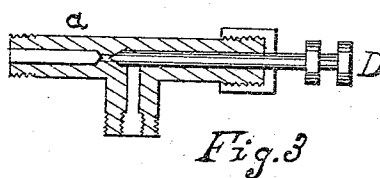
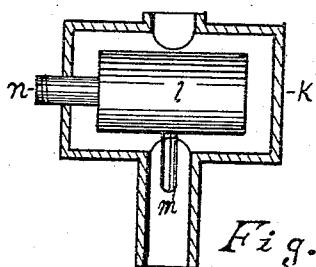
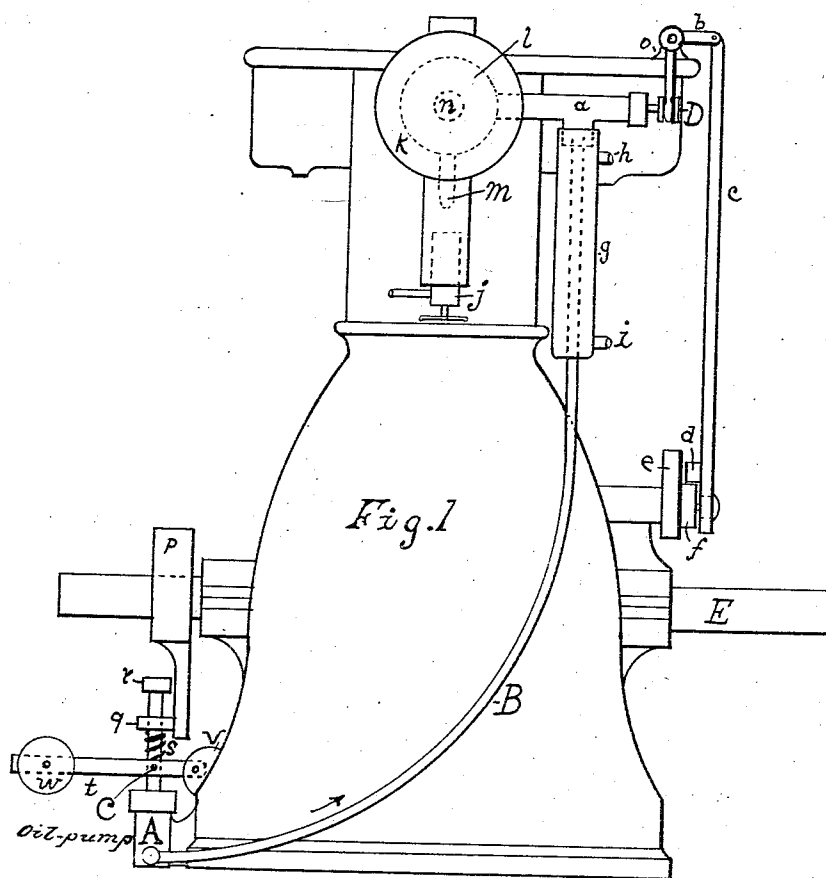


(No Model.)

H. SWAIN.
GAS OR OIL ENGINE.

No. 564,769.

Patented July 28, 1896.



Witnesses
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UNITED STATES PATENT OFFICE.

HADWEN SWAIN, OF SAN FRANCISCO, CALIFORNIA.

GAS OR OIL ENGINE.

SPECIFICATION forming part of Letters Patent No. 564,769, dated July 28, 1896.

Application filed April 16, 1895. Serial No. 545,906. (No model.)

To all whom it may concern:

Be it known that I, HADWEN SWAIN, a citizen of the United States, residing at San Francisco, in the county of San Francisco and State of California, have invented certain new and useful Improvements in Vapor or Oil Engines; and I do hereby declare the following to be a full, clear, and exact description of said invention, such as will enable others skilled in the art to which it most nearly appertains to make, use, and practice the same.

