

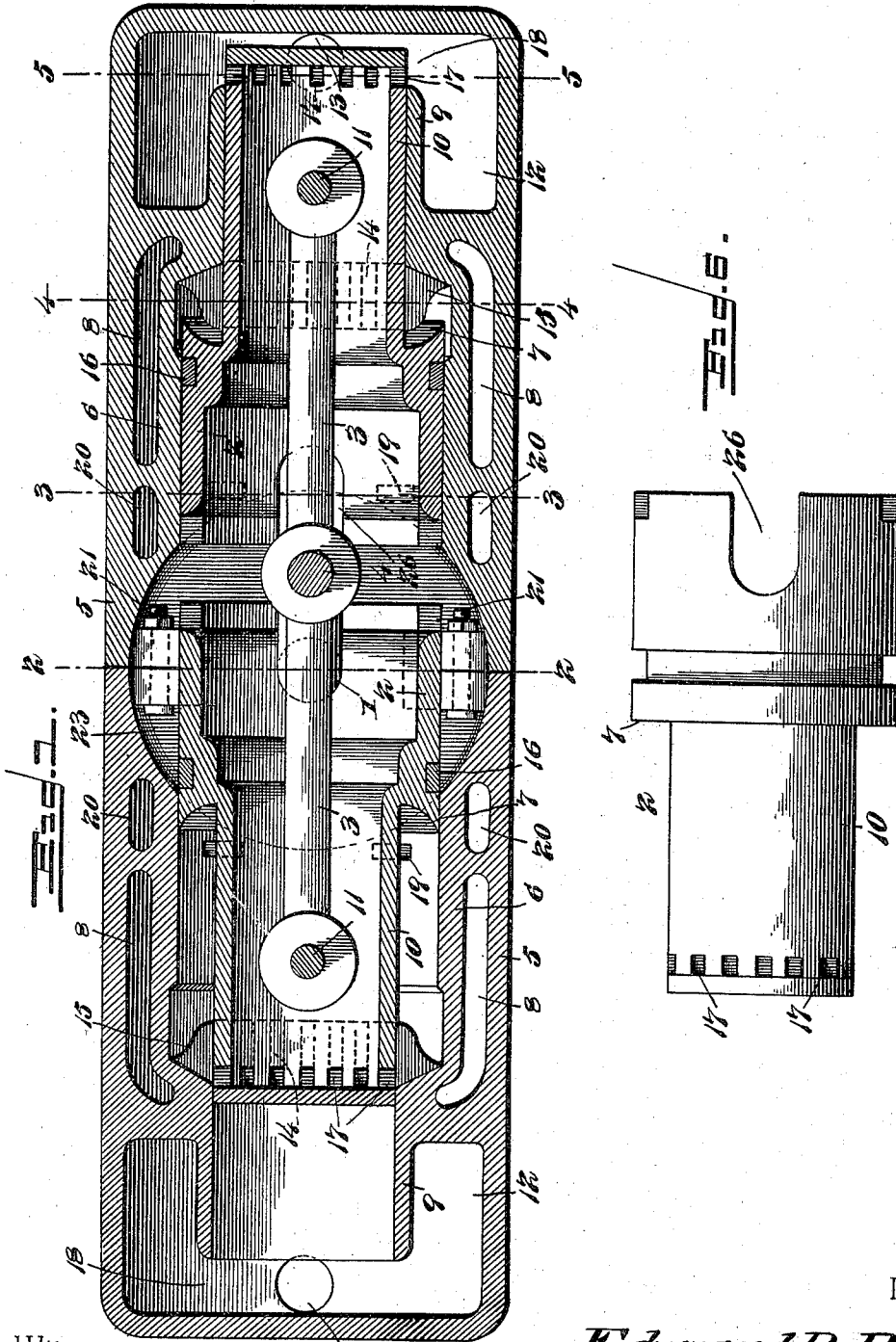
(No Model.)

2 Sheets—Sheet 1.

E. B. DAKE.
GAS ENGINE.

No. 584,674.

Patented June 15, 1897.



