(No Model.) 2 Sheets—Sheet 1.

G. W. STEWART.

GAS ENGINE.

No. 381,488. Patented Apr. 17, 1888.

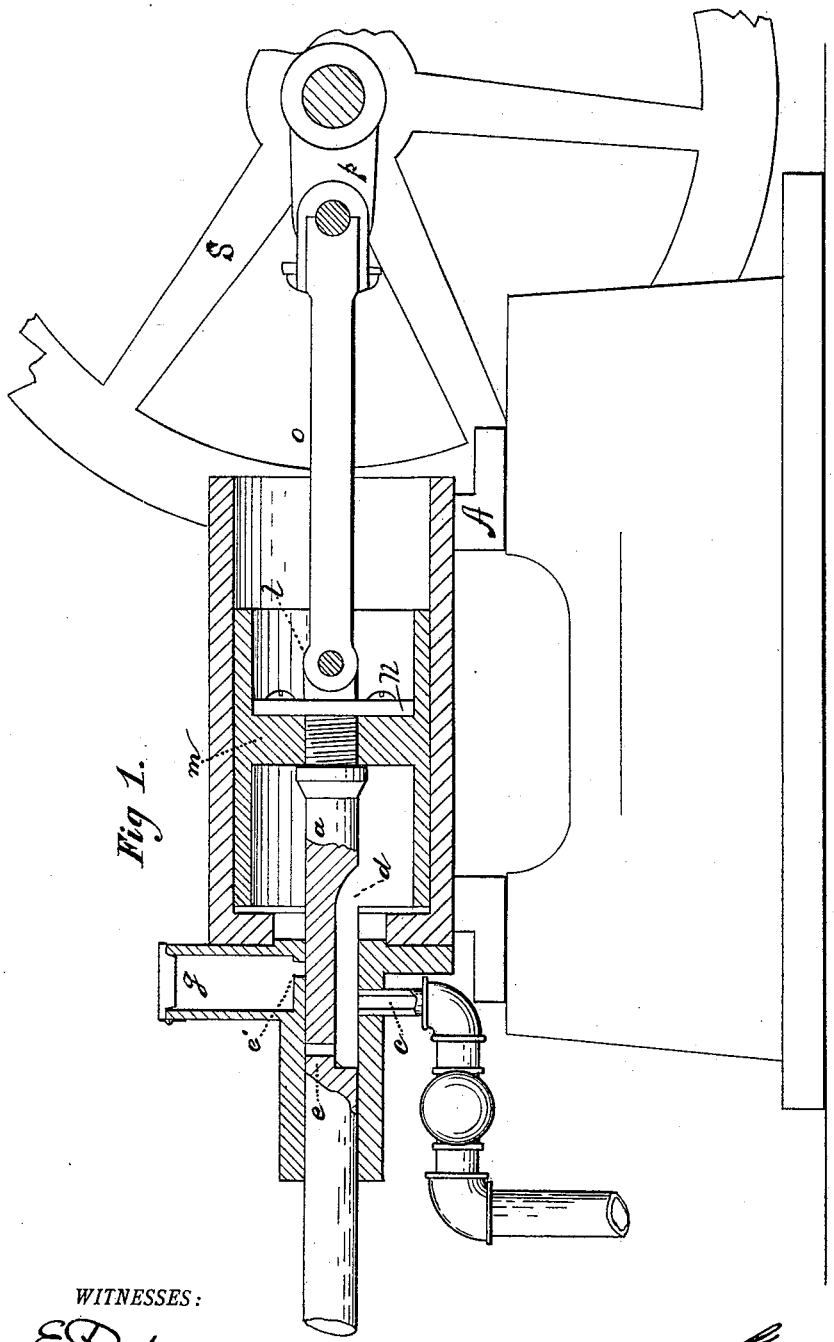


Fig 1.

WITNESSES:

E. Rubees.

R. J. Kirk Jr.

INVENTOR,

George W. Stewart.

(No Model.) 2 Sheets—Sheet 2.

G. W. STEWART.

GAS ENGINE.

No. 381,488. Patented Apr. 17, 1888.

Fig 2.

