No. 887,013. PATENTED MAY 5, 1908.

J. W. PACKARD & W. A. HATCHER.

HYDROCARBON ENGINE.

APPLICATION FILED FEB. 12, 1902.

2 SHEETS—SHEET 1.

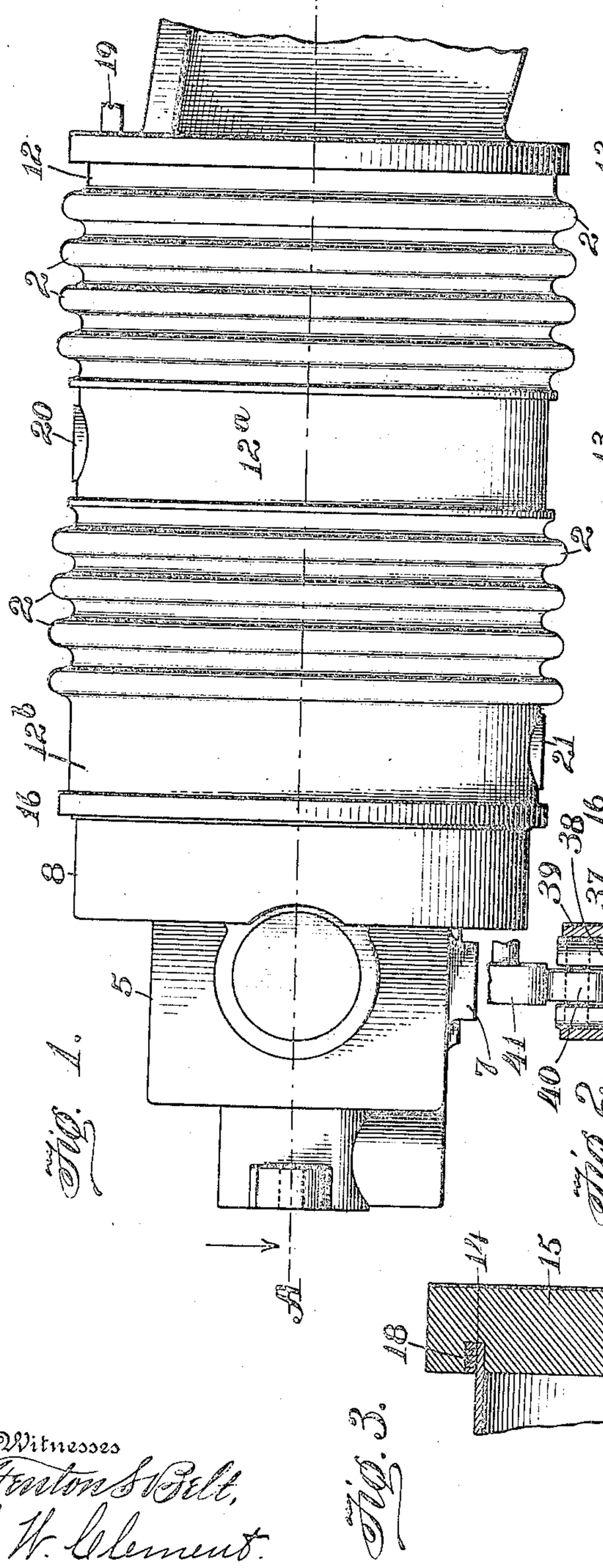

Fig. 1.

