No. 622,934. Patented Apr. 11, 1899.

D. WAITS.

REVERSING GEAR FOR ENGINES.

(Application filed May 22, 1897.)

(No Model.)

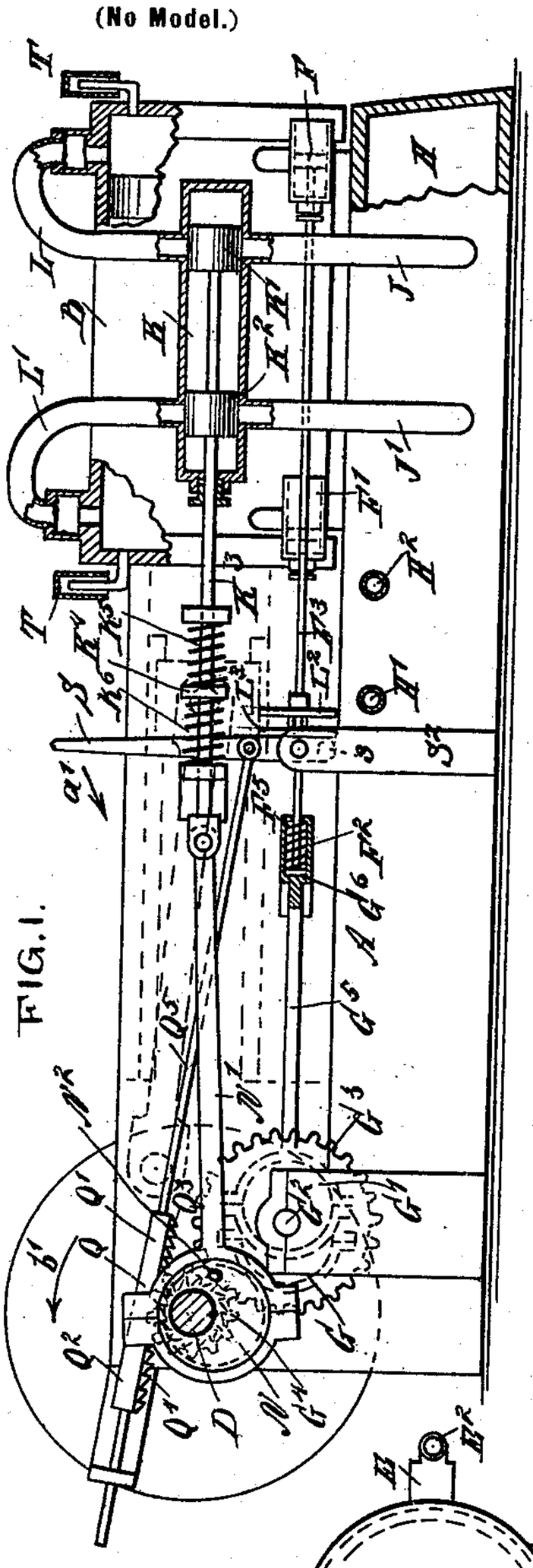

FIG. 1.