Witnesses

E. M. Stewart
E. B. Dake

By *his* Attorneys,

Edward B. Dake

C. A. Snow & Co.

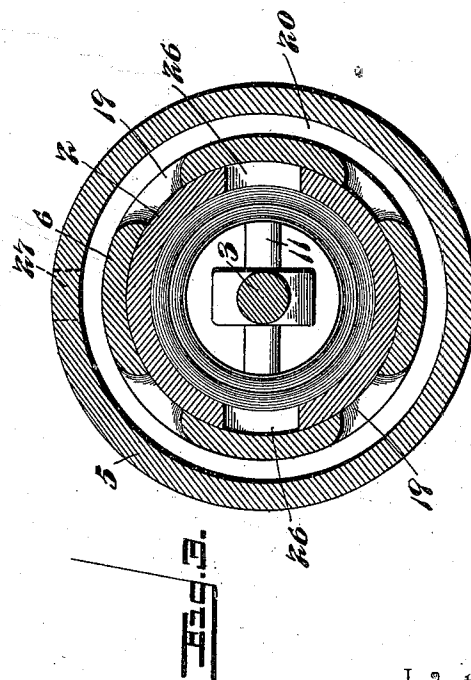
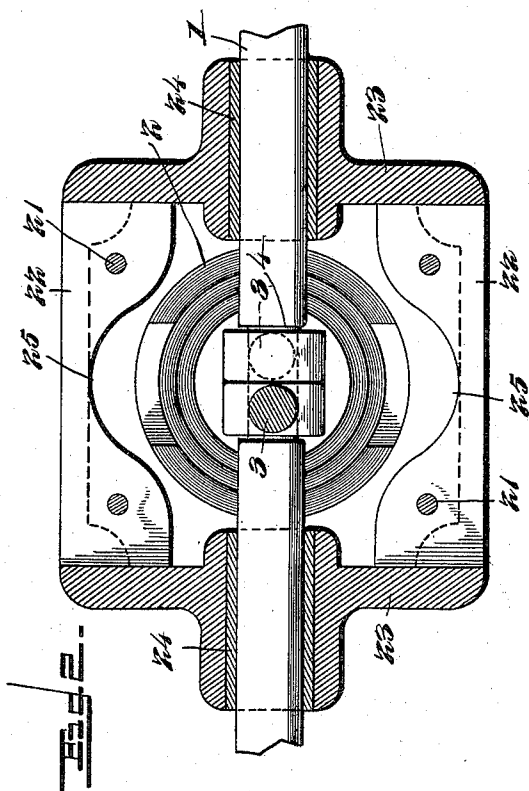
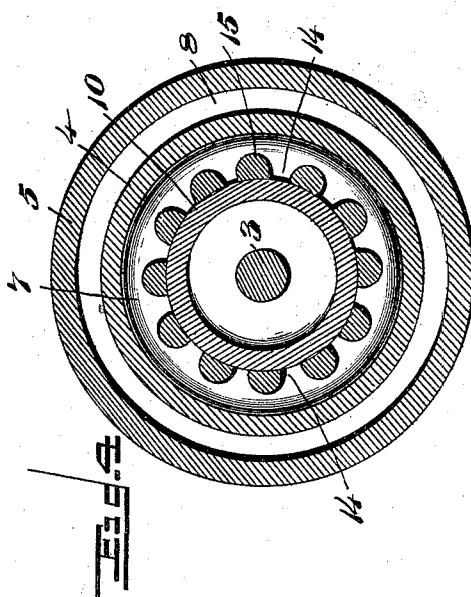
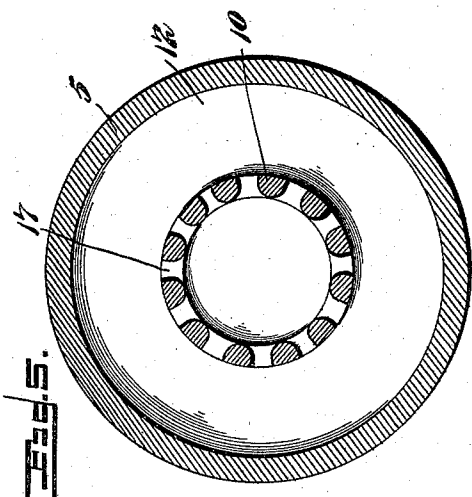
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E. M. Stewart
C. E. Doyle

By *W. H. S.* Attorneys,

Inventor

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UNITED STATES PATENT OFFICE.

EDWARD B. DAKE, OF MUSKEGON, MICHIGAN.

GAS-ENGINE.

SPECIFICATION forming part of Letters Patent No. 584,674, dated June 15, 1897.

Application filed April 17, 1896. Serial No. 588,026. (No model.)

To all whom it may concern:

Be it known that I, EDWARD B. DAKE, a citizen of the United States, residing at Muskegon, in the county of Muskegon and State of Michigan, have invented a new and useful Gas-Engine, of which the following is a specification.

My invention relates to gas-engines, and has for its object to provide a simple and efficient construction and arrangement of parts whereby the explosive force, as gas, may be utilized advantageously to communicate motion through a reciprocatory piston or pistons disposed coöperatively to a rotary part, such as a driven shaft, said arrangement being compact and having the moving parts protected from accumulations of dust.

