(No Model.)

2 Sheets—Sheet 1.

G. JORANSON.

GAS ENGINE.

No. 574,610. Patented Jan. 5, 1897.

Fig. 1

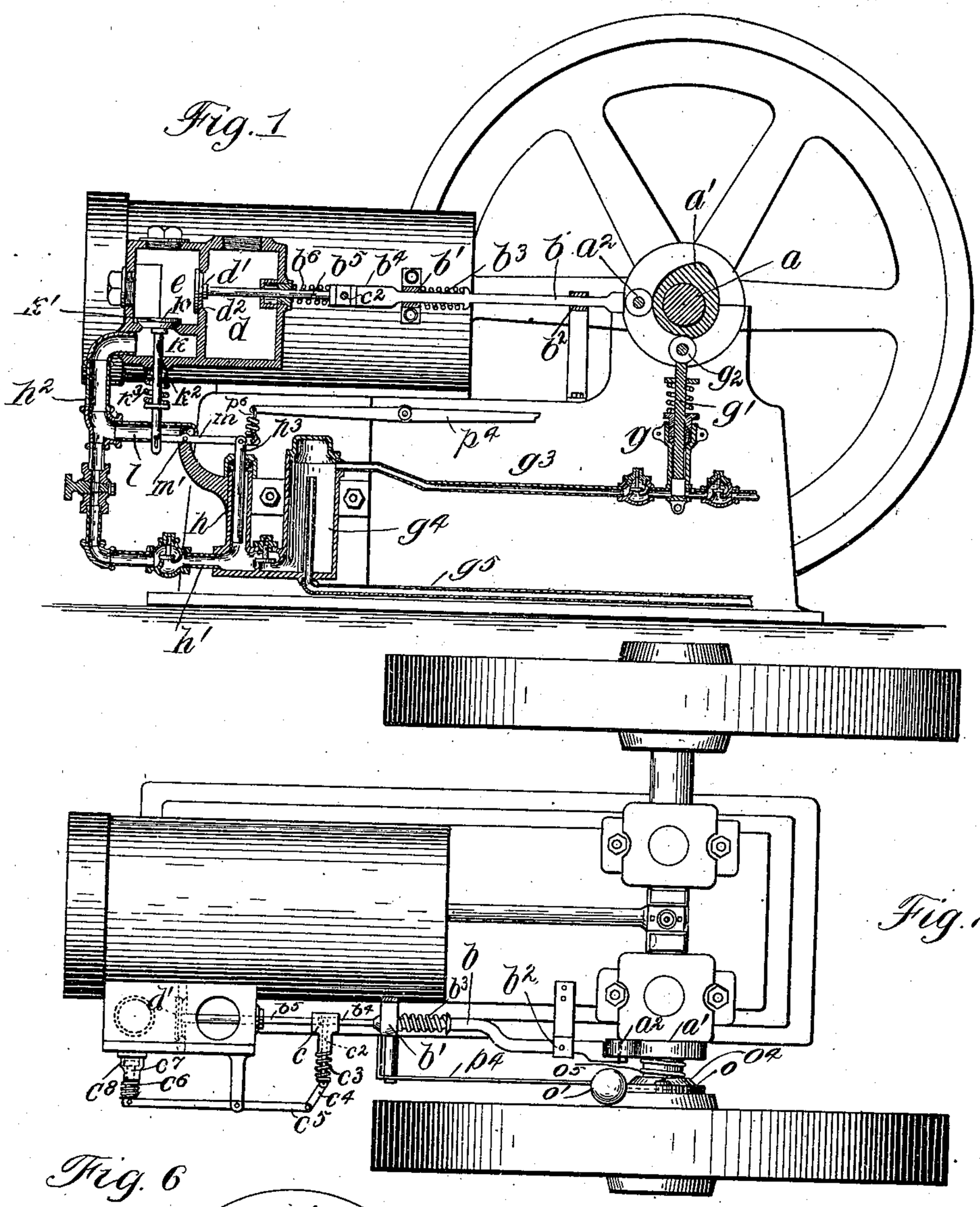


Fig. 2.