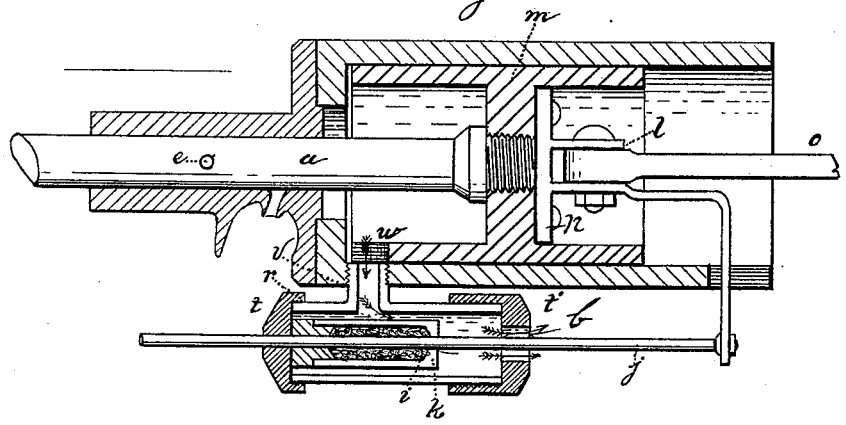


Fig 3.

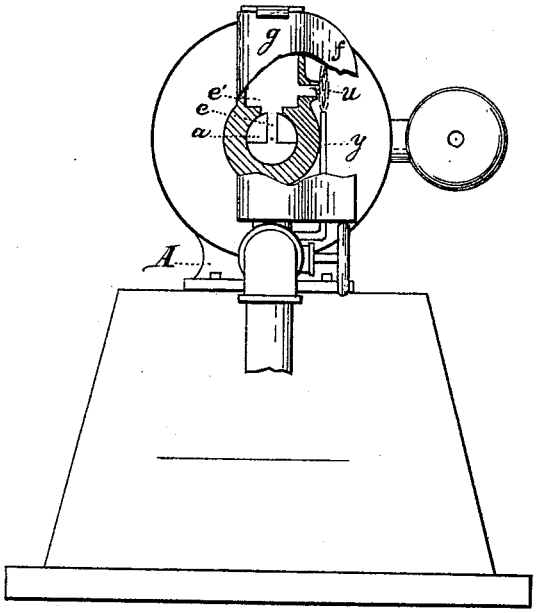
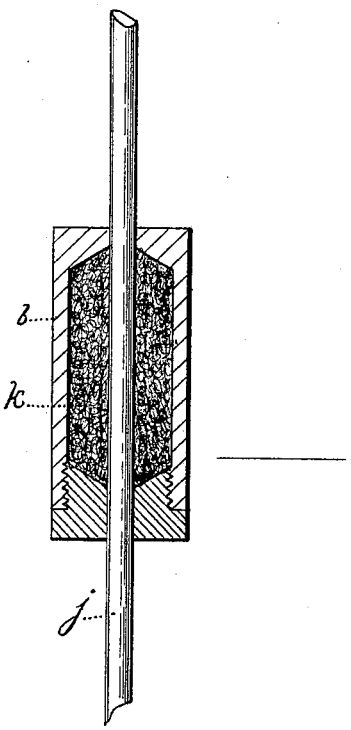


Fig 4.



WITNESSES:

E. Forbes.
A. J. Kirk Jr.

INVENTOR,

George W. Stewart.

UNITED STATES PATENT OFFICE.

GEORGE W. STEWART, OF NEW YORK, N. Y.

GAS-ENGINE.

SPECIFICATION forming part of Letters Patent No. 381,488, dated April 17, 1888.

Application filed July 25, 1887. Serial No. 245,169. (No model.)

To all whom it may concern:

Be it known that I, GEORGE W. STEWART, of the city, county, and State of New York, have invented a new and useful Improvement in Gas-Engines, of which the following is a specification.

This invention relates to gas-engines, its object being to automatically ignite and explode the gas within the cylinder, so as to utilize the same to its greatest efficiency, and thus obtain a very simple, cheap, and at the same time powerful engine. The manner in which I accomplish this result is fully illustrated in the accompanying drawings, which form part of this specification, and in which similar letters of reference indicate corresponding parts.

