No. 892,609. PATENTED JULY 7, 1908.

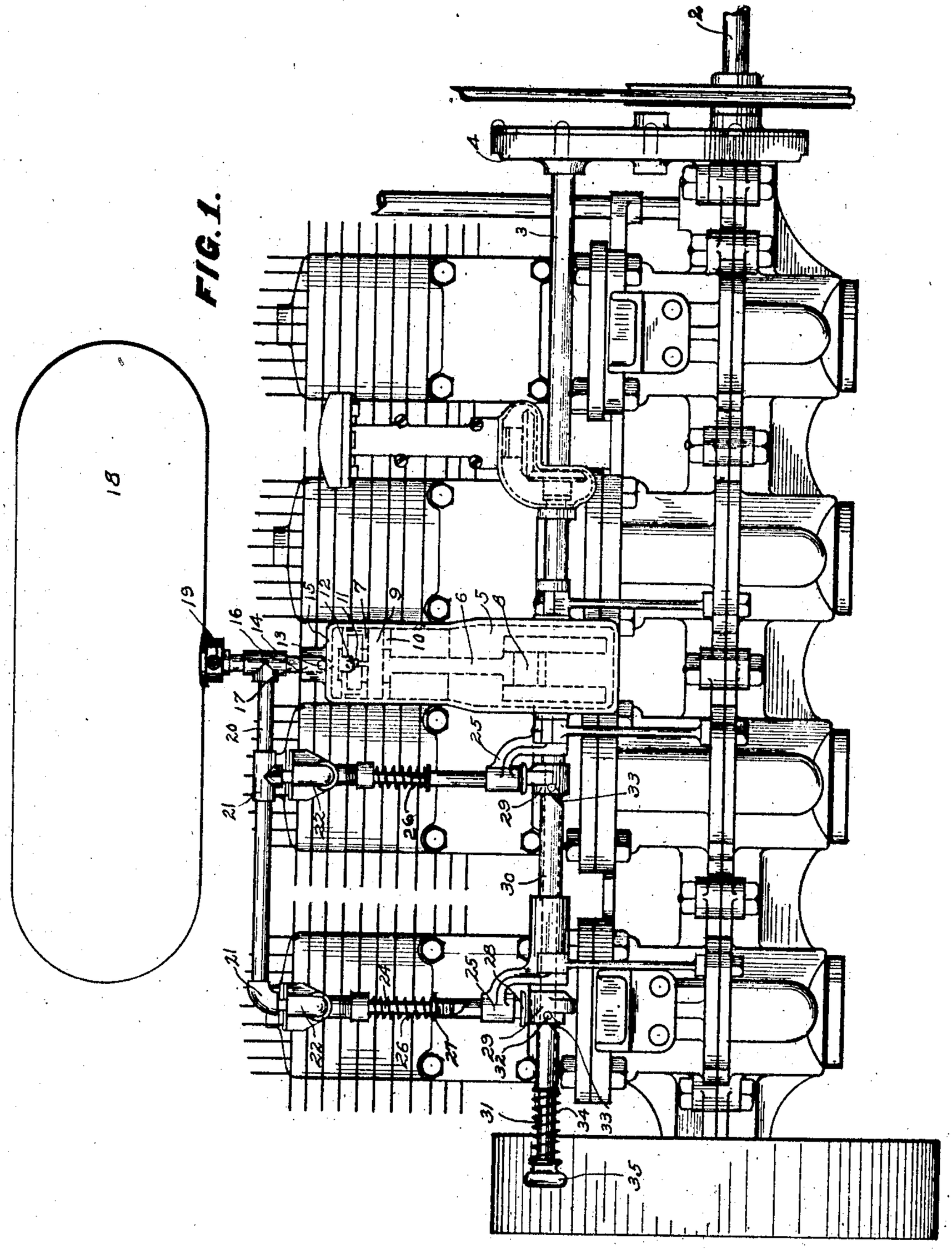
L. S. NASH.

STARTING DEVICE FOR EXPLOSIVE ENGINES.

APPLICATION FILED JULY 31, 1907.

2 SHEETS—SHEET 1.

FIG. 1.



WITNESSES
C. R. Stuckney
Anna M. Dorr.

LAWRENCE S. NASH
INVENTOR
BY Baldwin & Baldwin
ATTORNEYS

No. 892,609. PATENTED JULY 7, 1908.

L. S. NASH.

STARTING DEVICE FOR EXPLOSIVE ENGINES.

APPLICATION FILED JULY 31, 1907.

2 SHEETS—SHEET 2.

FIG. 2.

