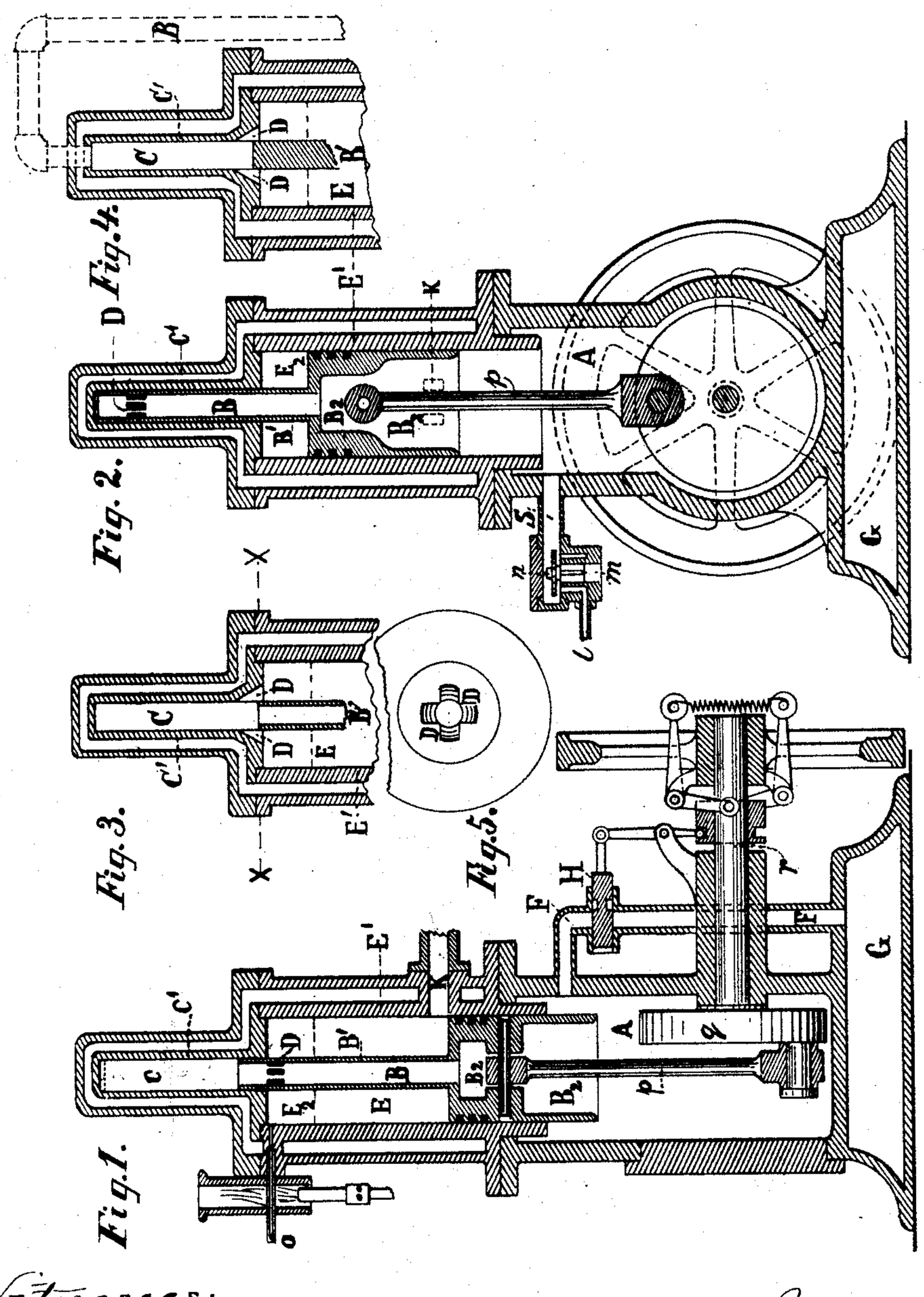
(No Model.)

F. BURGER.

GAS ENGINE.

No. 585,651. Patented July 6, 1897.



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UNITED STATES PATENT OFFICE.

FRANZ BURGER, OF FORT WAYNE, INDIANA, ASSIGNOR OF THREE-FOURTHS TO HENRY M. WILLIAMS, OF SAME PLACE.

GAS-ENGINE.

SPECIFICATION forming part of Letters Patent No. 585,651, dated July 6, 1897.