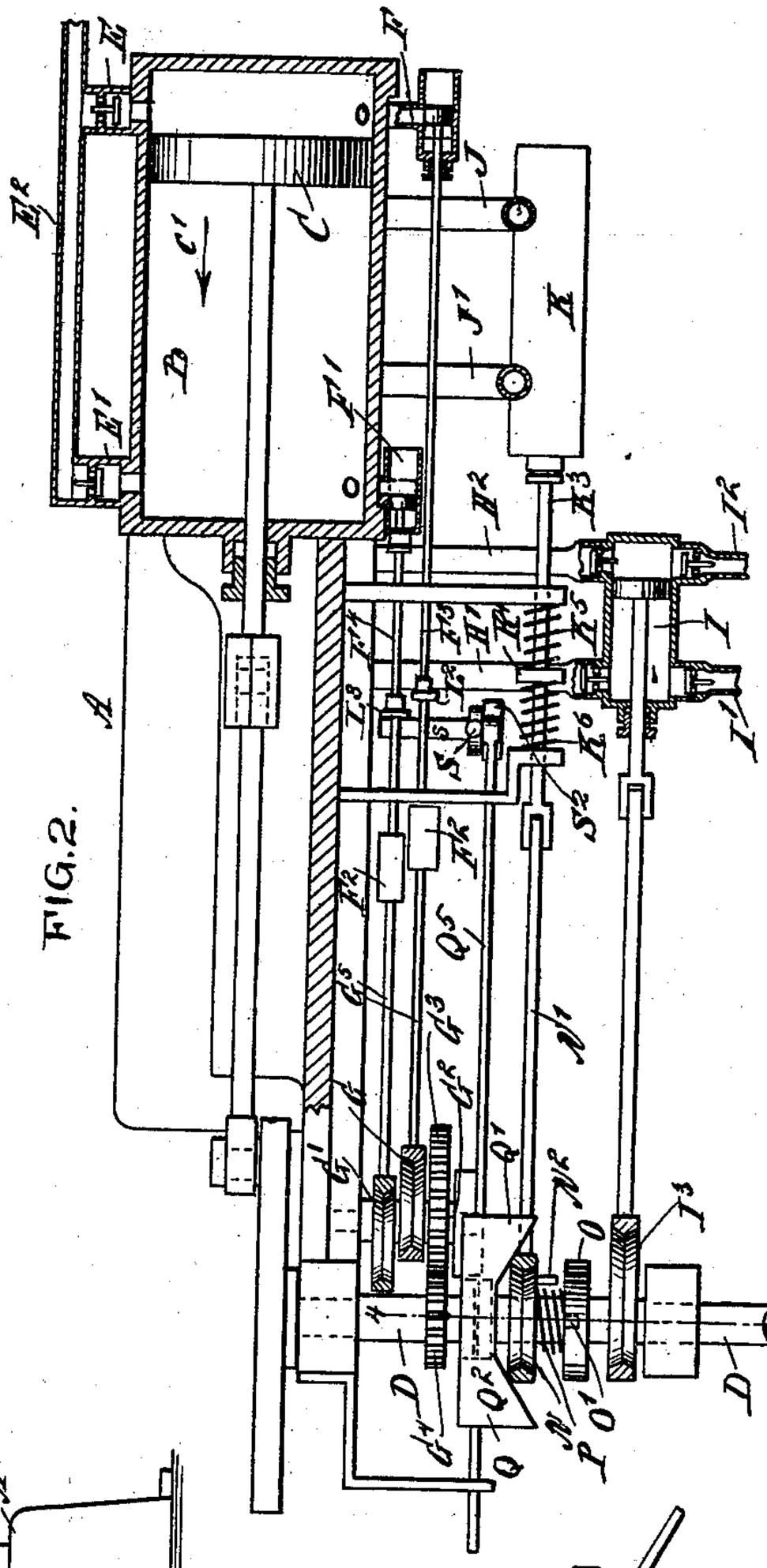

FIG. 2.

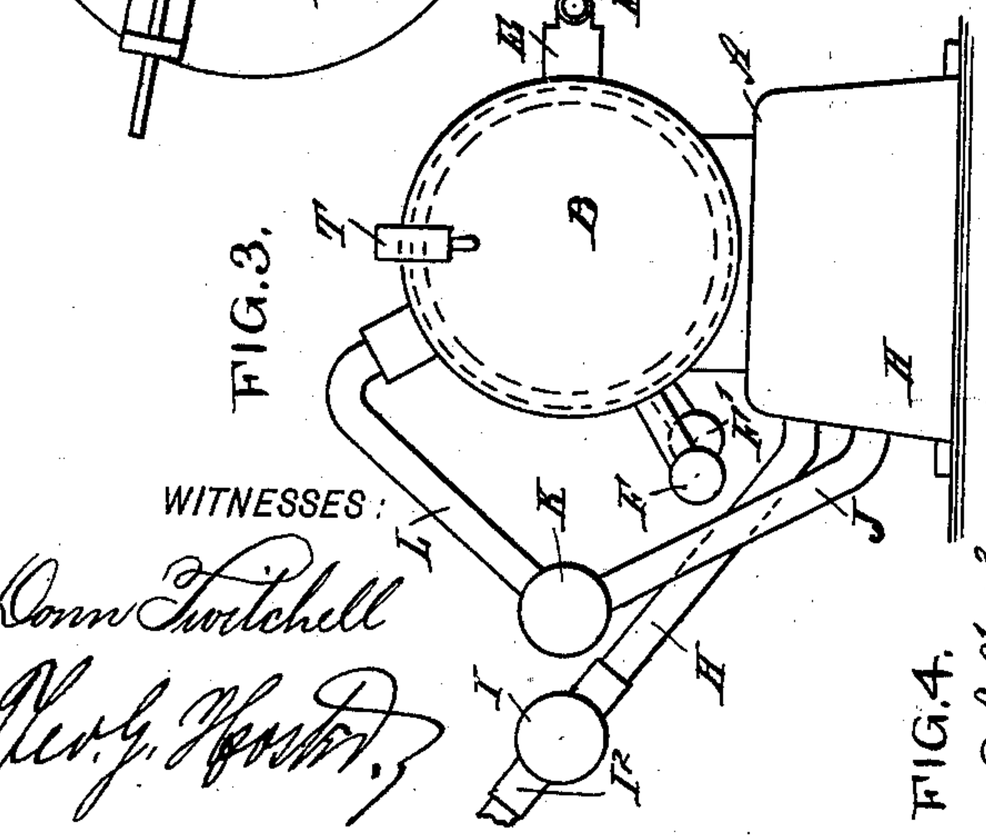

FIG. 3.