Fig. 6

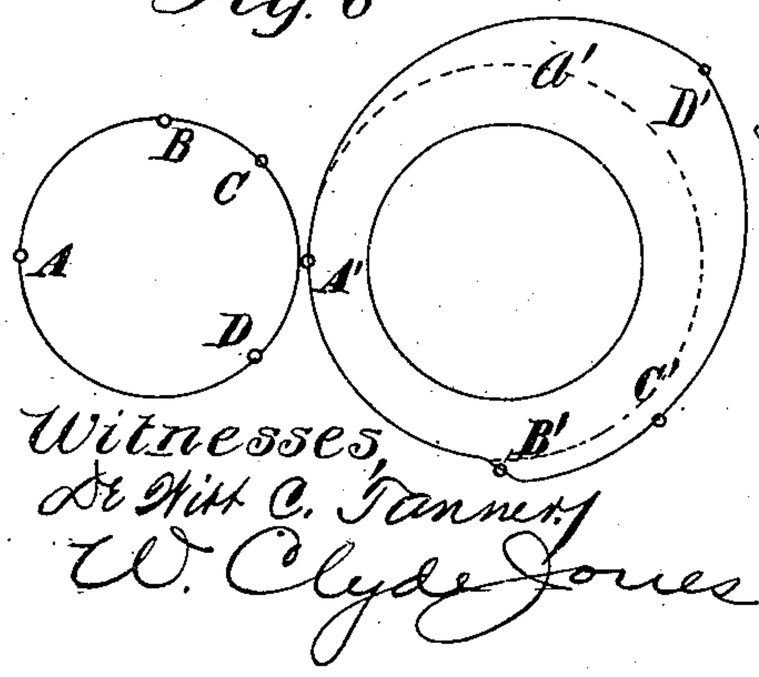


Fig. 7

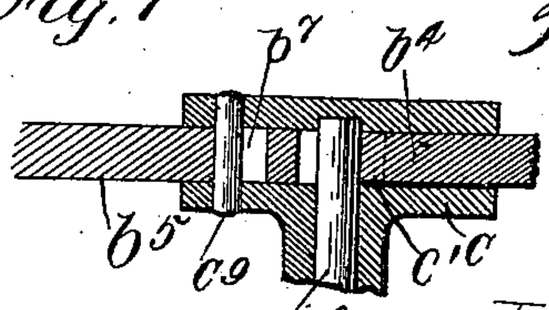
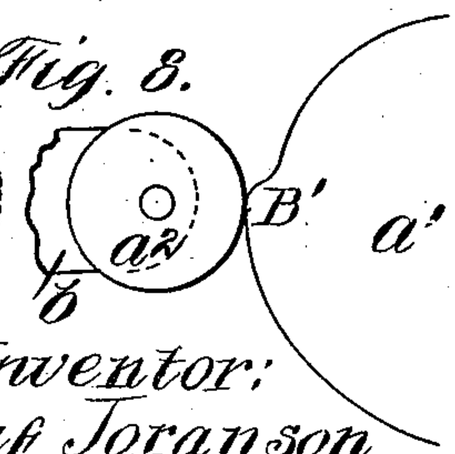


Fig. 8.



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(No Model.) 2 Sheets—Sheet 2.

G. JORANSON.

GAS ENGINE.

No. 574,610. Patented Jan. 5, 1897.