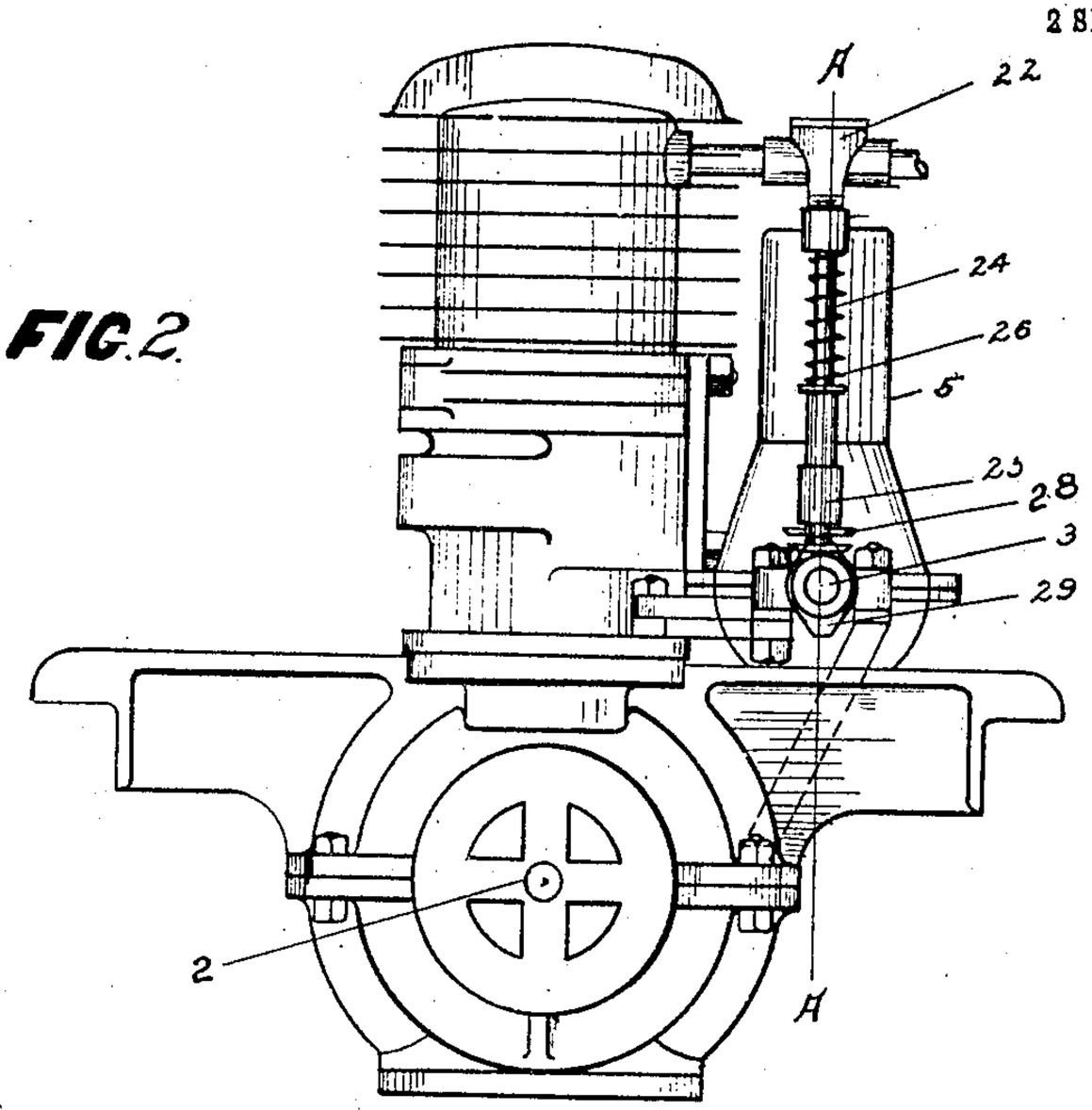
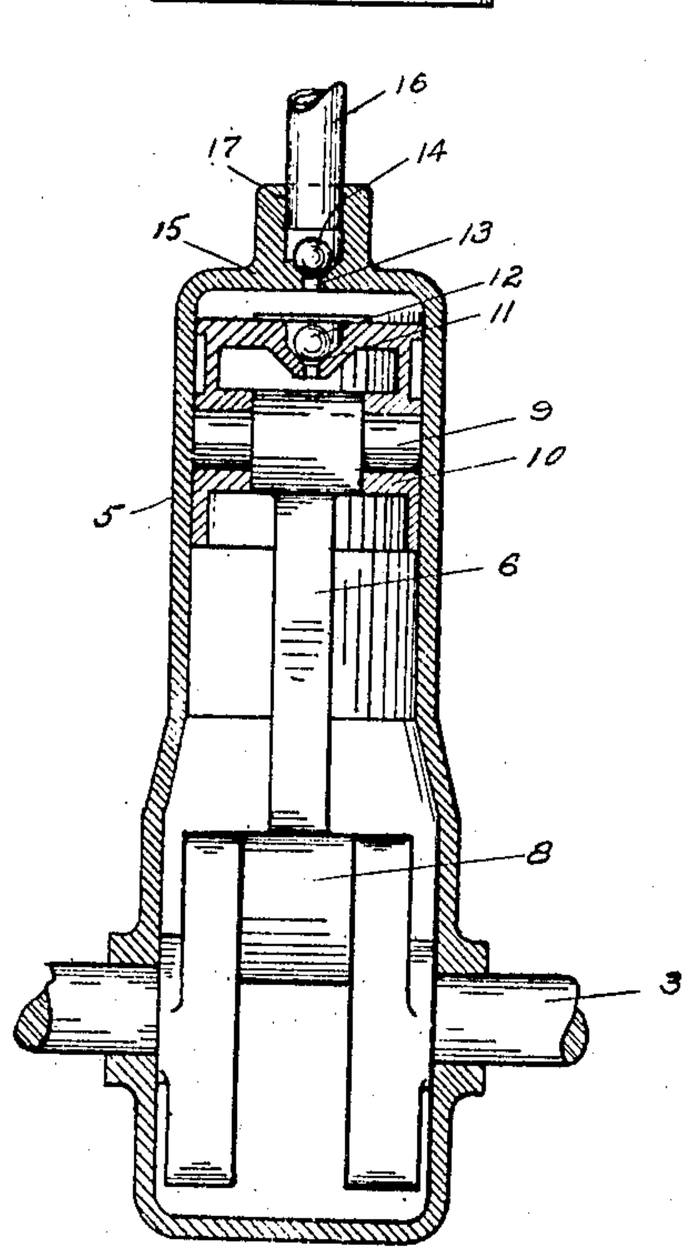


