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A. ALTMANN & F. KÜPPERMANN.

PETROLEUM MOTOR.

No. 412,228. Patented Oct. 8, 1889.

Fig 1.

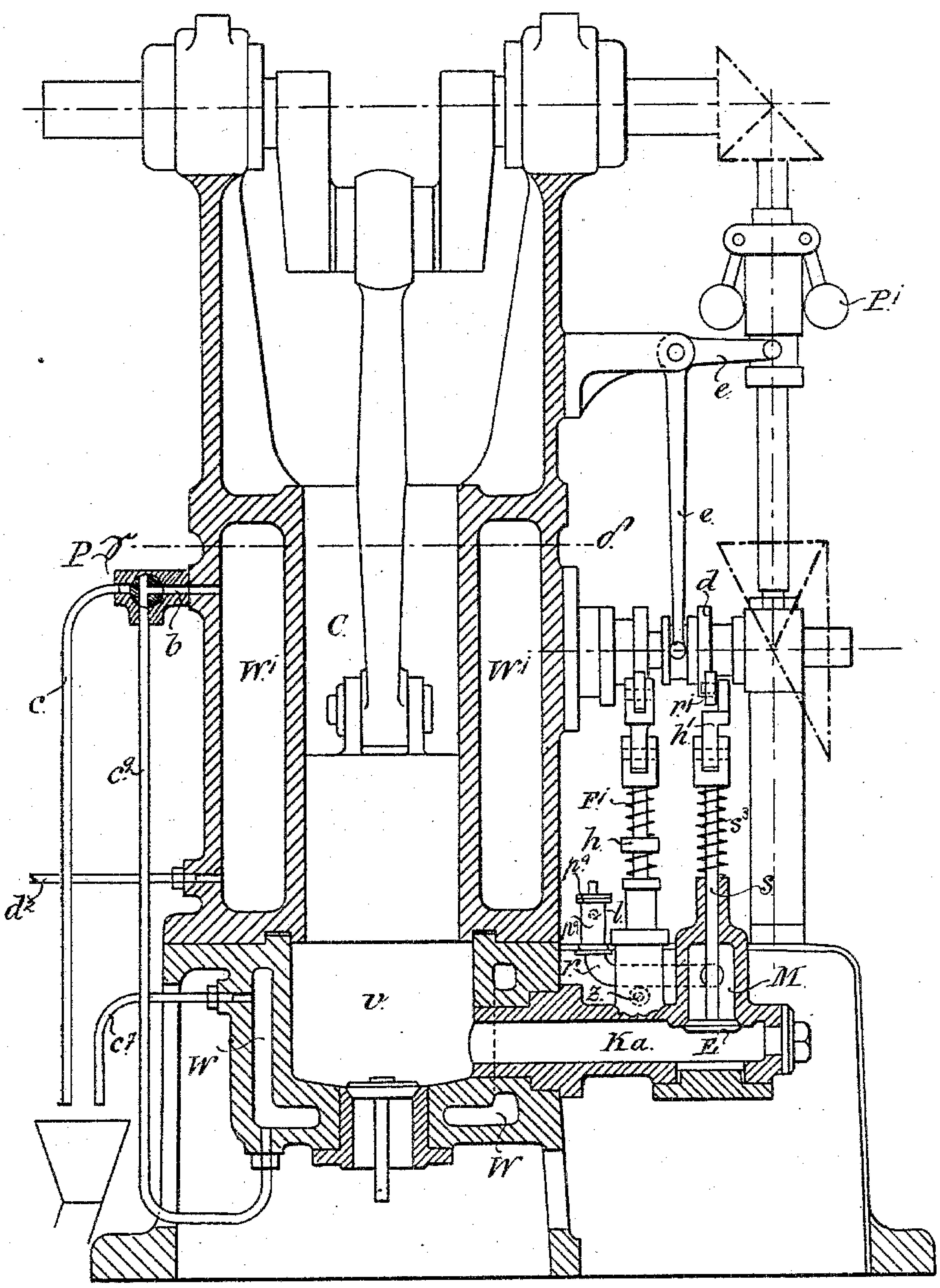

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Fig 2.

