(No Model.) 2 Sheets—Sheet 1.

P. MURRAY, Jr.

GAS ENGINE.

No. 305,466. Patented Sept. 23, 1884.

Fig. 1.

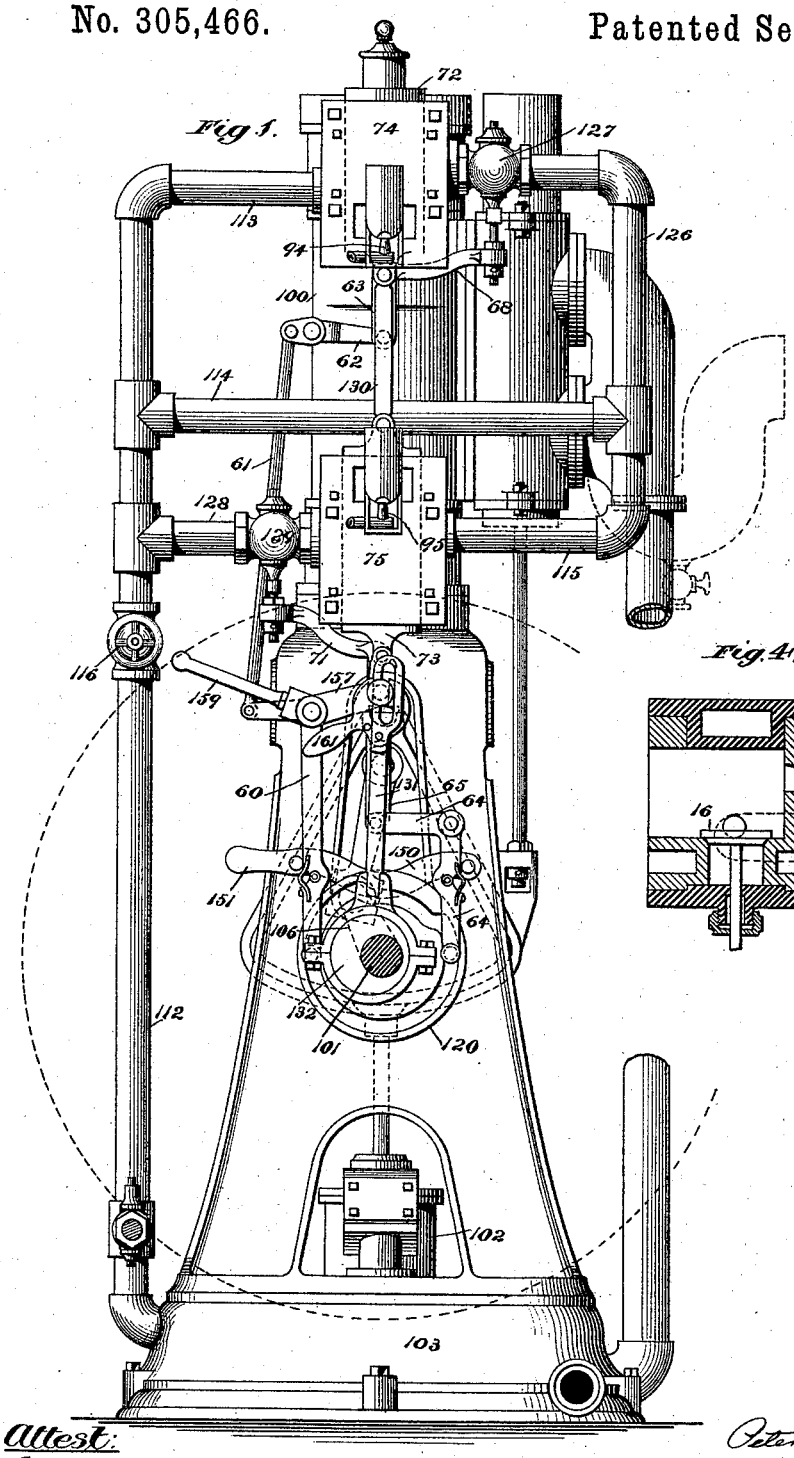
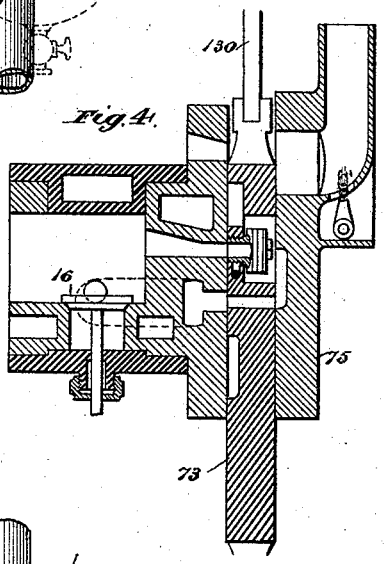


Fig. 4.



