J. A. BURNHAM, Jr.

GAS ENGINE.

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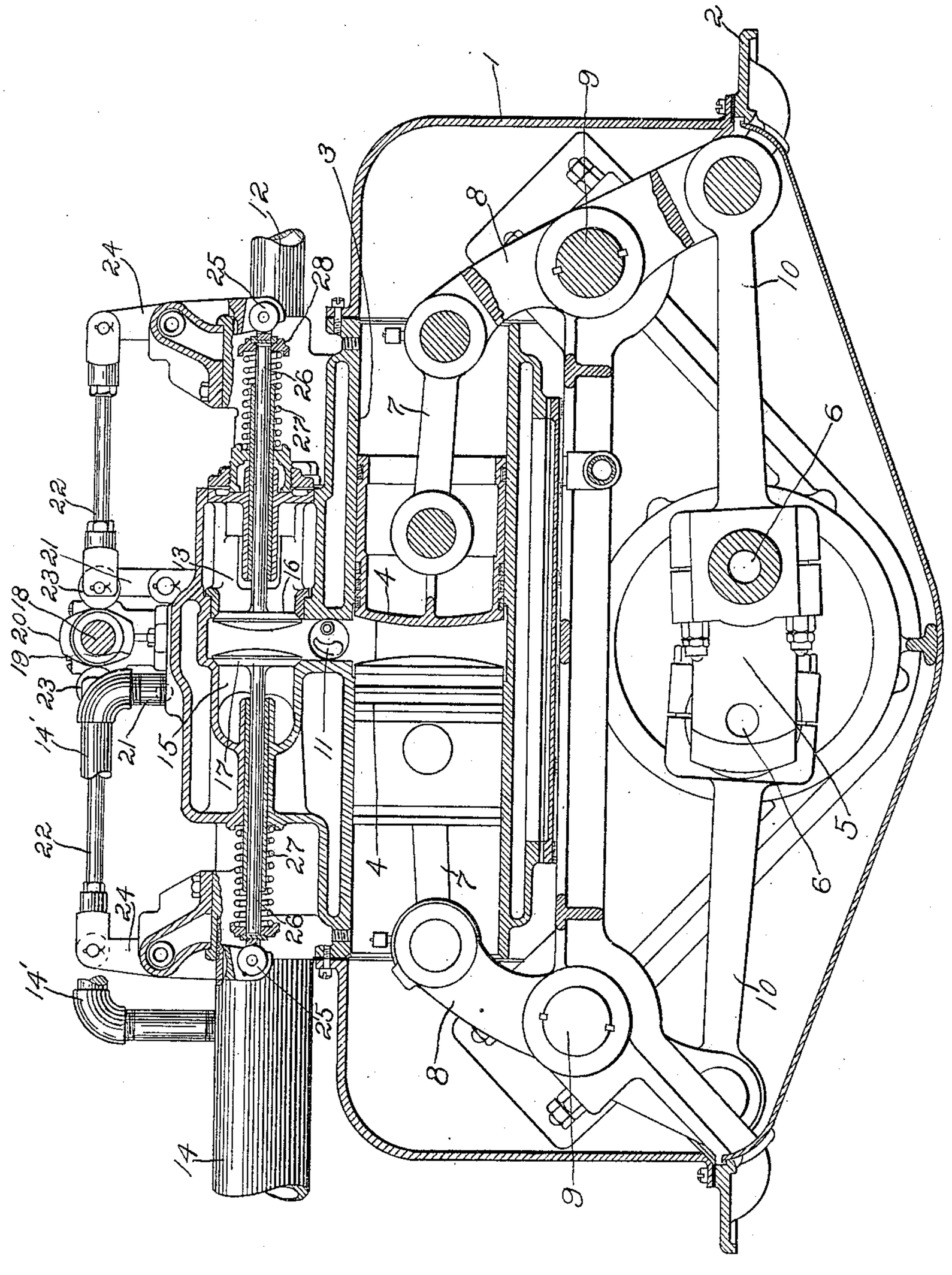
993,291. Patented May 23, 1911.



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UNITED STATES PATENT OFFICE.

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GAS-ENGINE.

993,291. Specification of Letters Patent. Patented May 23, 1911.

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To all whom it may concern:

Be it known that I, JOHN A. BURNHAM, Jr., a citizen of the United States, residing at Boston, in the county of Suffolk, State of Massachusetts, have invented an Improvement in Gas-Engines, of which the following description, in connection with the accompanying drawings, is a specification, like letters on the drawings representing like parts.