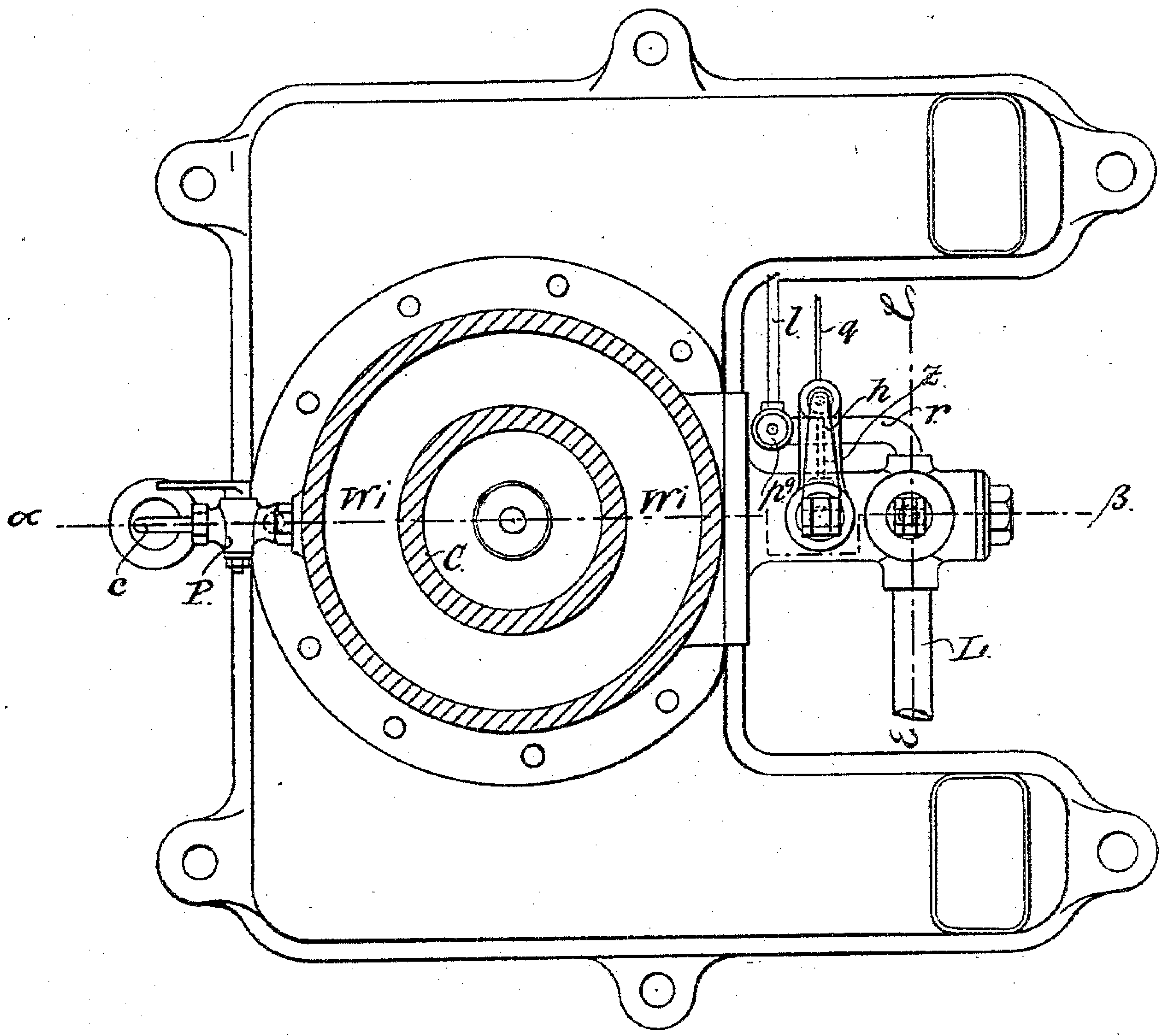

