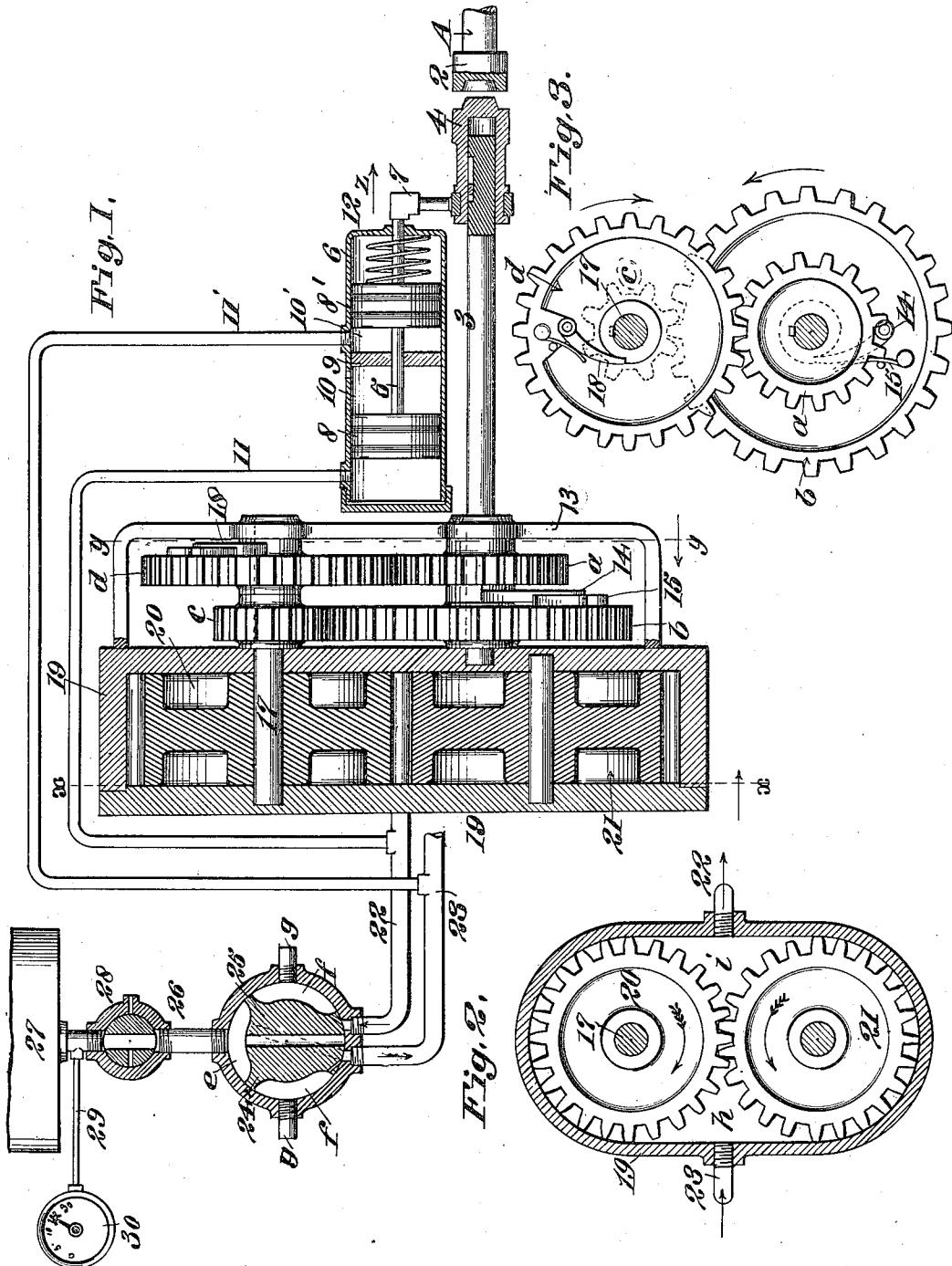


B. N. BOTTS.
GAS ENGINE STARTER.
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1,065,025.

Patented June 17, 1913.



Witnesses,
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UNITED STATES PATENT OFFICE.

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GAS-ENGINE STARTER.

1,065,025.

Specification of Letters Patent.

Patented June 17, 1913.

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To all whom it may concern:

Be it known that I, BARNET N. BOTTS, a citizen of the United States, residing at Paso Robles, in the county of San Luis Obispo and State of California, have invented new and useful Improvements in Gas-Engine Starters, of which the following is a specification.

This invention relates to a starter for gas engines and the like.

It is the object of this invention to provide a device for starting gas engines and the like which is designed to act on the engine shaft, and which is provided to obviate the usual cranking operations now generally in use and remove the difficulties and inconveniences incident thereto.