Further objects and advantages of this invention will appear in the following description, and the novel features thereof will be particularly pointed out in the appended claims.

In the drawings, Figure 1 is a longitudinal central section of a gas-engine constructed in accordance with my invention. Fig. 2 is a transverse central section on the line 2 2 of Fig. 1. Fig. 3 is a transverse section on the line 3 3 of Fig. 1, taken through the exhaust-ports and exhaust-chamber. Fig. 4 is a transverse section on the line 4 4 of Fig. 1, taken through the explosion-chamber and the ports communicating therewith and through the water-jacket. Fig. 5 is a transverse section on the line 5 5 of Fig. 1, taken through the compression-chamber and the inlet-ports of the hollow piston. Fig. 6 is a side view of one of the pistons.

Similar numerals of reference indicate corresponding parts in all the figures of the drawings.

The engine embodying my invention comprises a plurality of members disposed radially with relation to a common shaft 1, each member including a moving part or piston member 2, which is connected by means of a pitman 3 to a crank 4 on said shaft.

In the drawings I have illustrated an engine in which two members only are employed, said members being arranged in coaxial alignment, as shown in Fig. 1. Inasmuch as the radially-disposed members are similar in construction a detail description of one will

apply to both of those illustrated in the drawings and equally to others which may be arranged in a similar or radial position with relation to the driven shaft. 5 designates a casing which incloses a cylinder 6, in which operates the piston 2, said piston having a terminal abutment 7, which is preferably concaved, as shown. The space 8, intervening between the casing or shell 5 and the cylinder 6, forms a water-jacket to prevent overheating of the cylinder.

Communicating with the explosion-cylinder 6, preferably at its outer end, is a pump or suction cylinder 9, in which operates a plunger 10, consisting of a tubular reduced extension of the piston 2, said piston being hollow, with its cavity in open communication with the interior of the plunger to accommodate the pitman 3, by which motion is communicated from the piston to the crank 4, the outer extremity of the pitman being fulcrumed upon a wrist-pin 11, preferably arranged within the hollow extension or plunger 10.

Communicating with the outer end of the pump or suction cylinder is a compression-chamber 12, formed in the shell or casing 5 and tapped to form a supply-port 13, through which an explosive fluid, such as a mixture of gas and air, is admitted during the inward stroke of the plunger, said supply-port being provided with the usual check-valve or its equivalent, (not shown,) whereby the escape of the explosive agent is prevented upon an outward stroke of the plunger.

Communicating ports 14 are formed between the pump or suction cylinder and the explosion-chamber, the same being arranged in a circumferential series, with interposed separating-webs 15, which are provided with convex edges to correspond approximately with the concaved abutment of the operating-piston, said piston being provided with a packing ring or rings 16. Inlet-ports 17 are also provided in the outer extremities of the plunger, the same being adapted to communicate alternately with the compression-chamber 12 and the ports 14 during the operation of the engine, the interval between the throat 18 of the compression-chamber and the ports 14 being approximately equal to the length of stroke of the piston. Also, exhaust-ports 19

are formed in the wall of the explosion-chamber in communication with an exhaust-chamber 20, arranged within the shell or casing between the inner portion of the cylinder 6 and said shell or casing, the interval between said ports 19 and the ports 14 being slightly less than the length of stroke of the piston.

In the drawings two members constructed as above described are arranged in coöperative position with their inner extremities bolted together, as at 21, the contiguous extremities of the shells being constructed to form a transverse cylindrical enlargement 22, having removable heads 23, in which the bearings 24 for the driven shaft 1 are formed, the central portion of the interior of said enlargement being cut away to form a cavity 25 (shown in Fig. 2) to allow free movement of the crank-arm 4.

The piston members are arranged with their open inner ends in alinement and communication, said extremities being longitudinally slotted, as shown at 26, to straddle the driven shaft, as shown in Figs. 1 and 6.

In operation the explosive agent is drawn into the pump or suction cylinder during the inward movement of the plunger and is subsequently compressed in the compression-chamber during the outward stroke of said plunger. When the plunger reaches the limit of its outward movement, the compressed agent is admitted into the interior of the hollow piston through the ports 17, and as the corresponding ports of the other piston member are simultaneously in alinement with the communicating ports 14 the explosive agent will also pass from the interior of the hollow piston into the explosion-chamber 6. For instance, in Fig. 1 the piston is shown at the limit of its stroke toward the right, and hence the inlet-ports 17 of the right-hand piston member are in communication with the compression-chamber and the corresponding ports 17 of the left-hand piston member are in communication with the ports 14, whereby during the admission of the explosive agent to the interior of the piston through the right-hand terminal inlet-ports 17 said agent is exhausted through the left-hand terminal ports 17 and the communicating ports 14 into the left-hand explosion-cylinder. During the succeeding stroke of the piston toward the left the explosive agent is again drawn into the right-hand pump or suction cylinder while the contents of the left-hand explosion-cylinder are compressed, and when the piston has reached the limit of its stroke in said direction the explosive agent is ignited in said left-hand explosion-cylinder to give an impulse in the opposite direction to the piston. When the abutment 7 of the left-hand piston member uncovers the exhaust-ports 19 of said left-hand explosion-cylinder, the products of combustion will escape into the exhaust-chamber 20, and from thence through an outlet 27 into the atmosphere. During said movement of the left-hand piston, due to