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Fig 4

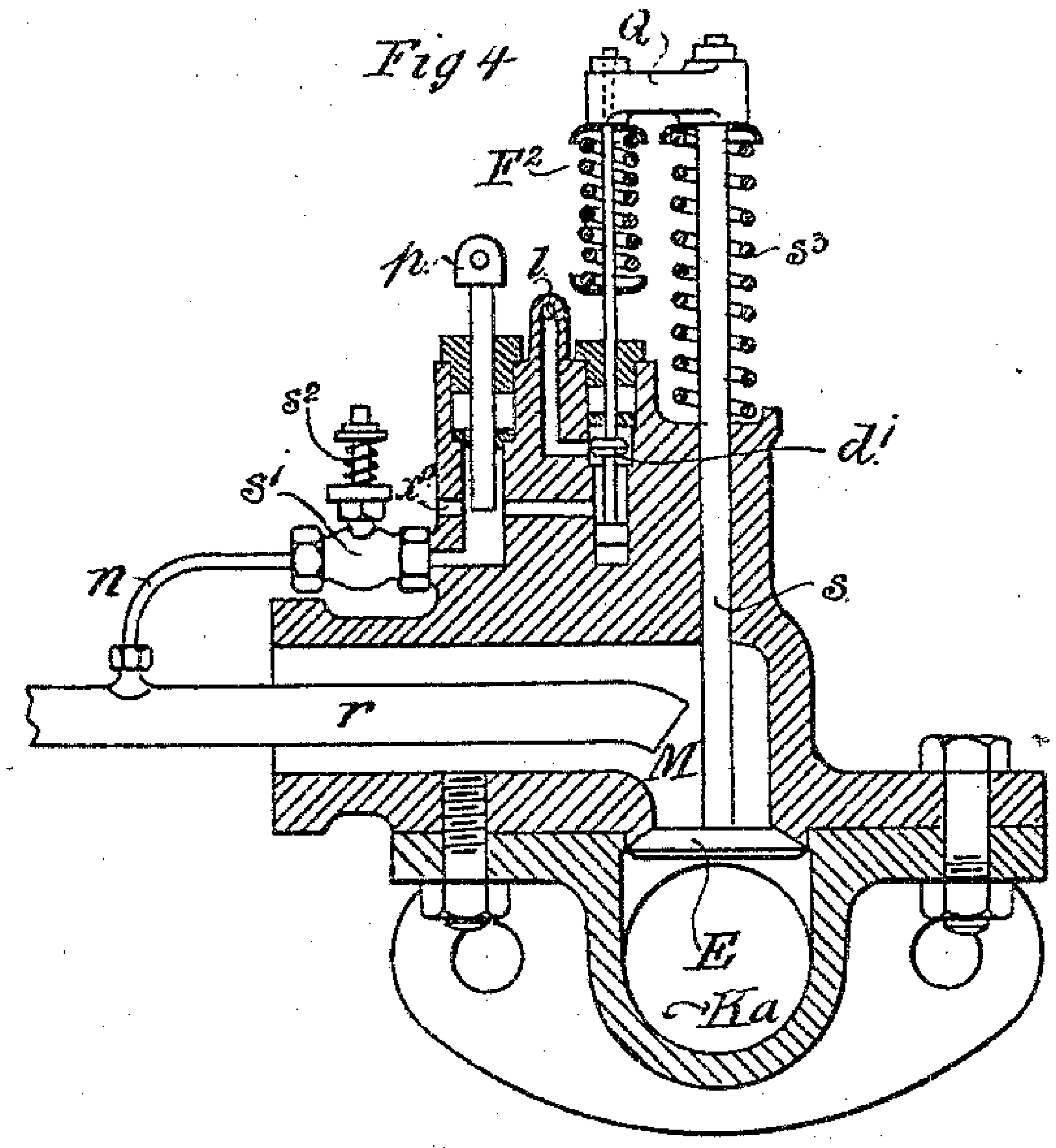