Figure 1 represents a longitudinal vertical section showing the manner in which the gas is supplied to the cylinder through the feed-pipe *c* and the supply-port *d* in the piston-rod *a*, also the igniting-ports *e* and *e'*. Fig. 2 represents a horizontal section through the body of the engine and relief or exhaust valve, to show the exhaust-port and illustrate the operation of the valve, which will be hereinafter explained. Fig. 3 represents an end view of the front end of the engine with a portion of the hood *f* and funnel *g* broken away, showing the piston rod *a* and a portion of the neck-casting in cross-section to better illustrate the method of igniting the flame; and Fig. 4 illustrates an enlarged longitudinal section of the valve *i*, to show the manner in which the same is gripped to the stem *j* by means of the asbestus packing *k*.

The piston *m*, Figs. 1 and 2, is made of the usual form and provided with a cap, *n*, which is secured thereto, and which is provided with the ordinary rod couplings, *l*, to which is secured the driving-rod *o*. The driving-rod *o* is connected to the crank *p* of the balance-wheels *s*, which are provided with the usual shaft-bearings, &c., to permit of its perfect operation.

The piston-rod *a* is provided on its under side with a supply-port, as *d*, which is of a proper length to create a communicating channel between the feed-pipe *c* and the inside of the cylinder, as shown in Fig. 1. Through the neck of the casting, on its lower side, the feed-pipe *c* is secured, so as to connect its channel with that of the supply-port *d*. On the upper side of the piston-rod *a*, slightly inside of its solid portion, a hole is provided, as *e*, which may be termed the "igniting-port." This port is arranged to communicate at the proper moment of the stroke of the piston with another igniting-port, *e'*, which is provided in the upper side of the neck-casting and communicates with the funnel *g*. In the side of the funnel *g*, as shown at *u*, Fig. 3, is a small port in the form of a tip, by means of which the flame is communicated to the gas at the proper time, as will be hereinafter explained in connection with the operation of the relief-valve.

As shown at *w*, Fig. 2, the cylinder is provided with an exhaust-port, which communicates with the relief-valve by means of the neck *v*, which secures the cylinder *r* of the relief-valve to the main cylinder of the engine. On each end of the cylinder *r* are secured the caps *t* and *t'*. These caps are secured to the cylinder, as illustrated, the cap *t'* being provided with a long threaded portion to permit of its being adjusted to regulate the stroke of the valve according to the stroke or speed of the engine, it being understood that when the engine is running at a high rate of speed it will require a longer stroke of the valve *i* in order to keep the exhaust-passage open for a longer period of time. To accommodate this requirement the cap *t'* can be unscrewed to any desired distance, thus lengthening out the cylinder *r* and increasing the stroke of the valve.

As illustrated at *b*, Fig. 2, the cap *t'* is provided with an opening, through which the stem *j* travels, which is sufficiently larger than the stem to permit of a free exhaust, also to admit the requisite proportions of air into the cylinder on the return-stroke to create combustion, while the corresponding opening in the cap *t* is the requisite size to permit of the free passage of the valve-stem and nothing more. The construction of the valve *i* is illustrated in Figs. 2 and 4, which show the valve mounted upon the valve-stem, the valve consisting simply of a tube solid at one end and a suitable plug to screw in the opposite end, with a hole drilled through the solid end, and the plug and tube sufficiently large to accommodate an easy movement of the valve-stem, the

packing *k* being relied upon to hold the valve in position. One of the lugs *l*, as shown in Fig. 2, is extended and bent at rectangle, so as to form an arm, to which the end of the valve-stem is secured, as shown in Fig. 2, so that the valve-stem has the same travel of stroke as the piston. The distance between the valve *i* and the cap or valve-seat *t'* being much less than the stroke of the piston, it requires that the valve *i* be secured to the stem with sufficient grip to be carried back and forth and held against its seat at each end of the cylinder, but with sufficient freedom to permit the stem to slide through the valve and complete its stroke, as described in the operation of the engine hereinafter.

The method of igniting the gas is illustrated in Figs. 2 and 3, which show the burner *y* tapped into the main supply-pipe *c*, from which it receives the requisite flow of gas to keep a proper-sized blaze burning constantly in front of the igniting-port *u*, as shown in Fig. 3.