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(No Model.)

2 Sheets—Sheet 2.

P. MURRAY, Jr.

GAS ENGINE.

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Fig. 2.

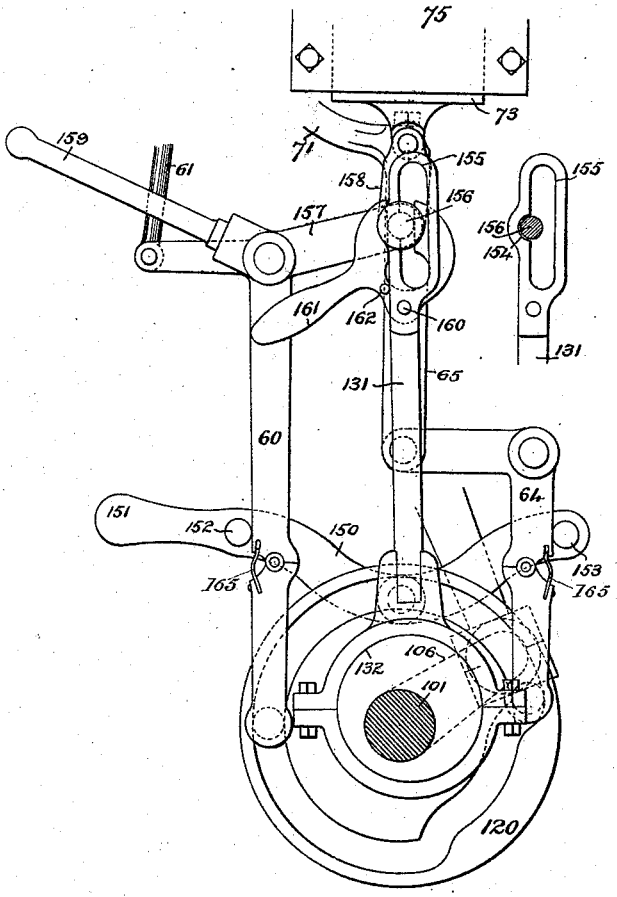
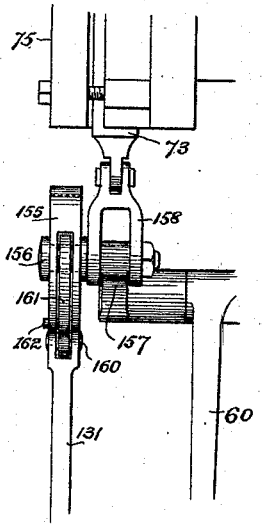


Fig. 3.



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UNITED STATES PATENT OFFICE.

PETER MURRAY, JR., OF NEWARK, NEW JERSEY, ASSIGNOR TO THE MURRAY MOTOR MANUFACTURING COMPANY, OF SAME PLACE.

GAS-ENGINE.

SPECIFICATION forming part of Letters Patent No. 305,466, dated September 23, 1884.

Application filed January 12, 1884. (No model.)

To all whom it may concern:

Be it known that I, PETER MURRAY, Jr., a citizen of the United States, residing in the city of Newark, county of Essex, and State of New Jersey, have invented certain new and useful Improvements in Gas-Engines, fully described and represented in the following specification and the accompanying drawings, forming a part of the same.

In an application for United States Letters Patent filed in the Patent Office on the 27th day of October, 1883, Serial No. 110,192, I have shown and described a gas-engine in which the power-piston is driven by the explosion of charges of mixed gas and air, which are admitted alternately into the opposite ends of the power-cylinder upon the opposite sides of the piston. In this engine the explosive mixture, instead of being drawn into the cylinder by the piston, flows to the cylinder from a tank or reservoir in which a sufficient pressure is maintained to cause the mixture to flow into and fill the cylinder upon either side of the piston whenever the induction-valve of that end of the cylinder is opened. The induction and exhaust valves of the power-cylinder, and also the ignition-valves for firing the charges alternately admitted into the opposite ends of the cylinder, are operated through suitable connections from the main shaft of the engine, and are so timed that the charge of the explosive mixture will be admitted into each end of the cylinder at the time when the piston has nearly or quite reached the limit of its stroke toward the opposite end, and that the charge so admitted will not be fired until the piston has reached the limit of its return-stroke, all of which features are fully illustrated and described in my said application, to which reference is made for a more extended explanation of the same. In the organization shown in my said application the connections for operating the induction and ignition valves are so constructed and arranged that whenever the engine is brought to rest it is necessary, in order to again set the engine in motion (assuming that sufficient pressure exists in the tank to cause the explosive mixture to flow into and fill the cylinder as soon as the induction-valves are opened) to open the throttle and then turn the main shaft until one of the induction-valves has been opened to admit a charge upon one side of the piston and the ignition-valve of the corresponding end of the cylinder has been moved into position to fire said charge.