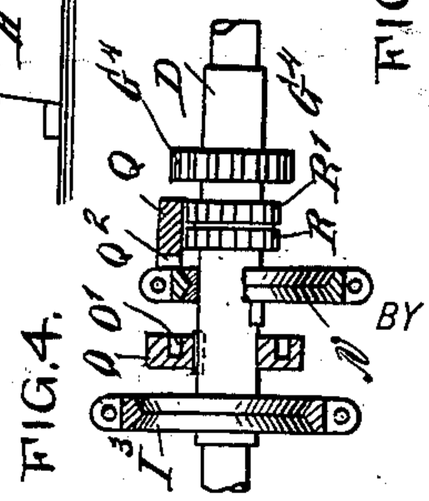

FIG. 4.

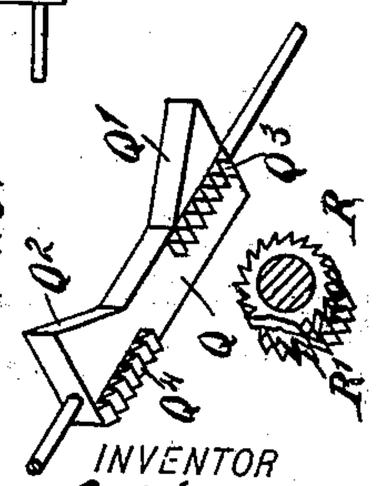

FIG. 5.

WITNESSES:

Donn Trotchell

Rud. J. Hoster

INVENTOR

D. Waits.

BY

Munn & Co

ATTORNEYS.

UNITED STATES PATENT OFFICE.

DANIEL WAITS, OF ROUSEVILLE, PENNSYLVANIA.

REVERSING-GEAR FOR ENGINES.

SPECIFICATION forming part of Letters Patent No. 622,934, dated April 11, 1899.

Application filed May 22, 1897. Serial No. 637,708. (No model.)

To all whom it may concern:

Be it known that I, DANIEL WAITS, of Rouseville, in the county of Venango and State of Pennsylvania, have invented a new and Improved Reversing-Gear for Engines, of which the following is a full, clear, and exact description.

The object of the invention is to provide a new and improved reversing-gear more especially designed for use on gas and the like engines and arranged to permit of reversing the engine without undue jar to the working parts.

The invention consists of certain parts and details and combinations of the same, as will be fully described hereinafter and then pointed out in the claims.

Reference is to be had to the accompanying drawings, forming a part of this specification, in which similar characters of reference indicate corresponding parts in all the figures.

Figure 1 is a side elevation of the improvement with parts in section. Fig. 2 is a sectional plan view of the same. Fig. 3 is an end elevation of the same. Fig. 4 is a transverse section of part of the improvement on the line 4 4 of Fig. 2; and Fig. 5 is a perspective view of the shifting rack and its wheels, shown in a detached position.

The engine is mounted on a suitable bed-plate A and is provided with the usual cylinder B, in which reciprocates the piston C, connected in the usual manner with the main driving-shaft D. The cylinder B is provided at its ends with the usual valved inlets E and E′, connected with a supply-pipe E^2, leading from a suitable source of motive-agent supply, (a mixture of gas and air.) The ends of the cylinder B are also provided with the valved exhausts F and F′, connected with eccentrics G and G′, respectively, arranged on a shaft G^2, provided with a gear-wheel G^3, in mesh with a gear-wheel G^4, secured on the main driving-shaft D, the proportion between the said gear-wheels being such that it requires two revolutions of the shaft D to make one stroke of each of the valves of the exhausts F and F′. The valve-stems F^3 F^4 of the exhaust-valves have preferably a yielding connection F^2 with the rods for the eccentrics G and G′, as plainly indicated in Fig. 1, so that the valves of the exhausts readily move into an open or a closed position.

In the bed-plate A is arranged a reservoir H for containing compressed air or other fluid under pressure and connected by pipes H′ and H^2 with an air-compressor I, of any approved construction, and having the usual valved inlets I′ and I^2. The piston of the compressor I is actuated by an eccentric I^3 from the main driving-shaft D; but the compressor may be driven by other suitable means, and the reservoir H may be separated entirely from the engine, if desired. The reservoir H is, however, connected by two pipes J and J′ with a chest K, connected by pipes L and L′ with the ends of the cylinder B.