Fig. 3

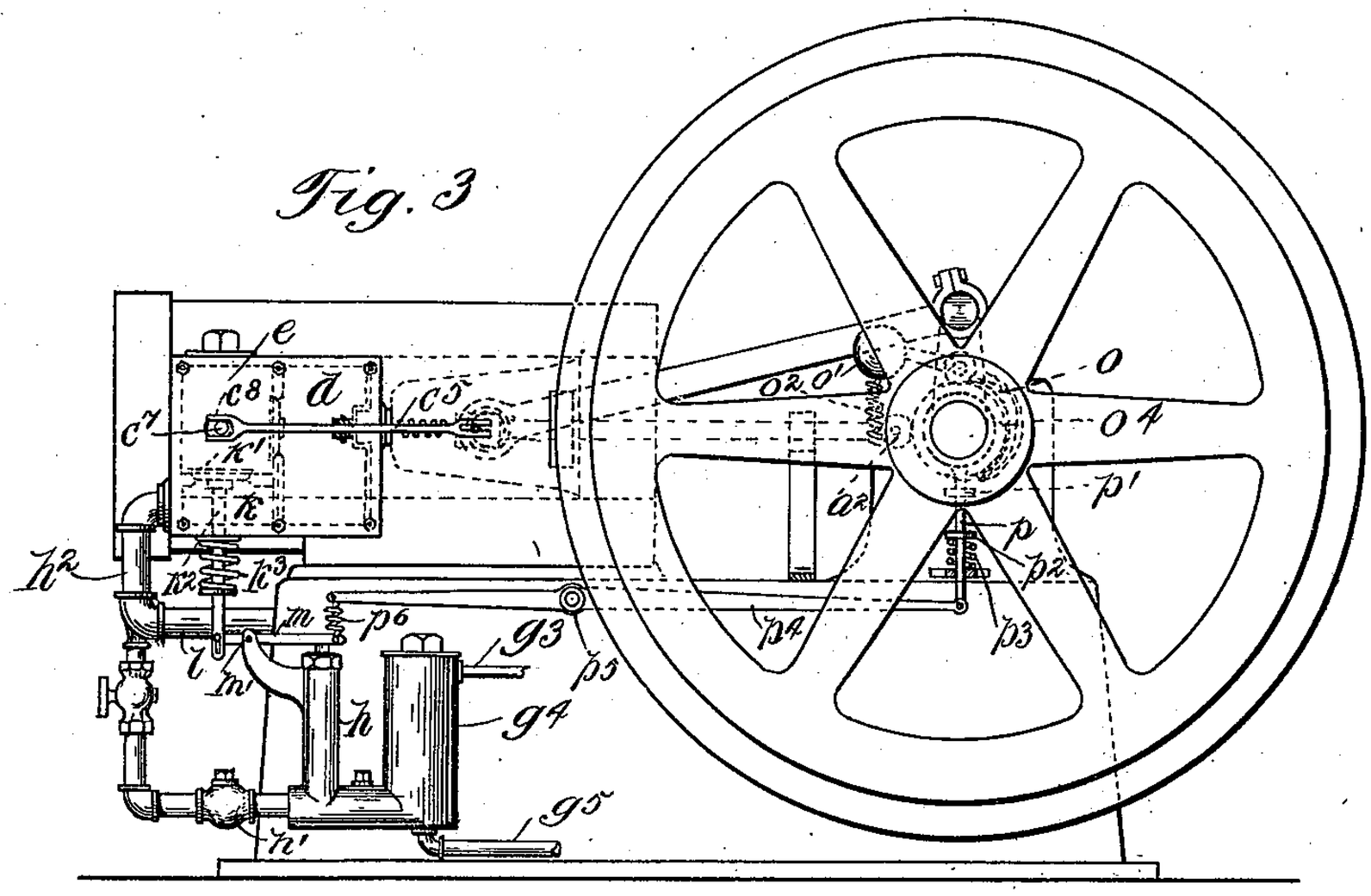


Fig. 4

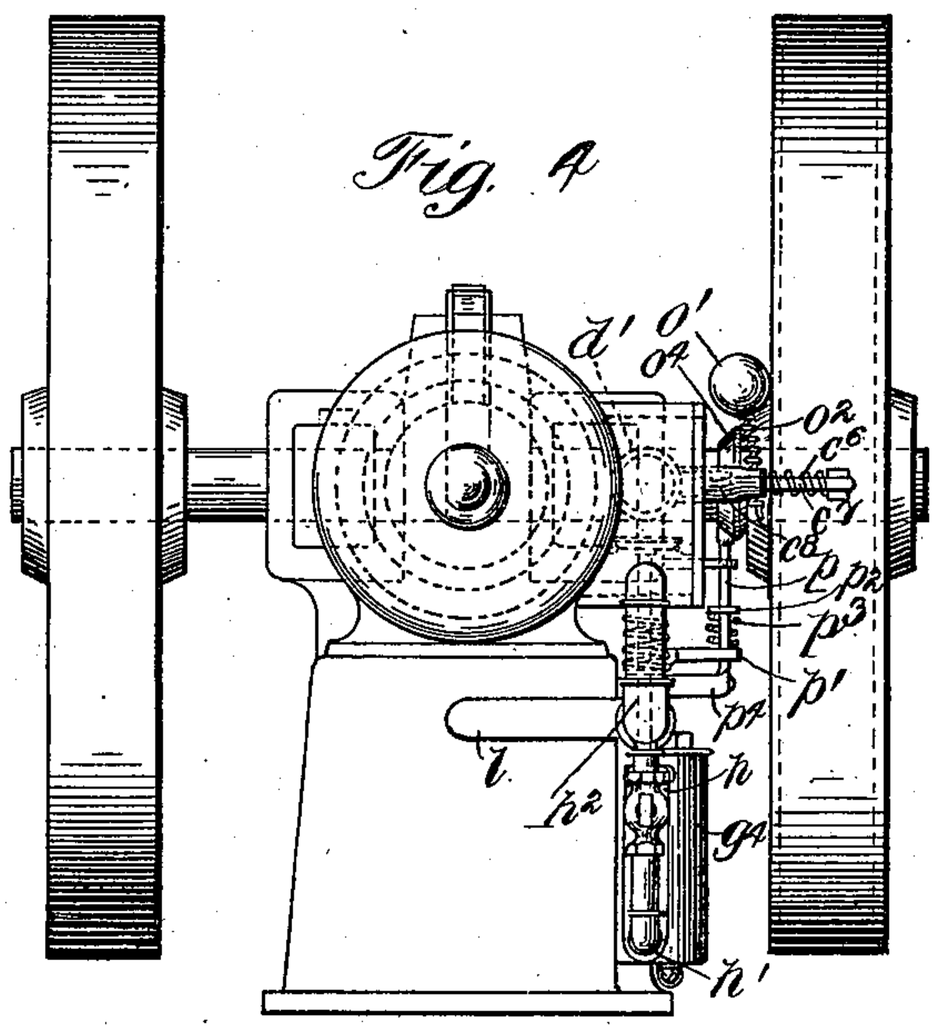


Fig. 5.

