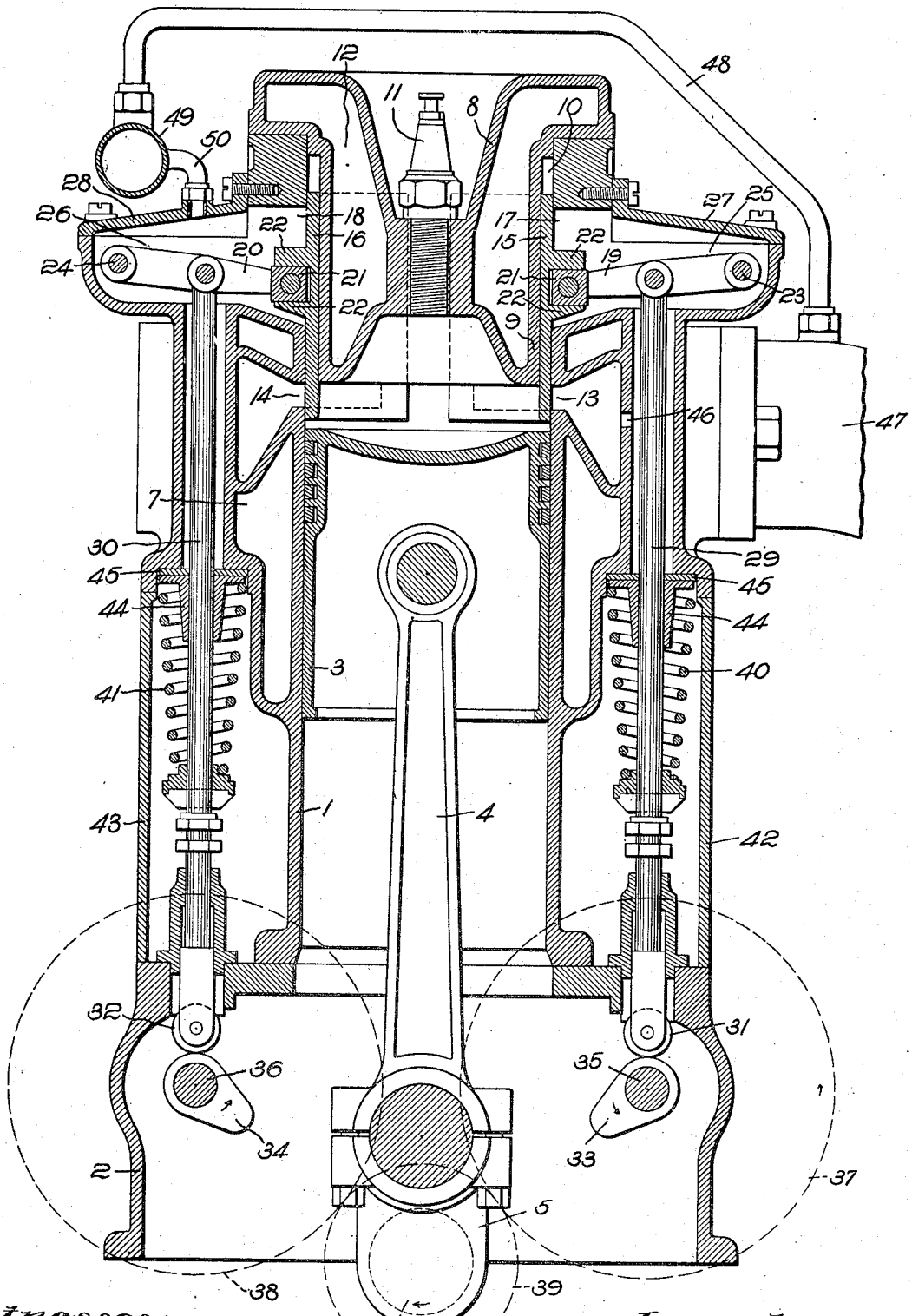
A. ROSNER.

INTERNAL COMBUSTION ENGINE.

APPLICATION FILED JUNE 13, 1912.

1,149,986.

Patented Aug. 10, 1915.



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UNITED STATES PATENT OFFICE.

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INTERNAL-COMBUSTION ENGINE.

1,149,986. Specification of Letters Patent. Patented Aug. 10, 1915.

Application filed June 13, 1912. Serial No. 703,453.

