No. 661,235. Patented Nov. 6, 1900.

# L. CHARON & F. MANAUT.

## PETROLEUM MOTOR.

(Application filed Nov. 9, 1899.)

(No Model.) 5 Sheets—Sheet 1.

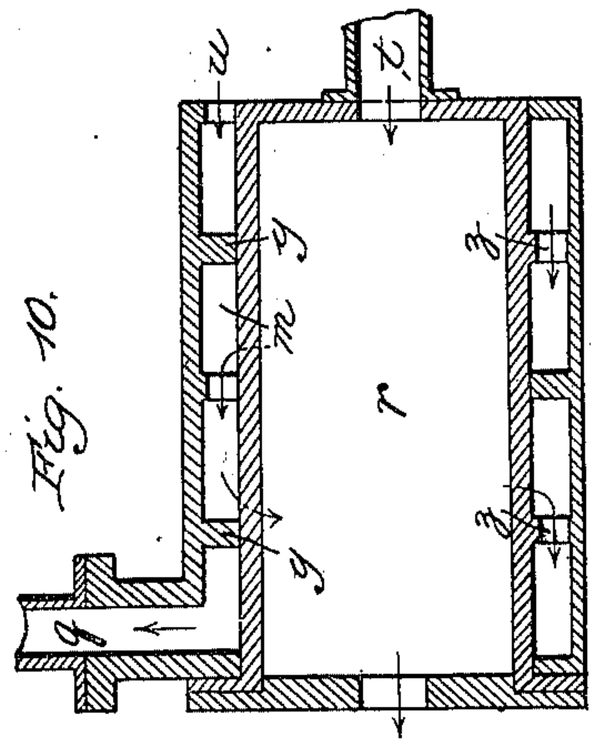


Fig. 10.