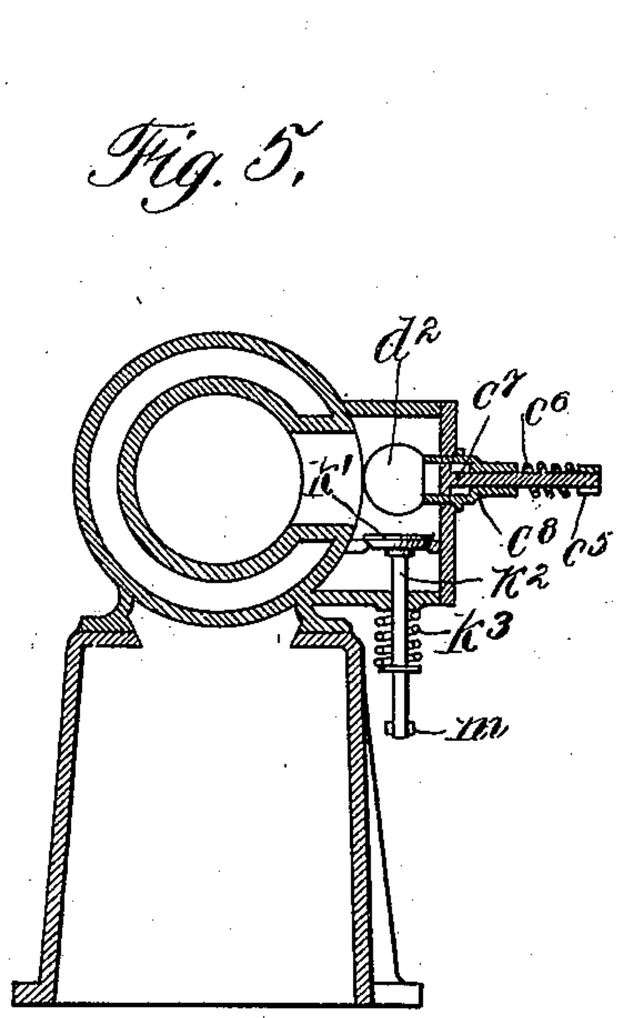


Fig. 9.

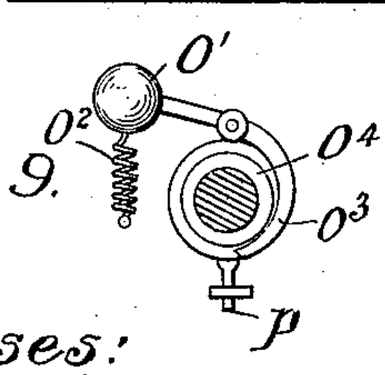
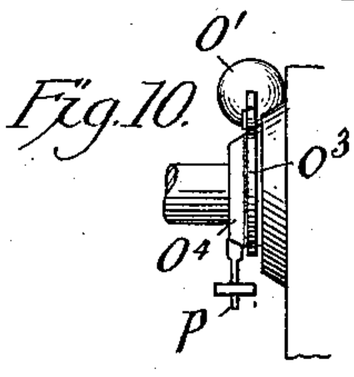


Fig. 10.