To all whom it may concern:

Be it known that I, ADOLPH ROSNER, a subject of the Emperor of Austria-Hungary, and a resident of Bridgeport, county of Fairfield, State of Connecticut, have invented an Improvement in Internal-Combustion Engines, of which the following description, in connection with the accompanying drawings, is a specification, like characters on the drawings representing like parts.

This invention relates to internal combustion engines, and particularly to means for controlling the admission of fuel to the cylinder and the exhaustion of waste gases therefrom.

The invention will be best understood by reference to the following description when taken in connection with the accompanying illustration of one specific embodiment thereof, while its scope will be more particularly pointed out in the appended claims.

In the drawings there is shown a transverse sectional elevation taken through the cylinder of a multiple cylinder engine equipped with one form of the invention.

Referring to the drawings and to the embodiment of the invention there submitted for illustrative purposes, the engine there shown is provided with a fixed main cylinder 1 supported upon the crank casing 2 and having the working piston 3 connected by the connecting rod 4 to the crank 5 and crank shaft 6. The working space of the cylinder or that part through which the piston travels is surrounded by the water jacket 7 and the piston slides in direct contact with the water jacketed walls of the fixed cylinder. The rear end of the cylinder is closed by the cylinder head 8 which is bolted or otherwise fixedly secured to the head end of the cylinder, preferably forming a gas-tight joint and a gas-tight closure. The cylinder head has a portion 9 which projects into the rear end of the cylinder, the projecting portion being of lesser diameter than the diameter of the cylinder and providing thereat an annular space 10 between the cylinder and the reentrant walls of the head. The cylinder head has the centrally arranged spark plug 11 and is provided with the water jacket 12. At the rear of the cylinder, beyond the working space thereof and in close proximity to the projecting portion of the cylinder head, are provided the oppositely disposed admission and exhaust ports 13 and 14, respectively. While these parts may be otherwise located, they are preferably formed in the walls of the cylinder bore itself and as indicated in dotted lines extend each part way around the cylinder.

In the described embodiment of the invention the ports 13 and 14 are controlled by independently movable slide valves 15 and 16, respectively. While the valves might consist of flat plates or have other than a curvilinear shape, for convenience in construction as well as efficient operation, each valve preferably comprises an arc-shaped segmental plate having a curvature corresponding to the curvature of the cylinder bore so that it is adapted to seat thereagainst and having edges which may be in sliding abutment with each other, but herein are shown as separated by an intervening space. These valve plates or slides are moved independently up and down by means to be more fully described, so that their ends, which in their lowermost positions terminate short of the piston and the working space of the cylinder, are alternately projected each over its respective port to close the same and subsequently withdrawn therefrom to open the port. The valve slides at their inner faces are exposed to the pressure of the gas contained in the cylinder so that they are automatically seated during the compression and working strokes of the piston, the high pressure exerted radially outward against the valves holding them effectively each against its seat and preventing all leakage at the ports. To move the valves independently and in properly timed relation, valve-moving means are provided having connection with the valves through openings 17 and 18, respectively, formed in the cylinder walls and in the seats over which the valves slide. Working in the openings 17 and 18 there are provided the actuating levers 19 and 20, respectively. These are connected to the valves at their sides or faces, each by means of a trunnion block 21 seated between lugs 22 projecting outwardly from the valves, the block being spanned by and jointed to the forked ends of the lever. The openings 17 and 18 being formed in the cylinder and the valves

