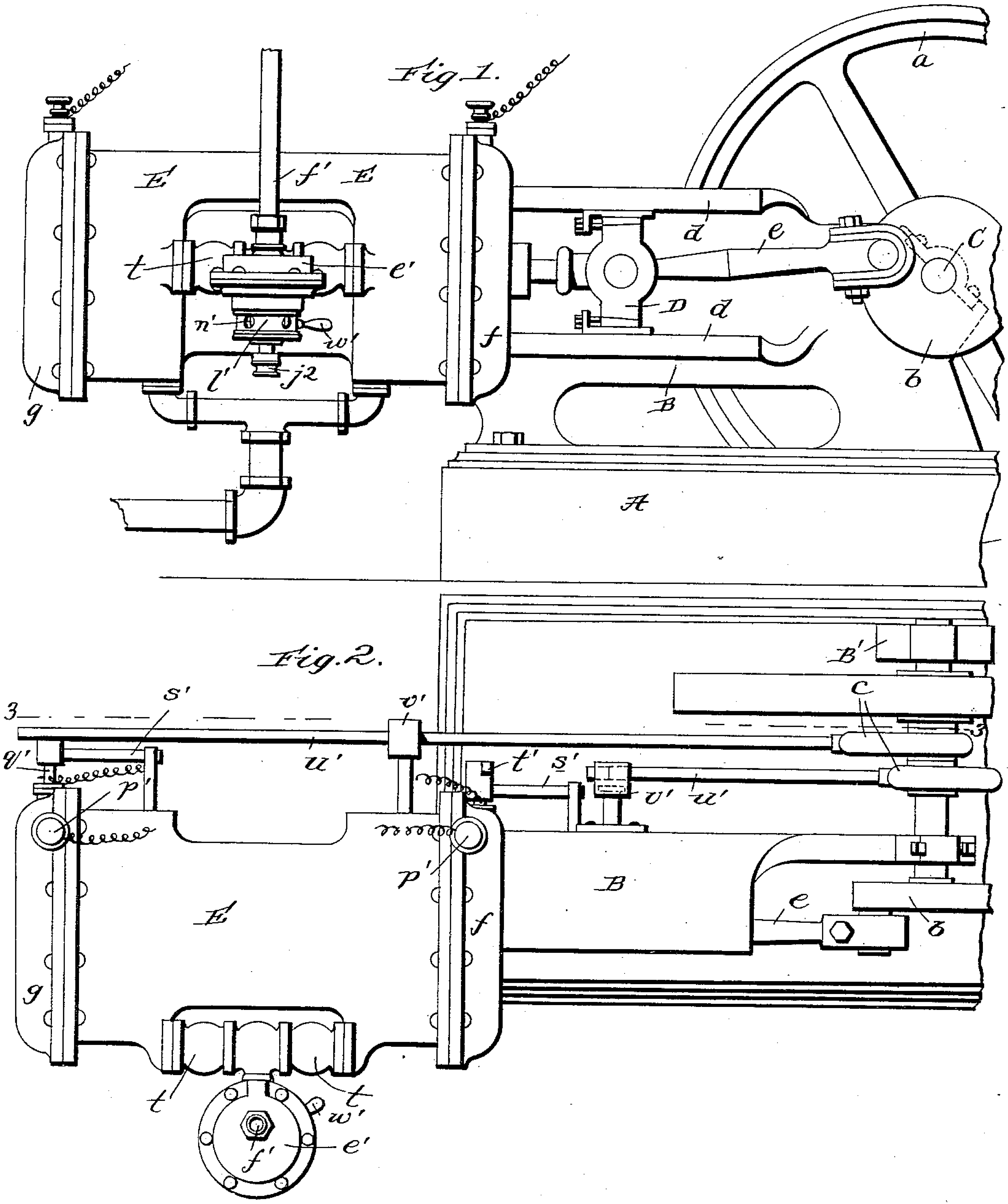
No. 632,917. Patented Sept. 12, 1899.

C. R. DAELLENBACH.

EXPLOSIVE ENGINE.

(Application filed Oct. 1, 1898.)

(No Model.) 4 Sheets—Sheet 1.



Witnesses:
C. H. Raeder
Thomas E. Turpin

Inventor
C. R. Daellenbach
By James J. Sheehy
Attorney

THE NORRIS PETERS CO., PHOTO-LITHO., WASHINGTON, D. C.

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(No Model.) 4 Sheets—Sheet 2.

Fig. 3.