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UNITED STATES PATENT OFFICE.

GUSTAF JORANSON, OF BERWYN, ILLINOIS.

GAS-ENGINE.

SPECIFICATION forming part of Letters Patent No. 574,610, dated January 5, 1897.

Application filed September 20, 1895. Serial No. 563,053. (No model.)

To all whom it may concern:

Be it known that I, GUSTAF JORANSON, a citizen of the United States, residing at Berwyn, in the county of Cook and State of Illinois, have invented a certain new and useful Improvement in Gas-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 a gas or oil engine, my object being to provide means for opening and closing the exhaust-valve, and, furthermore, to provide a pump adapted to be actuated at proper intervals to force the oil into the ignition or mixing chamber.

In gas-engines, as usually constructed, a working stroke occurs only during each alternate cycle, an explosion taking place, which drives the piston forward, the return stroke of the piston being utilized to eject the exploded gas from the cylinder, while a second stroke creates a suction to draw a fresh supply of gas and air into the cylinder, the explosion taking place upon the subsequent return of the piston to the initial position. Since the exhaust-valve must be opened only on each second stroke, some means for causing the opening of the valve once during each two strokes must be provided, and it has been usual to employ gear-wheels for securing the proper movement.

It is the object of my invention to secure the opening of the exhaust-valve at the proper time without the employment of gear-wheels, which are troublesome and hard to keep in repair, and I utilize the pressure within the cylinder for effecting, through intermediate mechanism, the opening of the exhaust-valve.

In the preferred form of my invention I employ a cam mounted upon the main shaft of the engine, the cam being adapted to engage a roller carried upon the end of the longitudinally-moving valve-rod, which carries the exhaust-valve. The valve-rod is made in two parts, the one carrying the roller being adapted to continuously move to and fro, while the part carrying the valve remains normally at rest, being moved only when a pin or projection is inserted between the two parts, whereby the longitudinal movement of the part carrying the roller is imparted to the portion upon which the valve is mounted. In order to secure the interposition of the pin or projection between the two parts of the valve-rod at the proper moment, the pin is connected, through intermediate lever mechanism, with a small piston adapted to move in a cylinder which communicates with the main cylinder of the engine, so that when the piston nears the end of its travel the valve-operating piston is moved forward, due to the compression within the cylinder, thus thrusting the pin between the two parts of the valve-rod, so that as the valve-rod is moved longitudinally the exhaust-valve is opened at the proper time to permit the escape of the exploded gases. I also utilize the varying pressure within the cylinder of the engine for operating the pump which forces the oil into the ignition-chamber. An admission-port is provided through which the air and oil are admitted into the mixing-chamber, the port being normally closed by a valve, which, when a partial vacuum is formed within the cylinder as the piston moves forward, is drawn from its seat by the suction, thus opening the port for the admission of the air and oil. The plunger of the pump is connected with the valve, so that as the valve moves, due to the suction, the plunger is thrust into its barrel to force the oil into the ignition-chamber.

I provide a governor which responds to changes of speed for controlling the stroke of the pump, the governor preferably acting to vary the tension of a spring opposing the movement of the inlet-valve, the pump-plunger being mounted to move with the inlet-valve. The extent to which the pump-plunger is moved by the inlet-valve thus depends upon the tension of the spring. In practice I find it desirable to provide for a slight freedom of movement between the pump-plunger and the inlet-valve, so that when the speed is a maximum and the inlet-valve is unable to move the pump-plunger against the tension of the spring the inlet-valve may move relatively to the pump-plunger to permit the partial opening of the inlet-valve and thus admit air to the cylinder; otherwise the engine-piston would create a vacuum, thus necessitating the waste of considerable power in moving the piston forward. The governor acts

constantly upon the inlet-valve and the pump-plunger, the tension of the spring being continuously varied in exact accordance with the change of speed of the engine. The governor is thus of the continuous-contact type as distinguished from that class in which the governor acts at intervals to control the speed according as it rises above or decreases below definite values. By the employment of a continuous-contact governor the quantity of explosive material drawn into the cylinder is exactly proportional to the power to be developed.