FIG. 3.



WITNESSES
C. R. Stickney
Anna M. Dorr.

LAWRENCE. S. NASH
INVENTOR
BY Bartlett & Bartlett
ATTORNEY'S.

UNITED STATES PATENT OFFICE.

LAWRENCE S. NASH, OF DETROIT, MICHIGAN.

STARTING DEVICE FOR EXPLOSIVE-ENGINES.

No. 892,609. Specification of Letters Patent. Patented July 7, 1908.

Application filed July 31, 1907. Serial No. 386,358.

To all whom it may concern:

Be it known that I, LAWRENCE S. NASH, 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 Starting Devices for Explosive-Engines, of which the following is a specification, reference being had therein to the accompanying drawings.

This invention relates to starting devices for explosive engines whereby a supply of compressed air is maintained automatically at a constant pressure by the engine, and is admitted to act directly on the pistons when desired, through valve connections operated by one of the parts of the engine.

The invention consists in the matters hereinafter set forth, and more particularly pointed out in the appended claims.

In the drawings, Figure 1 is a view in side elevation of a multi-cylinder two-cycle engine provided with a starting device embodying the invention. Fig. 2 is a view in end elevation of the engine, and starting mechanism. Fig. 3 is a view in section on line A—A of Fig. 2.

Referring to the drawings, 1 represents in outline the cylinders and frame of the engine, having a main shaft 2 and a horizontal commutator shaft 3, driven in unison therewith through a gear train 4 or the like.

A vertically disposed air pump cylinder 5 is secured at any convenient point on the engine base above and in line with the shaft 3. The pump cylinder is open at its lower end, which is carried down and extended as a case for a piston rod 6 which operates a piston 7 through wrist pin and crank connection 8 with the shaft 3.

The piston rod is connected to the piston by a horizontal pin 9, secured in bosses 10 on the side wall of the head. An apertured valve seat 11, preferably centrally disposed, is formed in the piston head and is sufficiently recessed at its upper end to readily retain a ball or other closure 12, which seals the aperture against downward passage of air. A similar apertured valve seat 13 with downwardly acting ball closure 14 is formed in the cylinder head 15, and a pressure pipe 16, screwed or otherwise secured to an outer nipple 17 in the head over the seat connects the pump to a pressure tank 18 of any suitable design, placed at any convenient point. A shut off valve 19 of any suitable construction is interposed between the tank and pump cylinder. This piston is so adjusted in relation to the cylinder head that the compression obtained in the cylinder at each stroke is equal to that to be maintained in the tank, so that after the latter is once filled, the balls, which are in effect check valves, do not operate because of the balance pressure, and the pump cylinder does not receive or force in a fresh charge until the pressure again falls.