The pipes J and L and J′ L′ are connected or disconnected with each other by means of valves K′ and K^2, respectively fitted to slide in the chest K and secured on a common valve-stem K^3, provided with a collar K^4, pressed on on opposite sides by springs K^5 and K^6 to hold the said stem K^3 and the valves K′ and K^2 normally in the position shown in Fig, 1 to disconnect the pipes J and L and J′ and L′ from each other. The outer end of the valve-stem K^3 is pivotally connected with the eccentric-rod N′ of an eccentric N, mounted to rotate loosely on the main driving-shaft D, and the said eccentric is provided with a transversely-extending pin N^2, adapted to engage one of two oppositely-arranged apertures O′, formed on one face of a disk O, secured to the shaft D. The eccentric N is, however, normally out of engagement with the disk O and is held in this position by a spring P, but is moved into engagement with the disk O by the wedges or cams Q′ Q^2, extending transversely from a rack Q, mounted to slide longitudinally and formed on its under side with rack-teeth Q^3 and Q^4, standing in opposite directions and adapted to engage toothed wheels R and R′, respectively, secured on the shaft D. The rack Q is provided with a rod Q^5, connected with the reversing-lever S, fulcrumed on the bed-plate and normally standing in a vertical position, as shown in Fig. 1, so as to hold the rack-teeth Q^3 and Q^4 out of engagement with the toothed wheels R and R′. When the lever S is moved by the operator to the left in the direction of

the arrow a', then the rack Q is shifted, so as to move the teeth Q^3 over to the toothed wheel R and at the same time shift by the wedge Q' the eccentric N outwardly to move the pin N^2 finally in engagement with one of the apertures O'. When the lever S is moved in the inverse direction of the arrow a', then the rack-teeth Q^4 move over the other toothed wheel R', and at the same time the wedge Q^2 engages the eccentric N and shifts the same outward to move the pin N^2 in engagement with one of the apertures O' in the disk O. When this takes place, the movement of the disk O causes a turning of the eccentric N, so that the valves K' and K^2 are both moved simultaneously into an open position to connect the reservoir H by the pipes J J' L L' with the ends of the cylinder B. When the rack Q moves, however, into its normal position, then the spring P at once presses the eccentric N back to its former position to move the pin N^2 out of engagement with the opening O', so that the eccentric N comes to a standstill at the time the valves K' and K^2 are in their normal or closed position, as shown in Fig. 1.

It is understood that when the rack-teeth Q^3 are moved over the toothed wheel R and the latter rotates with the shaft D in the direction of the arrow b', then the teeth of the toothed wheel simply glide over the teeth Q^3; but when the main shaft D is reversed, as hereinafter more fully described, then the said toothed wheel R by being in mesh with the rack-teeth Q^3 causes a sliding of the rack Q to the right to move the reversing-lever S back into its normal vertical position, whereby the wedge Q' moves out of engagement with the eccentric N, and the latter is moved out of gear with the disk O by the spring P at the time the valves Q' and Q^2 are in a closed position, as above mentioned. The same operation takes place when the lever S has been shifted in the inverse direction of the arrow a' by the operator and then left in this position until the engine is reversed—that is, the shaft D again runs in the direction of the arrow b', so that the toothed wheel R' then in mesh with the rack-teeth Q^4 causes a shifting of the rack Q to the left to move the lever S back to its normal vertical position and to disengage the wedge Q^2 from the eccentric N, so that the spring P shifts the eccentric N back to its normal position to move the eccentric out of gear with the disk O. This takes place at the time the valves K' and K^2 are in a closed position. The pivotal connection between the eccentric-rod N' and the valve-rod K^3 is sufficiently loose to permit the sliding motion of the eccentric-disk above referred to.

The yielding connection F^2 between each of the valve-rods F^3 F^4 and the corresponding eccentric-rod G^5 of the eccentric G or G' consists principally of a cylinder G^6, containing a spring F^5, pressing on the headed end of a corresponding valve-stem F^3—that is to say, the coil-spring F^5 is interposed between the head of the valve-stem F^3 and the opposite end of the cylinder or sleeve G^6. Thus the said head of stem F^3 is seated against the closed end of sleeve G^6, but is free to move in the opposite direction when the tension of the spring F^5 is overcome. This arrangement allows the exhaust-valve to remain in a closed position during the suction and compressing periods, while the corresponding eccentric moves in its usual course, it being understood that the spring F^5 is then compressed, and when the piston is at the end of its working stroke and is starting on the return or exhaust stroke then the exhaust-valve will move into an open position to allow the products of combustion to pass to the outer air.

