No. 626,022. Patented May 30, 1899.

I. B. HAMMOND.

ENGINE.

(Application filed Jan. 23, 1897.)

(No Model.) 2 Sheets—Sheet 1.

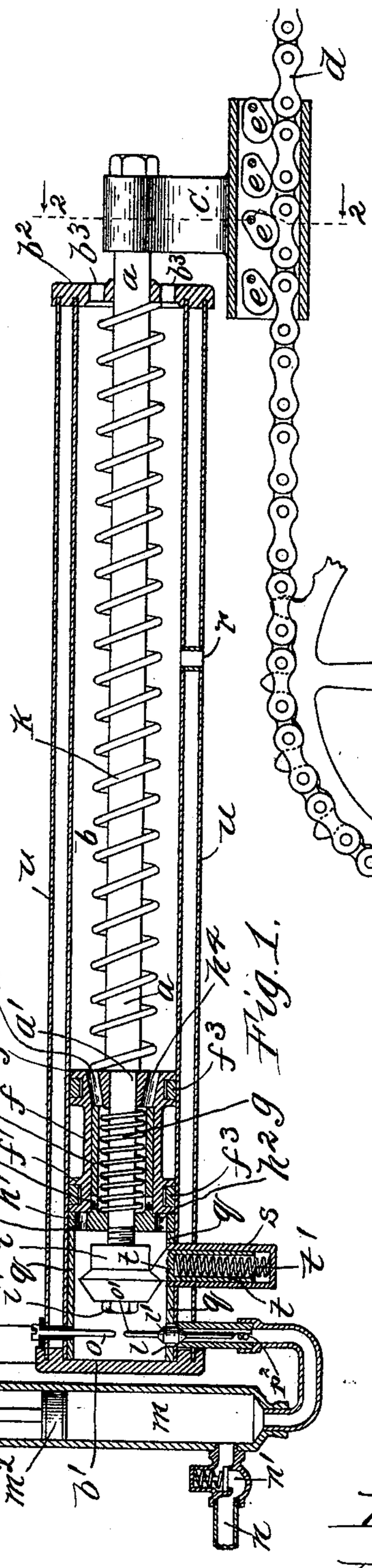

Fig. 1.

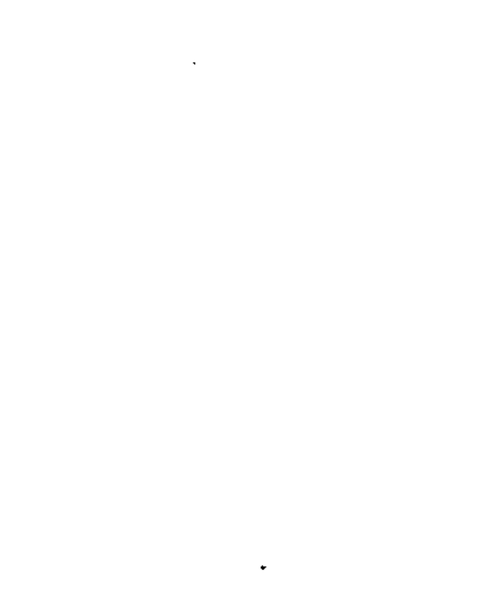

Fig. 2.