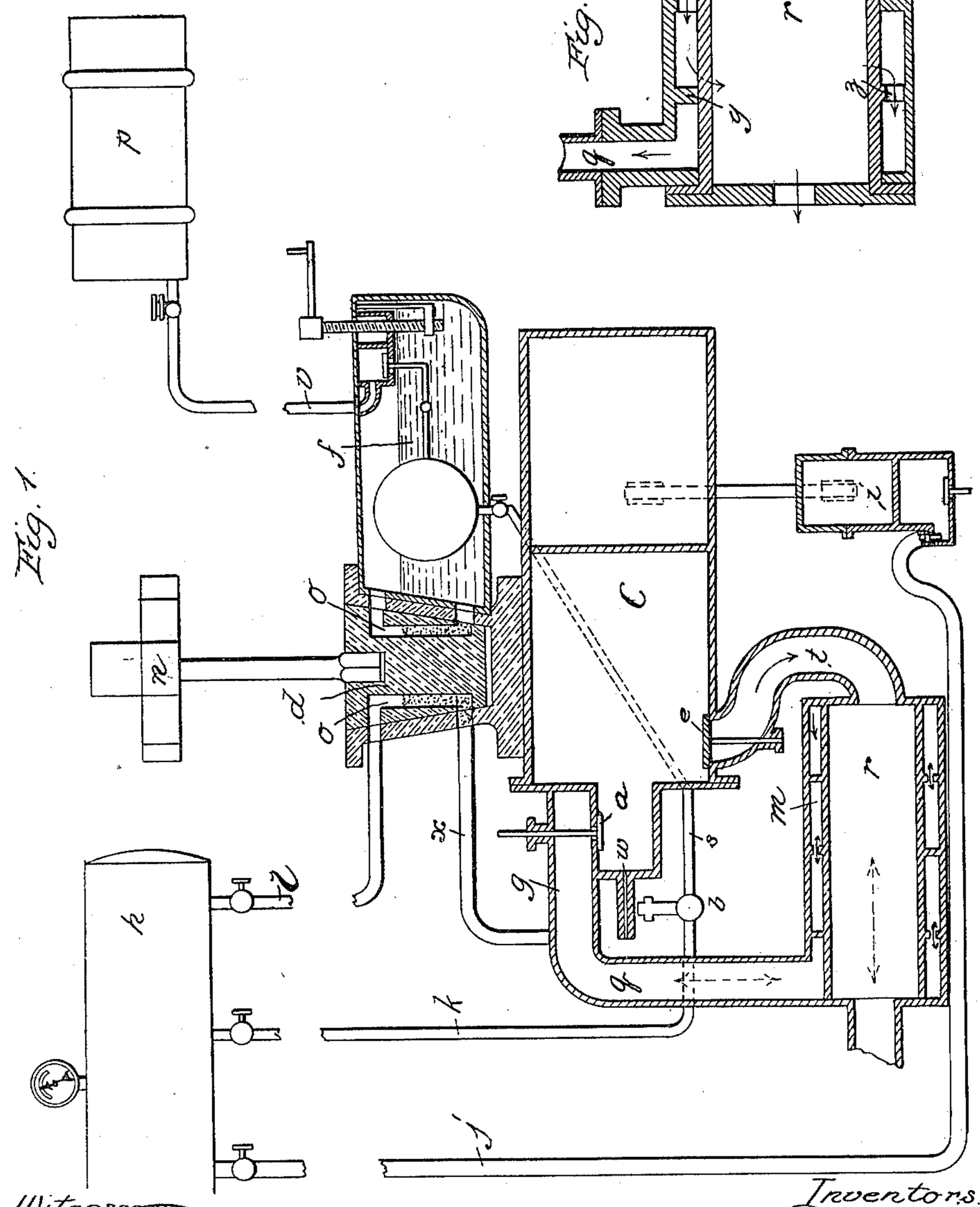


Fig. 1.

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## PETROLEUM MOTOR.

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(No Model.) 5 Sheets—Sheet 2.