This invention relates particularly to explosive engines such as gas engines in which an explosive mixture is introduced in successive charges, to be ignited in any preferred manner. It will be apparent, however, that certain features of the invention are not restricted to any particular type of engine but may be of general application.

In order that the principles of the invention may be apparent, I have, in the accompanying drawing, disclosed one type or embodiment thereof wherein is shown a central, vertical section of the engine taken through the cylinder, the valve chest and the related parts.

Having reference to that particular type or embodiment of the invention herein selected for illustrative purposes, the casing, which is preferably employed and which may be of any suitable conformation and construction suitably to house the operating parts or certain of them, is indicated at 1, it being mounted upon or suitably secured to a base 2 of any desired character.

The illustrated embodiment of the invention is a gas engine having reciprocating pistons, preferably opposed to each other. To that end a cylinder or combustion chamber 3 is suitably mounted in the casing 1 and is herein shown as horizontally disposed and as having disposed therein for horizontal reciprocation the pistons 4, 4, provided, if desired, with proper packing rings or the like to afford a close working fit within the cylinder.

The driven or crank shaft of the engine, which herein is shown as disposed beneath and extending transversely of the cylinder, or combustion chamber, is represented at 5, it having in the present instance a pair of crank pins 6, oppositely connected thereto, each crank pin being connected to a piston 4 and, as herein shown, through the instrumentality of a link 7 pinned at one end to the piston and at its opposite end to a vertically disposed rocking lever 8, suitably pivoted at 9 in the framing of the engine. To the opposite end of each rocking lever is suitably connected a rod 10, connecting it to one of said crank pins. By the described construction, the explosion of each charge imparts an outward movement of reciprocation to the pistons 4 and thereby through the described connections imparts rotation in the proper direction to the shaft 5, the pistons being returned to the position indicated in the figure through the momentum of the parts to compress the succeeding charge and to receive the impact thereof when exploded.

By the described construction the engine is perfectly balanced in all directions, thus avoiding vibration and excessive strains. All the parts when moving are always symmetrically distributed about the center line, the center of gravity remaining stationary. By the described arrangement an explosion occurs for every revolution of the crank shaft, one crank pin receiving an impulse on the overstroke of the crank simultaneously with the other crank pin receiving an impulse on the under stroke, thus equalizing all strains.

Any suitable type of igniting device may be employed. In the present instance a suitable form thereof is indicated at 11, herein shown as disposed centrally of the cylinder or combustion chamber 3 and preferably in the conduit leading thereto. It will be observed that herein the driven or crank shaft and the igniting device are disposed midway of the length of the cylinder. By such disposition of the driven or crank shaft a proper balancing of the parts is secured.

While the explosive mixture may be conveyed in any suitable manner to the cylinder or combustion chamber and the burned gases suitably discharged therefrom, in the present instance the inlet pipe is indicated at 12 as communicating with the inlet valve chamber 13. The exhaust pipe 14 communicates by a passage 14′, herein shown as broken away, with the exhaust valve chamber 15. In the present type of the invention the inlet and exhaust valves 16 and 17 are shown as mounted for longitudinal reciprocation in said valve chambers 13 and 15, respectively, and as disposed parallel with the cylinder or combustion chamber 3. Moreover, said valves are herein indicated as mounted at

substantially equal distances from the vertical axial line of the engine which, as heretofore indicated, passes through the driven shaft 5 and through the cylinder or combustion chamber 3 midway the ends thereof, and close to such vertical axial line. While the position of the valves may be varied as found desirable, the described location is found peculiarly effective not only because the charges are entered directly into the cylinder midlength thereof and in proximity to the igniting device 11, but thence in a highly efficient manner, but because, by disposing both inlet and outlet valves in line with, and as herein shown, opposed to each other and in line with the path of reciprocation of the pistons 4, the valves are most effectively disposed for easy and proper mechanical operation thereof and a great simplicity, compactness of construction is attained. Furthermore, I am thereby enabled to secure a balanced and symmetrical disposition and operation of parts.