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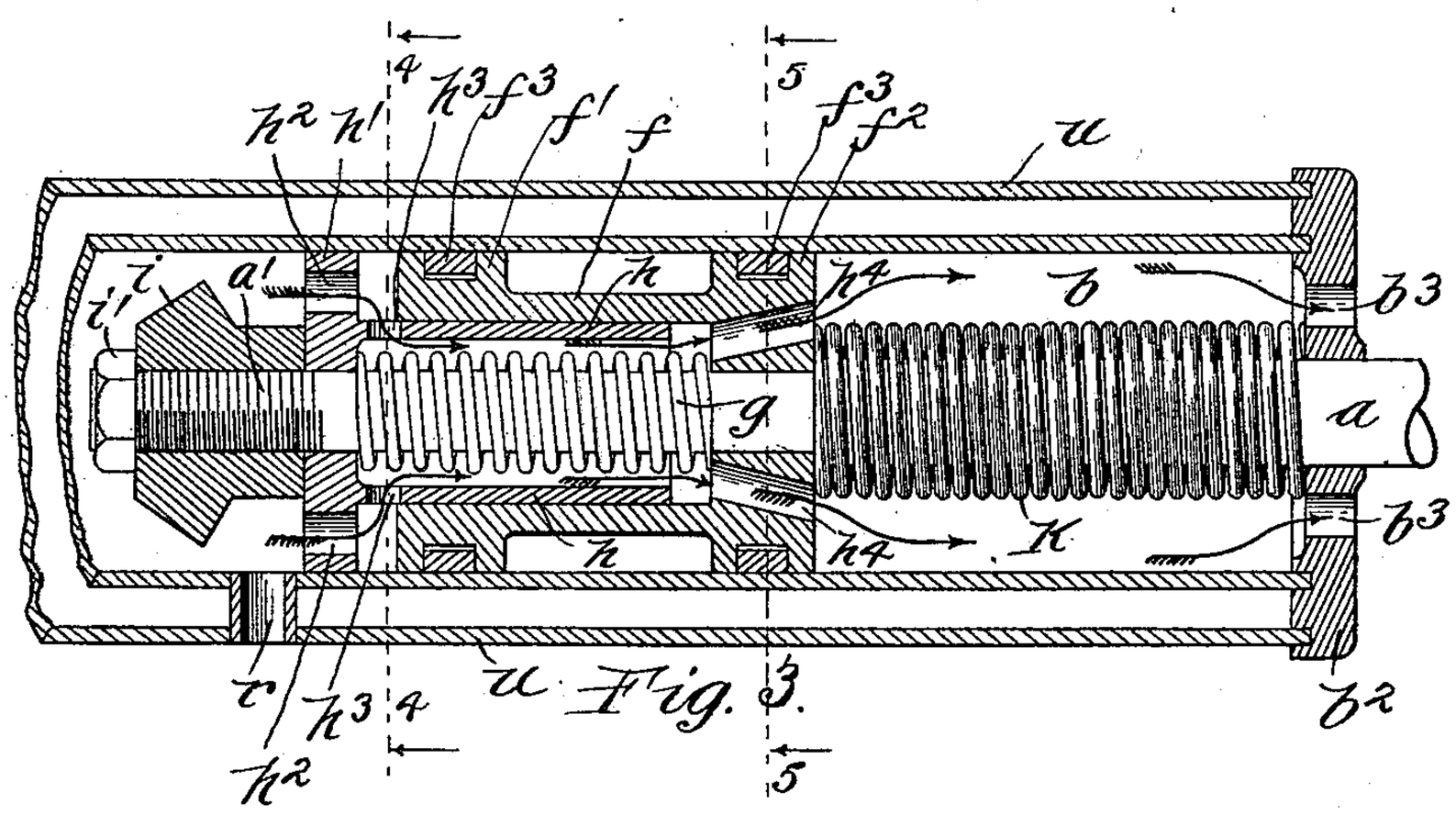

Fig. 3.

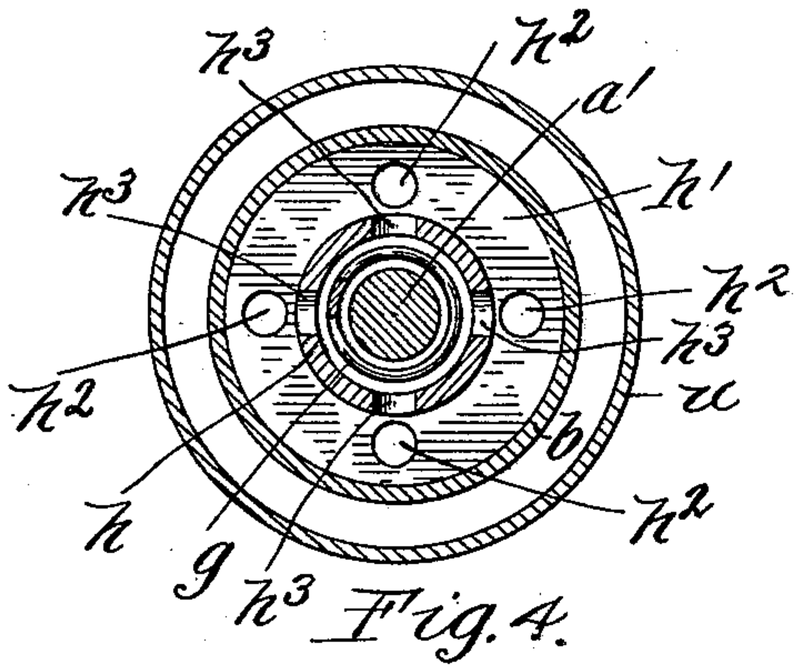

Fig. 4.

