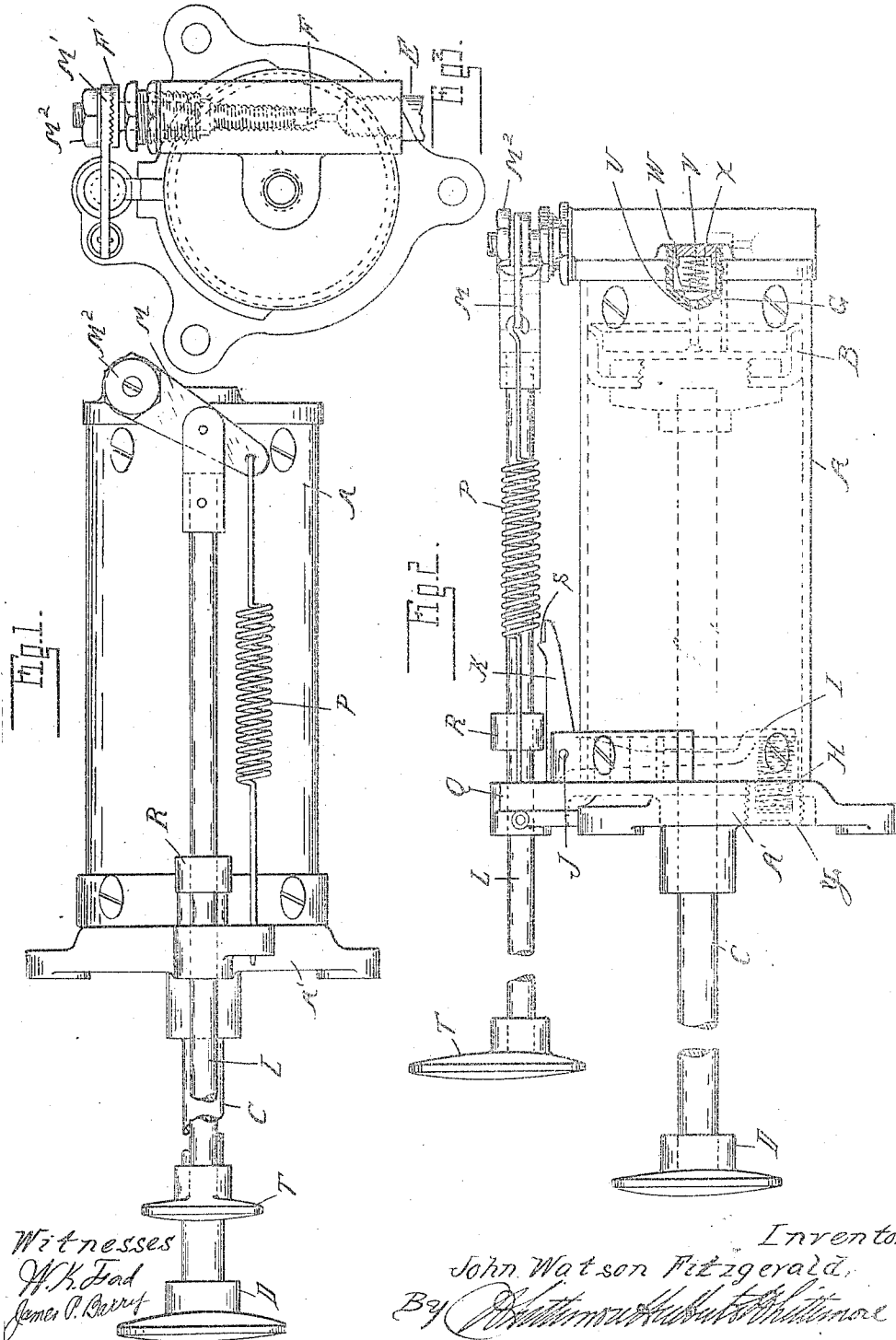


J. W. FITZGERALD.
ENGINE STARTER.
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Patented Jan. 21, 1913.



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UNITED STATES PATENT OFFICE.

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ENGINE-STARTER.

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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 Detroit, in the county of Wayne and State of Michigan, have invented certain new and useful Improvements in Engine-Starters, of which the following is a specification, reference being had therein to the accompanying drawings.

10 The invention relates to engine starters of that type in which a volume of gas is injected into the explosion chamber to form an ignitable gaseous charge for the initial explosion. The gas is usually drawn from a storage tank in which it is held at relatively high pressure and as a consequence a pressure reducing means such as a restricted passage is usually placed between the gas supply and the engine cylinder. It is however, difficult to govern the force of the explosive charge on account of variation in either pressure or volume which occur from time to time.

It is the object of the present invention to provide means for introducing gaseous charges of predetermined mass or explosive force without reference to variations in pressure of the gas in the storage tank.

To this end the invention consists in the construction as hereinafter set forth.

In the drawings,—Figure 1 is a plan view; Fig. 2 is a side elevation; Fig. 3 is an end elevation of the apparatus.

A is a cylinder or measuring receptacle of predetermined capacity suitable for the desired gaseous charge to be injected into the explosion chamber, B is a piston within the cylinder and C is an actuating plunger therefor provided with a knob or bearing D adapted for operation by hand or foot.

E is a gas inlet conduit from the storage tank or other source of supply (not shown), F is a needle valve or other means for restricting the flow of gas and G is a port leading into the cylinder A adjacent to the piston.