This invention relates to improvements in vapor or oil engines; and it consists in the novel construction and arrangements of the parts whereby liquid oil is forced into the cylinder against the pressure of the air previously admitted and compressed therein, whereby the quantity of oil injected into the said cylinder is constant, whereby the pressure upon the oil is maintained independently of the engine, whereby the oil is maintained in liquid form until it is injected into the cylinder, whereby the injecting of the said oil is timed with reference to the running of the engine, and whereby ignition of the explosive fluid is accomplished irrespectively of the artificial means of heating the igniting-chamber after the starting of the engine, all as hereinafter more specifically described.

In the accompanying drawings, Figure 1 is an elevation of an upright engine provided with this invention. Fig. 2 is a detail view of the ignition-chamber. Fig. 3 is a detail view in section of the inlet-valve controlling the flow of the oil.

In this invention the cylinder is provided with the ignition-chamber *l*, which is slightly removed from the said cylinder by means of the connecting-tube *n*. By means of this small connection through the tube *n*, the heat in the ignition-chamber *l* is not transmitted to the cylinder of the engine, which is maintained cold by means of the usual water-jacket. The ignition-chamber *l* is provided with the extension or closed tube *m*. The ignition-chamber and extension *m* are contained within the asbestos-lined jacket *K*, which is provided to prevent the radiation of the heat from the chamber *l*. The said jacket is further provided with suitable opening at the top for the purpose of ventilation or draft for the lamp *j*. The lamp *j* is so arranged that its heat is thrown direct against the lower

end of the tube *m*. By this means, concentrating, as it does, the heat upon a small spot, that spot is soon brought to an ignition heat, so that when the explosive fluid is forced into the chamber *l* it is ignited by impingement upon that spot, whether the chamber *l* is heated to a sufficient degree or not. For the lamp here described I sometimes substitute an electrical attachment to produce this preliminary heating.

Within the chamber *l* I place in scattered form bundles of iron or platinum wire or scraps. By the use of these bundles, which absorb the heat caused by the vaporization of the oil as it enters the chamber *l*, I quickly produce an igniting medium allowing me to dispense with the artificial heat of the lamp *j*. As the engine continues its operation the heat of the continuous explosions raises the temperature of the whole chamber *l* to the ignition-point. I find this form of ignition, by reason of not having to depend upon the lamp *j*, or other form of artificial heat, to be of great service in many forms of engines, but especially those designed for use in launches.

Opening into the chamber *l* is the tube which carries the inlet-valve *a*. This valve is closed by means of the needle *D*, as shown in Fig. 3. The outer passage of the said valve is connected to the tube *B*, which extends to the pump *A*, by means of which the oil is supplied under constant pressure to the rear of the valve *a*. The pump *A* is of any suitable form of plunger-pump having valves, (and preferably an air-chamber,) and is arranged to be operated on its outward stroke by the engine. (See Fig. 1.) This operation is accomplished by means of the connection to the crank-shaft of the engine through the eccentric *p*, having an extension provided with the collar *q*, which fits around the plunger-rod of the pump *A* and under the head *r* of the same. By this means the quantity of oil in the pump *A* is constantly maintained, as when the quantity becomes exhausted sufficiently to allow the plunger-rod to fall so that the head *r* is brought within the stroke of the eccentric *p* and its collar *q* it is immediately raised by the action of the said eccentric. The downward pressure on the plunger-rod is maintained by the lever *t*, which is pivotally connected to the frame of the engine at *V* and to the plunger-rod by means of the pin

C. It is provided at the outer or free end with the set-weight *w*. By means of this weight I can produce any desired pressure in the pipe B and behind the valve *a*. Further, this pressure, being irrespective of the running of the engine, is constant. To augment the action of this weight, I have placed around the plunger-rod and interposed between the lever *l* and the collar *q* the spiral spring *s*. While I have shown the use of both the weighted lever and the spiral spring, it will be readily understood that I can dispense with either without altering the spirit of this invention, which is to maintain a constant downward pressure upon the plunger-rod of the pump A.