In order to suitably operate the inlet and exhaust valves 16 and 17 periodically, in the present instance I provide a cam shaft 18, herein shown as disposed above the cylinder or combustion chamber 3 and valve chambers 13 and 15, transversely of said cylinder and preferably in the described vertical axis of the engine. Rotation may be imparted in any suitable manner to the cam shaft 18, herein shown as having disposed thereon cams 19 and 20, which may be in effect a double cam or separate cams suitably alined upon the cam shaft. While motion may be conveyed in any suitable manner from the cam shaft to the inlet and exhaust valves intermittently to operate them at the proper periods, in the present instance each valve is operated through the instrumentality of a lever 21, herein shown as suitably mounted upon the framework or casing, and a link 22 suitably pinned to the lever 21 and having a roll 23 engaging with the proper cam upon the cam shaft 18, thereby to impart an axial movement or thrust to the link 22 which, at its opposite end, is pinned to a lever 24 suitably mounted in the framework and herein shown as carrying at its opposite end a roll 25 adapted to engage the end of the spindle or stem 26 of the inlet or exhaust valve, as the case may be. By the described construction each valve is positively opened at the proper time. Any suitable means may be provided to close the valves but in the present instance I have employed coiled springs 27, herein shown as surrounding the valve spindles, between a portion of the casing and abutments 28 suitably mounted near the extremity of the valve stems, and opposing the thrust of the cams 19 and 20.

It will be observed that by disposing the cam shaft substantially centrally of the engine and transversely of the cylinder or combustion chamber 3, I am enabled similarly to operate each valve by parts that are interchangeable and, moreover, all operating strains are equally distributed. All of the operating parts are compactly arranged and symmetrically disposed with reference to the vertical axial line of the engine, thus affording a balanced movement of parts found in practice to be highly efficient and conducive to economy and simplicity of operation.

Having thus described one type or embodiment of my invention, I wish it to be understood that although I have employed specific terms of description, such terms are used in a generic or descriptive sense merely and not as terms of limitation, the scope of the invention being set forth in the following claims.

1. An explosive engine comprising a cylinder or combustion chamber, opposed reciprocating pistons located therein, a driven shaft whereto said pistons are operatively connected to impart rotation thereto, inlet and exhaust passages communicating with said cylinder, valves controlling said passages, said valves being opposed to each other and disposed substantially parallel with said pistons, and operating means for said valves symmetrically disposed with respect to the axis of the engine.

2. An explosive engine comprising a cylinder or combustion chamber, opposed reciprocating pistons located therein, a driven shaft whereto said pistons are operatively connected to impart rotation thereto, inlet and exhaust passages communicating with said cylinder, valves controlling said passages, said valves being opposed to each other and disposed substantially parallel with said pistons, and operating means for said valves symmetrically disposed with respect to the vertical axis of the engine.

3. An explosive engine comprising a cylinder or combustion chamber, opposed reciprocating pistons located therein, a driven shaft whereto said pistons are operatively connected to impart rotation thereto, inlet and exhaust passages communicating with said cylinder, valves controlling said passages, said valves being opposed to each other and disposed substantially parallel with said pistons and symmetrically with respect to the vertical axis of said engine, a valve operating shaft disposed substantially in the vertical axis of the engine, and operating connections between said shaft and said valves.

4. An explosive engine comprising a horizontally disposed cylinder or combustion chamber, opposed reciprocating pistons located therein, a driven shaft whereto said pistons are operatively connected to impart rotation thereto, inlet and exhaust passages communicating with said cylinder, valves controlling said passages, said valves being

mounted above said cylinder, opposed to each other and disposed substantially parallel with said pistons, a valve operating shaft disposed above said valves, and valve operating connections between said shaft and said valves.

5. An explosive engine comprising a horizontally disposed cylinder or combustion chamber, opposed reciprocating pistons located therein, a driven shaft whereto said pistons are operatively connected to impart rotation thereto, inlet and exhaust passages communicating with said cylinder midway the length thereof, valves controlling said passages, said valves being mounted above and in close proximity to said cylinder, opposed to each other and disposed substantially parallel with said pistons, a valve operating cam shaft disposed above said valves and in close proximity thereto, positive valve opening connections between said cam shaft and said valves, and springs tending normally to seat said valves.

6. An explosive engine comprising a cylinder or combustion chamber, opposed reciprocating pistons located therein, a driven shaft whereto said pistons are operatively connected to impart rotation thereto, inlet and exhaust passages communicating with said cylinder, valves controlling said passages, said valves being opposed to each other and disposed substantially parallel with said pistons, a valve operating cam shaft disposed substantially midway between the ends of said cylinder, and lever connections between said cam shaft and valves for operating the same.