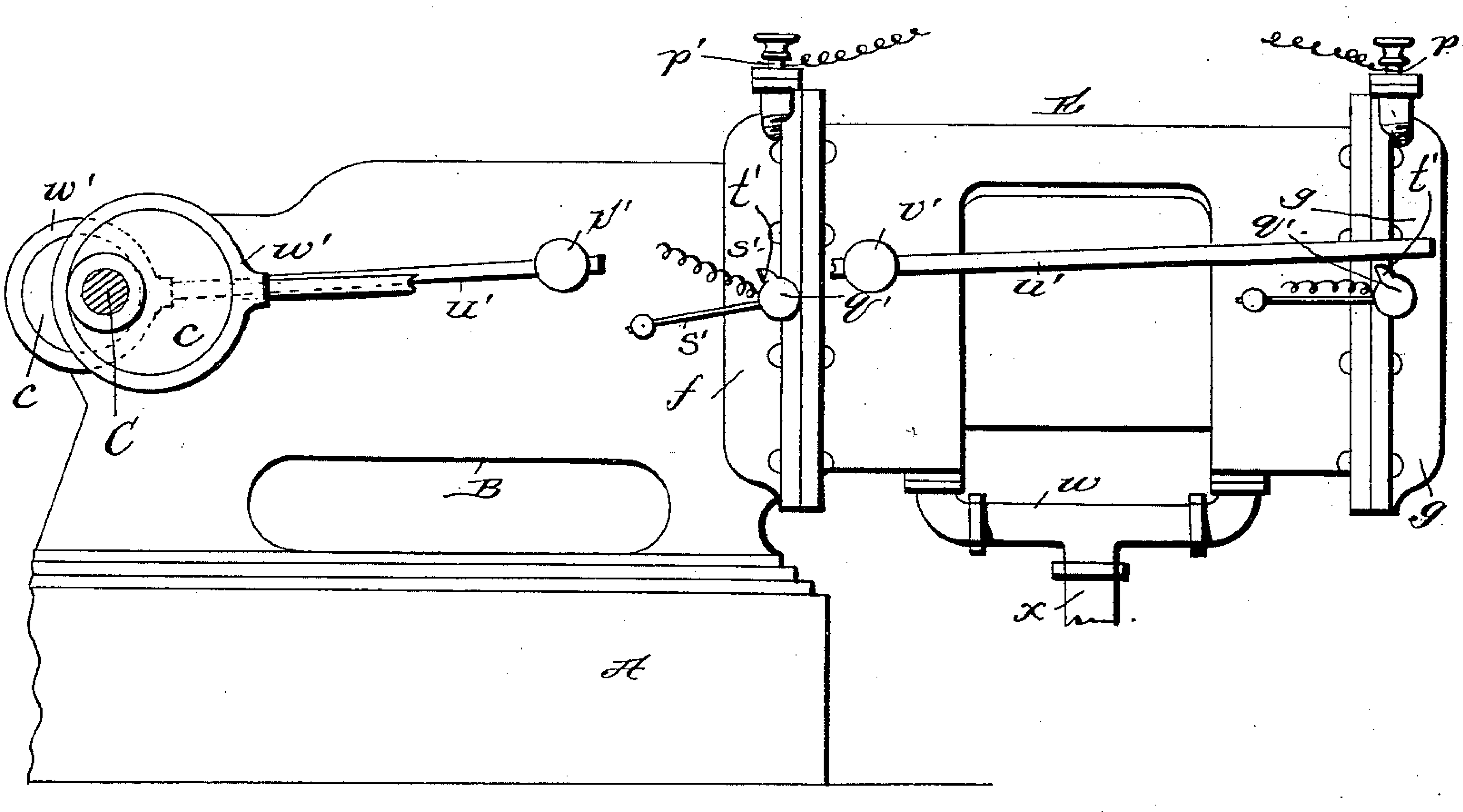

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Fig. 4.