With the parts as thus far described the gas entering the cylinder through the port G will force the piston B outward, and inasmuch as there is no resistance to the

movement of this piston other than its friction in the cylinder and the friction on its operating plunger, the pressure of gas behind the piston will be but slightly greater than atmospheric pressure. I have however, provided means for increasing this pressure comprising a spring H or other measuring force arranged in the path of the piston as it approaches the end of its strokes and resisting further movement thereof. This will cause the pressure within the cylinder to rise, due to the continued inflow through the port G under the actuation of the higher gas pressure in the storage tank and this action will continue until the resistance of the spring is overcome and the piston resumes its movement. A predetermined limit of pressure is obtained by automatically closing the valve F and this is accomplished by a trip released by the movement of the piston against the resistance of the spring H.

In the specific construction shown the trip mechanism comprises a lever I against which the spring H abuts and which stands in the path of the piston. This lever is in the form of a bell crank pivoted at J and having a laterally extending arm K which is adjacent to a rod L connected by a rock arm M to the stem of the valve F.

P is a spring for closing the valve and which as shown is connected to the rock arm M and a lug Q on the cylinder.

R is a collar on the rod L and S is a detent on the bell crank arm K for engaging with said collar when the rod L has been adjusted to open the valve.

T is a knob or handle at the end of the rod L for actuating the same.

In operation, in normal position the piston B is at the end of the cylinder adjacent the port G and the valve F is closed so as to cut off communication between the conduit E and the cylinder. When it is desired to start the engine the rod L is first actuated by pressure upon the knob T and is adjusted to a position where the rock arm M will open the valve F, and the detent S on the bell crank arm K will engage with the collar R. The de-

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tent will thus hold the rod L from being returned by the spring P and by holding the valve S open will permit the inflow of gas from the conduit E through the restricted port of the valve and port G into the cylinder. This will move the piston forward until it bears against the lever I where further movement will be resisted by the spring H. The continued inflow of gas will cause the pressure to rise within the cylinder and when this pressure reaches a point sufficient to overcome the tension of the spring the lever I will be actuated, withdrawing the detent S from the collar R and permitting the spring P to return the rod L and close the valve F. As a result the cylinder A contains not only a measured volume of gas but a volume at an exactly predetermined pressure and therefore a definite mass. This volume is then introduced into the explosion chamber by pressure upon the knob D which forces the plunger C inward, the piston B ejecting the gases through a port U and conduit V. Premature escape of gas through this conduit during the filling of the cylinder is prevented by a valve W which is closed by a spring X sufficient in tension to prevent opening by the gaseous pressure developed within the cylinder but insufficient to hold the valve closed when the piston B is actuated by the pressure of hand or foot on the knob D.

To alter the tension of the spring H so as to offer a predetermined resistance to the movement of the piston, said spring is seated in a plug Y having a threaded engagement with the head A' of the cylinder, said plug being adjustable from outside the cylinder to vary the tension on the spring. Provision is also preferably made for adjusting the valve F in relation to its actuating rock arm M so as to determine the degree of opening of the valve. This as shown, consists of a serrated collar F' on the valve stem engaging a correspondingly serrated face M' on the rock arm M, while a lock nut M² holds these members in engagement. This will permit of adjusting the valve by loosening the nut M² and moving the arm M to the desired point of adjustment, after which it is again clamped by the nut M².

What I claim as my invention is:

1. The combination with a cylinder having a piston therein, of a conduit for admitting gas under pressure to said cylinder against said piston, a valve controlling the admission of gas to the cylinder, mechanism for automatically closing said valve, a detent for holding said mechanism with the valve in open position, a trip actuated at the completion of movement of the piston

under the impelling force of admitted gas to release said detent and permit the closing of said valve, and means for resisting the operation of said trip by said piston to obtain a predetermined pressure of gas in the cylinder.

2. The combination with a cylinder and a piston therein, of a plunger for actuating said piston in one direction, means for admitting gas from a source of supply under pressure into said cylinder to actuate the piston therein in an outward direction, a valve controlling the admission of gas to the cylinder, a rod connected with said valve to open or close the same, tension means operating on said rod to close the valve, a latch detent for engaging with said rod when the valve is open to hold the same from closing, a trip arm for said latch detent extending into the path of said piston, and a resisting spring for said trip arm for preventing the operation thereof until a predetermined gaseous pressure is obtained in the cylinder.

3. The combination with a cylinder, a piston therein and a plunger for actuating said piston, of means for admitting gas from a source under pressure to said cylinder to move the piston therein outward, a valve controlling admission of gas to the cylinder, a rock arm for opening and closing said valve, a rod for actuating said rock arm, a spring for holding said rod and rock arm with the valve closed, a latch detent engageable with a shoulder on said rod for holding the latter with the valve in open position, a trip arm connected with said latch detent extending into the path of said piston, a spring for resisting movement of said trip arm, and means for varying the tension of said spring.

4. The combination with a cylinder, of a piston therein, a plunger for actuating said piston extending outward through one end of said cylinder, a bell crank lever fulcrumed on said cylinder and having one arm extending thereinto in the path of the piston and adjacent to the cylinder head through which the plunger passes, a rod slidably mounted on said cylinder, a rock arm connected thereto, a needle valve controlled by said rock arm and governing a gas admission port into said cylinder, a spring operating upon said rod to hold said valve in closed position, a shoulder on said rod for engagement with a detent on said bell crank lever to hold the valve in open position, and a spring resisting movement of said bell crank lever to hold said valve from closing until a predetermined gaseous pressure in the cylinder is obtained.

5. The combination with a cylinder, of a piston therein, a plunger for actuating said

piston, a valve controlling admission of gas to said cylinder behind said piston, a rod for actuating said valve, a spring for holding said rod with the valve in closed position, a collar on said rod, a latch detent for engaging said collar to hold said valve in open position, an actuating arm for said latch detent extending into the path of said

piston, and a spring for resisting movement of said operating arm.

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

JOHN WATSON FITZGERALD.

Witnesses:

JAMES P. BARRY,

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