7. An explosive engine comprising a horizontally disposed cylinder or combustion chamber, opposed reciprocating pistons located therein, a driven shaft whereto said pistons are operatively connected to impart rotation thereto, inlet and exhaust passages communicating with said cylinder, valves controlling said passages, said valves being opposed to each other and disposed substantially parallel with said pistons, a valve operating cam shaft disposed above said valves and substantially midlength the cylinder and having cams thereon, levers directly engaging said valves to open the same, thrust links adapted to be impinged upon by said cams upon said cam shaft to convey motion through said levers to said valves, and spring mechanism tending to return said valves to their seats.

8. An explosive engine comprising a horizontally disposed cylinder or combustion chamber, opposed reciprocating pistons located therein, levers whereto said pistons are respectively connected, a driven or crank shaft, cranks oppositely disposed upon said shaft and operatively connected to said levers respectively, inlet and exhaust passages communicating with said cylinder, valves controlling said passages, said valves being opposed to each other and disposed substantially parallel with said pistons, a valve operating shaft, and lever connections therefrom to operate each valve.

9. An explosive engine comprising a horizontally disposed cylinder or combustion chamber, opposed reciprocating pistons located therein, levers whereto said pistons are respectively connected, a driven or crank shaft, cranks oppositely disposed upon said driven shaft and operatively connected to said levers respectively, inlet and exhaust passages communicating with said cylinder, valves controlling said passages, said valves being opposed to each other and disposed substantially parallel with said pistons, a valve operating shaft, and lever connections therefrom to operate each valve, said lever connections being disposed symmetrically with respect to the vertical axis of the engine.

10. An explosive engine comprising a horizontally disposed cylinder or combustion chamber, opposed reciprocating pistons located therein, levers whereto said pistons are respectively connected, a driven or crank shaft, cranks oppositely disposed upon said shaft and operatively connected to said levers respectively, inlet and exhaust passages communicating with said cylinder, valves controlling said passages, said valves being opposed to each other and disposed substantially parallel with said pistons, a valve operating cam shaft disposed transversely above said pistons and substantially midlength said cylinder, thrust links oppositely disposed with respect to said cam shaft, levers to which said thrust links are connected, said levers directly engaging said valves to open the same, and means tending normally to seat said valves.

11. An explosive engine comprising a horizontally disposed cylinder or combustion chamber, opposed reciprocating pistons located therein, levers whereto said pistons are respectively connected, a driven or crank shaft, cranks oppositely disposed upon said shaft and operatively connected to said levers respectively, inlet and exhaust passages communicating with said cylinder, valves controlling said passages, said valves being opposed to each other and disposed substantially parallel with said pistons, a valve operating cam shaft disposed transversely above said pistons and substantially midlength said cylinder, thrust links pivotally mounted and oppositely disposed with respect to said cam shaft, vertically mounted levers to which said thrust links are operatively connected, said levers directly engaging said valves to operate the same, and springs tending normally to seat said valves.

12. An explosive engine comprising a horizontally disposed cylinder or combustion

chamber, opposed reciprocating pistons located therein, a driven shaft, lever and link connections between said pistons and said shaft to impart rotation thereto, inlet and exhaust passages communicating with said cylinder, valves controlling said passages, said valves being mounted above said cylinder, opposed to each other and disposed substantially parallel with said pistons, a valve operating shaft disposed above said valves, adjacent thereto and symmetrically with respect to said valves, positive connections for opening said valves, and springs tending to restore said valves to their seats.

13. An explosive engine comprising a horizontally arranged cylinder or combustion chamber, opposed reciprocating pistons located therein, a driven shaft, link and lever connections from each piston to said shaft to impart rotation thereto, inlet and exhaust passages communicating with said cylinder substantially midlength thereof, valves disposed above said cylinder, opposed to each other, disposed substantially parallel with said pistons and seated substantially midlength said cylinder, a valve operating shaft located above said valves but adjacent thereto, levers operated by said shaft and directly engaging said valves to open the same, and means to return said valves to their seats.

In testimony whereof, I have signed my name to this specification, in the presence of two subscribing witnesses.

JOHN A. BURNHAM, Jr.

Witnesses:
SIDNEY F. SMITH,
HENRY W. TONE.