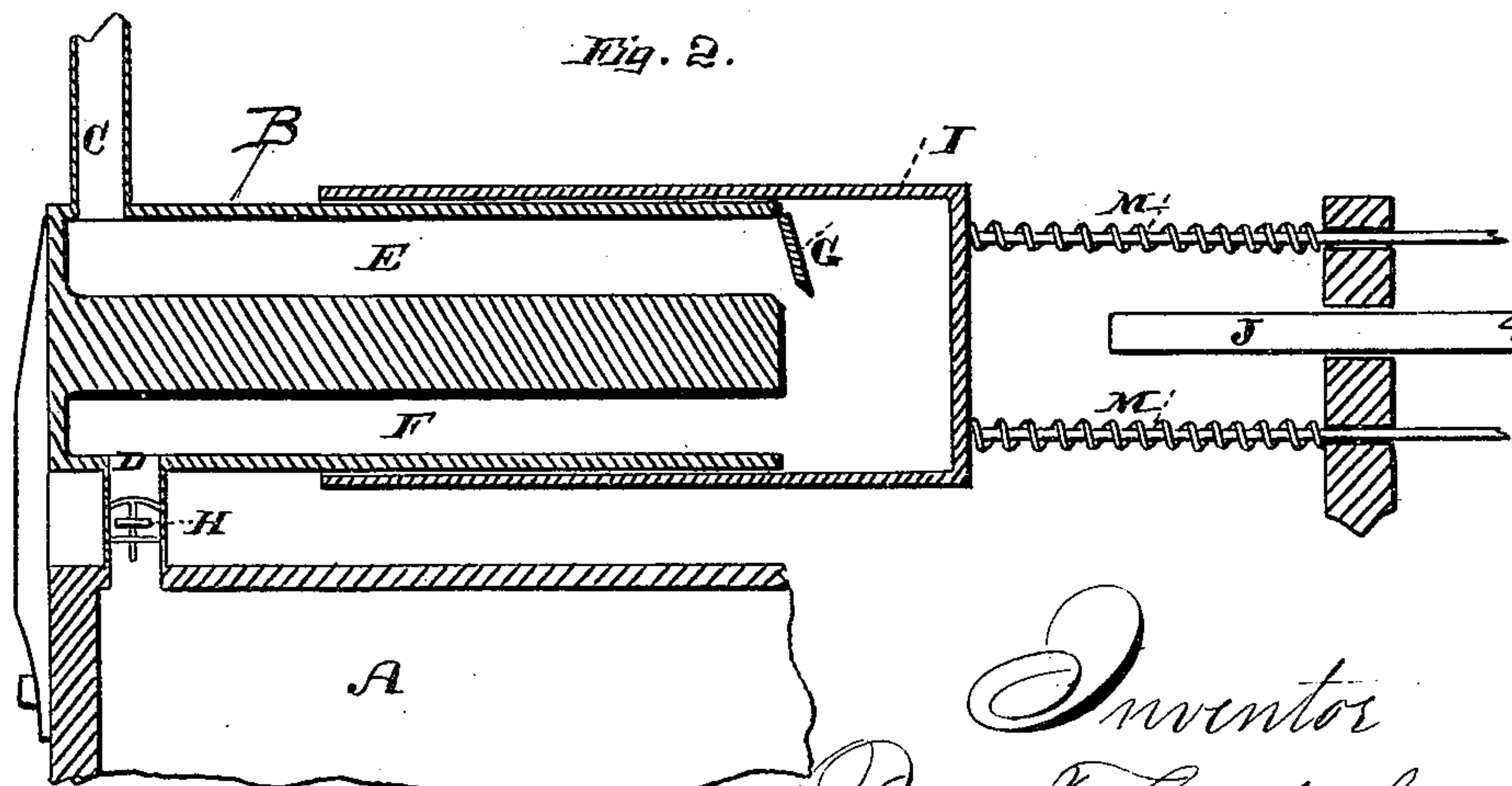
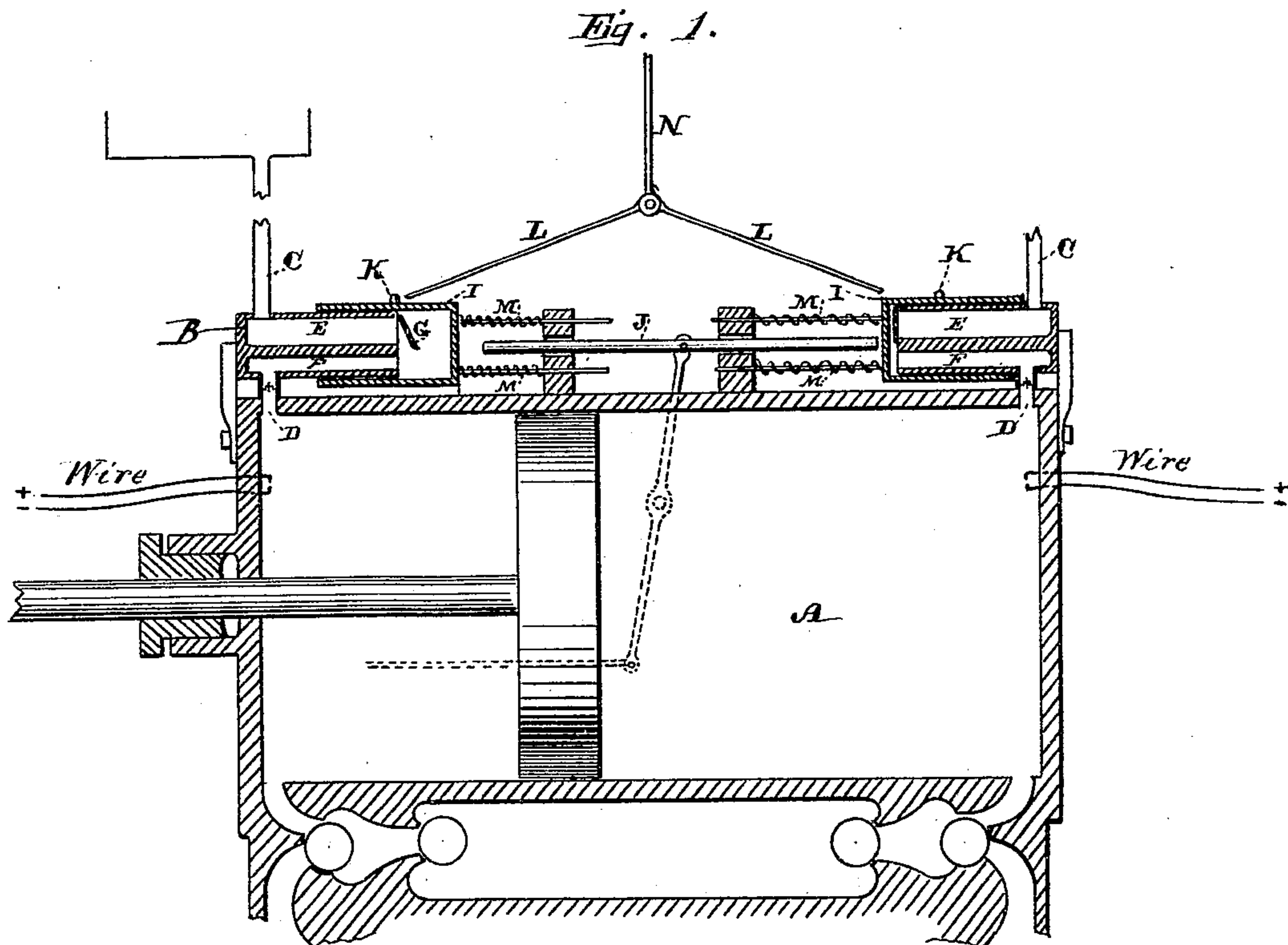