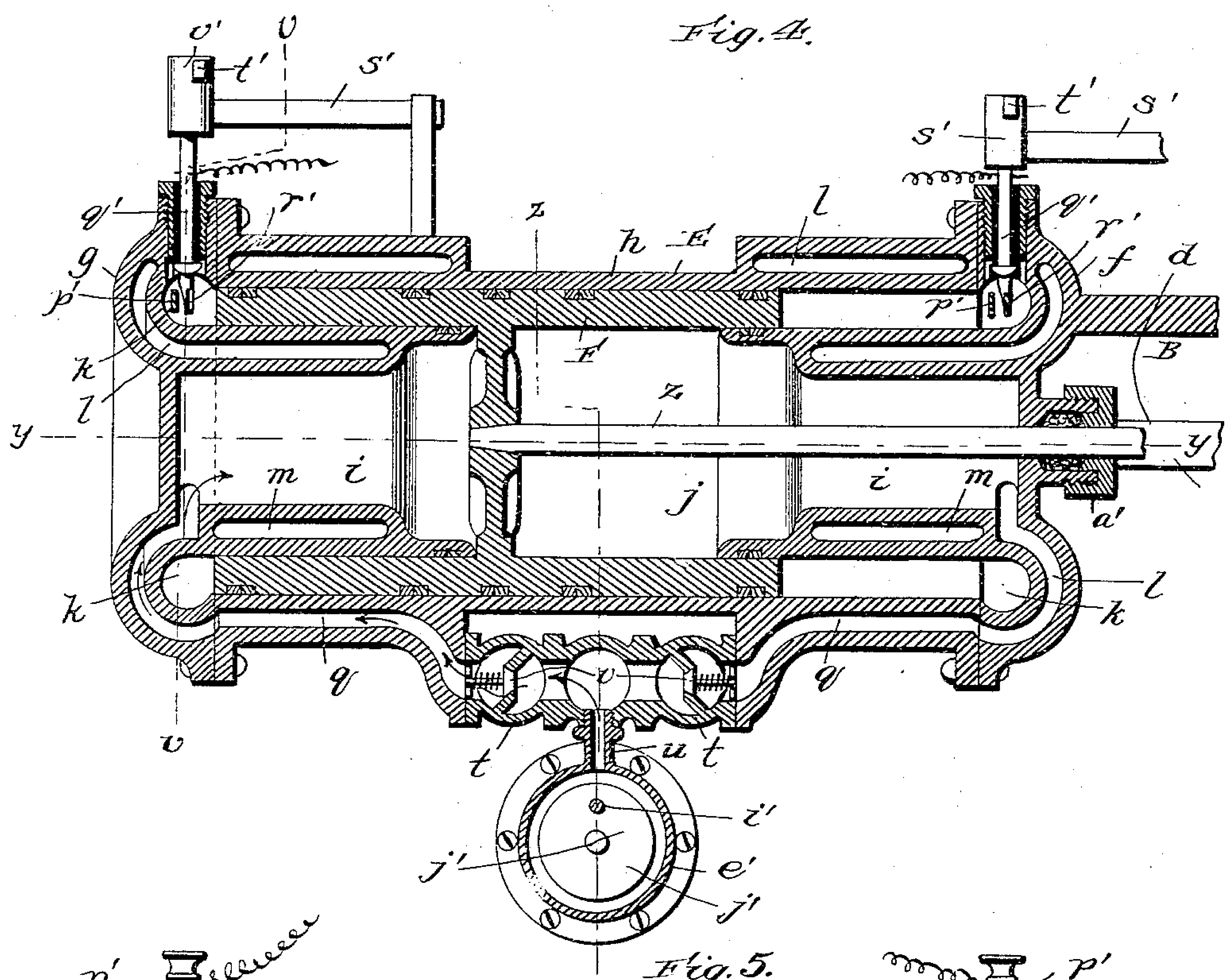

Fig. 5.