The present invention relates to a gas-engine of the construction shown in my said application, and particularly to the connections by which the induction and ignition valves are operated, it being the object of the invention to provide connections for this purpose by which, after the engine has been brought to a state of rest, these valves can be operated so as to again set the engine in motion without the necessity of turning the main shaft.

In the accompanying drawings, Figure 1 is a side elevation of a gas-engine similar to that shown in my said application, but provided with connections for operating the induction and ignition valves embodying the present invention. Fig. 2 is a side elevation upon an enlarged scale of the valve-operating devices. Fig. 3 is a partial edge view of the same, and Fig. 4 is a vertical section upon an enlarged scale, showing the lower induction and ignition valves.

Referring to said figures, it is to be understood that, as to its principal parts, the engine therein shown is the same as that shown in my former application before referred to. The explosive mixture, after being drawn into the pump 102, is forced into the tank 103, from which it passes through the pipe 112 and branches 113 114 115 and 126 128 to the opposite ends of the power-cylinder 100. The admission of the explosive mixture to the lower end of the power-cylinder is controlled by the induction-valves 16 and 129, which are operated from the main shaft 101 through a cam, 120, lever 64, rod 65, and arm 71. The admission of the mixture to the upper end of the cylinder is controlled by an induction-valve similar to the valve 16 and a valve, 127, which valves are also operated from the cam 120 through a lever, 60, rod 61, lever 62, link 63, and arm 68. The charges admitted to the opposite ends of the cylinder are fired at the proper times by burners carried in ignition-valves 72 73, which reciprocate beneath covering-plates 74 75, and are operated from the main shaft through an eccentric, 132, eccen-

tric-rod 131, and connecting-link 130. All of the parts just mentioned are substantially the same both as to construction and operation, except in certain particulars, which will be hereinafter explained, as in the engine shown in my said former application, to which reference is made for a more full and complete description of these parts and also of the other parts of the engine, which are not referred to herein, as such reference is not necessary to enable a person skilled in the art to understand the present invention.

Referring to Fig. 2, it will be observed that the lower arms of the levers 60 64, instead of being made rigid, as in the construction shown in my former application, are provided with knuckle-joints, which are arranged to bend in only one direction, and are held rigid during the ordinary operation of the engine by means of stiff springs 165.

Pivoted to the frame-work of the engine, just inside of the levers 60 64, is a lever, 150, which is provided with a handle, 151, and with studs 152 153, which project outward just outside of the levers 60 64, respectively. By means of this construction it becomes possible, by depressing the handle 151, and thus rocking the lever 150, to cause the stud 153 to impinge against the lever 64 and bend the same on its knuckle-joint against the force of the spring 165, and thus, through the rod 65 and arm 71, open the lower induction-valves. On raising the handle 151 the spring 165 will restore the arm of the lever 64 to its straight condition, as shown, and on raising said handle still farther the stud 152 will be caused to impinge against the lever 60, thereby causing it to bend upon its knuckle-joint against the force of its spring 165, and thus, through the rod 61, open the upper induction-valves. Upon restoring the lever 150 to its normal position the spring 165 of the lever 60 will cause the lower arm of said lever to resume its straight position, as shown. By simply releasing the handle 151 after it has been either raised or lowered, as just described, the force of the springs 165 in restoring the arms of the levers 60 64 to their straight positions will cause the lever 150 to assume the position shown in the drawings.

The rod 131, through which the eccentric 132 operates the ignition-valves, instead of being connected directly to the lower ignition-valve, 73, as in the construction shown in my former application, is in the present case connected indirectly to said valve in the following manner: The rod 131 is provided at its upper end with a slot, 155, of a length equal to or somewhat greater than twice the throw of the eccentric 132, and in one of the walls of this slot, about midway of its length, is formed a circular recess or depression, 154. Pivoted to the lower end of the ignition-valve 73 is a link, 158, from the lower end of which projects a stud, 156, which passes through the slot 155, as best shown in Fig. 3. The lower end of the link 158 is also pivotally connected to the end of a lever, 157, which is fulcrumed upon the same stud upon which the lever 60 vibrates, and is provided with a handle, 159, by which it can be operated, as will hereinafter appear.