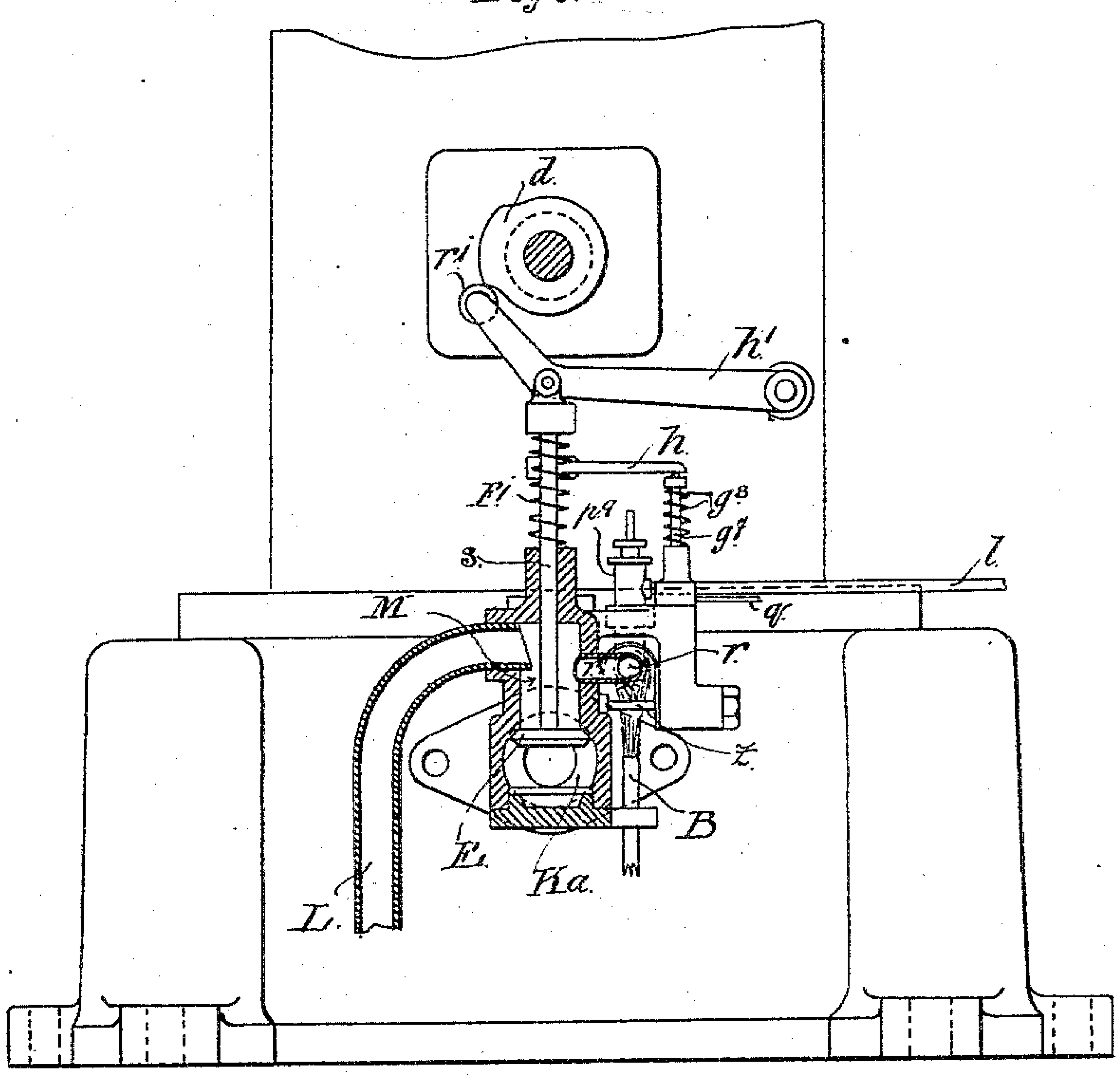