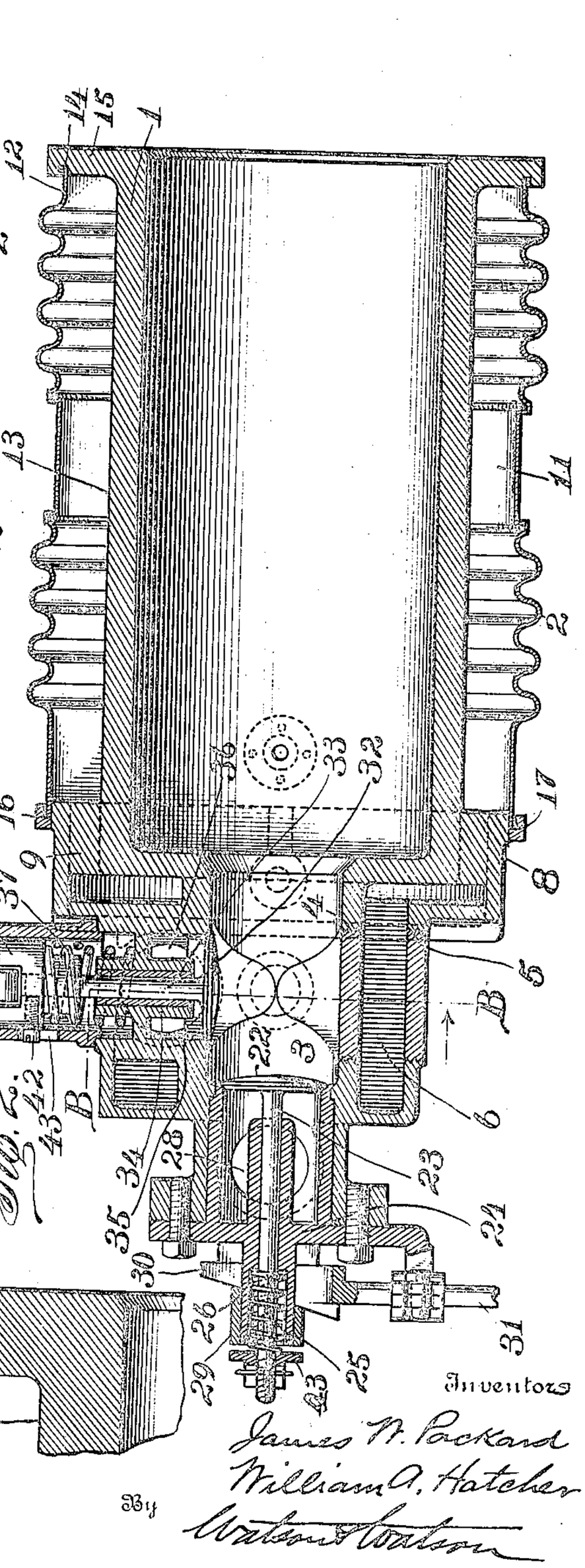

Fig. 2.

Fig. 3.

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2 SHEETS—SHEET 2.

Fig. 4.