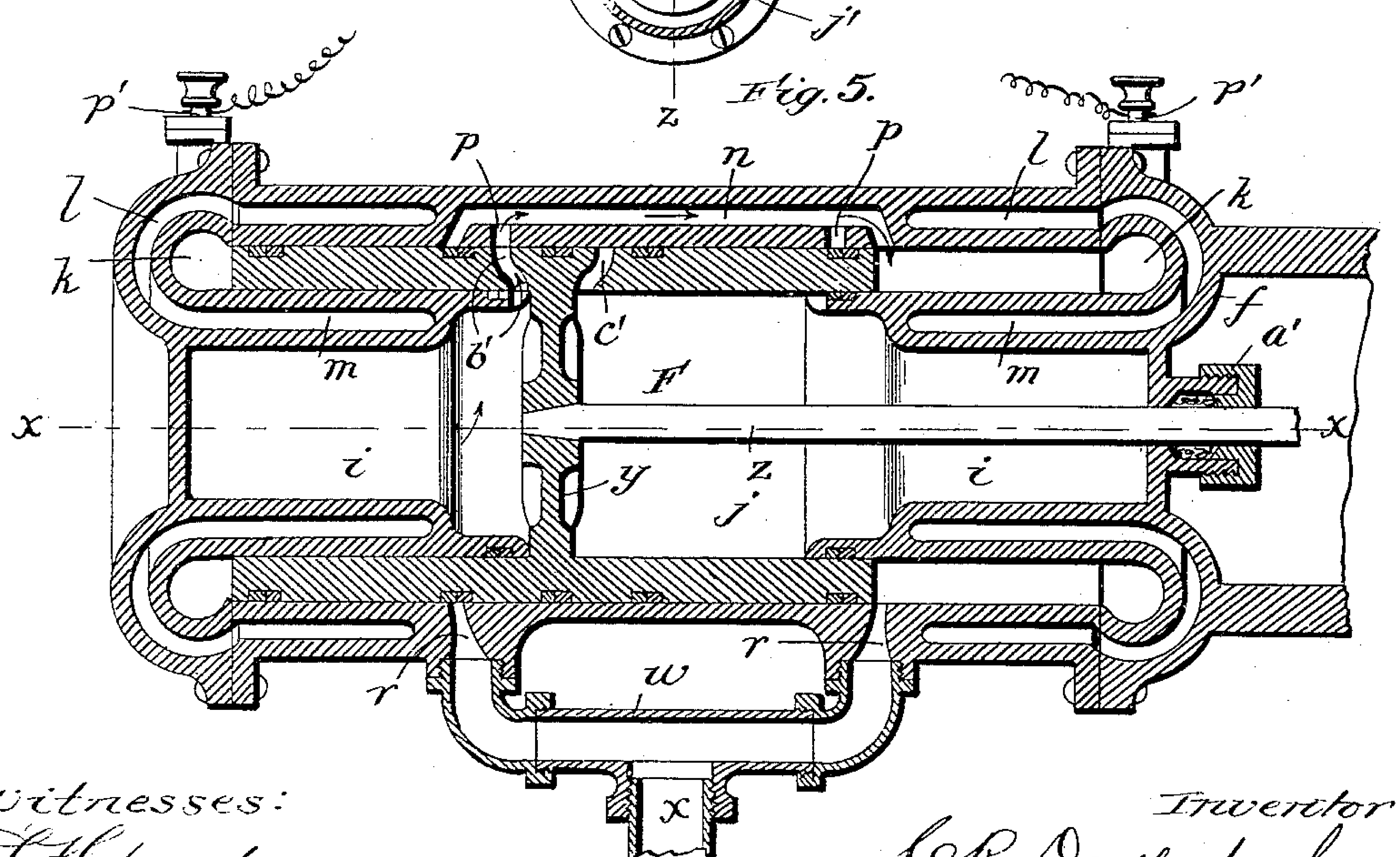

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Fig. 6.

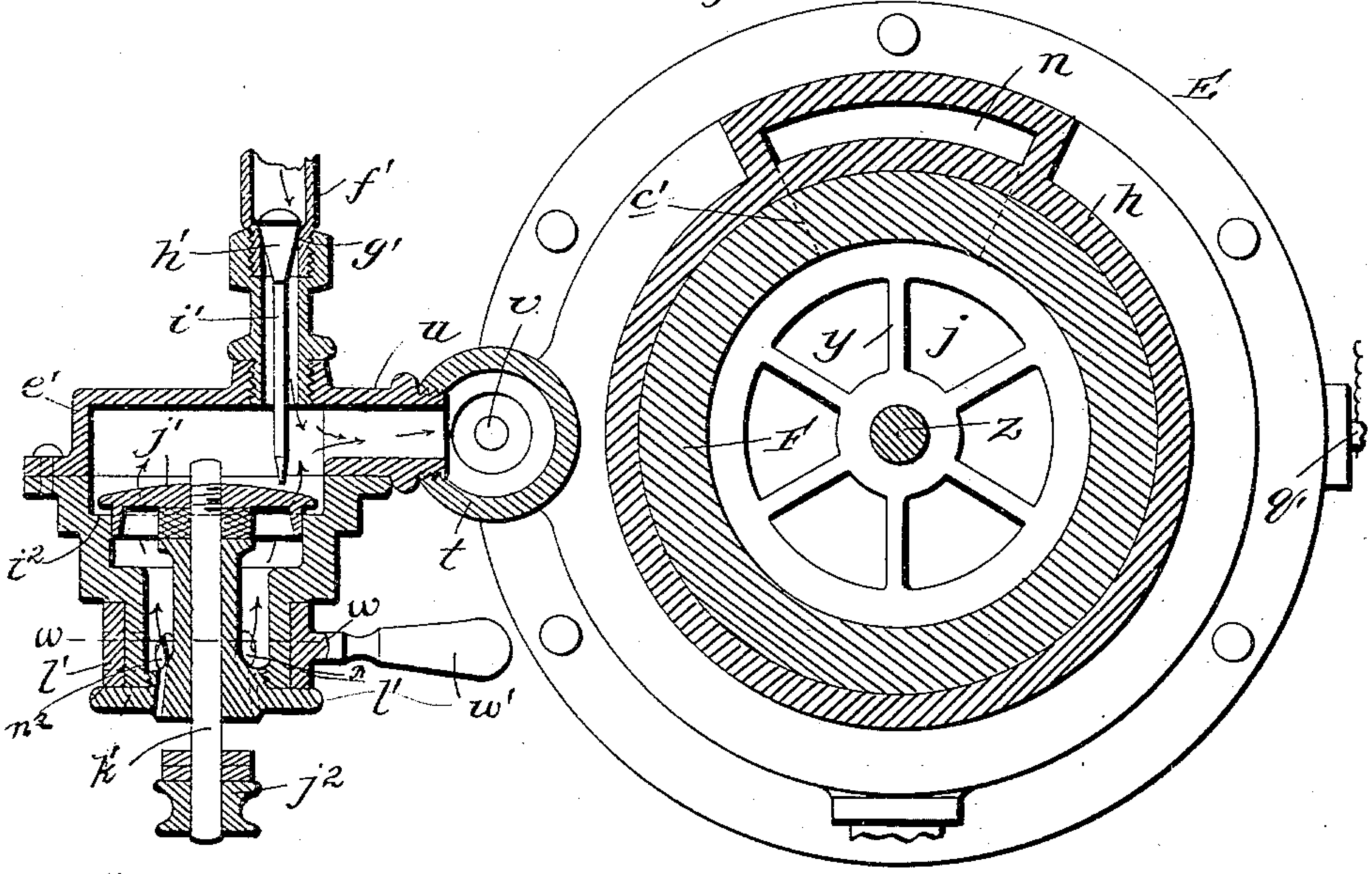


Fig. 8.