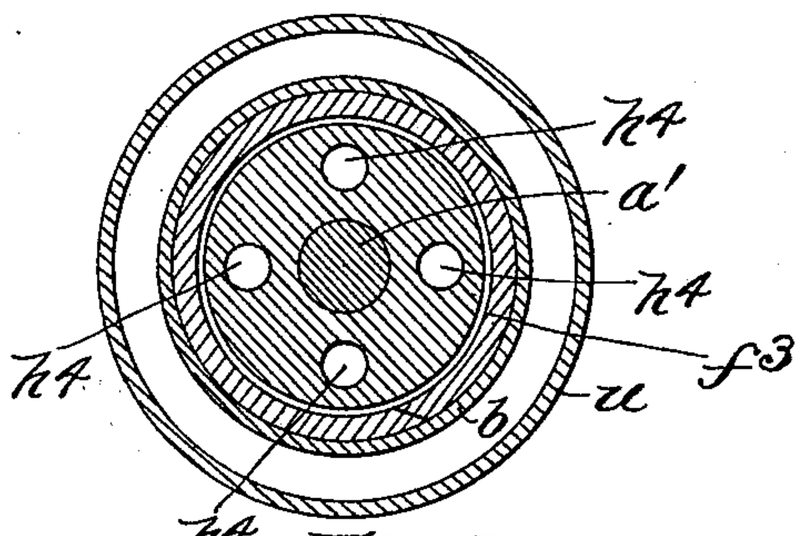

Fig. 5

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UNITED STATES PATENT OFFICE.

ISAAC B. HAMMOND, OF PORTLAND, OREGON.

ENGINE.

SPECIFICATION forming part of Letters Patent No. 626,022, dated May 30, 1899.

Application filed January 23, 1897. Serial No. 620,424. (No model.)

To all whom it may concern:

Be it known that I, ISAAC B. HAMMOND, a citizen of the United States, residing at Portland, in the county of Multnomah and State of Oregon, have invented a certain new and useful Improvement in Engines, (Case No. 1,) of which the following is a full, clear, concise, and exact description, reference being had to the accompanying drawings, forming a part of this specification.

My invention relates to that class of engines or motors in which the power is generated by the explosion of gas—as, for example, naphtha or any suitable gas, being forced into the exploding-chamber, may be ignited or exploded by means of the electric spark or otherwise.

My invention contemplates that the explosion of the gas will store up, in the form of compressed springs or air or otherwise, energy in such form as to be readily applied by suitable mechanical means, as gears and sprocket-chains, to do the work required.

My invention or motor I have designed especially for use in connection with motor-cycles, though it will be apparent that the principal features thereof may be readily adapted to many analogous uses.

The principal and novel features of my invention may be stated in a general way to consist in a cylinder and piston, valves connected therewith, and an explosion-chamber so arranged and combined that the user may at will ignite charge after charge of gas in the explosion-chamber to reciprocate the piston and the piston-rod connected therewith to do the work required.

In my motor the cylinder and valves are so constructed and arranged that when an explosion takes place the piston-rod is forced forward against the tension of a spring, and as its forward stroke is completed vents provided in the valve are opened, so that the piston under spring-pressure may be forced back to its first position unobstructed.

My invention further relates to certain details of construction which will be hereinafter more particularly described.

My invention will be more readily understood by reference to the accompanying drawings, in which—

Figure 1 is a sectional elevation of a motor constructed in accordance with my invention, the motor being shown in operative relation with a sprocket chain and wheel. Fig. 2 is a sectional view thereof on line 2 2 of Fig. 1. Fig. 3 is a detail sectional view of a portion of the motor, showing the piston-valve mechanism. Fig. 4 is a sectional view on line 4 4 of Fig. 3. Fig. 5 is a sectional view on line 5 5 of Fig. 3.