Application filed March 26, 1894. Serial No. 505,205. (No model.)

To all whom it may concern:

Be it known that I, FRANZ BURGER, a citizen of the United States, residing in the city of Fort Wayne, in the county of Allen and State of Indiana, have invented certain new and useful Improvements in Explosive Motors or Engines Using Explosive Gaseous Mixtures for Generating Power similar to the class commonly known as "gas-engines," of which the following is a specification.

Multiplicity of parts, expense of construction, and uneven irregular power production and transfer are three serious defects of explosive-motors that I have sought to overcome (successfully, I believe) by my invention.

My construction of a projection from the piston-head extending through the explosion-chamber and an extension of the explosion-chamber fitted to receive such projection, in connection with appropriate placing of the inlet and outlet openings of the explosion-chamber, accomplishes the admission and compression of the charge and expulsion of the products of combustion at every revolution by the stroke and return of the piston, and in connection with a reservoir at the rear of the piston-head into which the explosive elements are admitted and which is connected with the inlet-ports of the explosion-chamber heats and mixes thoroughly the explosive elements.

The piston-head and its small projection and receiver, with appropriately-placed charging and exhaust ports, do away with expensive and complex valves, cranks, and other devices and make possible an explosion and power impulse for every revolution, the only additional element required being suction at the exhaust or pressure at the inlet port. I use the latter, and produce it by means of a therewith-connected reservoir behind the piston-head, into which the gas and air or other explosive mixture are directly drawn by the return and compressed by the stroke of the piston.

The power and speed are regulated by a secondary reservoir communicating with that into which the mixture is directly drawn by a passage-way kept closed at ordinary speed by a valve which is opened by any suitable governor adjusted to open such valve whenever the speed exceeds the desired number of revolutions per minute.

I attain the objects sought and remedy the defects mentioned by the mechanism illustrated in the accompanying drawings, in which—

Figures I and II are vertical sections of an upright engine made by planes at right angles to each other, illustrating one means of accomplishing the desired results, showing, in connection with the novel devices invented by me, familiar and well-known working parts of an explosive-motor and representing the piston-head at the limit of its motion at the end of its stroke in Fig. I and beginning thereof in Fig. II. Figs. III and IV are vertical sections representing the extension of the combustion-chamber and part of the piston projection, in which figures the inlet-ports are formed so as to surround the projection instead of being formed in the projection, Fig. III showing a hollow projection and Fig. IV representing the same as solid. Fig. V is a cross-section on the line X X and illustrates the inlet-ports in the cylinder extension.

Similar letters refer to similar parts in the several views.

The term "compression-space" is applied to the space occupied by the explosive charge at the commencement of the stroke and the term "combustion-chamber" includes the compression-space and that part of the space inside the cylinder through which the face of the piston-head travels.

A represents a space back of the piston-head equal to or greater than the space within the cylinder traversed by the piston-head, air-tight except for two openings—viz., an inlet *s*, through which the explosive elements enter, and an outlet B, through which the explosive mixture passes directly, as indicated in Fig. IV, or by way of the opening B^2, of a hollow piston-head, as shown in Figs. I and II, to the extension C of the explosion-chamber E, and thence via the inlet-ports D into the explosion-chamber E.

B represents a passage-way for the explosive mixture from the reservoir A, either

through a projection B′ of the piston-head or a conduit outside the piston—as, for example, a pipe leading from A around outside the cylinder, as shown in Fig. IV, to a space C within an extension C′ of the cylinder.

C represents the space within an extension C′ of the cylinder and is merely an extension of the combustion-chamber, though no combustion ever takes place within it owing to the projection B′ of the piston-head fitting so closely within its walls.

D D represent the inlet-ports of the combustion-chamber and may be openings in the projection B′ of the piston-head, if hollow, or in the end of the cylinder or wall of the combustion-chamber; in the former from the passage B and in the latter from the space C, into the combustion-chamber E.

E represents the combustion-chamber—*i. e.*, entire space which the charge occupies from its ignition to its escape from the cylinder through the exhaust-ports, the inclosing walls of such space including that part of the cylinder above and below the limit of the pathway of the face of the piston-head and E^2 that part of the combustion-chamber beyond the limit of the piston-head's movement.

K represents the exhaust-ports, which are at the extremity of the combustion-chamber reached by the face of the piston-head in its stroke.