A further object is to provide an engine starter which is simple in construction, efficient and reliable in operation, and which is applicable for use on any style or type of engine in which it is desirable to rotate the engine shaft prior to setting the engine in operation to actuate the pistons or other mechanism whereby the explosive mixture is drawn into the explosion chamber in readiness for automatic ignition.

Another object is to provide an engine starter of the above character which embodies a motor for the compression of air, which is adapted to be rotated by the air compressed, a clutch for connecting the motor to the engine shaft, and a train of transmission gearing interposed between the engine shaft and the motor, by which the motor will be rotated at slow speed when driven by the engine shaft, at which time it is utilized as a compressor and will be rotated at high speed when operated by the compressed air and employed in driving the engine shaft.

Other objects, together with the advantages to be derived by the use of this invention will appear in the following specification.

The invention consists of the parts and the construction and combination of parts, as hereinafter more fully described and claimed, having reference to the accompanying drawing, in which—

Figure 1 is a vertical section of the invention, partly in elevation. Fig. 2 is a section on the line X—X, Fig. 1, slightly reduced. Fig. 3 is a section on the line Y—Y, Fig. 1, slightly reduced.

In the drawings, A represents an engine shaft which may be the drive shaft of any type of engine and adapted to be given a rotary motion. A female clutch member 2, preferably of the friction type, is mounted on the end of the shaft A, and reciprocally mounted on a revoluble shaft 3 disposed in alinement with the engine shaft A is a male clutch member 4 which is keyed on the shaft 3 and revoluble therewith.

The clutch member 4 is connected to a piston rod 5 mounted in a cylinder 6 by means of a strap 7, which rides in an annular groove formed on the clutch member 4. The piston rod 5 is provided with a pair of spaced pistons 8—8', which are arranged in the cylinder 6 on each side of a partition 9 disposed within the cylinder about midway of its length to separate the cylinder into two compartments, each of which is connected to air supply pipes 11—11' respectively.

The pistons 8—8' are designed to be reciprocated in one direction by air pressure to throw the male clutch member 4 into engagement with the female clutch member 2, as will be later described; the clutch member 4 being normally held out of engagement with the clutch member 2 by means of a helical spring 12 wound on the piston rod 5 within the cylinder 6, and bearing between the end of the cylinder and the piston 8' in such manner as to retain the piston rod 5 and the pistons 8—8' thereon in their rearmost position in the cylinder 6, as shown in Fig. 1.

The shaft 3 is supported in suitable bearings, not necessary to be here shown. One end extends through a frame 13 and has a pinion *a* and a spur wheel *b* mounted thereon; the pinion *A* being fixed to the shaft 3 while the spur wheel *b* is loose thereon and free to revolve independent of the shaft 3 in one direction, but engageable therewith so that the wheel *b* and shaft 3 will rotate in unison in the other direction by means of a pawl 14 on the wheel *b*, which is normally positioned by a spring 15 to engage a notched collar formed either on the shaft 3 or on the back of the pinion *a*, so that the wheel *b* may be rotated by the shaft 3, or vice versa.

The spur wheel *b* meshes with a pinion *c* fixed on a revoluble shaft 17, and the pinion *a* meshes with a spur wheel *d* loose on the

shaft 17; the spur wheel *d* having a spring pressed pawl 18 mounted thereon which is adapted to engage a notched collar on the shaft 17 in such manner that the shaft 17 and spur wheel *d* will be connected together so as to rotate in unison in one direction; the shaft 17 and spur wheel *d* being free to revolve independent of each other in the other direction.

The shaft 17 extends into an inclosed casing 19 and has a toothed wheel 20 rigidly mounted thereon which gears with a similar toothed wheel 21 revolubly mounted in the casing 19. The gear wheels 20—21 are incased in the casing 19 with the outer faces of the teeth on their diametrically opposed sides in slidable contact with the inner face of the end walls of the casing 19; the end walls conforming to one-half the addendum-circle or circumference of the geared wheels and connected together by parallel, straight, side walls, as shown in Fig. 2.

The depth of the inside of the casing 19 corresponds to the thickness of the gear wheels 20—21, so that the outer faces of the latter will be in close slidable contact with the inner faces of the broad side walls of the casing 19, as shown in Fig. 1.

Connecting with the spaces formed in the casing 19 on each side of the point of mesh of the gear wheels 20—21 are a pair of pipes or other conduits 22—23 which lead to and terminate in a valve casing 24. Connected to the pipes 22—23 are the pipes 11—11', before mentioned, leading from the cylinder 6.

Mounted within the valve casing 24 is a revoluble disk 25 which is formed with a passage *e* extending diametrically there-through, one end of which passage is adapted to be thrown into register with the ends of either of the pipes 22—23 while the other end is arranged to be in constant communication with a pipe 26 leading from a reservoir 27 of any suitable description. The periphery of the disk 25 is cut away on diametrically opposite sides between the ends of the passage *e* to form grooves or passages *f*, through which air may be exhausted from either of the pipes 22—23; these passages being arranged to be in constant communication with exhaust ports *g* in the valve casing 24, as shown in Fig. 1.