(No Model.)

P. F. GOODRICH.
ENGINE.

No. 270,418.

Patented Jan. 9, 1883.



Witnesses
Geo. H. Strong
Wm. A. Brook

Inventor
P. F. Goodrich
By Dewey & Co. Attys

UNITED STATES PATENT OFFICE.

PERRY F. GOODRICH, OF SAN FRANCISCO, CALIFORNIA, ASSIGNOR OF
ONE-FOURTH TO DEXTER SALISBURY, OF SAME PLACE.

ENGINE.

SPECIFICATION forming part of Letters Patent No. 270,418, dated January 9, 188 .

Application filed February 6, 1882. (No model.)

To all whom it may concern:

Be it known that I, PERRY F. GOODRICH, of the city and county of San Francisco, State of California, have invented an Improved Engine; and I hereby declare the following to be a full, clear, and exact description thereof.

My invention relates to certain improvements in engines; and it consists in a means for expanding the steam or vapor which is introduced into the cylinder at a low pressure to a higher temperature and pressure by the admission of a quantity of explosive material into the cylinder with the steam at the beginning of each stroke and igniting and exploding the same after the piston has commenced its stroke.

Referring to the accompanying drawings for a more complete explanation of my invention, Figure 1 is a longitudinal section, showing my invention. Fig. 2 is an enlarged section.

In the present case I have shown an apparatus by which the oil or other suitable hydrocarbon or other substance may be admitted to the cylinder of a steam-engine, so that a quantity of oil depending upon the work and needs of the engine may be admitted into the cylinder from each end with each stroke of the engine, to be mingled with a quantity of steam at a low pressure, which has also been admitted, and then exploding the mixture.