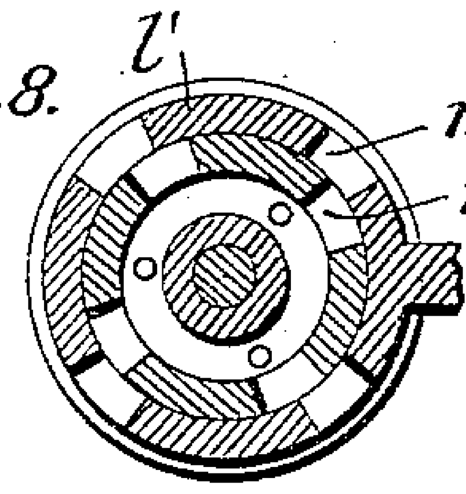
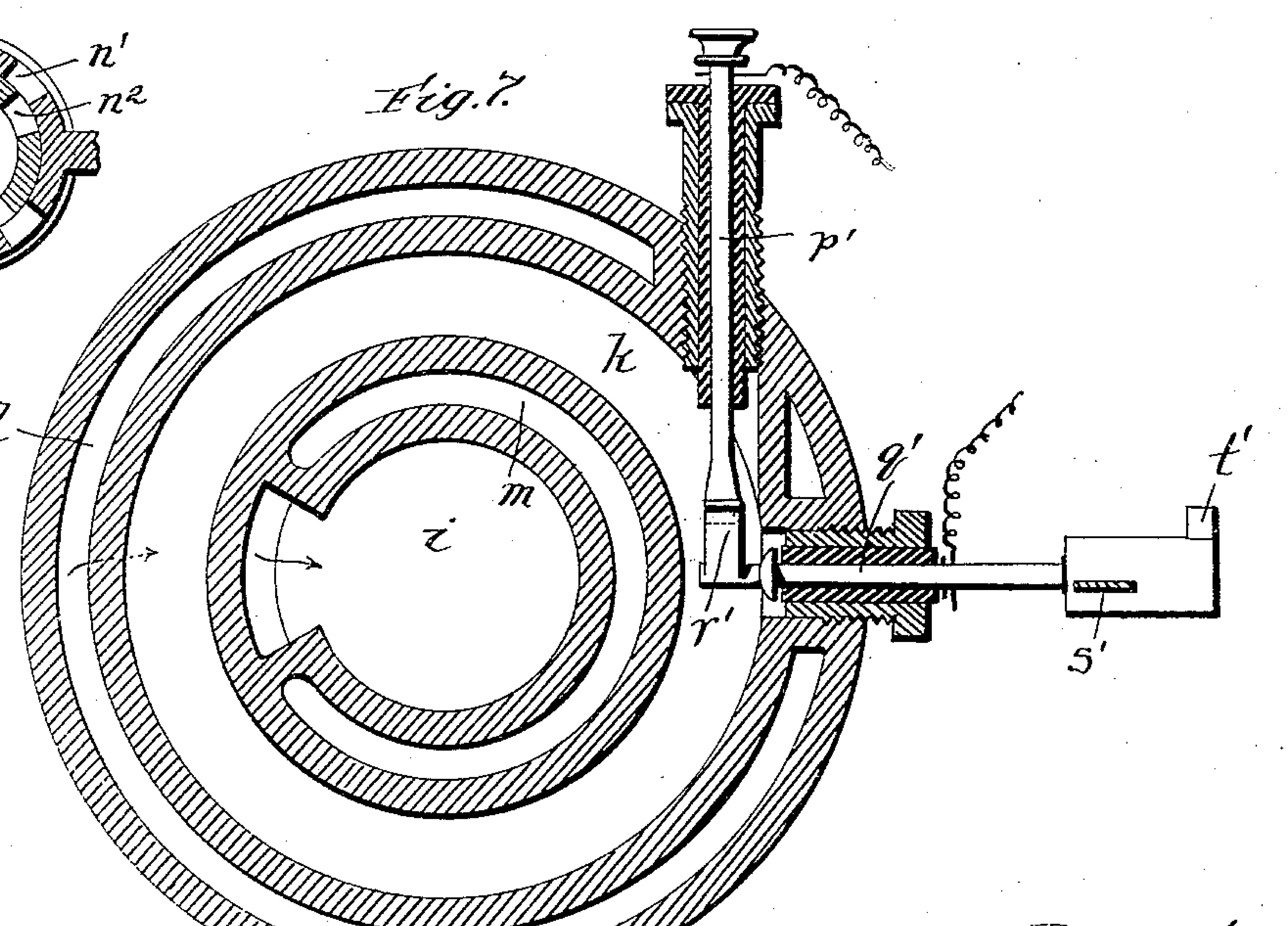


Fig. 7.