Fig 3.



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PETROLEUM MOTOR.

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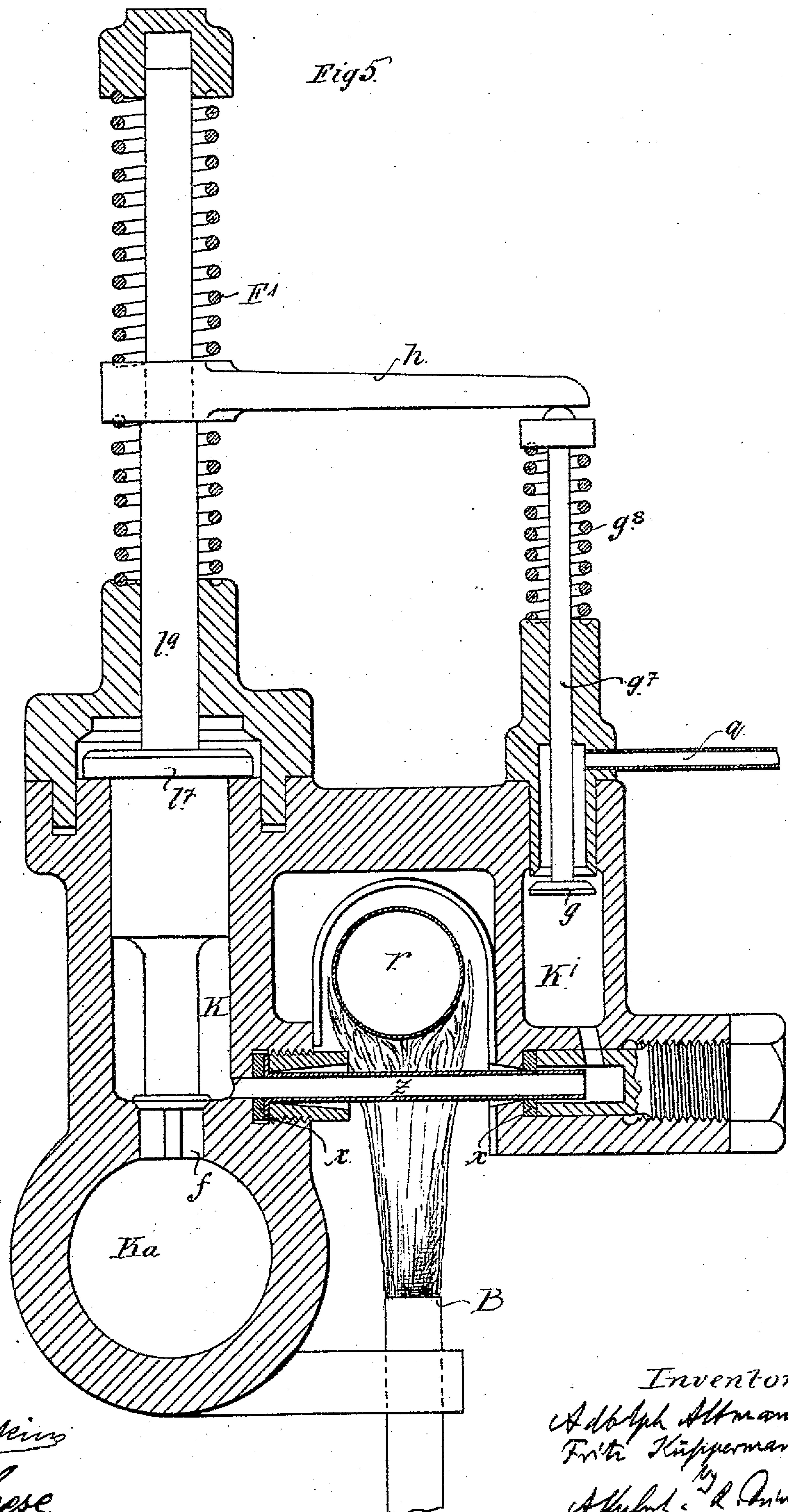

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UNITED STATES PATENT OFFICE.

ADOLPH ALTMANN AND FRITZ KÜPPERMANN, OF BERLIN, GERMANY.

PETROLEUM-MOTOR.

SPECIFICATION forming part of Letters Patent No. 412,228, dated October 8, 1889.

Application filed April 24, 1889. Serial No. 308,460. (No model.) Patented in France November 6, 1888, No. 193,948.

To all whom it may concern:

Be it known that we, ADOLPH ALTMANN and FRITZ KÜPPERMANN, both subjects of the King of Prussia, German Emperor, and residents of Berlin, in the Kingdom of Prussia, German Empire, have invented certain new and useful Improvements in Petroleum-Motors, (for which we have received Letters Patent in France, November 6, 1888, No. 193,948,) of which the following is a clear specification.

Our improved petroleum-motor described in the following specification and illustrated in the accompanying drawings works in the well-known "four-movement" manner of Beau de Rochas by means of a piston and high compression of the mixed petroleum-gas and air drawn into the explosion-chamber by suction; but instead of exploding this mixture by compression we introduce into the machine an igniting-tube, which causes a more complete explosion and removal of the waste products of the same from the machine. In addition to this we have an arrangement for regulating the power of the motor by means of governors and for cooling the explosion-chamber with water.

The well-known actions which take place in this class of four-movement motors are described, briefly, in the following: First, first upward movement of the piston, suction of the mixed air and petroleum-gas; second, first downward movement of the piston, compression of the mixed air and gas sucked in and explosion of the same shortly before the piston reaches the dead-point; third, second upward movement of the piston, power generated by the explosion of the mixture of petroleum gas and air; fourth, second downward movement of the piston, expulsion of the waste products of the explosion. While, therefore, the crank-shaft is making two complete revolutions in one working period through the gearing of the bevel-wheels the slide-valve makes only one movement.

The petroleum-motor has the following parts: First, a mechanical arrangement for vaporizing the petroleum, which boils at a high temperature; second, an arrangement for regulating the power of the motor by means of the working of the governors on the inlet-valve eccentric; third, an arrangement for exploding the mixture; fourth, an arrangement for driving the pump; fifth, an arrangement of an explosion-chamber having a cooling-jacket and an igniting-tube having no cooling-jacket; sixth, a cooling-jacket for the whole cylinder. These six parts will be exactly described in the following.

