No. 748,029. PATENTED DEC. 29, 1903.

H. G. UNDERWOOD.

EXPLOSIVE ENGINE.

APPLICATION FILED JULY 14, 1902.

NO MODEL.

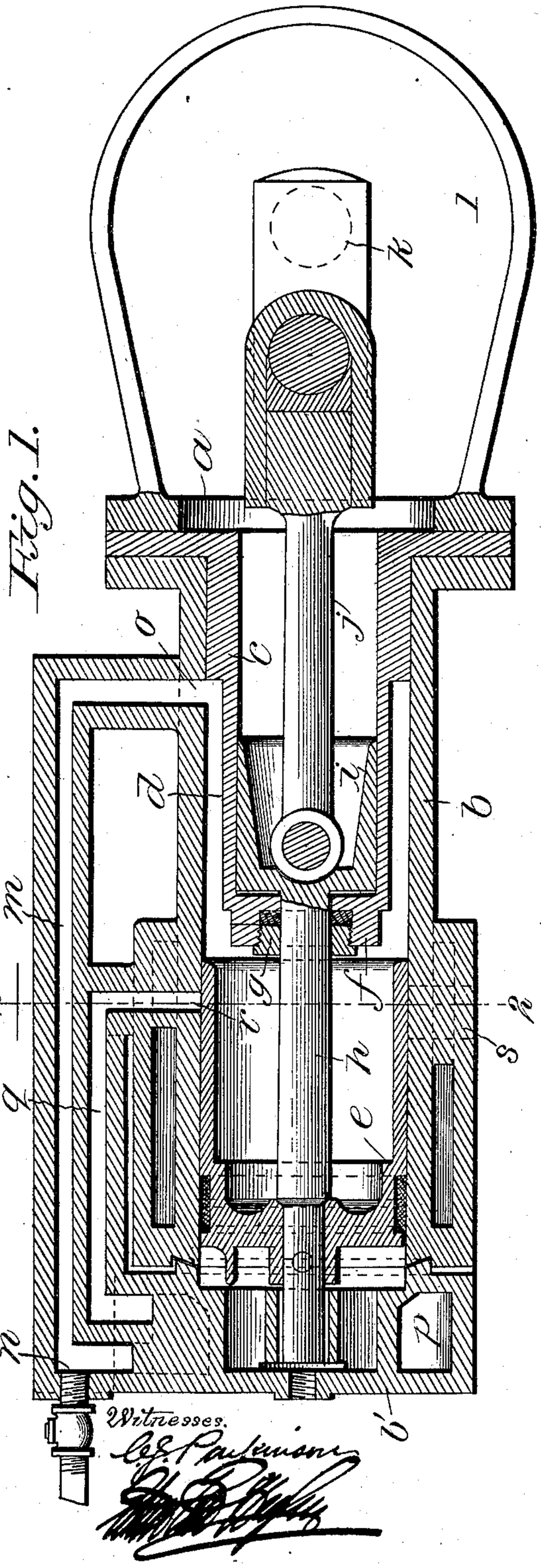

Fig. 1.

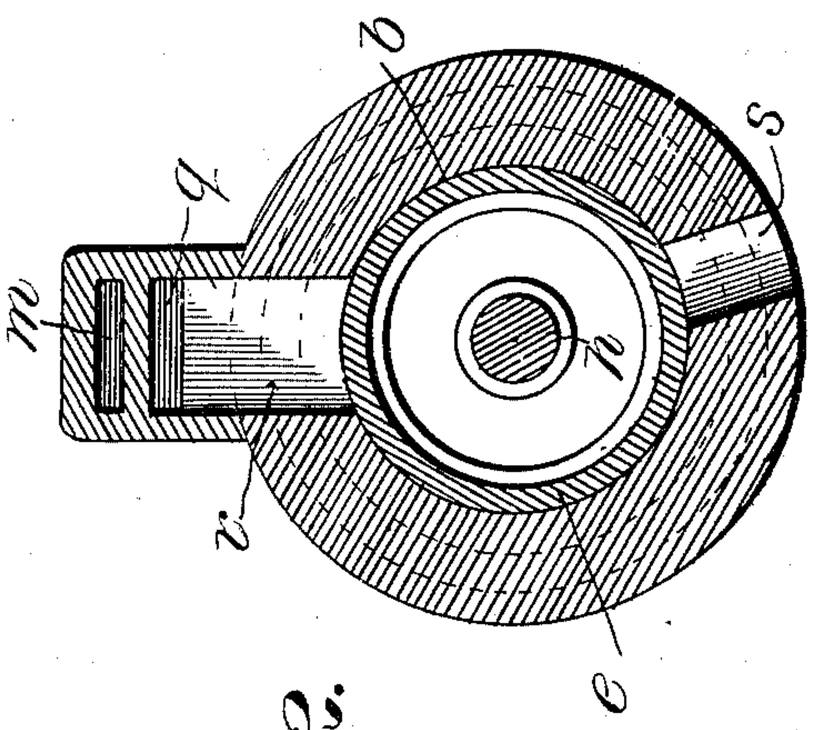

Fig. 2.

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No. 748,029. Patented December 29, 1903.

UNITED STATES PATENT OFFICE.

HERBERT GEORGE UNDERWOOD, OF STAMFORD, CONNECTICUT, ASSIGNOR TO THE INTERNATIONAL POWER VEHICLE COMPANY, OF STAMFORD, CONNECTICUT, A CORPORATION OF WEST VIRGINIA.