I will describe my invention by reference to the accompanying drawings, in which—

Figure 1 is a vertical sectional view of a specific form of engine embodying my invention. Fig. 2 is a top view thereof. Fig. 3 is a view in elevation. Fig. 4 is an end view. Fig. 5 is a transverse sectional view through the cylinder and ignition-chamber. Fig. 6 diagrammatically illustrates the relative movements of the crank of the engine and the cam effecting the actuation of the exhaust-valve. Fig. 7 is a sectional view showing in detail the connection between the parts of the exhaust-valve rod. Fig. 8 is a detailed view of the cam and its engaging roller. Figs. 9 and 10 are detail views of the governor.

Like parts are designated by the same letters of reference in each of the several figures.

Upon the shaft a of the engine is mounted a cam a', against which a cam-roller a^3, mounted upon the end of the valve-rod b, is adapted to bear. The valve-rod b is adapted to move longitudinally in the bearings b' b^2, and a coiled spring b^3 rests between the bearing b' and a collar provided upon the valve-rod to yieldingly press the valve-rod toward the cam.

The end of the valve-rod b, which is formed into a tongue b^4, is adapted to move in a slot c', carried in the casting c. (See Fig. 8.) The casting c is mounted upon the portion b^5 of the valve-rod, and the latter passes through a stuffing-box into the exhaust-chamber d, and carries upon its end the exhaust-valve d', adapted to seal the exhaust-port d^2, opening from the ignition-chamber e into the exhaust-chamber d. A coiled spring b^6 normally maintains the exhaust-valve d' in position to seal the port d^2. A pin c^2 is adapted to move within the casting c and normally rests with its end drawn back, so as to permit the tongue b^4 to move freely within the slot c', a coiled spring c^3 being provided for maintaining the pin c^2 in this position. When the pin c^2 is thrust forward into the slot c', it is engaged by the end of the tongue b^4 upon the advance of the valve-rod b and the portion b^5 of the valve-rod which carries the casting c is moved to the left to raise the exhaust-valve d' from its port. The pin c^2 must be thrust forward in position to be engaged by the tongue b^4 only upon each second stroke, that is, as the piston is moving forward during its working stroke. The pressure of the gas within the cylinder during explosion is utilized for advancing the pin c^2, the end of the pin being connected by a link c^4 with a pivoted lever c^5, upon the end of which is mounted the rod c^6, carrying upon its end the piston c^7, adapted to move within the cylinder c^8. The pressure within the engine-cylinder moves the small piston c^7 to rock the lever c^5 upon its pivot and thrust the pin c^2 forward into the path of the tongue b^4.

The form of the cam a' is shown in detail in Fig. 6, the cam-surface being concentric between the points A′ and B′, likewise concentric between the points B′ and C′, though with a greater radius. Between the points C′ and D′ the radius of the cam gradually increases until it is of a maximum length at the point D′, the radius then gradually decreasing to the point A′. The main shaft of the engine, upon which the crank and cam are mounted, as shown in the several figures, is rotated in a clockwise direction, and the roller a^2 engages the concentric portion A′ B′ of the cam while the crank is traveling from A to B. While the crank is traveling from B to C the roller a^2 engages the concentric portion B′ C′ of the cam. While the crank is traveling from C to D the roller a^2 is in engagement with the portion C′ D′ of the cam, and the roller is in engagement with the portion D′ A′ of the cam while the crank is traveling from D back to the initial position A. The construction of the casting c and associated parts is illustrated in detail in Fig. 8, a cotter-pin c^9, carried upon the casting c, being adapted to move in a slot b^7, provided in the end of the portion b^5 of the valve-rod. While the crank is traveling from A to B the pin c^2 is thrust forward into the position illustrated in Fig. 8, the end of the tongue b^4 occupying the position indicated by the dotted line in Fig. 8, that is, out of engagement with the pin c^2. During this time the roller a^2 is in engagement with the portion A′ B′ of the cam, this portion being concentric and the tongue consequently remaining at rest.

When the portion B′ C′ of the cam engages the roller, the tongue b^4 is thrust forward and engages the pin c^2, thus locking the pin in its advanced position and preventing its withdrawal should for any cause (such as the leakage of the gas past the piston) the pressure upon the small piston c^7 be removed. During the time the portion B′ C′ of the cam is in engagement with the roller the crank is traveling from B to C, and at the point C the exhaust-valve begins to open, the portion C′ D′ of the cam engaging the roller and moving the valve-rod b^5 to the left. The exhaust-valve is completely open when the point D′ of the cam is in engagement with the roller, at which time the crank occupies the position D. As the portion D′ A′ of the cam engages the roller the exhaust-valve is gradually closed. The exhaust-valve thus begins to open when the crank is at the point C, is completely

opened when the crank is at the point D, and is closed at the end of the stroke, that is, when the piston is returned to its initial position.