The manner of mounting the engine is to provide it with legs, as shown at A, Figs. 1 and 3, and screwing the said legs to the bed-plate or foundation. This manner of mounting engines of this character is so common that it is thought hardly necessary to go into any further description, excepting to say that as a novel and new feature I make the bed-plate in the form of a box and utilize its interior space for the purpose of storing the gas when so desired. In other words, it is a gas-reservoir.

The operation of my engine is as follows, assuming that the gas is burning from the burner *y*, as shown in Fig. 3: Gas, being admitted through the supply-pipe *c*, will flow through the supply port or channel *d* of the piston-rod into the cylinder. The piston is then moved forward, and the supply of gas is cut off by the solid portion of the piston-rod covering the supply-pipe *c*. After the piston has cut off the supply of gas, the igniting-ports *e* and *e'* are in communication with each other, so that a sufficient jet of gas will escape through the said igniting-ports into the funnel *g*, as shown in Fig. 3, and will be ignited by the blaze from the burner *y* through the tip *n*. The gas in the cylinder will then explode and expand its forces against the piston, thus driving it to the limit of its stroke. This operation is repeated automatically with each stroke of the piston, depending upon the force of the balance-wheels to complete the return-stroke, unless it should be in cases where a twin engine is built.

The operation of the exhaust-valve is as follows: The side of the piston being slightly cut away to permit of a free exhaust, as shown at *w*, Fig. 2, air is admitted into the cylinder through the cap *t'* in sufficient quantities to mix with the gas being supplied and create the necessary combustion when ignited. At the beginning of the stroke, as above described, the valve *i* begins a corresponding travel to that of the piston, being carried by the valve-stem *j* and arm which is secured to one of the legs *l*. The valve *i* travels with the valve-stem until the valve has been seated to the inside of the cap or seat *t'*, and the supply of air is then cut off. The valve remains and keeps the exhaust-ports closed while the valve-stem completes its stroke with the piston. Immediately upon the beginning of the return-stroke, the valve *i*, being clutched to the stem by its asbestus packing, will travel with the stem, and thus open the exhaust-port, leaving the exhaust a free exit, as indicated by the arrows. This operation is repeated at each stroke, the side of the cylinder being slightly slotted to accommodate the arm which carries the valve-stem.

Having thus described my invention, what I claim, and desire to secure by Letters Patent, is as follows, to wit:

1. An exhaust and air-supply mechanism which consists of the cylinder *r*, provided at each end with the caps or seats *t* and *t'*, the valve-stem *j*, carried by the engine-piston and provided with a valve, as *i*, arranged to be seated by the valve-stem before the same has completed its stroke and to be unseated again at the beginning of its return-stroke, as set forth and specified.

2. A gas-engine constructed of a proper cylinder and piston, as *m*, secured to a piston-rod extension, as *a*, provided with the supply port or channel *d* and igniting-port *e*, arranged to communicate through the igniting-port *e'* with the funnel *g*, in combination with a gas-supply pipe, *c*, and burner *y*, as and for the purpose specified.

3. A gas-engine constructed of a suitable cylinder with the piston *m*, piston-rod extension *a*, provided with the supply-channel *d*, arranged to communicate with and receive gas from the supply-pipe *c*, the same to be ignited, as described, through the ports *e* and *e'*, in combination with an exhaust and air-supply mechanism, consisting of the cylinder *r* and provided with the caps *t* and *t'*, the valve-stem *j*, carried by the piston *m*, and provided with a valve, as *i*, all arranged to operate as described, and for the purpose specified.

4. A gas-engine constructed of a suitable cylinder and piston, as *m*, and rod *a*, provided with the supply and igniting ports, as described, the supply-pipe *c*, and igniting-burner *y*, all arranged to operate as described, in combination with a relief mechanism, which consists of the valve *i*, arranged to be operated by the valve-stem *j* within the cylinder *r* in such a manner as to close the exhaust-port before the stroke of the piston is completed, and to open the same again at the beginning of the return-stroke, as described.

In testimony that I claim the foregoing improvement in gas-engines, as above described, I have hereunto set my hand this 12th day of July, 1887.

GEORGE W. STEWART.

Witnesses:
STEPHEN J. COX,
SAMUEL KILPATRICK.