Like letters refer to like parts parts throughout the different figures.

A reciprocating piston-rod or plunger a is mounted to travel in a cylinder b, having end plates b' b^2, the latter end plate being provided with a central hole, which fits the piston-rod and which guides it in a rectilinear path. The end of the rod a that projects outside of the cylinder carries a guide c, through which a belt or sprocket-chain d passes. Mounted upon the interior of the guide c I provide a series of pawls e e, which are so mounted as to escape engagement with the sprocket-chain when the piston-rod is traveling outward from the cylinder, but which engage the sprocket-chain upon the return stroke of the piston to impart longitudinal motion to the chain and rotary motion to the sprocket-wheel engaging the same. The sprocket-wheel may in turn be connected with any suitable mechanism to which it is desired to transmit rotary motion, as the working shaft of a motor-cycle.

The inner end of the piston-rod a is provided with a stem a', upon which is mounted the piston f. This piston is provided with two circular portions f' f^2, the latter of which is fitted tightly upon said stem. These circular portions are provided with annular recesses, which receive packing-rings f^3 f^3 of well-known construction for the purpose of preventing leakage between the cylinder and piston. The body portion of the piston is made in the form of a cylinder surrounding the stem a', an annular space intervening between the interior wall of the piston and the stem of sufficient size to accommodate a helical spring g, which surrounds the stem, and a cylindrical plunger h, removed a sufficient distance from the helical spring to provide for clearance. The cylindrical plunger h is provided with a circular end plate h', having a central bore, which permits of the free reciprocation of the stem through the same. The free end of the stem a' is threaded, an

adjustable cap-nut i, preferably of the form shown, being screwed upon the stem. A set-nut i' is provided to secure the adjustment of nut i. The spring g tends, under conditions which will be hereinafter set forth, to thrust the cylindrical plunger h outwardly from the piston. The adjustable nut i is provided to limit the outward thrust of the plunger.

I provide a helical spring k between the piston and end plate b^2, which surrounds the piston-rod a, which when relieved of opposing force places the piston in the position shown in Fig. 1. When it is desired to reciprocate the plunger to the right, pressure is exerted upon the piston to counteract the force of spring k. The preferred means for exerting this pressure will be set forth hereinafter. As the piston is advanced the spring k is compressed, energy thus being accumulated therein. When the piston is relieved of pressure, the spring k returns the same and the piston-rod to the position shown in Fig. 1. The pawls e e, carried by the guide c, engage the sprocket-chain d preferably upon the return stroke of the piston and rod, said chain being thus advanced and rotary motion contributed thereby to the sprocket-wheel.

I provide an inlet l between the end plate b' and the piston, through which the explosive gas or element is admitted. This inlet communicates with the bottom of a pump m. A duct n, leading from a supply of fuel, preferably naphtha, is let into the bottom of the pump-barrel.

The plunger m' of the pump carrying the piston m^2 may be operated in any suitable manner, preferably in the case of motor-cycles or similar vehicles by the foot of the rider, a stirrup m^3 upon the upper end of the plunger being provided to receive the foot.

A check-valve n' is provided in the duct n, adapted to admit the fuel into the pump-barrel when the piston m^2 is ascending. When said piston is forced down, the valve n' is closed and the fuel previously admitted to the same is forced through the inlet l. The inlet l is provided with a check-valve l', constructed to permit the passage of fuel from the inlet to the portion of the cylinder b between the piston thereof and the end plate b' when the plunger m' is descending. When the fuel within the pump-barrel and inlet l is relieved of pressure exerted thereon by the piston m^2, the check-valve l' prevents the fuel previously admitted to the cylinder b from returning.

To ignite the fuel within the cylinder, I preferably provide an electric sparking device, which consists, preferably, in a fixed contact o and a movable contact o', carried by or formed of the check-valve l', which constitute the electrodes of a circuit p, including the battery p'. A flexible connection or wire p^2 electrically connects the valve l' with the valve-seat. As the fuel is being forced within the cylinder b the electrodes o and o' are brought into contact to complete the circuit p. When the check-valve l' is seated, which occurs when the plunger m^2 has descended to its lower limit, a spark is established between the electrodes, which ignites the fuel within the chamber.