Witnesses:

C. H. Raeder

Thomas E. Turpin

Inventor

C. R. Daellenbach

By James J. Sheehy

Attorney

UNITED STATES PATENT OFFICE.

CHARLES R. DAELLENBACH, OF ELLWOOD CITY, PENNSYLVANIA, ASSIGNOR, BY DIRECT AND MESNE ASSIGNMENTS, TO THE ELLWOOD CITY GAS ENGINE COMPANY, OF SAME PLACE.

EXPLOSIVE-ENGINE.

SPECIFICATION forming part of Letters Patent No. 632,917, dated September 12, 1899.

Application filed October 1, 1898. Serial No. 692,395. (No model.)

To all whom it may concern:

Be it known that I, CHARLES R. DAELLENBACH, a citizen of the United States, residing at Ellwood City, in the county of Lawrence and State of Pennsylvania, have invented certain new and useful Improvements in Explosive-Engines; and I do declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same.

My invention relates to explosive-engines, and has for its general object to provide an explosive-engine which is so constructed that the strokes of the piston in both directions are caused by pressure back of the same and which in consequence is capable of developing great speed and power.

With the foregoing in view the invention will be fully understood from the following description and claims when taken in conjunction with the annexed drawings, in which—

Figure 1 is a side elevation of my improved engine with one end partly broken away. Fig. 2 is a plan view of the same. Fig. 3 is a section taken in the plane indicated by the line 3 3 of Fig. 2, with parts broken away. Fig. 4 is a horizontal section of the piston-cylinder, taken in the plane indicated by the line *x x* of Fig. 5. Fig. 5 is a vertical section taken in the plane indicated by the line *y y* of Fig. 4. Figs. 6 and 7 are enlarged transverse sections taken in the planes indicated by the lines *z z* and *v v*, respectively, of Fig. 4; and Fig. 8 is a detail section taken in the plane indicated by the line *w w* of Fig. 6.

In the said drawings similar letters designate corresponding parts in all of the several views, referring to which—

A designates the bed of my improved engine.

B B′ designate standards which are connected to and rise from the bed. C designates a drive-shaft which is journaled in said standards and is provided, in addition to the usual balance-wheel *a* and crank-wheel *b*, with two eccentrics *c* for a purpose presently described.

D designates a cross-head which is arranged and adapted to reciprocate between guides *d*, formed in the standard B, and is connected with the crank-wheel *b* by a pitman *e*, and E designates the piston-cylinder, the forward end *f* of which is preferably formed integral with the standard B, as better shown in Figs. 1, 2, and 4. This cylinder E in the preferred embodiment of the invention comprises the said forward head *f*, the rear head *g*, and the body *h*, interposed between and connected to the heads *f g*, and it is provided with compression-chambers *i* at its opposite ends, a central space *j* between said compression-chambers, annular explosion-chambers *k*, surrounding the compression-chambers, water-jackets *l*, surrounding the explosive-chambers and having suitable inlets and outlets, (not shown,) and annular water-spaces *m*, interposed between the compression-chambers and explosive-chambers and communicating with the water-jackets. The cylinder E is also provided (see Fig. 5) with a longitudinal passage *n*, which communicates at its ends with the explosion-chambers *k* and has ports *p* adjajent to said ends for a purpose presently described, and said cylinder is further provided with inlet-passages *q* for the explosive or explosive mixture and exhaust ports or passages *r* for the products of combustion, as better shown in Figs. 4 and 5. The passages *q* communicate at their inner ends with the compression-chambers *i*, and at their outer ends they are connected to a valve-casing *t*, which in turn is connected at its middle to an explosive-supply pipe *u* and has inwardly-opening valves *v* adjacent to its ends, as shown. The exhaust-ports *r* are arranged at about the points shown in communication with the explosion-chambers and are preferably connected, as shown, to the T-head *w* of a pipe *x*, which may lead to any desired point of discharge.

F designates the piston of the engine. This piston F is of tubular form and suitable diameter to snugly fit the explosion-chambers *k*, and it is provided at its middle with the central imperforate diaphragm *y*, to which the piston-rod *z* is connected, said rod extending through a stuffing-box *a′* in the cylinder-head *f* and being connected at its forward end to the cross-head D, as shown. The said piston

F is further provided with ports b' c', which are disposed at opposite sides of the head y for a purpose presently described.