*Fig. 2.*

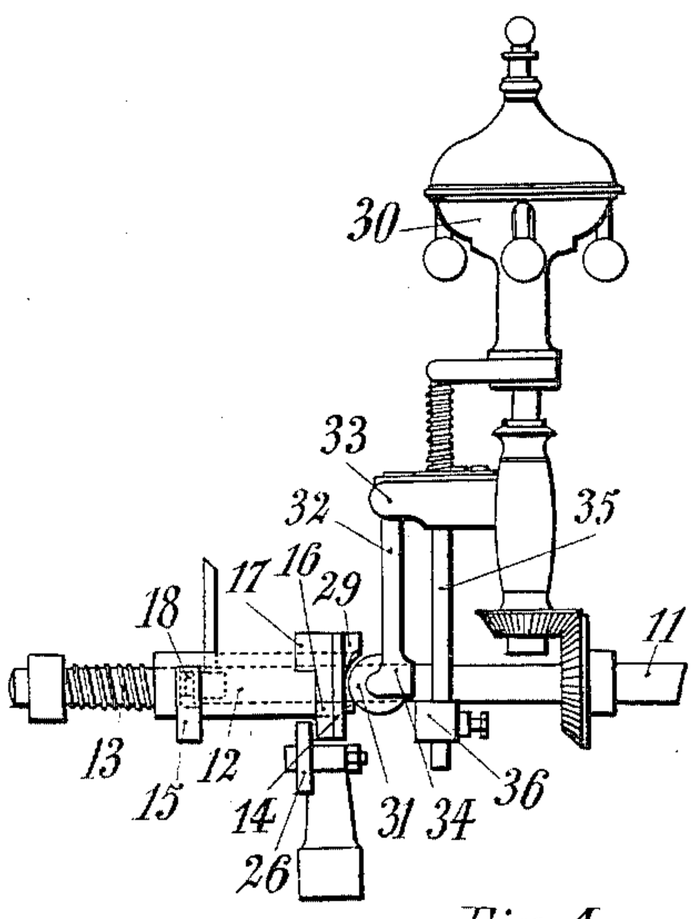



*Fig. 3.*

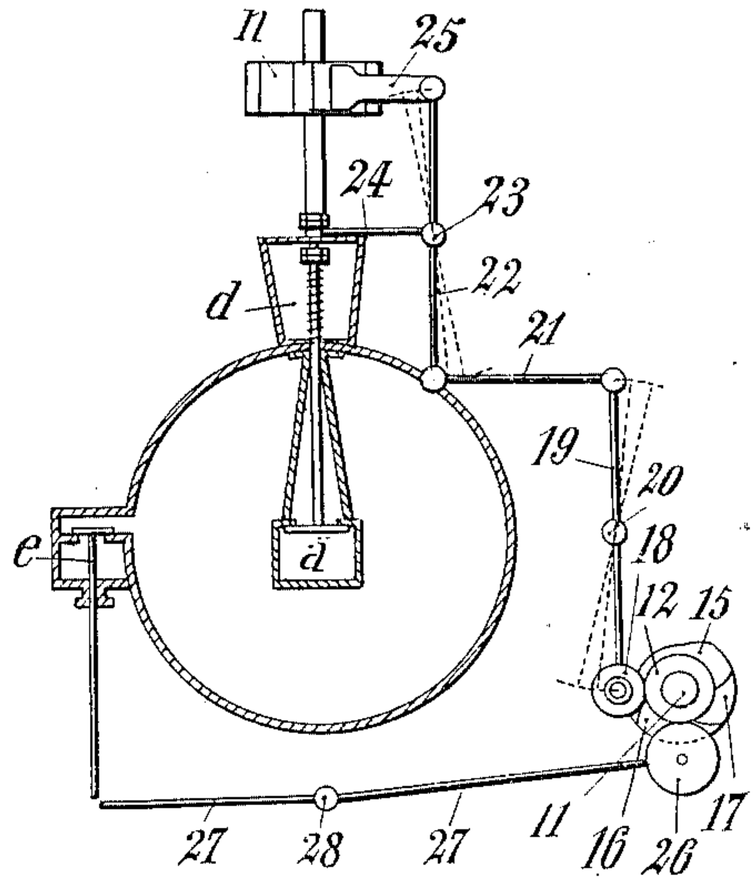



*Fig. 4.*

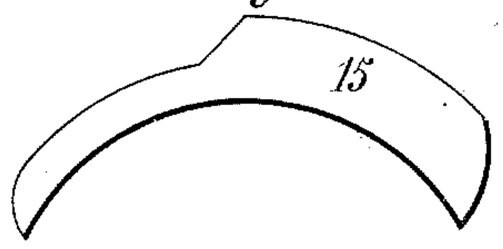



*Fig. 5.*

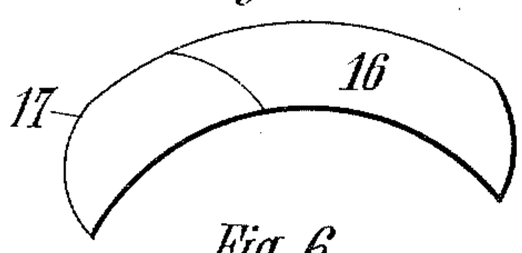
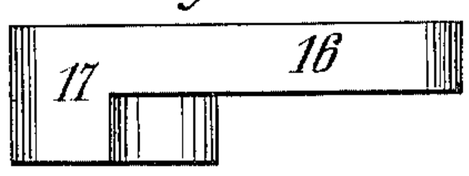



*Fig. 6.*

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No. 661,235. Patented Nov. 6, 1900.

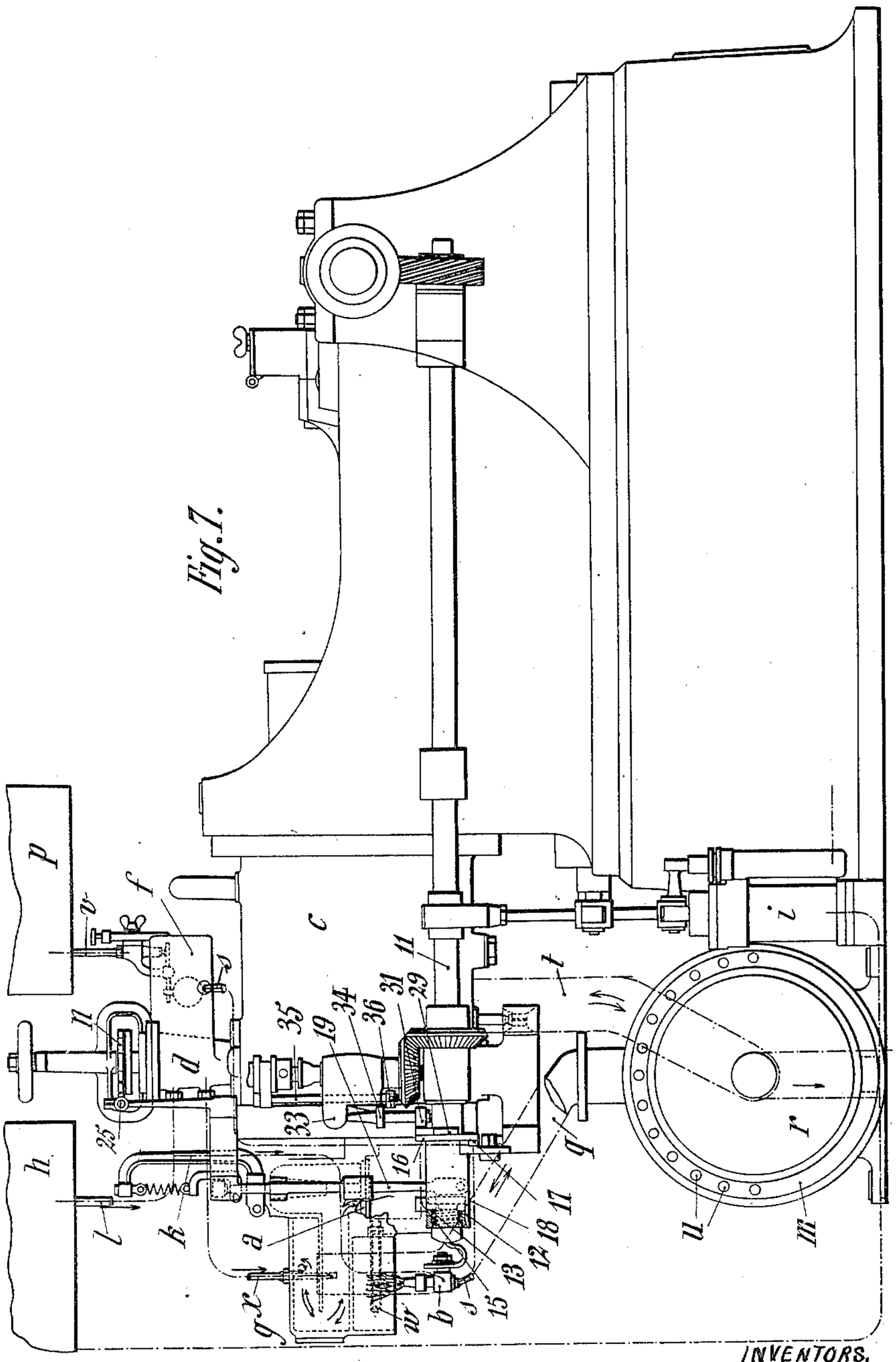
# L. CHARON & F. MANAUT.