A pump g is provided, the plunger g' of which carries a cam-roller g^2, adapted to be engaged by the cam a', the plunger being thus reciprocated during each revolution of the cam. The pump g is connected by a pipe g^3 with a reservoir g^4, from which extends an overflow-pipe g^5. The reservoir g^4 communicates with the barrel of a pump h, the pump h being connected by means of a pipe h' with a pipe h^2, extending to the admission-port k, opening into the ignition-chamber e, said port k being normally closed by a valve k'. An air-pipe l communicates with the pipe h^2. The oil from the pump h and the air from the pipe l pass through the port k into the ignition-chamber. Upon the valve k' is mounted a rod or stem k^2, normally pressed downward by means of a coiled spring k^3 to maintain the valve k' upon its seat. The lower end of the rod k^2 is connected with a lever m, pivoted at m' and connected by its opposite end to the plunger h^3 of the pump h. During the working stroke of the piston the valve h' is maintained closed by the pressure within the cylinder, and during the subsequent return stroke, while the exhaust is taking place, the valve k' remains closed, but upon the advance of the piston a partial vacuum is formed within the cylinder and the suction causes the movement of the valve k' inward, the valve being then raised from its seat. The raising of the valve from its seat causes the turning of the pivoted lever m upon its pivot m' and thrusts the plunger h^3 of the pump h downward, thus forcing the oil through the pipes h' and h^2 into the ignition-chamber. At the same time air is admitted through the pipe l and passes with the oil into the ignition-chamber.

I provide a governor which acts to vary the stroke of the plunger under varying loads, at the same time acting to control the movement of the inlet-valve. The governor comprises a pivoted lever o, carrying upon its end a ball o', a spring o^2 being provided for opposing the outward movement of the governor-ball. Upon the lever o is provided a wedge-shaped portion o^3, which is adapted to rest between the hub of the fly-wheel and the wheel o^4, mounted upon the shaft a and being capable of moving longitudinally thereon, a spring o^5 being provided for yieldingly maintaining the wheel o^4 toward the hub of the fly-wheel. The wheel o^4 carries a beveled periphery adapted to engage the beveled end of a rod p, moving vertically in the bearings p' p^2, a spring p^3 being provided for normally maintaining the rod p in an elevated position. The rod p is connected by its end to the end of the pivoted lever p^4, journaled at p^5 to fractionally rotate. The opposite end of lever p^4 is connected by a spring p^6 with the end of lever m. As the speed increases, due to a decrease of the load, the governor-ball o' flies outward, thus thrusting the wedge-shaped portion o^3 between the hub of the fly-wheel and the wheel o^4 and moving wheel o^4 longitudinally upon the shaft a. The beveled periphery of the wheel o^4 thus engages the beveled end of rod p, thrusting the same downward and rocking the lever p^4 to increase the tension with which the spring p^6 pulls the end of lever m upward. The force required to raise the inlet-valve k' is thus increased, and in consequence the suction within the cylinder is unable to move the inlet-valve and the plunger of the pump through as great a distance as before the tension of the spring p^6 was increased. When the speed of the engine decreases, the tension of the spring p^6 is decreased and the movement of the inlet-valve and the stroke of the pump-plunger are increased.

While I have illustrated my invention in connection with a specific mechanical construction, it is evident that my invention may be otherwise embodied, and I do not desire to limit myself to details of mechanical construction.

Having described my invention, what I claim as new, and desire to secure by Letters Patent, is—

1. In a gas-engine, the combination with the exhaust-valve and actuating connections therefor, of a cam of irregular periphery mounted upon the main shaft of the engine, a short portion of the periphery of said cam being adapted to lock and maintain said actuating connections of the valve in operative position, another and longer portion being adapted to open the valve, and the remaining and longest portion permitting the closing of the valve and the release of the actuating connections thereof, substantially as described.

2. In a gas-engine, the combination with ignition-chamber e of the exhaust-valve d', slotted casting c, rod b^5 connecting the exhaust-valve and the said casting, piston c^7 moving in cylinder c^8 by the force of the explosion in the ignition-chamber, pin c^2 actuated by the movement of the said piston to enter within the slot in casting c in the path of valve-rod b, valve-rod b extending within the slot in casting c and cam a' of irregular periphery mounted upon the main shaft of the engine, a short portion of the periphery of said cam being adapted to lock and maintain the actuating connections of the valve in operative position, another and longer portion being adapted to open the valve, and the remaining and longest portion permitting the closing of the valve and the release of the actuating connections thereof, substantially as described.