The pipe u, before described, may be connected with any suitable source of explosive supply. I prefer, however, to connect it to the carbureter I, which forms part of my invention and is illustrated in detail in Figs. 6 and 8. This carbureter comprises a casing e', to which the pipe u is connected, a vertically-disposed pipe f', which is designed to be connected with a source of hydrocarbon-supply and is provided with a valve-seat g', a valve h', which is arranged in the pipe f' above the seat g' and is provided with the depending stem i', the vertically-movable valve j', which is disposed below said stem i' and above a shoulder i^2 in the casing and has the stem k', extending through the casing and equipped with the stop j^2 at its lower end, and the collar l', which is mounted on the lower end of the casing and is provided with a handle w' and with one or more apertures n', designed to be registered with similar apertures n^2 in the casing-wall after the manner illustrated in Fig. 8. In virtue of this construction of carbureter it will be observed that when the engine is in operation the suction created by each stroke of the piston F will raise the valve j' and through the medium of the same will also raise the valve h', with the result that both air and hydrocarbon will be admitted into the carbureter, where they will be thoroughly commingled prior to being drawn into the explosive-chambers of the engine. It will also be observed that through the medium of the collar l' the admission of air may be readily regulated and the speed of the engine thereby governed, it being simply necessary when the engine is to be run at full speed to adjust the said collar l' so as to make its apertures n' coincide with the apertures n^2 of the carbureter-casing and when the speed of the engine is to be reduced to adjust the collar l' so as to close the apertures n^2 of the casing a greater or less extent. From this it follows that when the apertures n^2 are entirely closed and the air necessary to support combustion is shut off the engine will stop.

The sparking mechanism of the engine is better illustrated in Figs. 2, 3, and 7, and comprises, in addition to the eccentrics c before described, the stationary contact-pieces p', which are each electrically connected with one pole of a suitable electrogenerator (not illustrated) and are extended through but insulated from the wall of the cylinder and have resilient inner terminals within the combustion-chambers k, and the movable or rocking contact-pieces q', which are electrically connected with the opposite pole of the electrogenerator and are journaled in but insulated from the walls of the cylinders and have fingers r' at their inner ends and within the combustion-chambers designed and adapted to impinge against the resilient portions of the stationary contact-pieces p'. The rocking contact-pieces q' are connected with springs s', which serve to normally hold the fingers r' away from the stationary contact-pices p', and said pieces q' are also provided with projections t'. (Better shown in Fig. 2.) These projections t' are designed for the engagement of the rods u', which extend loosely through swivel-bearings v' and terminate at their rear ends in straps w', receiving the eccentrics c on the shaft C, as shown. The said eccentrics c are oppositely disposed, and consequently it will be observed that with the engine in operation one rod u' will be moved forwardly while the other is moved rearwardly. When the rods move forwardly, they will press against the projections t', and thereby rock the contact-pieces q', so as to carry the fingers r' against the stationary contact-pieces p', and will then ride over the said contact-pieces t' and permit the fingers r' to quickly jump away from the contact-pieces p' and form the sparks. The eccentrics c being oppositely disposed, as stated, it follows that sparks will be formed in the explosion-chambers alternately.

The movements of the parts comprised in my improved engine are so timed that with the apertures n' of collar l' arranged coincident with the apertures n^2 of the carbureter-casing the operation is as follows: On the stroke of the piston F toward the right a charge of explosive mixture is drawn through the carbureter I, valve-casing l, and the left-hand passage q into the left-hand compression-chamber i of the piston-cylinder. On the succeeding stroke of said piston toward the left a charge of explosive mixture is drawn through the carbureter and right-hand passage q into the right-hand compression-chamber i, while at the same time the charge previously drawn into the left-hand chamber i is compressed. When the piston in its movement toward the left reaches a position which brings its port b' into register with the port p to the left, the right-hand end of the passage n will be open to the right-hand explosion-chamber k, and in consequence the compressed charge of explosive in the left-hand compression-chamber i will pass therefrom through port b', port p, and passage n into said right-hand explosion-chamber. On the succeeding stroke of the piston toward the right the charge of explosive mixture in the right-hand explosion-chamber will be again compressed until the cylinder reaches the end of said stroke, when a spark will be formed in said right-hand explosion-chamber, and the resulting explosion drives the piston toward the left. During the movement stated of the piston toward the right the charge of explosive in the right-hand compression-chamber i will be compressed until the port c' of the piston registers with the right-hand port p, when the compressed explosive will pass through the port c', the right-hand port p, and the passage n into the left-hand explosion-chamber. On the succeeding stroke of the piston to the left this charge of explosive in the left-hand explosion-chamber k will be compressed until the piston reaches the end of said stroke, when a spark will be created in said explosion-chamber and an explosion result which will drive the piston again toward the right. When the piston is moved, as stated, by an explosion in one of the explosion-chambers k, the exhaust-port r of such chamber will be uncovered when the end of such movement is reached, so as to permit the escape of the products of combustion. At the same time the end of the passage n contiguous to said explosion-chamber will be uncovered, so as to permit of the entry into said explosion-chamber of the compressed charge of explosive from the compression-chamber at the opposite end of the cylinder, as before described. Such charge of explosive will quickly clear the explosion-chamber of the products of combustion, as will be readily appreciated.