## PETROLEUM MOTOR.

(Application filed Nov. 9, 1899.)

(No Model.) 5 Sheets—Sheet 3.

Fig. 7.

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## PETROLEUM MOTOR.

(Application filed Nov. 9, 1899.)

(No Model.)

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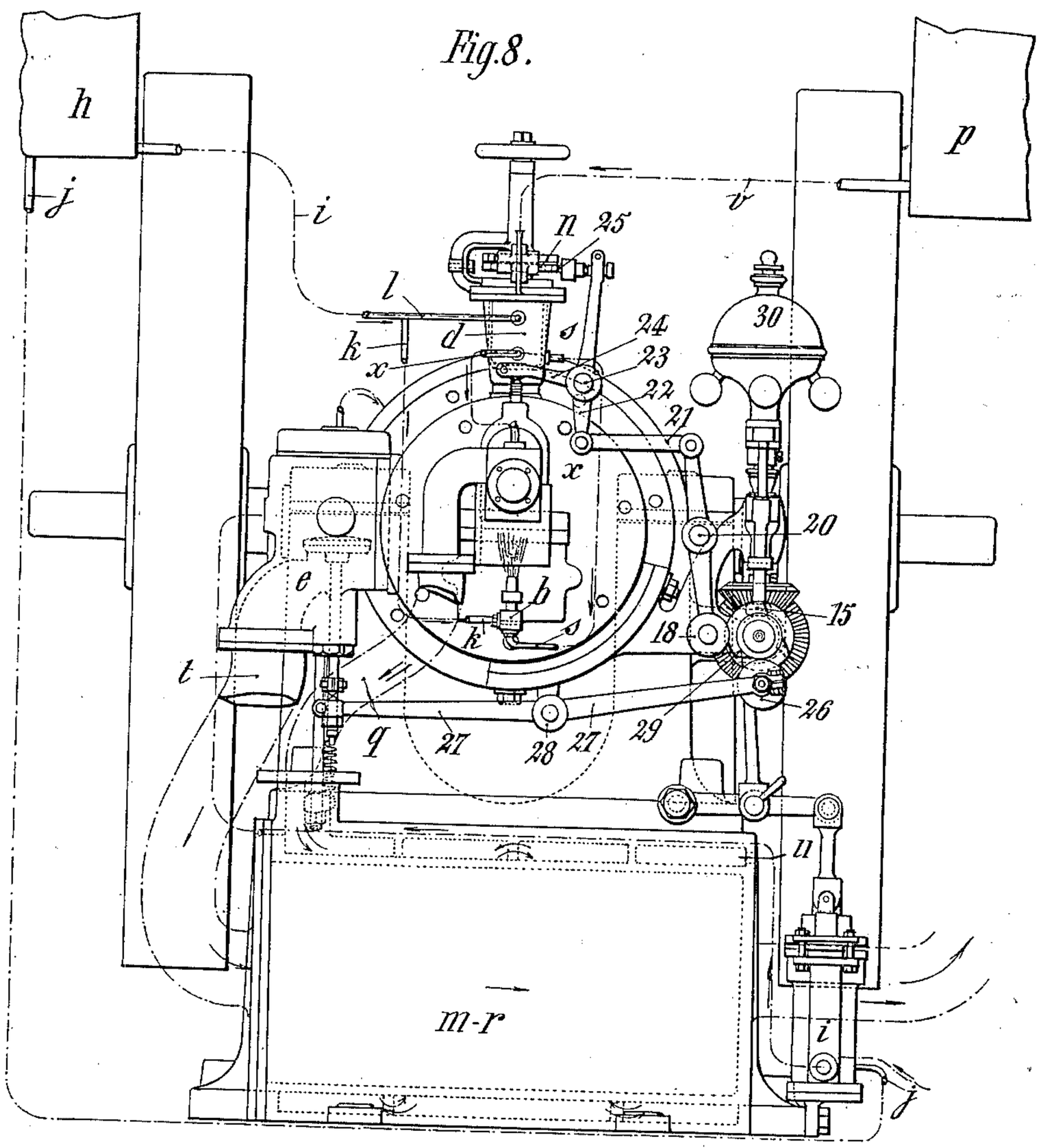
*Fig. 8.*