Where liquid fuel is employed, such as naphtha, it may be desirable to intermix a quantity of air with the naphtha to produce a highly-explosive gas. This may be accomplished in any well-known way, as by the provision of a valve in the pipe n between the source of fuel-supply and the pump, the valve being constructed to admit air to the pipe n as the piston ascends and to be closed when the piston descends in a well-known manner. This gas is ignited by the spark established upon the separation of the electrodes o o'. The gas upon being ignited is exploded and thereupon drives the piston and piston-rod toward the end b^2 of the cylinder, the spring k being thereby compressed. After the piston and rod have been thus advanced the gas between the end plate b' and the piston is exhausted, as will be presently set forth, permitting the spring k to return the piston and rod to their initial positions, whereupon the chain d is impelled, as before set forth.

I provide an annular stop q to limit the piston and its rod in their return stroke.

I will now describe the means that I preferably employ for exhausting the gas within the cylinder.

Four apertures h^2 h^2 are preferably provided in the end plate h', which are adapted under certain conditions to communicate with apertures h^3, formed in the cylindrical plunger h near the end plate h'. The space within the plunger is made to communicate with that portion of the cylinder between the piston and end plate b^2 through the medium of sloping apertures h^4 h^4. The stop q serves to force the plunger h within the piston to bring the portions h' f' together, whereby the apertures h^2 h^3 are closed, so that the gas admitted to the cylinder cannot escape when admitted. After ignition the pressure of the gas upon the end plate h' prevents the spring g from thrusting the plunger h outwardly during the travel of the piston. When, however, the piston has traveled to its limit toward plate b^2, an exhaust r becomes interposed between the piston and plate b', and the spring, momentarily relieved of the pressure of the gas, thrusts the plunger h into the position shown in Fig. 3, so that during the return stroke of the piston through the agency of spring k the gas displaced will find vent through the apertures h^2 h^3, the bore of plunger h, apertures h^4 h^4, and apertures b^3 b^3, provided in the end plate b^2.

I provide a tubular guide s, in which is placed a cylindrical pawl or detent t, within which is placed a helical spring t', which thrusts the pawl t upwardly. This pawl is adapted to engage the nut i when the parts occupy the position shown in Fig. 1 to pre-

vent the pressure exerted by the pump from prematurely advancing the piston. When, however, an explosion occurs, the engagement of the pawl with the nut *i* is insufficient to prevent the stroke of the piston.

I provide a cylindrical jacket *u* about the cylinder *b*, between which and the cylinder water or other cooling agency is confined for the purpose of reducing the heat generated in the operation of the motor.

It is obvious that changes in details of construction may readily be made in the apparatus of my invention, and I do not therefore desire to be limited to the precise construction shown.

It is obvious that my invention may be applied to other purposes than that described.

I have particularly set forth herein one type of apparatus embodying my invention; but

I claim, and desire to secure by Letters Patent, all such modifications and adaptations of my invention as may be made by those skilled in mechanics, the following:

1. In a motor, the combination with a cylinder, of a piston adapted to reciprocate therein and operatively connected with mechanism to be actuated, means for admitting gas or fuel under pressure to said cylinder, a detent adapted to maintain the piston at one end or portion of its stroke while the gas is being thus admitted, and means for igniting the gas in the cylinder, the detent being adapted to be disengaged from the piston upon the pressure of the gas within the cylinder being increased upon its ignition, substantially as described.

2. In a motor, the combination with a cylinder, of a piston adapted to reciprocate therein, a support *c* actuated by the piston, a pawl *e* carried by the support, a chain or belt *d* adapted to be engaged by the pawl, means for admitting gas or fuel under pressure to said cylinder, a detent adapted to maintain the piston at one end or portion of its stroke while the gas is being thus admitted, and means for igniting the gas in the cylinder, the detent being adapted to be disengaged from the piston upon the pressure of the gas within the cylinder being increased upon its ignition, substantially as described.

In witness whereof I hereunto subscribe my name this 16th day of January, A. D. 1897.

ISAAC B. HAMMOND.

Witnesses:
GEORGE P. BARTON,
JOHN W. SINCLAIR.