Pivoted to the lever 131 at the point 160, just below the slot 155, is a lever, 161, which is enlarged above its pivotal point and slotted so as to embrace the stud 156. When the lever 161 is in the position shown in the drawings, the depression 154 in the wall of the slot 155 is forced over the stud 156, and is held in that position by a pin, 162, passed through the lower part of the lever 161 and resting against the side of the rod 131, thereby securely holding the stud in said depression and rigidly connecting the rod 131 and link 158, so that the ignition-valves will be operated by the eccentric 132. Upon removing the pin 162 and raising the handle of the lever 161 the rod 131 will be rocked so as to carry the depression 154 away from the stud 156, thus disconnecting the rod from the link 158 and permitting the stud 156 to move freely in the slot 155, so that the ignition-valves can be moved independently of the eccentric 132. When the parts are in this condition, by raising or lowering the handle 159 of the lever 157 the ignition-valves can be moved upward or downward to the full extent of their travel, so as to fire a charge in either end of the cylinder of the engine independently of the eccentric 132.

Assuming that the explosive mixture in the tank or reservoir is under sufficient pressure, the operation of the connections just described, in starting the engine, is as follows: If the engine has stopped in such position that the power-piston covers neither of the exhaust-ports, the main shaft must be turned by hand until the crank 106 is in such position that the piston will cover either the upper or lower of the exhaust-ports, according as the crank is above or below the center. If the piston, when the engine stops, is in either of these positions, then the main shaft will not have to be moved. The power-piston being in the proper position, as just described, the throttle-valve will be opened and the handle 151 raised and lowered, so as to bend the levers 60 64 upon their knuckle-joints, and thus open the upper and lower induction-valves 116 and admit charges of the explosive mixture above and below the power-piston. The handle 151 will then be released and the lower arms of the levers 60 and 64 will be restored to their straight positions by the springs 165. The pin 162 will then be removed from the lever 161, and the latter raised, so as to disconnect the rod 131 from the link 158. The permanent burners 94 95 of the ignition-valves will be lighted and the handle 159 of the lever 157 will then be either raised or lowered, depending upon the end of the cylinder in which it is desired to fire the charge. When the engine starts, the lever 161 will be depressed, so as to force the depression 154 over the stud 156, and the

pin 162 will be replaced, so as to rigidly connect the rod 131 to the link 158, and the engine will then continue to operate in the ordinary manner, as described in my former application.

The form of connections just described for operating the induction and ignition valves is very important in the case of large engines, or where it would require more power than could be exerted by a single person to turn the main shaft of the engine, and also in those engines in which no crank and shaft is used, in engines for stamping-mills, hammers, and for other purposes where it is necessary to reverse the action of the engine, and where complete control of the movements of the piston in either direction is necessary.

By employing two eccentrics and the ordinary link-motion in common use, in connection with this form of valve-operating apparatus, the engine can be used on locomotives, steam-vessels, and for other purposes where it is necessary to reverse the action of the engine.

What I claim is—

1. The combination, with a valve, of a pivoted lever operated by a cam for moving the same, said lever being jointed, so that without removing it from contact with the cam it can be bent, and thus move the valve, and provided with a spring by which it is automatically restored to its original straight condition after being bent, substantially as described.

2. The combination, with a valve, of a pivoted lever, 60 or 64, operated by a cam for moving the same, said lever being provided with a knuckle-joint, a lever for bending it upon said joint, and a spring for causing it to resume its original position after being bent, substantially as described.

3. In a gas-engine, the combination, with the induction-valves and valve-rods, of the levers 64 65, and cam 120, for operating the same, said levers being jointed, as shown, and the lever 150, for bending both of the levers 64 65 upon said joints, substantially as described.

4. The combination, with the eccentric-rod 131, slotted at one end, and provided with the recess or depression 154, of the link 158, connected to the valve, and provided with a stud, 156, passing through said slot, and the slotted lever 161, pivoted to the rod and arranged to embrace said stud, substantially as described.

5. The combination, with the eccentric-rod 131, slotted at one end, and provided with the recess or depression 154, of the link 158, connected to the valve, and provided with a stud, 156, passing through said slot, the slotted lever 161, pivoted to the rod and arranged to embrace said stud, and the lever 157, connected to said link, substantially as described.

6. In a gas-engine, the combination, with the induction and ignition valves, of the levers 64 65, and eccentric-rod 131, for operating the same, said levers being jointed, and said rod slotted and provided with the recess 154, as shown, the lever 150, for bending both of the levers 64 65 upon their joints, the link 158, having the stud 156 extending through said slot, the slotted lever 161, pivoted to the rod 131, and the lever 157, connected to the link 158, substantially as described.

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

PETER MURRAY, JR.

Witnesses:
J. A. HOVEY,
T. H. PALMER.