts with a gear on the engine shaft to rotate said shaft in one direction of movement of the rack and thereby impart the initial impulse to the engine, and embodies in its construction improved means for controlling the operation of the movable piston whereby the device is rendered very positive in its operation, the invention also including other features of construction whereby numerous deficiencies common to this class of automatic engine starters are eliminated.

With the above ends in view, I provide the piston cylinder 5 in which a reciprocating piston 6 is arranged. The piston rod 7 is secured to the piston 6 and extends through one end of the cylinder. A head 8 is secured upon and closes the other end of the cylinder 5. A valve 9 is arranged upon the forward end of the piston cylinder through which the rod 7 extends, the valve member 10 being normally seated by means of the spring 11. The valve stem 12 is connected to the member 10 and is vertically movable in the lateral extension or enlargement 13 formed on the cylinder head in the upper end of which the valve is arranged. The lower end of the stem 12 is enlarged in diameter as indicated at 12′ and has its extremity rounded or spherically formed for engagement upon a rib 14 formed upon the movable piston rod 7. The port 15 of the valve 9 is connected by means of the pipe 16 with the inlet port 17. With this pipe, approximately intermediate of the inlet and outlet ports, the exhaust pipe 18 is connected.

The piston 6 is adapted to be reciprocated in its cylinder 5 by means of compressed air or other actuating fluid which is contained in a tank or reservoir 19 mounted in any convenient place upon the frame of the machine. The admission of the actuating fluid to the piston cylinder is controlled through the medium of a double acting foot operated valve 20. This valve as illustrated in the accompanying drawings, includes the casings 21 which are integrally or otherwise connected together and have plugs 22 threaded therein to receive one end of the valve springs 23. These springs normally act to retain the valve members 24 upon their seats. The valve stems 25 are vertically movable and are adapted to be engaged and actuated by means of an oscillatory arm or bar 26 which is pivotally mounted upon the bottom of the connection between the valve casings as indicated at 27. The ends of this oscillatory bar are formed with semi-

circular enlargements 28 which bear upon the ends of the valve stems 25. This bar 26 is moved through the medium of a foot rod 29 provided with a tread plate 30 on its upper end and pivotally connected at its other end to the bar 26 as designated at 31. A spring 32 is arranged upon the foot rod 29 and is disposed between a collar 33 fixed on said rod and the lower connecting bar of the valve casings. The foot rod 29 extends through suitable openings in the upper and lower connecting bars of the valve casings. The spring 32 normally acts to engage one end of the oscillatory bar 26 with the stem of one of the valves 24 to unseat said valve. This valve case is connected by means of the exhaust pipe 18 with the pipe 16 hereinbefore referred to and conducts the air exhausted from the piston 5 in the inward or reverse stroke of said piston from whence it is exhausted to the atmosphere through the port 34 in the valve case which is disposed below the seat of the valve member 24. The other valve case 21 is connected by means of the pipe 35 at a point below the valve member, with the valve 9 which is arranged on the forward end of the cylinder 5 and is adapted to supply air to said valve. A pipe 36 also connects the air tank 19 with said valve case above the valve member. The stem of the exhaust valve is of less length than that of the inlet valve whereby, when the foot rod 29 is depressed, the valve member 24 of the exhaust will be seated before the inlet valve member is raised from its seat to permit the passage of compressed air from the air tank to the cylinder valve 9 through the medium of the connecting pipe 35. The valve member 10 is automatically raised from its seat to open communication between said valve and the rear end of the piston cylinder, by means of the rib 14 which engages the lower end 12′ of the valve stem in the reverse or inward movement of the piston. The piston cylinder is provided in its forward end with an exhaust port 5′ which opens when the piston is at the extreme end of its forward movement and after the valve 10 has been seated so that a portion of the air behind the piston is exhausted. Pressure is not applied upon the foot rod 29 until the piston has completed its inward stroke and the air has been exhausted from behind the piston through the pipe 18 and the normally open exhaust valve of the double acting foot valve 20. As the compressed air is admitted through the cylinder valve 9 to the rear end of said cylinder, the piston is moved forwardly and the rod 7 thereof projected through the forward end of the cylinder.

The piston rod 7 is provided upon its under side with the rack teeth 37 and the rib 14 on said piston rod is disposed in a longitudinal channel or groove 38 provided in the lateral extension 13 of the forward cylinder head. The rack teeth 37 on said piston mesh with the teeth of a gear 39 which is loosely mounted upon the engine shaft 40. A ratchet 41 is keyed upon said shaft adjacent to the gear 39 and upon one face of said gear a circular plate 42 is arranged, said plate being provided with ribs 43 for engagement in the grooves 44 in the face of the gear. This plate has mounted upon its other face at diametrically opposite points the dogs 45 which are normally and yieldingly held in engagement with the teeth of the ratchet 41 by means of suitable leaf springs 46 which are fixed at one of their ends to the gear plate 42. These dogs 45 are adapted to lock the gear 39 upon the engine shaft to rotate said shaft in the forward or outward movement of the piston rod through the medium of the co-engaged gear teeth and the rack teeth 37. At the end of the outward or effective stroke of the piston, said piston is reversed or returned to its normal position at the inner end of the cylinder through the medium of a helical spring 47 which is arranged upon the engine shaft 40 and has one end fixed to the gear 39 and its other end to one of the bearings or supports 48 which are formed upon the ends of arms 49 integrally formed upon the extension 13 of the cylinder head.