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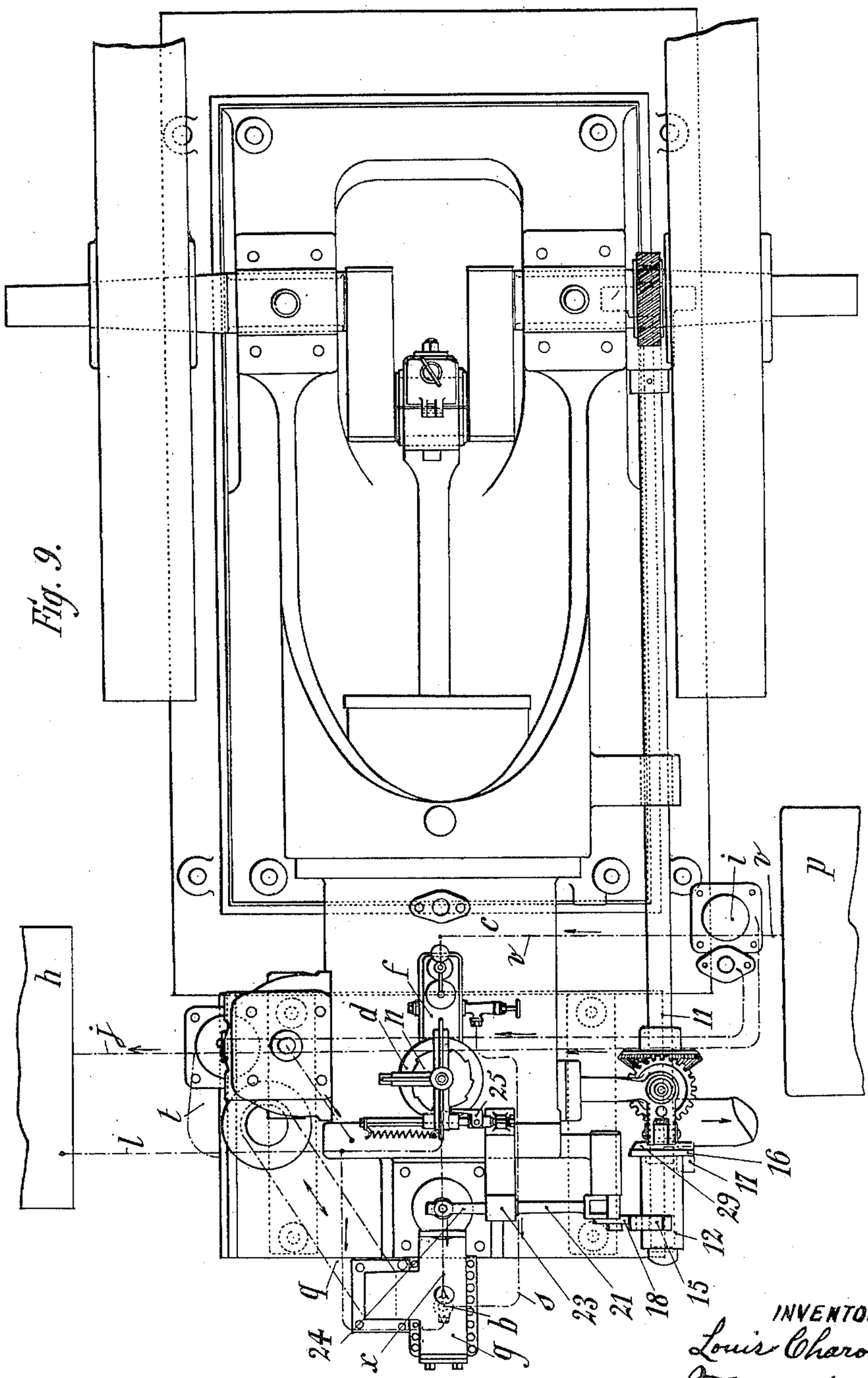
## PETROLEUM MOTOR.

(Application filed Nov. 9, 1899.)

(No Model.) 5 Sheets—Sheet 5.