A lateral branch pipe 20 leads from the tank pipe to the compression end of the two engine cylinders beyond the commutator and air pump, into which it opens through proper fittings 21 and valves 22. The latter are preferably secured in an axial plane of the commutator shaft. Their closures, preferably conical, and of the vertical lift type are operated by longitudinally reciprocable stems 24, passing through guide brackets 25 on the engine frame and are kept normally seated by spiral springs 26 or the like, in compression between the valve casings and suitable, adjustable stop collars 27 on the shaft. A tappet 28 of any preferred form is secured in the lower end of each stem. The tappets may be intermittently operated by suitable cams 29 that are longitudinally reciprocable on an extension 30 of the commutator shaft, rotatable in bearings which, as a convenient detail of construction, may be in the tappet brackets 25.

A longitudinally reciprocable shifting rod 31 is concentrically secured in the extensions 30 and is movably interlocked with the extension and cams by pins or studs 32 which engage oblique slots 33 in the extension. A spring 34 in compression between the extension and a hand knob 35 of the projecting end of the rod 31, normally holds the shifting rod projected with the cams out of engagement with the tappets. The oblique stud slots give the cams a part turn as they move them into engagement with the tappets when the rod is pushed in. In setting up the mechanism, the cams, slide rod, tappets and slots are so disposed and timed in relation to the engine that there is an automatic selective action whereby pushing in the slide rods admits the integral charge to that cylinder only which is in the expansion phase of its cycle, that is, in which the piston is at or receding from the point of highest compression. Thereafter, the revolution of the engine auto-

matically operates the air valves in proper order until explosion of the regular charge takes place, when the releasing of the slide rod allows its spring to throw it and the cams and tappets become disengaged and the valves closed.

Obviously the design and construction may be varied without departing from the spirit of the invention, and I do not care to limit myself to any particular form or arrangement of parts.

What I claim as my invention is:—

1. Starting mechanism for a multi-cylinder engine, comprising a pair of valves each adapted to admit compressed air to a cylinder of the engine, a cam shaft driven by the engine cams movable on the said shaft, adapted to operate said valves, a slide rod journaled in the shaft, oblique slots formed in the shaft, studs extending through the slots, connecting the slide rod and cams, and a spring on the slide rod, normally holding said cams disengaged with the valves.

2. Starting mechanism for a multi-cylinder engine, comprising a pair of valves each adapted to admit compressed air to a cylinder of the engine, tappets connected to the valves, a cam shaft driven by the engine, cams movable thereon, adapted to operate the tappets in time with the engine, a slide rod concentrically secured longitudinally in the shaft, said shaft formed with oblique slots, studs engaging the slots and connecting the slide rod and cams, and a spring normally projecting the rod toward the end of the slots remote from the tappets.

3. Starting mechanism for a multi-cylinder engine, comprising an air pressure tank connected to two of the engine cylinders, an air pump for the tank, a check valve opening from the pump to the tank, an air valve between each of said cylinders and the tank, cams on the pump shaft adapted to operate said valves, a slide rod longitudinally movable in the shaft said shaft having oblique slots, studs extending through the slots connecting the cams and the slide rod, and a spring adapted to normally hold the rod projected and the cams disconnected with the valve.

4. Starting mechanism for a multi-cylinder engine, comprising a pressure tank, an air pump therefor, a shaft parallel to the main shaft, driven in unison therewith, and operatively connected to the pump, connections between the compression ends of two of the engine cylinders and the tank, air valves therein, longitudinally reciprocable tappet rods transverse to the pump shaft sliding in guide brackets in which the pump shaft is journaled, a slide rod longitudinally movable in an axial aperture through the pump shaft, said shaft having slots formed oblique to its axis, whose inner ends are in substantial alinement with the tappet rods, cams on the shaft secured to the slide rod by studs passing through the slots, and a spring between the rod and shaft, adapted to normally hold said studs at the outer ends of said oblique slots.

5. In a multi-cylinder two-cycle engine, provided with a commutator drive shaft rotating in unison with the main shaft, a pressure tank, an air pump for the tank whose piston is reciprocated by rod and crank connection with the commutator shaft, an extension of said shaft journaled in guide brackets on the engine, connections between the tank and two of the engine cylinders, an air valve opening into each of said cylinders in said connections, tappet rods transverse to the shaft extension operating said valves, cams on said extension, a slide rod extending axially through the shaft extension, said extension having slots formed therein oblique to its axis, studs passing through the oblique slots connecting the cam and slide rod and a spring between the rod and extension adapted to normally hold said rod and cams disengaged from the tappets.

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

LAWRENCE S. NASH.

Witnesses:
C. R. STICKNEY,
OTTO F. BARTHEL.