In order to obviate liability of breakage of the parts by retrograde movement of the engine shaft when the piston has completed its inward or non-effective stroke, I provide the lifting elements 50 which are pivotally mounted as indicated at 51 in longitudinal slots or recesses formed in one of the bearings 48. These lifting elements are normally held in position in said grooves with their free ends disposed upon opposite sides of the ratchet 41, by means of the leaf springs 52 which are secured at one end to the bearing 48. In the outward or effective stroke of the piston when the gear 39 is locked upon the engine shaft, the dogs 45 engage under the free ends of the lifting elements 50 and move the same against the tension of the springs 52, said dogs retaining their positions in locked engagement with the ratchet. In the reverse movement of the gear caused by the unwinding of the spring 47, the dogs move idly over the ratchet teeth and over the free ends of the lifting elements 50, said elements throwing the dogs outwardly. When the piston 6 reaches the limit of its inward movement, said dogs are disposed in the positions indicated in Fig. 4, wherein they are shown arranged upon the ends of the elements 50 entirely out of contact with the ratchet teeth. It will thus be seen that in the event that the engine shaft should accidentally "back kick" or rotate in a reverse direction, the gear and plate 42 will remain stationary on said shaft, the ratchet 41 alone

turning with the same. In this manner the possibility of damage or breakage of the various elements is avoided.

From the foregoing it is believed that the construction and operation of my improved engine starting device will be thoroughly understood.

The mechanism is at all times under the control of the operator, the double acting valve 20 being arranged in a convenient position upon the dash board of the machine for engagement by the foot of the operator. The engine may be easily and quickly started without requiring him to leave his seat.

The invention is also extremely positive and reliable in practical use and by providing the arrangement of parts as above set forth, many serious defects which have heretofore existed in devices of this character are eliminated.

While I have shown and described the preferred construction of my invention, it will be understood that the device is susceptible of a great many minor modifications without departing from the essential feature or sacrificing any of the advantages thereof.

Having thus described the invention what is claimed is:—

1. In an engine starting device, the combination with a cylinder and a piston mounted to reciprocate therein, of a gear loosely mounted on the engine shaft, a rod extending from the piston through one end of the cylinder having rack teeth formed thereon for engagement with the teeth of said gear, a valve in one end of the cylinder, means carried by the piston rod to engage and open said valve in the movement of the piston in one direction, said cylinder having an exhaust port at its other end, an air supply tank to supply air to said cylinder valve, and means under the control of the operator to admit air through said valve to one end of the cylinder to move the piston in one direction and rotate the engine shaft, such means normally exhausting air from the same end of the cylinder in the reverse movement of the piston.

2. In an engine starting device, the combination with a cylinder and a piston mounted to reciprocate therein, of a gear loosely mounted on the engine shaft, a rod extending from the piston through one end of the cylinder and having rack teeth formed thereon engaging with the gear teeth, means for locking the gear upon the engine shaft to rotate said shaft in one direction of movement of the piston, a spring seated valve arranged in one end of the cylinder, means carried by the piston rod to automatically open said valve in the effective stroke of the piston, the other end of said cylinder having an exhaust port therein, a connection between said valve and the exhaust port of the cylinder, a double foot operated valve normally open to said exhaust port, the operation of said valve closing the exhaust and opening communication with the cylinder valve, and a supply tank connected to said foot operated valve to supply pressure fluid to the cylinder valve.

3. In an engine starting device, the combination with a cylinder and a piston to reciprocate therein, of a gear loosely mounted on the engine shaft, a piston rod connected to the piston and having rack teeth to engage the teeth of said gear, means for locking the gear on the engine shaft in one direction of movement of the piston rod to rotate said shaft, a spring seated valve arranged in one end of said cylinder, means carried by the piston rod to automatically open said valve and hold the same open during a portion of its effective stroke, said cylinder having an exhaust port in its forward end which is opened after the closing of said valve, said cylinder also having a port communicating with the valve chamber and an exhaust port in its opposite end, a connection between said ports, a supply tank, a pair of foot operated valves, a connection between one of said valves and the pipe connecting said ports, said valve having an exhaust port and being normally open to exhaust air from one end of the cylinder, a connection between the other of said valves and the cylinder valve, a connection between said valve and the air supply tank, the opening of said latter valve to admit air through the cylinder valve to the rear end of the cylinder simultaneously closing communication between the other of said valves and the exhaust.

4. In an engine starting device, the combination with a cylinder and a piston mounted to reciprocate therein, of a gear loosely mounted on the engine shaft, a rod connected to said piston having rack teeth formed thereon to engage with the gear teeth, a ratchet keyed upon said shaft, a plate arranged upon one face of the gear and carried thereby, dogs pivoted upon said plate at diametrically opposite points yieldingly held in engagement with the teeth of the ratchet to lock the gear on said shaft in one direction of movement of the piston rod whereby the engine shaft is rotated, pivotally mounted elements having their free ends disposed adjacent to the ratchet adapted to be engaged and moved by said dogs in the effective stroke of the piston, said elements at the end of the reverse stroke of the piston moving the dogs and supporting the same out of contact with the teeth of the ratchet substantially as and for the purpose specified.

5. In an engine starting device, the combination with a cylinder and a piston mounted to reciprocate therein, of a gear loosely

mounted on the engine shaft, a rod fixed to the piston having rack teeth formed thereon for engagement with the gear teeth, a ratchet keyed upon the shaft, a plate carried by the gear, pivoted dogs arranged on said plate at diametrically opposite points normally and yieldingly held in engagement with the ratchet teeth to lock the gear on the shaft whereby said shaft is rotated in one direction of movement of the piston, and oppositely disposed spring held elements pivotally mounted at one of their ends and disposed at their other ends on opposite sides of the ratchet, said members moving the dogs out of contact with the ratchet teeth at the end of the reverse stroke of the piston, substantially as and for the purpose specified.

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

GREGORY JOHN SPOHRER.

Witnesses:

JOHN E. FEENEY,

HUGH REILLY.