It follows from the foregoing that the strokes of the piston in both directions are caused by pressure back of the same and that consequently the engine is rendered exceedingly powerful and capable of developing high speed.

It will be observed that an explosion takes place precedent to each stroke of the piston and in a chamber or space separated from the chamber or space containing the piston-rod, which precludes leakage of flame and products of combustion from the cylinder. It will further be observed that the inner central area of the piston creates on one side a vacuum in order to draw a fresh charge of explosive into one compression-chamber i, while at the same time and during the same stroke said central area on the other side compresses the charge of explosive which was drawn into the other compression-chamber i incident to the previous stroke of the piston; also, that the outer tubular area of the said piston is acted on at one end by an explosion in one of the chambers k, while the same area at the opposite end simultaneously compresses a new charge of explosive in the other chamber k for a subsequent explosion.

I have specifically described the construction and relative arrangement of the parts in the present embodiment of my invention in order to impart a full, clear, and exact understanding of an engine constructed in accordance with the same. I do not, however, desire to be understood as confining myself to such construction and arrangement, as such changes or modifications may be made in practice as fairly fall within the scope of my invention.

Having thus described my invention, what I claim is—

1. In an explosive-engine, the combination of a piston-cylinder having compression-chambers at its opposite ends, explosion-chambers surrounding said compression-chambers, exhaust-ports communicating with the explosion-chambers, and a passage interposed between and connected at its ends with the explosion-chambers and provided with the inwardly-directed ports adjacent to said ends, a tubular piston snugly fitting the explosion-chambers and having a diaphragm, at an intermediate point of its length, movable between the compression-chambers and also having ports at opposite sides of said diaphragm and adapted to register with the ports of said passage, and suitable means for igniting the explosive in the explosion-chambers, substantially as specified.

2. An engine comprising a cylinder, and a piston having an inner central area and an outer tubular area extended in opposite directions beyond the inner central area; the inner central area being adapted to create on one side a vacuum for the purpose of drawing a fresh charge of explosive into the cylinder while at the same time and incident to the same stroke said inner central area on the opposite side compresses a charge of explosive which was drawn into the cylinder during the previous stroke, and the outer tubular area being adapted to be acted upon at one end by an explosion in the cylinder while its opposite end compresses a charge in the cylinder for the subsequent explosion, substantially as specified.

3. An explosive-engine comprising a tubular piston having a diaphragm at an intermediate point of its length, a cylinder containing the piston and having compression-chambers disposed at opposite sides of the diaphragm of the piston, and explosion-chambers surrounding the compression-chambers and receiving the tubular ends of said piston, and means controlled by the piston for effecting communication between the compression-chambers and the explosion-chambers, substantially as specified.

4. An explosive-engine comprising a tubular piston having a diaphragm, a cylinder containing the piston and having compression-chambers disposed at opposite sides of the diaphragm of the piston and provided with induction-ports for explosive, and explosion-chambers surrounding the compression-chambers and receiving the tubular ends of said piston and having exhaust-ports controlled by said ends, and means controlled by the piston for effecting communication between one compression-chamber and the explosion-chamber at the opposite side of the piston, and communication between the other compression-chamber and the explosion-chamber at the opposite side of the piston, alternately, substantially as specified.

5. An explosive-engine comprising a piston, a cylinder containing the piston and having compression-chambers disposed at opposite sides of the piston, and explosion-chambers also disposed at opposite sides of the piston, and means controlled by the piston for effecting communication between the compression-chamber and the explosion-chamber at the

opposite side of the piston, and communication between the other compression-chamber and the explosion-chamber at the opposite side of the piston, alternately, substantially as specified.

6. In an explosive-engine, the combination of a piston-cylinder having a compression-chamber and an explosion-chamber at each end and also having exhaust-ports communicating with the explosion-chambers, and a passage interposed between and connected at its ends with the two explosion-chambers and provided with the inwardly-directed ports adjacent to said ends, an explosive source of supply connected with the compression-chambers, and a piston interposed between and separating the two compression-chambers and also interposed between and separating the two explosion-chambers and having ports for effecting communication between the compression-chambers and the passage connected with the explosion-chambers, substantially as specified.

7. In an explosive-engine, the combination of a piston-cylinder having a compression-chamber and an explosion-chamber at each end and also having exhaust-ports communicating with the explosion-chambers, an explosive source of supply connected with the compression-chambers, and a piston interposed between and separating the compression-chambers and also interposed between and separating the explosion-chambers the said piston-cylinder having a passage connected at its ends to the explosion-chambers, and ports leading from said passage adjacent to the ends thereof, and the piston having coacting passages for effecting communication between each compression-chamber and the explosive-chamber at the opposite end of the cylinder, substantially as specified.

In testimony whereof I have hereunto set my hand in presence of two subscribing witnesses.

CHARLES R. DAELLENBACH.

Witnesses:

JOHN F. HAINES,

H. N. MARSHALL.