3. The combination with a cam mounted upon the shaft of the engine, of a part carrying a cam-roller adapted to engage said cam and to be reciprocated thereby, an exhaust-valve, a longitudinally-movable part upon which said valve is mounted, a slot carried in the end of one of said parts within which a

tongue carried upon the other part is adapted to move, a pin adapted to be inserted into said slot in the path of said tongue, an auxiliary cylinder in communication with the engine-cylinder, and a piston moving in said cylinder and connected with said pin; substantially as described.

4. The combination with a rod b^5 carrying the exhaust-valve, of the casting c mounted upon the end thereof and carrying a slot c', said casting having a slight freedom of movement relatively to the exhaust-valve, the tongue b^4 adapted to be reciprocated in the slot c', the pin c^2 adapted to be moved into the slot in the path of said tongue, and the cam a' for reciprocating said tongue and having the concentric portion B' C' adapted to maintain the end of the tongue in engagement with the pin c^2 without imparting longitudinal movement to the rod b^5; substantially as described.

5. The combination with a part adapted to be moved by the suction within the engine-cylinder, of a pump-plunger operated thereby, a spring opposing the movement of said plunger, and a governor for regulating the tension of said spring; substantially as described.

6. The combination with an inlet-valve adapted to be moved by the suction within the engine-cylinder, of a pump-plunger operated thereby, and a governor for regulating the movement of the plunger and the inlet-valve to control the quantity of explosive mixture admitted to the engine-cylinder; substantially as described.

7. The combination with an inlet-valve adapted to be moved by the suction within the engine-cylinder, of a pump-plunger, a spring opposing the movement of the inlet-valve and the plunger, and a governor for varying the tension of said spring to control the quantity of explosive mixture drawn into the engine-cylinder; substantially as described.

8. The combination with an inlet-valve operated by the suction within the engine-cylinder, of a pump-plunger moved by said valve, a governor for controlling the strokes of the pump-plunger and of the inlet-valve, and means for permitting a slight freedom of movement of the valve relatively to the plunger to admit air to the engine-cylinder when the plunger remains at rest; substantially as described.

9. The combination with a longitudinally-movable wheel or disk mounted upon the engine-shaft, of a wedge interposed between said wheel and a part mounted stationarily upon the engine-shaft, said wedge when moved serving to impart longitudinal movement to said wheel or disk, a governor-ball for moving said wedge, a controlling-lever continuously in engagement with said longitudinally-movable wheel and adapted to be operated by the longitudinal movement of said wheel, a pump-plunger, and an inlet-valve, the stroke of said plunger and the stroke of said inlet-valve being controlled by the movement of said operating-lever; substantially as described.

10. The combination with a longitudinally-movable wheel or disk mounted upon the engine-shaft, of a wedge interposed between said wheel and a part mounted stationarily upon the engine-shaft, said wedge when moved serving to impart longitudinal movement to said wheel or disk, a governor-ball for moving said wedge, a controlling-lever continuously in engagement with said longitudinally-movable wheel and adapted to be operated by the longitudial movement of said wheel, and an inlet-valve the stroke of which is controlled by the movement of said operating-lever; substantially as described.

11. In a gas-engine, the combination with the ignition-chamber e, of the exhaust-valve d', slotted casting c, rod b^5 connecting the exhaust-valve and the said casting, piston e^7 moving in cylinder e^8 by the force of the explosion in the ignition-chamber, pin c^2 actuated by the movement of the said piston to enter within the slot of casting c in the path of valve-rod b, valve-rod b extending within the slot in casting c, cam a' mounted upon the main shaft of the engine, the periphery of said cam being provided with portions A' C', C' D' and D' A', the latter portion being respectively of increasing and decreasing radius, a short portion of the periphery A' C' being adapted to actuate the valve-rod to lock and maintain pin c^2 in position when the said pin is forced within the slot, portion C' B' being adapted to open the valve, and the longer portion B' A' permitting the closing of the valve and the release of the actuating connections thereof, substantially as described.

In witness whereof I hereunto subscribe my name this 16th day of September, A. D. 1895.

GUSTAF JORANSON.

Witnesses:
CARL H. PETERSON,
W. CLYDE JONES.