EXPLOSIVE-ENGINE.

SPECIFICATION forming part of Letters Patent No. 748,029, dated December 29, 1903.

Application filed July 14, 1902. Serial No. 115,606. (No model.)

To all whom it may concern:

Be it known that I, HERBERT GEORGE UNDERWOOD, a citizen of the United States of America, and a resident of Stamford, county of Fairfield, and State of Connecticut, have invented certain new and useful Improvements in Explosive-Engines, of which the following is a specification.

My invention relates to certain improvements in explosive-engines, and especially to means for insuring a circulation of air around the walls of the cylinder for cooling it and for forcing the air so heated into the cylinder to form a part of the explosive charge by closing the forward end of the cylinder and providing suitable ports whereby the movement of the piston-head therein provides for the pumping action before specified.

In my prior patent, No. 666,827, of January 29, 1901, an engine having the general construction herein specified is shown, but not claimed, the claims on the feature above specified having been canceled in response to a requirement of division by the Patent Office.

My invention therefore consists in the construction of the cylinder of an explosive-engine in such a manner that while provision is made for connecting the piston with the crank-shaft the forward end of the cylinder serves as a pump to draw air through cooling-chambers in the wall of the cylinder and in the construction, arrangement, and combination of the several parts of which it is composed, as will be hereinafter more fully described and claimed.

Referring to the accompanying drawings, in which corresponding parts are designated by corresponding marks of reference, Figure 1 is a central longitudinal section embodying my invention, and Fig. 2 is a transverse section on lines 2 2 of Fig. 1.

It has heretofore been proposed to place a closed extension upon the forward end of the cylinder and to mount the crank-shaft therein, using the closed interior of the extension as a part of the air-pump; but this is attended with the disadvantage that the compressed air confined in the casing blows the oil out of the crank-shaft bearings, which therefore soon heat. It is obviated in my improved device, which, as shown, consists of a diaphragm *a*, mounted on and closing the forward end of the cylinder *b*. The central portion *c* of this diaphragm is by preference made tubular, fitting snugly within the forward end of the cylinder and extending rearwardly thereof, the rearward exterior portion of the tubular extension being reduced in diameter, as at *d*. The piston-head *e* is cup-shaped, having a central recess on its front face, into which on the forward movement of the piston-head the tubular extension is adapted to enter. The rearward end of the tubular extension is provided with a head *f* and a packing-box *g*, through which the piston-rod *h*, carrying the piston-head *e* on its rearward end, is adapted to travel, a circular cross-head *i* being carried on the forward end of the piston-rod and being guided by the inner face of the tubular extension, which is bored to receive it. The usual connecting-rod *j* and crank-shaft *k* is provided, the latter being carried in the forward extension *l* of the cylinder *b*.

Suitable passage-ways are provided in the walls of the engine and on the engine structure to serve as ports for the air-compressing pump formed by the tubular extension and the piston-head and to pass the air around the cylinder and parts thereof and to lead it to the interior of the cylinder. In the drawings I have illustrated these passages as the passage *m*, leading from the valve-controlled port *n* to the port *o*, formed in the side of the explosion-cylinder, near the forward end thereof, and to the cooling-cylinder *p*, surrounding the explosion-head *b'*, and the passage *q*, leading from the cooling-chamber to the air-induction ports *r* of the cylinder. In the walls of the cylinder is also located the oil-hydrocarbon injector *q'*, which communicates with the interior of the cylinder by the passage-way q^2. A suitable exhaust-port *s* is also provided, as indicated in dotted lines in Fig. 1.

In the operation of my invention it will be seen that with the parts in the position shown in Fig. 1 upon the forward movement of the piston-head the latter will slide over the reduced forward extension *c*, which enters the

depression in its forward face and compresses the air therein, which has been admitted through the valve *n* and passage-way *m*. When the piston-head has about completed its movement, it uncovers the air-induction port *r*, and the compressed air rushes through the cooling-chamber *p* and passage-way *q* to the interior of the cylinders. Upon the return of the parts to the position shown the piston-head closes the air-induction port *r*, and atmospheric pressure opens the valve *n* and air rushes into the vacuum formed between the forward face of the piston-head and the rearward extension of the diaphragm. This operation will be continued on each successive stroke of the piston.

It will be seen that by my invention I am enabled to relieve the forward extension of the cylinder and crank-bearing from all pressure and that by my improved form of diaphragm, with its improved form of extension, I provide an effective guide for the piston-rod and an effective packing therefor, inasmuch as not only does the packing-box serve to restrain the passage of air, but that the cross-head itself serves as an auxiliary re-strainer and packing, while the cup-shaped head, in combination with the tubular extension, provides a large bearing between the piston-head and cylinder with a total displacement of the air contained therein, and this with great compactness of the parts.

Having thus fully described my invention, what I claim as new, and desire to secure by Letters Patent of the United States of America, is—

In an explosive-engine, the combination with an explosion-cylinder, having a closed forward end and an explosion-head, a piston-head in the cylinder, a valve-controlled air-induction port at the rear end of the cylinder, a passage therefrom to the forward end and a piston-controlled air-passage connecting the rear end of the first passage and the cylinder, and extending around the piston-head, substantially as described.

Signed at Stamford, Connecticut, this 25th day of June, 1902.

HERBERT GEORGE UNDERWOOD.

Witnesses:

WM. F. WATERBURY,

WM. H. BUMP.