In order to make the description more clear, reference is made to the accompanying drawings, in which similar letters denote similar parts throughout the several views.

Figure 1 is a vertical section through the middle of the motor on line α β, Fig. 2. Fig. 2 shows a section on line γ δ in Fig. 1. Fig. 3 is a side elevation, partly in section, along line ε ζ in Fig. 2. Fig. 4 shows the arrangement of the suction-valve when a petroleum-pump is used, drawn to a larger scale. Fig. 5 is a section showing the igniting-tube and outlet-valve drawn to a larger scale.

The arrangement for vaporizing the petroleum is shown in detail in Figs. 3 and 5. Situated under and partly surroundedby the inlet-valve of the motor is the vaporizing-chamber *r*. This chamber is so situated that it can be heated by the same flame B which heats the igniting-tube *z*. The pipe *n*, coming from the suction or regulating valve p^9, joins the pipe *r* in larger motors, where a petroleum-pump *p*, Fig. 4, is substituted for this valve. The valve p^9 receives its supply of petroleum through the pipe *l*, which connects it with a petroleum-tank. When, now, the piston by its upward movement causes a vacuum in the explosion-chamber *v*, and the valve E, leading into K^a and *v*, is open, a certain fixed quantity of petroleum coming from the supply-pipe *l* will be sprinkled into the vaporizing-pipe *r*, through the valve p^9. This quantity will be converted into vapor in the chamber *r*, and sucked as such, together with the air coming through pipe L, through the mixing-chamber M and K^a into the explosion-chamber *v*. It will enter the chamber *v* as an explosive mixture. During the compression, expansion, and exhaust periods the heat which the vaporizing-chamber has lost in vaporizing the petroleum will be replaced by the flame B.

In order that the motor, in consequence of the petroleum vaporized, may not run at too high a speed for the amount of work to be done, a regulation of the power generated is provided for. The cam d, which works the valve E, Figs. 1 and 3, is connected by the angle-lever e e with the governor in such a manner that when the number of revolutions per minute increases, the collar which is attached to the governor sinks down, taking with it the short arm of the angle-lever e e. The longer arm will in consequence be pushed toward the left in Fig. 1, carrying with it the cam d, so that the left-hand side, Fig. 1, of the roller r' on the valve-rod s of the valve E passes the cam d without being influenced by the same, and the valve E remains closed. In this case neither air nor petroleum-gas will be sucked into the explosion-chamber, and the puffing out of the waste products ceases until the number of revolutions has sunk slightly under the normal, when the collar of the governor will again rise, taking with it the angle-lever e e, which then pushes the cam d to the right, and in consequence places it again in connection with the spindle of the valve E.

The exploding arrangement shown in Fig. 5 consists, principally, of a porcelain or metal pipe z in open connection with the chambers K and K′. This pipe should be insulated as well as possible by means of asbestus, as shown in Fig. 5 at x x. The pipe z is heated by means of an oil-gas Bunsen burner B. The exploding of the compressed mixture takes place immediately before the piston has reached its dead-point. The explosion is caused by the raising of the valve f either through the working of the spring F′ or from the inside pressure, whereby the valves l^7 and g open inside and shut against the outside. They are caused to shut more tightly against the outside after the explosion has taken place by the pressure of the gases. The exploding of the mixture is absolutely certain, because any air or waste products which may have been present in the pipe z have been pressed into the chamber K′, so that only the good explosive mixture coming from K and K^a will be exploded. Immediately after the explosion has taken place the valves are moved so that the valve f is held shut from the beginning of the suction period to the end of the compression period by the pressure of an eccentric on the spring F′. During this time the valve g is open, and thus the chambers K′ and K and the igniting-tube z are placed in open connection with the air outside.

In the case where a pump is used instead of the regulating-valve p^9 the suction-valve of the pump is precisely regulated and governed, as shown in Fig. 4. The rod s of the valve E is connected by a cross-piece Q with the rod of the suction-valve d' in such a manner that when the valve E is open the suction-valve d' is shut and pressed by the spring F^2, which is pressed together by the cross-piece Q to the extent of the difference between the hubs of the two valves E and d'. In this case the plunger of the pump will drive the petroleum coming from the supply-pipe l through valve d' into the vaporizing-chamber r. In the case of the regulation of the power generated, as described above, the valve E remains shut, and in consequence the valve d' will remain open and the oil will be pressed back into the supply-pipe l.