Fig. 9.

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# UNITED STATES PATENT OFFICE.

LOUIS CHARON AND FRÉDÉRIC MANAUT, OF PARIS, FRANCE.

## PETROLEUM-MOTOR.

SPECIFICATION forming part of Letters Patent No. 661,235, dated November 6, 1900.

Application filed November 9, 1899. Serial No. 736,419. (No model.)

*To all whom it may concern:*

Be it known that we, LOUIS CHARON and FRÉDÉRIC MANAUT, engineers, citizens of the Republic of France, and residents of 40 Rue Laffitte, Paris, France, have invented certain new and useful Improvements in Petroleum-Motors, of which the following is a full, clear, and exact specification.

The principal disadvantages of heavy petroleum-motors as hitherto constructed are the following: The working of the motor is not independent of the variation in the level of the liquid contained in the petroleum-reservoir; and the liquid combustible distributed for each useful cycle is not completely used, which diminishes the power of the motor and increases the fouling. Even when the petroleum is not distributed in excess it is imperfectly utilized, because the flame is not sufficiently intense or is the cause of missing fire. In general the suction-chamber or the vaporizer is insufficiently heated and the air is not properly mixed with the petroleum admitted, especially in motors working without expansion.

In order to diminish the consumption of raw material, most inventors have made use of what may be called the principle of the "suppression of admission"—that is to say, the periodic suppression of a complete charge. This method, however, does not obviate the losses of material which occur at every useful charge as long as the work done by the motor is not equal to its maximum power, because a full charge is too much for the work to be effected; but even when the work done is normally equal to the power of the engine there still occur losses of material in consequence of the explosive power of the insufficiently-expanded gaseous mixture being badly utilized, so that the gases escape at an excessive temperature and pressure.

Now in a motor according to this invention the disadvantages hereinbefore mentioned are completely obviated. These results are obtained by a combination of new parts—such as a special burner, a special storing-chamber for the gaseous mixture, which allows of the almost complete recuperation of the heat of the exhaust, and a mechanical device which permits of the simultaneous application of the principles of "suppression" (of the admission of the gaseous mixture) and of "storing" a portion of the gaseous mixture admitted for utilization in the following cycle.

Figure 1 of the accompanying drawings is a diagram of a motor according to this invention. Fig. 2 is a diagrammatical longitudinal elevation of the distributing-shaft and of the mechanism which enables the combination of the principles of storing the gaseous mixture and of the complete suppression of the admission to be realized when the resistance is largely diminished. Fig. 3 is a corresponding diagrammatic side elevation. Figs. 4, 5, and 6 are detail views of the cams. Figs. 7, 8, and 9 represent the complete motor in detail in longitudinal elevation, end elevation, and plan, respectively. Fig. 10 shows in longitudinal section the special suction, storing, and exhaust chamber which is shown in Figs. 7 and 8 in end and longitudinal elevation, respectively.

In the diagram Fig. 1, *c* represents the cylinder of the motor, which is provided with two valves, of which one, *a*, is for drawing in the charge and the other, *e*, is for the exhaust. The valve *a* places the cylinder in communication with a vaporizer *g*, which is heated, together with the ignition-tube *w*, by a special burner *b* and communicates at one point by a pipe *x* with a petroleum-distributing valve *d* and at another point by a pipe *q* with a chamber *m* of a double suction and exhaust box *m r*. The distribution of the petroleum is effected by means of a plug *d*, which receives an intermittent rotary movement from a ratchet-wheel *n*, operated by the motor, so that passages *o* in the said plug are successively filled with liquid drawn from a tank *f*, in which the liquid is maintained at a constant level and which communicates by a pipe *v* with a petroleum-reservoir *p*. The passages *o*, which contain a quantity of liquid according to the level (which may be varied as desired) in the tank *f*, are each in turn put into simultaneous communication with the pipes *x* and *l*. The pipe *l* connects the distributing-valve with a reservoir *h*, into which a pump *i*, actuated by the motor, compresses air through a pipe *j*, and this compressed air forces the liquid contained in a passage through the pipe *x* into the vaporizer.

The exhaust-valve *e* establishes or interrupts communication between the cylinder *c* and the pipe *t*, that is connected to the central chamber *r* of the double box *m r*.

The burner *b*, which renders incandescent the ignition-tube *w*, that is protected by the casing of the vaporizer, as is clearly shown in Fig. 7, receives its fuel-supply through the pipe *s*.

The drawings show clearly the arrangement of the burner in relation to the complete motor. This arrangement is such that not only the ignition-tube is maintained incandescent, but the heat furnished by the burner is almost entirely utilized for heating the vaporizer.