It is understood that the tension of the spring F^4 is sufficient to overcome all friction of the valves immediately after each explosion; but the tension of the said spring is not sufficient to overcome the friction of the valves when the latter are under pressure.

The exhaust-valve stems F^3 F^4 are provided, respectively, with bars or stops L^2 L^3, with which the lower and horizontal arm *s*, Fig. 2, is adapted to come in contact when the vertical arm of lever S is shifted to the left, as indicated by arrow a' in Fig. 1. Said lever is pivoted on a post S^2.

The operation is as follows: When the several parts are in the position as illustrated in the drawings, the main driving-shaft D is rotating in the direction of the arrow b', and the rack Q is in its intermediate position, with the eccentric N out of engagement with the disk O, so that the valves K' and K^2 are in a closed position. The piston C travels now in the direction of the arrow c' and draws the explosive mixture through the valve E into the outer end of the cylinder, while the products of combustion in front of the piston pass out through the open exhaust-valve F' to the outer air. Now when it is desired to reverse the engine the operator moves the lever S in the direction of the arrow a', as previously explained, whereby the horizontal arm of said lever presses against stop L^3 on valve-stem F^4, and thus overcomes the resistance of spring F^5 and closes the valve of exhaust-port F'. Both exhaust-valves are then closed and the same movement of the lever S has simultaneously caused the eccentric N to momentarily clutch with disk O to cause the valves K' and K^2 to open to allow air or other fluid under pressure to pass from the reservoir H into both ends of the cylinder B simultaneously. The said valves instantly close and the check-valve of inlet-port E is also closed. Thus the air admitted to cylinder B is confined therein, so that the air in front of the piston is compressed, while that in the other side of it is correspondingly expanded. The pressure against the piston C tends to stop the momentum of the same in a very short time, and the surplus pressure on one side of the piston causes a return movement thereof before it

reaches the end of its stroke, so that the shaft D is started in the inverse direction of the arrow *b'*. When this takes place, the rack Q is moved back to its normal position, as above explained, and the valves K' and K^2 are closed, and the exhaust-valve F is now open to exhaust the compressed air from the cylinder and to allow a new explosive mixture to pass into the cylinder to be ignited and then act on the piston, so as to reciprocate the same to rotate the engine in the inverse direction of the arrow *b'*. It is understood that the cylinder B is provided at each end with a suitable igniting device T, as indicated in the drawings. Ignition occurs on alternate strokes of the piston. Thus it will be seen that by the arrangement described use is made of a compressed fluid to establish an equilibrium in the cylinder to stop the momentum of the piston as soon as possible and to start the piston on the reversing-stroke in a very short time and without shock or jar to the working parts of the engine. Furthermore, the reversing device is automatically returned into an inactive normal position, so that attention on the part of the operator is not required after he has shifted the lever S from its vertical position to an inclined position. It is further understood that as the engine is in motion at the time of the simultaneous admission of air to both ends of the cylinder an increase of pressure will be on one side of the piston and a decrease of pressure on the other side of the piston to insure a return movement of the piston as described.

Having thus fully described my invention, I claim as new and desire to secure by Letters Patent—

1. A reversing-gear for gas-engines, provided with a cylinder having valved exhausts, each operated from the main driving-shaft, and a yielding connection for the stem of the said exhaust-valve to permit the exhaust-valves to be thrown to a closed position when the reversing mechanism is operated, as shown and described.

2. A reversing-gear for gas-engines, comprising a reservoir containing a fluid under pressure valves for establishing communication between the reservoir and the ends of the cylinder, an eccentric for shifting the said valves and loosely mounted on the driving-shaft, a disk secured on the driving-shaft and adapted to be engaged by the said eccentric to rotate the latter with the shaft, and means substantially as described, for shifting the eccentric to move it in engagement with the said disk, as set forth.

3. A reversing-gear for gas-engines, comprising a reservoir containing a fluid under pressure valves for establishing communication between the reservoir and the ends of the cylinder, an eccentric for shifting the said valves and loosely mounted on the driving-shaft, a disk secured on the driving-shaft and adapted to be engaged by the said eccentric to rotate the latter with the shaft, means substantially as described, for shifting the eccentric to move it in engagement with the said disk, and means for moving the eccentric out of engagement with the disk automatically, as set forth.

DANIEL WAITS.

Witnesses:
CLARENCE P. GRUNDER,
EDWIN BOOZELL.