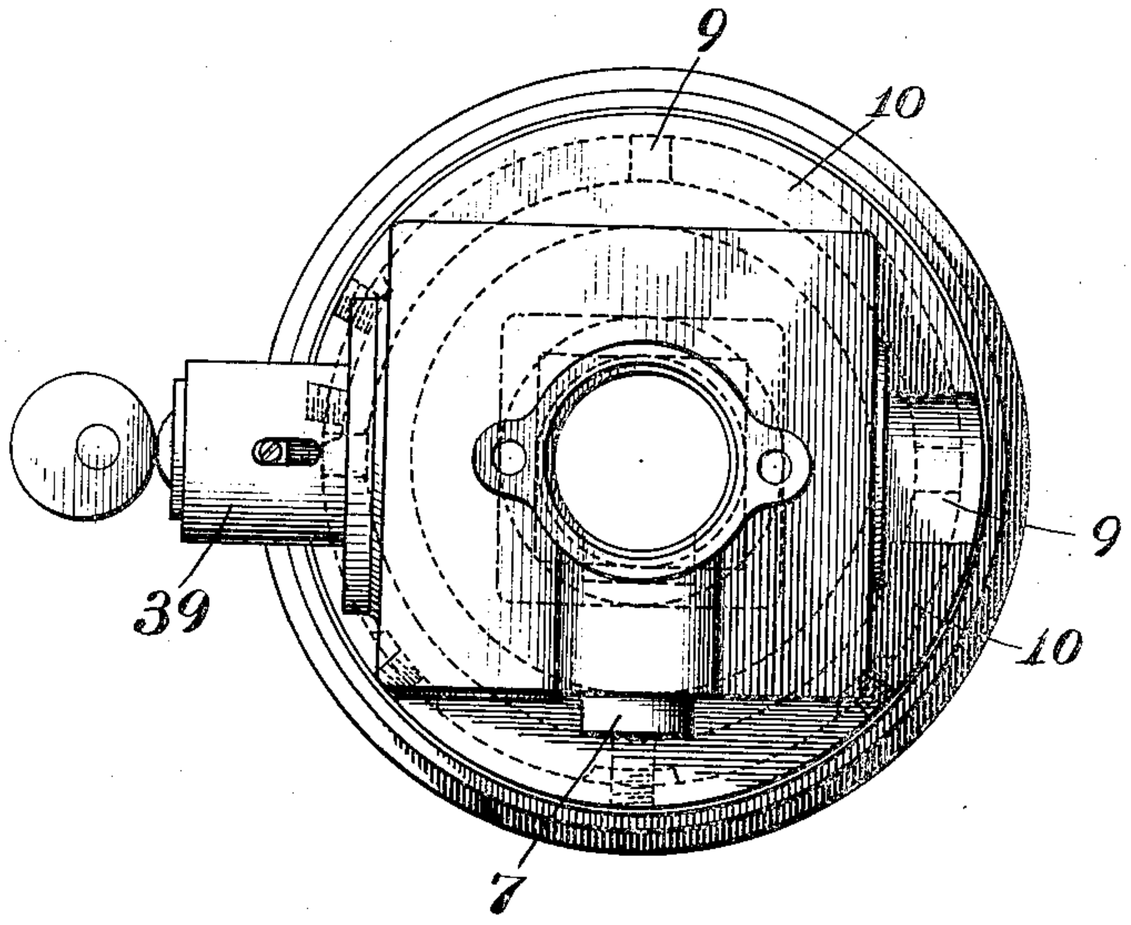
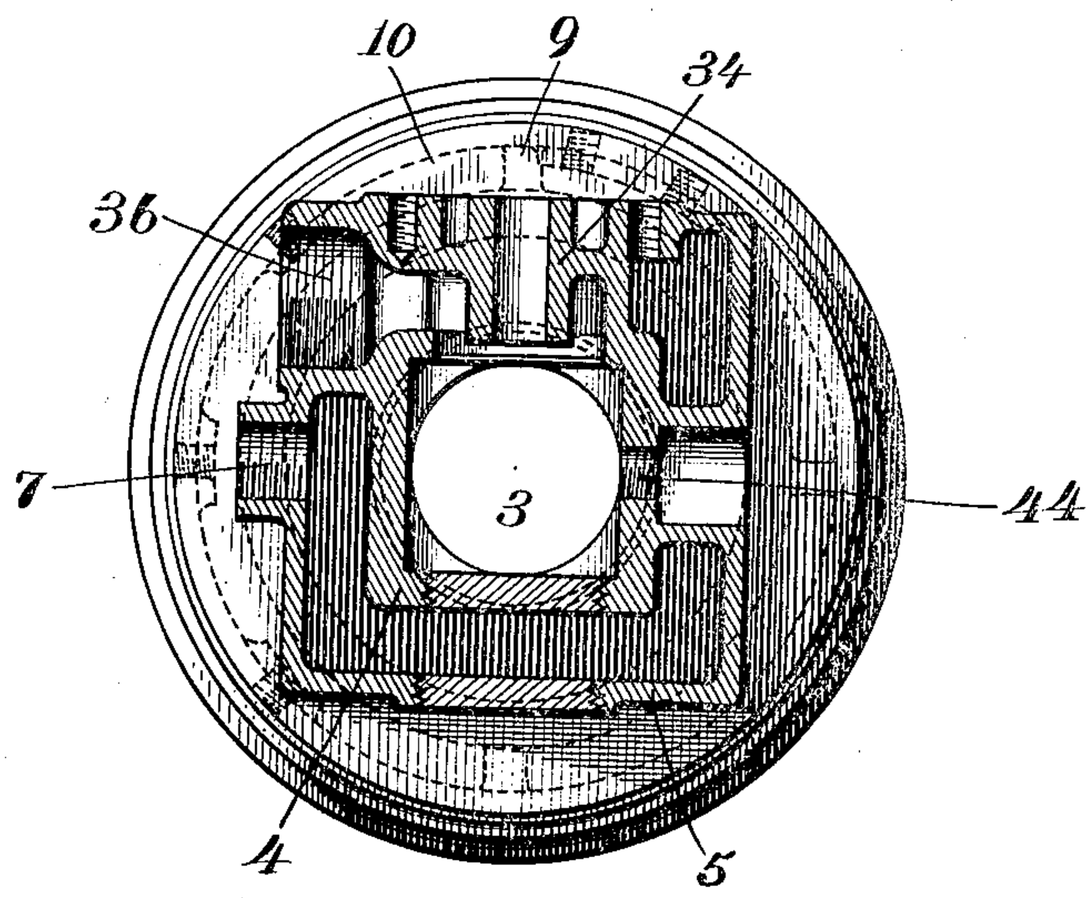