A cut-off valve 28 is disposed in the pipe 26 between the valve 24 and the reservoir 27 for the purpose of shutting off the passage of air from the reservoir, and connected to the pipe 26 between the valve 28 and the reservoir 27 is a pipe 29 which leads to a pressure indicator 30, which denotes the pressure of air in the reservoir 27 in the usual manner.

Let it be assumed that there is a quantity of air stored under pressure in the reservoir 27 and that it is desired to rotate the

engine shaft A, the operation of the invention will then be as follows: The cut-off valve 28 being opened to form a communication between the reservoir 27 and the valve 24, the disk 25 in the valve 24 is positioned so that the passage *e* will register with the end of the pipe 23 in order that air pressure will be delivered to the interior of the casing 19 into the space between the gears 20—21, indicated at *h* in Fig. 2. Air pressure passes from the pipe 23 through the pipe 11' into the cylinder 6 behind the piston 8', which acts to move piston rod 5 in the direction of the arrow *z* in Fig. 1, so as to throw the male clutch member 4 into engagement with the female clutch member 2 on the engine shaft A. The pressure of air in the space *h* in the casing 19 acts upon the teeth of the gears 20—21 in such manner as to cause them to rotate in unison in the direction indicated by the arrows in Fig. 2; the air being carried forward by the teeth of the gears into the chamber *i*, from whence it passes into the pipe 22 and is exhausted through the exhaust port *g* in the valve casing 24. The rotation of the gear 20 drives the shaft 17 and the pinion *c* thereon; the pinion *c* in turn rotating the toothed wheel *b* in such direction that the pawl 14 will engage the shaft 3 so as to rotate the latter and thereby revolve the engine shaft A through the clutch members 2—4 which acts to start the engine in the usual manner. When the engine has been started, the valve disk 25 is rotated so as to dispose the passage *f* in such position as to form a connection between the end of the pipe 23 and the exhaust port *g*, so that the air in the cylinder 6 behind the piston 8' will pass through the pipe 11' and be exhausted to the atmosphere through the valve 24; the cut-off valve 28 being previously closed. The spring 12 in the cylinder 6 acts on the piston 8' to throw the clutch member 4 out of engagement with the clutch member 2. When it is desired to compress air in the cylinder 27, the disk 24 is turned to throw the passage *e* into register with the end of the pipe 22, which causes air to be delivered to the pipe 11 and the cylinder 6 behind the piston 8; the cut-off valve 28 being previously opened. This action throws the clutch member 4 into engagement with the clutch member 2 by reason of the engine shaft A being rotated causing the shaft 3 to revolve and thereby rotate the pinion *a* and the toothed wheel *d* in such manner as to rotate the shaft 17 and the gears 20—21 in the direction traversed by the gears in starting the engine shaft A, as before described. This causes air to be drawn into the exhaust port *g* through the passage *f* and pipe 23 into the interior of the casing 19 at *h*, whence it is carried around by the gears

20—21 and discharged through the pipe 22 and the passage *e* in the disk 25, the pipe 26 and cut-off valve 28 into the reservoir 27. When a sufficient quantity of air has
5 been compressed in the reservoir 27, the disk 25 in the valve casing 24 is turned to exhaust the air in the cylinder 6 behind the piston 8 to throw out the clutch member 4, whereupon the cut-off valve 28 is closed.

10 Having thus described my invention, what I claim and desire to secure by Letters Patent is—

1. A gas engine starter having in combination a closed casing and a pair of inter-
15 meshing rotors operating therein, an engine shaft and a shaft alined therewith; gearing connecting the last-named shaft to one of the rotors; connecting means between the adjacent ends of said shafts, including a
20 clutch member slidable on said alined shaft; a compressed-air supply connecting with said casing; a cylinder; means for conducting compressed-air thereto; a piston having a rod connected to the slidable clutch
25 member and actuated in one direction by air pressure; means for actuating the piston in the other direction when the pressure of

air in the cylinder is reduced; and means whereby the rotors may be operated from the engine shaft to replenish the compressed
30 air supply.

2. An engine starter comprising a motor, consisting of a pair of geared wheels, a casing in which the gears are mounted and a shaft rotatable by one of said gears, means
35 for connecting this shaft to the crank shaft of an engine, means for delivering air under pressure to the casing to rotate the gears in one direction to drive said crank shaft, said first named means comprising a clutch,
40 one member of which is slidable on the first-named shaft, a cylinder and a piston therein connected to the slidable clutch member and actuated in one direction by air pressure, and means whereby the crank shaft
45 may be caused to rotate the motor to compress air.

In testimony whereof I have hereunto set my hand in the presence of two subscribing witnesses.

BARNET NIXON BOTTS.

Witnesses:

EMMA F. EXLINE,
CHARLES G. PUTNAM.