F represents a passage connecting the reservoir A with a secondary or regulating reservoir G, having any convenient capacity not, however, much less than A, and H is a valve for opening and closing such passage-way F.

p represents the piston-rod; *q*, the crank or circular disk attached to the shaft *r* for transferring the motion of the piston to such shaft.

Fig. I also shows an ordinary balance-wheel, a governor which opens F whenever the speed or number of revolutions becomes too great, and a hot-tube igniting apparatus *o* for exploding the charge. Fig. II discloses an apparatus for admitting air and gas to A in proper proportions, consisting of gas-pipe *l*, air-duct *m*, gravity-valve *n* for opening and closing both, and passage *s* for the mixture. Both Figs. I and II also disclose the usual water-jacket and other well-known parts of an explosive-engine.

The inlet and exhaust ports are so constructed and placed that the exhaust is partly open before any part of the new charge enters through the inlet-ports.

When the projection B′ is hollow and the inlet-ports are cut therein, (shown in Figs. I and II,) they open only when below C′, and the motion of B′ with the piston opens them at the extremity of the stroke and immediately closes them on the return, C′ acting as a fixed cut-off. If the ports are cut in C′, then they are open to C only when the free end of C′ is below them—*i. e.*, at the end of the piston stroke—and B′ acts as a movable cut-off for opening and closing them. The length of B′ and position and size of ports D are so adjusted as to open the inlet-ports fully at the end of the piston stroke and not at all until after the exhaust-ports have begun to open. B′ may be either solid or hollow if ports D are around it, but must be hollow at the free end at least if they are within it. The outside of B′ and inside of C′ are fitted, so as to exclude the possibility of flame passing between, but not necessarily closer.

The engine operates as follows: During the return of the piston the pressure in A is so reduced as to lift *n* and admit the required quantity of explosive elements for a charge, the same mixing with those already in A. The stroke by reducing the size of A compresses its contents so that when D is open to admit to the combustion-chamber a charge of the explosive mixture via the passage B and C if around or B^2, B, and C if through the piston-head and its projection, (according to the construction with or without a hollow piston-head and projection,) at the same time heating and more thoroughly mixing the same and expelling part of the combustion products from E. The return of the piston compresses this charge into the limits of the compression-space E^2 for firing immediately the piston passes the dead-point from return to stroke. Both inlet and exhaust ports are fully open at the end of the stroke. The shape of such part of the cylinder and inclosed space E^2 as is beyond the return of the piston is immaterial, if only the projection B′ is so fitted to the extension C′ as to open and close the inlet-ports, as above, and prevent the escape of flame from that end of the combustion-chamber.

The material and principles of construction of such motors are so well known that the foregoing will enable one skilled in the art to embody my improvements in an engine.

In explosive-motors I claim as new, and desire to secure by Letters Patent, the following:

1. The combination in a gas-engine, of a combustion-chamber having a hollow extension, a plunger having a projection working in said extension, and ports controlled by said extension and projection and admitting explosive mixture to said chamber only when the plunger is at the limit of its stroke, substantially as described.

2. The combination in a gas-engine, of a combustion-chamber having a hollow extension, a plunger having a hollow projection working in said extension and provided with ports which are controlled by said extension and projection and which admit explosive mixture to said chamber only when the plunger is at the limit of its stroke, substantially as described.

3. The combination in a gas-engine, of a water-jacketed combustion-chamber having a hollow water-jacketed extension, a plunger having a projection working in said extension and provided with ports which are controlled by said extension and projection, and

which admit explosive mixture to said chamber only when the plunger is at the limit of its stroke, substantially as described.

4. The combination in a gas-engine, of a combustion-chamber having a hollow extension, a plunger having an opening therethrough, and provided with a hollow projection in direct communication with said opening, and provided with ports which are controlled by said extension and projection, and which ports admit explosive mixture to said chamber only when the plunger is at the limit of its stroke, substantially as described.

5. The combination in a gas-engine, of a combustion-chamber having an exhaust at the point of limit of the stroke of the piston, and an igniter at the upper part of said chamber, a hollow extension of the chamber, and a plunger having a projection working in said extension and provided with ports which are controlled by the extension and projection, the said ports admitting explosive mixture to said chamber only when the plunger is at the limit of its stroke, substantially as described.

6. The combination in a gas-engine having the reservoir to the rear of the plunger, an additional reservoir, a passage or means of communication between the two reservoirs, and a valve in said passage connected with a governor, all substantially as shown and for the purpose set forth.

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Attest:

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