Fig. 5.



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UNITED STATES PATENT OFFICE.

JAMES W. PACKARD AND WILLIAM A. HATCHER, OF WARREN, OHIO, ASSIGNORS, BY MESNE ASSIGNMENTS, TO PACKARD MOTOR CAR COMPANY.

HYDROCARBON-ENGINE.

No. 887,013. Specification of Letters Patent. Patented May 5, 1908.

Application filed February 12, 1902. Serial No. 93,755.

To all whom it may concern:

Be it known that we, JAMES W. PACKARD and WILLIAM A. HATCHER, citizens of the United States, residing at Warren, in the county of Trumbull, State of Ohio, have invented certain new and useful Improvements in Hydrocarbon-Engines, of which the following is a specification.

This invention comprises improvements in explosive engines, and it relates to the arrangement of the water jacket surrounding the cylinder, and to other features illustrated in the accompanying drawing and set forth in the following specification.

In the drawing, Figure 1 is a side elevation of the engine cylinder; Fig. 2 is a sectional view of the lower half of the cylinder taken on the line A—A of Fig. 1, and showing the gas inlet and exhaust valves; Fig. 3 is a detail view showing the manner of securing the water jacket to the cylinder; Fig. 4 is a rear end view of the cylinder, and Fig. 5 is a section on the line B—B of Fig. 2.