Figs. 7, 8, and 10 show in detail the double suction and exhaust chamber, which consists of two concentric cylinders joined by a series of annular partition-walls *y*. The interior of the inner cylinder forms an internal cylindrical chamber *r*, into which the exhaust, gases pass before being discharged into the air. This chamber *r* serves for heating the annular space *m*, which surrounds it and into which the external air is drawn through the openings *u* in the front wall. The annular space *m* constitutes at the same time a suction-chamber and a storing-chamber for a portion of the mixture of air and petroleum drawn in during the preceding operation of the cycle, as will be hereinafter described. The said space is divided into several compartments by partitions *y*, perforated by openings *z*, that are located at diametrically opposite points. The circulation of the gaseous mixture returned from the cylinder after each aspiration and the circulation of the fresh air flowing in the opposite direction through the openings *u* are thereby retarded.

Now in normal working, when the output is equal to the designed power of the motor, the cycle of operations is the following: At the first operation—that is to say, on the first outward stroke of the cylinder-piston—the valve *a* is open and the valve *e* is closed, so that the mixture in the vaporizer *g* of external air which is heated in the space *m* and petroleum which is supplied by the distributing-valve *d* is admitted into the cylinder. At the second operation—that is to say, on the first return stroke of the piston—there are two phases. First, the valve *a* is still open and the valve *e* still closed. The piston therefore drives back out of the cylinder a portion of the mixture which it has just drawn in and which is then stored in the annular space *m* and in the suction-pipe *q*. Second, during the second portion of this first return stroke of the piston the valve *a* closes, while the valve *e* still remains closed, so that the gaseous mixture remaining in the cylinder becomes compressed, whereupon the ignition and the explosion occur. During the third operation—that is to say, the second forward stroke of the piston—the two valves *a* and *e* still remain closed, while the gases expand and do useful work. During the fourth operation, which corresponds to the second inward stroke of the piston, the valve *a* remains closed, but the valve *e* opens, thereby permitting the burned gases to escape and pass through the pipe *t* into the central chamber *r*, where they heat the gaseous mixture stored in *m* at the second operation and then escape into the atmosphere. During the final phase of the fourth operation the distributing-valve *d* is partially rotated and petroleum is injected into the vaporizer *g* and the cycle described is repeated. At the first operation of the second cycle, however, the piston draws in the gaseous mixture stored during the preceding cycle from the space *m*. Thereupon fresh air is drawn in under the conditions hereinbefore described through the openings *u* and mixed with the petroleum injected into the vaporizer. At the second operation partial storing and compression occur, at the third operation explosion and expansion, at the fourth expulsion of the burned gases, and so on. This is the cycle of operations which occurs when the motor is working normally.

The distributing mechanism, which causes the closing or opening of the admission and exhaust valves at the desired time, is represented in detail in Figs. 7, 8, and 9 and diagrammatically in Figs. 2 and 3. This mechanism is so arranged that in normal working the cycle hereinbefore described is obtained, and, moreover, when the speed of the motor exceeds a fixed limit the admission is thereby completely suppressed. This combination of the principles of storing the gaseous mixture and of suppressing the admission constitutes an important feature of this invention.

The distributing-shaft 11, to which the piston imparts, by means of any suitable transmission-gear, a continuous rotary motion, carries a sleeve 12, which may be moved in a longitudinal direction on the said shaft, while continuing to rotate with the shaft, by means of a pin or other suitable device engaging in a groove on the shaft. The sleeve 12 is under the action of a spring 13, which maintains it normally in the position indicated in Fig. 2 against an abutment 14, cast with or fixed upon the shaft 11. On the sleeve 12 there are fixed two cams, of which one, 15, (represented in side elevation in Fig. 4,) serves for simultaneously controlling the suction-valve *a* and the ratchet which actuates the petroleum-distributing valve, and the other, 17 16, (represented in elevation and in plan in Figs. 5 and 6, respectively,) which is double, serves for controlling the exhaust-valve *e* by the part 17 thereof when working normally. These several actions are clearly indicated in the diagram, Fig. 3. The cam 15 acts normally on a roller 18, suspended at the end of a lever 19, that oscillates about a fixed point 20 and is jointed at its opposite end to one of the ends of a link 21. The other end of