At the outer end of the needle D, I connect the one end of a bell-crank *b*, which is mounted pivotally on the frame of the engine at *o*. To the free end of the said bell-crank I attach the connecting-rod *c*, the other end of which is brought within the influence of the cam *f*. This construction may be infinitely varied. I have shown a very simple form, which consists in providing the lower end of the rod *c* with an elongated slot surrounding a pin driven into the shaft upon which the cam *f* is mounted. In the path of the cam *f* I place on the side of the rod *c* a friction-roller *d*. By this means whenever the cam *f* is rotated it strikes under the roller *d*, thereby raising the rod *c*, and through the bell-crank *b* draws outwardly the needle D, opening the valve *a*. An actuating-spring, (not shown in drawings,) connected to the rod *c* to draw it downward, will immediately restore the parts to their normal position, closing the valve *a*. The cam *f* is attached to the shaft carrying the cam *e*, which operates the exhaust-valve. This shaft, as in the ordinary construction, is geared two to one with the crank-shaft E.

To prevent the heat from being transmitted from the ignition-chamber to the pipe B, I have provided at the upper end of the said pipe a water-jacket *g*, having the inlet *h* and the outlet *i*. These pipes *h* and *i* may be connected to the water-jacket surrounding the cylinder of the engine or may have an independent circulatory system. If necessary, the tube containing the valve *a* may be contained within this water-jacket in order to insure the oil passing the valve *a* in liquid form.

In its operation an engine thus provided with my invention takes into the cylinder, in the way usual to gas or vapor engines, air, exploding every second revolution. The oil or gasoline is forced into the cylinder just or nearly as the crank reaches the inward center on the explosion or second stroke. The oil is not forced directly into the cylinder, but into the chamber *l*, which is heated to the ignition-point. The vaporous oil immediately communicates and enters into composition with the air which is compressed in the cylinder and said chamber, forming thereby the explosive fluid. This fluid in the first part

of the operation of the engine coming in contact with the extension *m*, heated to the point of ignition, causes an explosion of the whole volume of fluid contained within the cylinder and chamber *l*.

In order to force the liquid oil into the chamber *l*, against the compressed air in the cylinder and said chamber, it is necessary to produce a pressure on the oil to the rear of the valve *a* greatly in excess of the pressure upon the air contained in the chamber *l*. This I accomplish by means of the weight *w* and the pump A. The quantity of oil which is required to impregnate the air within the cylinder is so minute that I have found it impossible to secure the necessary accuracy by means of a pump actuated by any other than a constant ejecting impulse, such as shown in Fig. 1. As above described, the injection of the necessary amount of oil is timed and controlled by means of the valve *a*, which is operated by the cam *a* and the connections, bell-crank *b*, connecting-rod *c*, and roller *d*. The cam *f* is set on its two-to-one shaft, so as to time the opening of the valve *a* that the injection of the oil into the chamber *l* takes place just as or nearly as the crank-shaft reaches the inward center on the explosion-stroke.

Having thus described this invention, what I claim is—

1. In a vapor or oil engine such as described, having a heated ignition-chamber in combination with a supply-pipe connecting a reservoir and the ignition-chamber, a pump to force the oil in said supply-pipe toward the ignition-chamber, suitable independent devices to force inward the plunger of the said pump, lifting attachment connected with the running-gear adapted to draw the plunger outward when it sinks within the path of the said lifting attachment, and a valve connected to the running-gear of the engine to be opened during predetermined intervals the operation of the engine substantially as described.

2. In a vapor or oil engine such as described, the combination with a heated ignition-chamber, of a pump to force oil toward the ignition-chamber, a supply-pipe connecting said ignition-chamber and pump, springs connected to the plunger of said pump to produce a constant driving pressure in said pump, lifting device connected to the running-gear adapted to draw the plunger outward when it sinks to a predetermined point, a valve in said supply-pipe opening into the ignition-chamber, and interposed connections between the running-gear of the engine and valve to open the latter in accordance with the operation of the running-gear, substantially as described.

In testimony whereof I have hereunto set my hand this 2d day of April, 1895.

HADWEN SWAIN.

Witnesses:

W. T. GORHAM,
E. F. MURDOCK.