Referring to the drawing, 1 indicates the cylinder having the usual cylindrical opening within which the piston operates and having a gas chamber 3, at its rear end. The casing surrounding the gas chamber, and the rear end of the cylinder, is formed with double walls 4 and 5, between which is a water circulating space 6, having an inlet opening 7 in the lower side of the outer wall. The outer wall 5, extends around the rear end of the cylinder for a short distance, forming a hollow flange or head 8 upon the cylinder which is connected at intervals to the main body of the cylinder by integral webs 9, between which are left water passageways 10, as indicated by dotted lines in Figs. 2, 4 and 5. These passageways communicate with a water space 11, which is included between a sheet metal jacket 12 and the outer surface 13 of the cylinder body. As the body of the cylinder is subject to higher temperatures, and more sudden changes in temperature than the jacket, the longitudinal expansion of each, due to the heat is unequal, and it therefore becomes desirable to provide a jacket which may be expanded and contracted mechanically by the cylinder without straining the jacket or the joints between the jacket and the cylinder. The water jacket, therefore, consists of a sheet metal cylinder having annular corrugations 2 which render it readily expansible in the direction of its length. The forward end of the jacket is held within an annular groove 14 upon the rear face of a flange 15, cast upon the forward end of the cylinder, and the rear end within a flanged ring 16 which is shrunk upon the hollow flange 8. The jacket 12 is placed upon the cylinder by passing it over the rear end of the cylinder until the forward end enters the groove 14 and the flanged ring or collar 16 is then shrunk upon the cylinder against the rear end of the jacket, said rear end fitting within the annular recess 17, formed between the flange upon the ring and the periphery of the part 8. The ends of the jacket are secured within the recesses 14 and 17, in a water tight manner, by forcing several coils of wire 18, Fig. 3, within each recess and against the outer surface of the jacket, the wire being preferably of copper and of sufficient diameter to calk tightly within the recesses. The joint thus made is tight, durable and infusible at the highest temperature of the cylinder. An outlet 19, for the water is formed in the flange 15.

It will be seen that cool water entering at the inlet 7 will flow first around the explosion chamber and thence outwardly around the cylinder to the outlet 19, from whence it will escape to the cooling devices. The expansion and contraction of the body of the cylinder will not strain the jacket 12 for the reason that the latter is readily expansible. An oil inlet pipe 20, suitable for attachment of an oil cup extends outwardly from the cylinder through a part 12^a of the jacket which is not corrugated, and the pipe 21 to which the relief valve may be attached also extends through a part 12^b of the jacket which is not corrugated.

The gas inlet valve 22 is mounted upon a stem 23, which is movable longitudinally in a valve casing 24, secured at the end of the explosion chamber. This valve is normally held to its seat by a spring 25 fitting within a socket 26 in the valve casing and bearing outwardly against a collar 43 upon the valve stem. A gas inlet opening 28, extends into the valve casing in the rear of the valve. The distance to which the valve opens for the admission of gas is regulated by a stop collar 29 against which the collar 43 abuts when the valve is opened, and this stop collar is adjustable by means of a forked cam 30, upon a rod 31, the adjustment of the latter being under the control of the operator. The ex-

haust valve 32 is mounted upon a stem 33, sliding within a bearing 34, within a tubular passageway 35, extending through the inner and outer walls 4 and 5. An opening 36, suitable for attachment of an exhaust pipe, connects with said passageway in the rear of the valve 32. The valve is normally held to its seat by a spring 37 surrounding the bearing 34 and pressing outwardly against a head 38 in an extension 39 of the tubular casing. This head is provided with a roller 40 against which the cam 41 on the governor-shaft strikes at the proper time to open the exhaust valve. The head carrying the roller is prevented from turning by means of a guide screw or pin 42, passing through a guide slot 43 in the tubular extension and into the head. A threaded opening 44 is also formed in the walls of the explosion chamber for the attachment of a spark igniter.

Having described our invention what we claim and desire to secure by Letters Patent is:—

1. In an explosive engine, the combination with the cylinder of a water jacket surrounding the cylinder and securely connected at its ends to the ends of the cylinder, said water jacket having a series of transverse or annular corrugations, whereby opening of the joints between the jacket and the cylinder due to relative expansion and contraction is prevented.

2. In an explosive engine, the combination with the cylinder having an annular flange at one end provided with an annular recess and having a ring provided with an annular recess securely connected to its other end, of a water jacket surrounding the cylinder and having its ends securely fastened in said recesses, said water jacket having a series of transverse or annular corrugations, whereby opening of the joints between the jacket and the cylinder due to relative expansion and contraction is prevented.

In testimony whereof we affix our signatures in presence of two witnesses.

JAMES W. PACKARD.
WILLIAM A. HATCHER.

Witnesses:
E. L. WARNER,
C. H. DUNLAP.