It must be remarked here that the delivery-valve of the pump must be balanced with a spring to a little more than the weight of liquid column standing over the level of the pump o.

In Fig. 1 the explosion-chamber v is shown with a cooling-jacket W. The sides of the chamber K^a and the valve-seat E are not cooled. The vaporizing-pipe r is fixed to the inlet-valve E in such a manner that it may be heated by the same flame B, which heats the igniting-tube z. The cylinder C of the motor has also a cooling-jacket W′, which is, however, separated from that of the explosion-chamber. The cooling-water enters the cylinder-jacket through the pipe d^2, and flows out after having circulated round the cylinder at outlet-pipe b c.

At b is a three-way cock P. This cock can be so regulated that the cooling-water flows either direct from the cylinder-jacket W′ as waste or it may be made to flow out of the jacket W′ into the cooling-jacket W of the explosion-chamber through pipe C^9, and then to flow off through pipe C^7 as waste.

The advantage gained from having separate cooling-jackets for the cylinder and explosion-chamber is that it is possible to conduct off the heat which collects in the explosion-chamber either through the metal mass or by means of cold water.

By the combination in an explosion-chamber of a cooled part V and non-cooled part K^a the explosion-chamber is divided into a hot and cold zone. The igniting-tube z can be heated by the flame B before the motor is started. At first the motor should be started with the explosion-chamber v uncooled, and then this chamber can be afterward gradually cooled, according as the increasing heat originating from the successive explosions may demand.

The principal point in our improvements is that the smallest motors may be worked at the usual speed without the danger of any explosion by compression taking place on account of the cooling of the explosion-chamber, while the exploding of the mixed petroleum vapor and air is caused by the igniting-tube z and K^a in such an energetic manner that a complete oxidation of the mixture is effected, and thus the clogging of the inside of the apparatus with waste products of the explosion is totally avoided. In addition to this the heaviest sorts of petroleum (those kinds boiling at a very high temperature) are easily vaporized in the vaporizing-chamber r, and may with equal convenience be used for driving this motor.

Having thus fully described our invention, what we claim as our invention, and desire to secure by Letters Patent in the United States, is—

1. An exploding-chamber v, with the cooling-jacket W separated from the cooling-jacket W′ of the cylinder C, in combination with the non-cooled tube K^a, provided with the valve E, and with the mixing-chamber M, provided with the air-inlet L, and the vaporizing-chamber r, bearing the tube n for the petroleum, for the purpose described.

2. An exploding-chamber v, in connection with a tube K^a, provided with the valve E and with the chamber K, having the valves f and l^7, and the igniting-tube z, the latter being in connection with the outlet-valve g, in combination with the mixing-chamber M, having an air-suction inlet L and a vaporizing-chamber r, the latter being heated by a flame and being in connection with a tube guiding the fluid into the vaporizing-chamber r, for the purpose described.

3. The combination of an explosion-chamber v, having a water-cooled jacket, with chamber K^a, having valve E, governed by a governor P′ by means of bent lever e e, cam d, roller r', connecting-piece h', valve-rod s, and spring s^3, valve E, connecting chamber K^a with mixing-chamber M and vaporizing-chamber r, which receives its petroleum-supply through regulating-valve p^9 from supply-pipe l, K^a further connected by means of valve f and chamber K with igniting-tube z, in the manner and for the purpose substantially as described.

4. The combination of a non-cooled chamber K^a, adjoining the water-cooled explosion-chamber v, having a valve E opening into the mixing-chamber M and vaporizing-chamber r, and igniting-tube z, with a petroleum-pump p, having a suction-valve d', connected by a spring F^2 and cross-piece h with the valve-rod s and spring s^3, and a delivery-valve s', balanced by a spring s^2, in the manner and for the purpose substantially as described.

5. The combination of the non-cooled chamber K^a, having a valve f, connecting it with the igniting-tube z, a valve l^7, valve-rod l^9, spring F′, cross-piece h, with the chamber K′, having outlet-valve g, valve-rod g^7, and spring g^8, and with a water-cooled explosion-chamber v, in the manner and for the purpose described.

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

ADOLPH ALTMANN.
FRITZ KÜPPERMANN.

Witnesses:
B. ROI,
THEODOR HEESE.