the said link is jointed to a lever 22, which oscillates about a fixed point 23 and carries near its point of oscillation an arm 24 for controlling the valve *a* and at its upper end a pawl 25 for operating the ratchet-wheel *n*, that controls the petroleum-distributing valve. The part 17 of the cam 16 17 acts normally on a roller 26, mounted at one of the ends of a lever 27, which oscillates about a fixed pivot 28 and the opposite end of which acts on the rod of the valve *e*. The sleeve 12 is provided with an incline 29 on the face nearest the governor 30, and in the path of the said incline there is suspended a roller 31 at the end of a lever 32, that oscillates about a fixed point 33. In normal working this roller is simply driven outward by the incline 29; but from the sleeve of the governor there is rigidly suspended a rod 35, carrying at its lower end an adjustable collar 36, which when the speed of the motor increases rises with the rod and the governor-sleeve and engages with a shoulder 34 on the lever 32, so that the oscillation of the said lever from left to right is prevented. As long as the collar 36 remains in contact with the shoulder 34 the incline 29 (hereinafter called the "suppressing inclined plane") will move the cam-sleeve 12 toward the left against the action of the spring instead of moving the roller 31 and lever 32 toward the governor. By this means the cam 15 escapes the roller 18, and the normal suction of the mixture and the distribution of the petroleum do not occur, while the short portion 17 of the cam 16 17 escapes the roller 26, with which it is normally in contact, and the said roller comes into contact with the long portion 16 of the said cam.

Now the long part 16 of the cam is so arranged that the exhaust-valve remains open not only during the period of exhaust, but also during the period of suction—that is, during a complete revolution. When, therefore, the sleeve 12 is moved by reason of an abnormal increase in the speed, the distribution of the petroleum and the drawing in of the mixture from the annular chamber *m* are no longer effected, while the admission of the stored mixture, which remains in the annular chamber *m* until a succeeding admission or of external air, is suppressed. The principal effect obtained is a suppression of the admission of the gaseous mixture and of the distribution of the petroleum. Moreover, when the portion 16 of the cam 16 17 acts on the roller 26, and thus keeps the exhaust-valve open not only while the burned gases are being expelled, but also while the mixture is being drawn in, the piston draws in from the exhaust—*i. e.*, from the cylindrical chamber *r*—during each cycle of suppression. The total suppression of admission would have caused a vacuum in the cylinder during the period of suction—that is to say, during the first operation of the cycle—if this had not been obviated by leaving the cylinder at this moment in free communication with the exhaust—that is to say, with the atmosphere. In certain special cases fresh air may be drawn in from the atmosphere during the period of suppression instead of the hot gases of the exhaust. For this purpose there may be interposed between the exhaust-valve and the exhaust-chamber a flap-valve opening inwardly, which will act automatically each time suppression occurs.

The device hereinbefore described is arranged, by means of the position of the suppressing inclined plane 29, so that the movement of the cam-sleeve 12 may take place at the end of the third operation of the normal cycle—that is to say, at the moment when in the fourth operation the normal exhaust occurs, the valve *e* being open. During the first operation of the suppression-cycle the valve *e* remains open, while the valve *a* is closed, and the operations hereinbefore described follow one another consecutively.

It will be evident that a motor constructed according to the principles described will be very economical, as, on the one hand, the petroleum is utilized in a perfect manner in normal working by means of the principle of storing the mixture, and, on the other hand, when the motor does not give out all the energy for which it is constructed the suppression of the admission of the active gases into the cylinder takes place automatically.

Having now particularly described and ascertained the nature of the said invention and in what manner the same is to be performed, we declare that what we claim is—

1. In a four-cycle petroleum-engine, the combination with the cylinder and piston, of a vaporizer and a suction or storage chamber connected therewith, a distribution-valve controlling the flow of petroleum to the engine, a gas-valve controlling the passage of vapor to the cylinder means whereby in the normal action of the engine the said gas-valve will be held open during the suction-stroke and during a portion of the compression-stroke, and means whereby excessive speed of the engine will cause said gas and distribution valves to remain closed during the entire cycle of movement, substantially as described.

2. In combination, the cylinder and piston, a vaporizer and a storage-chamber connected therewith, a distribution-valve for controlling the flow of petroleum to said vaporizer, a gas-valve controlling the flow of the explosive mixture to the engine, means whereby in the normal action of the engine said gas-valve is held open during the suction-stroke and a portion of the compressing-stroke, means whereby on the excessive speed of the engine said distribution and gas valves are maintained closed, and means for preventing a vacuum in the cylinder during said closure, substantially as described.

3. In combination, the cylinder and piston, a vaporizer and storage-chamber both connected with said cylinder, a distribution-valve for controlling the flow of petroleum to said

vaporizer, a gas-valve controlling the passage from the vaporizer and storage-chamber to the cylinder, a shaft driven continuously by the engine, a cam-sleeve splined thereon carrying a cam, connections whereby said cam is caused to operate said distribution-valve, an incline on said sleeve, a rocking arm having its free end in juxtaposition to said incline, a governor and a stop or abutment operatively connected with said governor whereby said swinging arm is held rigidly against said incline, substantially as described.

In witness whereof we have hereunto set our hands in presence of two witnesses.

LOUIS CHARON.
FRÉDÉRIC MANAUT.

Witnesses:
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