It also relates to a means for governing the supply of material.

A is a steam-cylinder, which may be provided with any suitable or desired form of valve for the admission of steam, which is used at as low an initial pressure as is practicable. At each end of the cylinder, and connected with it, is a device for admitting a small charge of oil to the cylinder. This consists in the present case of a cylindrical plug or piston, B, having an ingress and an egress port, C and D, made in it, connecting with passages E and F, respectively, which extend longitudinally to the end of the piston. The ingress-passage has a hinged or other suitable valve, G, at its mouth, and the egress-passage has a check-valve, H, which prevents the return of the oil or of steam from the cylinder. Outside this piston B a hollow cylinder, I, slides, fitting

steam-tight, one end being closed. The piston remains stationary, but the sleeve or casing is movable, so as to vary the size of the space between the end of the piston and the inner end of the cylindrical casing; and this space determines the amount of oil which shall be allowed to enter the cylinder at each stroke. A rod, J, in line with the center of the casing, is moved by an eccentric from the engine-shaft, so as to reciprocate to and from the closed end of the casing. A lug, K, upon the outside of the casing, serves to engage the end L of the governor-arm, and by this the position of the casing with relation to the interior stationary piston, B, is regulated. Springs M draw the casing back from the end of the piston and tend to enlarge the chamber into which the oil is received, while the action of the governor is, by the vertical movement of its spindle N, to move the arms L to or from each other, so as to allow the casings to be drawn out to enlarge their chambers, or to force them to contract the chambers.

The operation will then be as follows: An oil-tank is placed at a suitable point to supply the chambers within the casing I at each end of the engine-cylinder A, the oil flowing through the passage E until the space or chamber is full at that end of the cylinder which is to receive steam. The reciprocating rod J then approaches and forces the casing I forward till its head is close to the end of the piston B. This action closes the valve G and opens the valve H, so as to allow the oil to pass from the chamber of I to the engine-cylinder simultaneously with the admission of steam.

The governor-spindle N is connected with the arms L at an angle, and it is operated by any of the usual appliances, so that a reduction of the speed of the engine will cause it to draw the arms L back, and thus allow the casing to be drawn farther back by its springs and admit more oil, while an increase of speed forces the arms forward, and by their action upon the lugs K they prevent the casing I from being drawn so far back by the springs M, and thus reduce the size of the chamber, and reduce to a corresponding degree the amount of oil which is admitted. The oil, as it

is forced into the engine-cylinder, meets the steam which is admitted at the same time by any well-known valve mechanism, and is by it converted into vapor, which mingles with the steam, so as to form an explosive compound.

5 A machine which will produce an electric spark is connected with the engine, and contact is made after the admission and after the piston has been started by steam-pressure alone, so as to explode the mixture and create a volume of gas, as well as increase the temperature, volume, and elasticity of the steam, by which the piston will be propelled with a power greatly in excess of that due to the low pressure of the steam which is originally admitted. It will be manifest that this or any equivalent apparatus may be employed to introduce the liquid, vapor, or gas to be exploded, as it acts in the place of a measure to hold the charge for each stroke, and its capacity is changed by the governor as more or less power is needed.

The important feature of my invention is the starting of a piston upon each stroke in its cylinder by a low initial pressure of steam or other vapor, and then largely increasing that pressure without an undue shock or strain from the explosion. It is also for the purpose of intensely heating and expanding a volume of wet steam introduced into a cylinder at a low pressure, so as to obtain its greatest elastic power after its connection with the boiler has been severed, and finally it may be employed to superheat steam of a low temperature and pressure for any purpose after it has been cut off from the boiler.

35 I have described in this case an apparatus for using oil or other liquid which may be vaporized and exploded; but it will be manifest

that any gas, vapor, or explosive substance in any form which is suitable may be employed with equal facility and effect. 40

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

1. In an engine, the method herein described of producing power, consisting in the admission into the cylinder of a body of explosive material and a volume of steam under low pressure to start the piston, and exploding the resultant vapor or gas after the piston has started, so as to propel the piston, substantially as herein described. 45 50

2. In an engine, the device consisting of the stationary plug or piston B, with its ingress and egress passages and valves, as shown, and the exterior sliding casing, I, forming a chamber between it and the plug or piston, in combination with the reciprocating rod J, whereby the explosive is admitted to and expelled from the chamber, substantially as herein described. 55 60

3. In an engine, the device consisting of the stationary piston B, with its ingress and egress passages, the exterior sliding casing, I, forming a chamber between itself and the piston, in combination with the governor-spindle N and arms L, whereby the size of the chamber may be regulated, substantially as herein described. 65

In witness whereof I have hereunto set my hand. 70

PERRY F. GOODRICH.

Witnesses:

S. H. NOURSE,

FRANK A. BROOKS.