the expansive force of the explosive agent in the left-hand cylinder 6, the right-hand plunger has been compressing the contents of the chamber 18, and hence as the ports 19 in communication with the left-hand explosion-chamber are opened to allow the escape of the products of combustion the inlet-ports 17 of the right-hand piston member are opened to admit the compressed explosive agent into the interior of the piston; also, simultaneously the ports 17 of the left-hand piston are brought into communication through the ports 14 with the left-hand explosion-chamber to allow the explosive agent to pass from the interior of the piston to said left-hand explosion-cylinder. The contents of the right-hand explosion-cylinder, which have been compressed during the movement of the piston toward the right under the influence of the preceding explosion in the left-hand explosion-cylinder, are now exploded by a suitable igniting device to give an impulse toward the left, and hence compress the contents of the left-hand explosion-chamber. Any suitable means for igniting the contents of the explosion-chambers alternately at the limits of the outward movements of the pistons operating in said cylinders may be employed, no means being illustrated in the drawings, inasmuch as my invention does not relate thereto, and any well-known device for the purpose will suffice.

Various changes in the form, proportion, and the minor details of construction may be resorted to without departing from the spirit or sacrificing any of the advantages of this invention.

Having described my invention, what I claim is—

1. In a gas-engine, the combination with a common driven shaft having a crank, of cylinders arranged radially with relation to said shaft, hollow pistons mounted for reciprocation in the cylinders and provided with closed outer and communicating inner ends, said pistons combining with the cylinders to form annular explosion-chambers, and adapted to be alternately arranged in communication with their respective explosion-chambers at the limits of their inward strokes, pitmen connecting said pistons with the crank of the driven shaft, and means for admitting the explosive agent to the interiors of the pistons at the limits of their outward strokes, substantially as specified.

2. In a gas-engine, the combination with a common driven shaft having a crank, of cylinders arranged radially with relation to said shaft, hollow pistons mounted for reciprocation in the cylinders and provided with closed outer and communicating inner ends, said pistons combining with the cylinders to form annular explosion-chambers, and adapted to be alternately arranged in communication with their respective explosion-chambers at the limits of their inward strokes, pitmen connecting said pistons with the crank of the

driven shaft, and means for admitting the explosive agent to the interiors of the pistons at the limits of their outward strokes, said pistons being provided with common lateral ports for admitting the explosive agent and for communication with the explosion-chambers, substantially as specified.

3. In a gas-engine, the combination with a driven shaft, of communicating radially-disposed explosion-cylinders, hollow pistons arranged in the cylinders and connected with said shaft, said pistons having abutments exposed in the explosion-cylinders, plungers carried by the pistons and operating in pump or suction cylinders communicating with supply-ports, and ports in the plungers for admitting explosive agent to the interior of the piston and adapted to communicate with ports in the explosion-cylinders, substantially as specified.

4. In a gas-engine, the combination with a driven shaft, of explosion-cylinders arranged radially with relation to said shaft, hollow pistons operating in said cylinders and having communicating inner ends, said pistons having hollow extensions forming plungers operating in pump or suction cylinders, compression-cylinders arranged in communication with the pump or suction cylinders, and

ports in the piston extensions or plungers adapted to communicate alternately with the compression-chambers and explosion-cylinders, substantially as specified.

5. In a gas-engine, the combination with a driven shaft, of explosion-cylinders arranged radially with relation to said shaft, pump or suction cylinders arranged in coaxial alignment with the explosion-cylinders, operating-pistons connected with said driven shaft and operating in the explosion-cylinders, said pistons being provided with reduced hollow extensions forming plungers operating in the pump or suction cylinders and provided at their outer extremities with inlet-ports, and compression-chambers arranged in terminal communication with the pump or suction cylinders, the inlet-ports of the plungers being adapted to communicate alternately with the compression-chambers and the explosion-cylinders, substantially as specified.

In testimony that I claim the foregoing as my own I have hereto affixed my signature in the presence of two witnesses.

EDWARD B. DAKE.

Witnesses:

W. A. MURRAY,
E. G. ROTE.