covering the same and being pressed automatically thereagainst by the pressure within the cylinder space all leakage outward is substantially prevented through the openings in the same manner as it is through the ports 13 and 14 when the latter are closed. The levers 19 and 20 are pivoted at 23 and 24, respectively, to work in chambers 25 and 26, respectively, formed in the engine casing, such chambers being closed by means of removable covers 27 and 28. To actuate the valves the levers have jointed connections respectively to the push rods 29 and 30, the latter being connected at their lower ends to the cam rolls 31 and 32, which bear respectively against the actuating cams 33 and 34 on the cam shafts 35 and 36. These cam shafts are driven at one-half the speed of the crank shaft through gears 37 and 38 meshing with the pinion 39 on the crank shaft. Each cam is provided with a projection which when brought beneath its cam roll lifts its respective valve and moves it back into the annular space 10 to open its respective port. On the withdrawal of the cam projection from the cam roll the valve is moved back to close its port under pressure of one of the valve closing springs 40 or 41, which latter encircle the push rods 29 and 30, respectively, and press the cam rolls down against the peripheries of the cams. The push rods and associated parts are housed in by the protecting casings 42 and 43. The invention being illustrated as applied to a four-cycle engine, the valve-opening movement takes place once for each two double strokes of the piston. While the valves are automatically seated by the pressure within the cylinder during the compression and working strokes and the resistance of the valves to leakage is automatically increased as the pressure within the cylinder increases, there is apt to be in this type of valve a tendency to leakage into the cylinder from without around the slides on the suction stroke and especially when the engine is throttled and running at low speeds. Under these conditions the vacuum within the cylinder increases on the suction stroke and the leakage of air through the openings 17 and 18 and around the edges of the slides admits a volume of air to the cylinder on the suction stroke which dilutes the mixture and tends to prevent the charge from firing. This suction also tends to lift the slide from its seat and to cause it to strike the cylinder head, thereby producing a slapping noise.

To prevent the leakage from without the cylinder into the same, I have herein protected the chambers 25 and 26 against the entrance of external air, said chambers being entirely closed at the top by the covers 27 and 28, respectively, and the valve-operating rods 29 and 30 passing down and out of said chambers each through a flanged bushing 44 and a rubber gasket 45, thereby providing a packed joint and substantially air tight joint thereat. By thus protecting the chambers 25 and 26 against the entrance of external air, the formation of any considerable vacuum on the suction stroke, such as may be due to throttling down the engine, cannot draw an appreciable volume of air from the chambers after the first stroke or two of the piston, even though the seating of the valves be such as to afford a more or less free communication between the chambers and the cylinder space on the suction stroke. This provision for preventing inward leakage during the suction stroke is found to give greatly improved results. As a further means for avoiding leakage and preventing the lifting of the slide valve from its seat, I may, and preferably do, open communication between the admission conduit of the engine and one or both of the chambers 25 and 26, thereby tending to equalize the vacuum in the said chamber or chambers and the vacuum within the cylinder on the suction stroke of the engine after the admission valve 15 is opened. This may be accomplished in various ways, but herein I have provided an opening 46 which places the admission space adjacent the admission port 13 in free communication with the chamber 25. This causes the suction within the said chamber to be maintained at the same point as the suction within the admission conduit. When the admission valve 15 is opened on the suction stroke, there results no greater tendency for leakage about the edges of the valve 15 from the chamber 25 than there is for the vapor to enter the cylinder through the port 13 which is then open and if such leakage should occur, it merely results in augmenting the admission and in drawing fuel vapor from the admission space through the opening 46 and chamber 25 about the edges of the valve into the cylinder. Similarly, if desired, the chamber 26 to which the outer face of the exhaust valve 16 is exposed may be connected to the admission conduit. This connection may be obtained in any desired way, but herein I have connected the admission pipe 47 through the pipe 48 with the manifold 49, the latter extending lengthwise the several cylinders of the engine and having communication at each cylinder with the space 26 through the branch pipe 50. The tendency of the exhaust valve 16 to lift from its seat during the suction stroke of the engine can do no harm, because it is counteracted by the suction in the admission conduit through pipes 48, 49 and 50.

It will be understood that the same principles may be applied to slide and other valves having different formations and shapes and located with relation to the piston and cylin-

der, otherwise than is shown in the specific embodiment of the invention illustrated.

While I have herein shown and described for purposes of illustration one specific form of the invention, it is to be understood that the latter is not limited to the precise constructional features disclosed nor to the form or relative arrangement of parts nor to the particular type of engine described, but that extensive modifications may be made in the illustrated embodiment of the invention without departing from the spirit thereof.

Claims:

1. In an internal combustion engine, the combination with a ported cylinder of a piston, a cylinder head having an inwardly projecting portion, a pair of segmental arc-shaped slide valves between the cylinder head and cylinder and controlling respectively the admission and exhaust ports, each valve having a port controlling portion adapted to be projected beyond the cylinder head and exposed to the seating pressure of the cylinder, valve moving means for each valve contained in a chamber and each engaging its valve through an opening in the valve seat, said chambers being protected against the entrance of external air, and means providing for communication between the admission conduit of the engine and each of said chambers, thereby tending to equalize the pressure in said chambers and the cylinder on the suction stroke of the engine.

2. In an internal combustion engine, the combination with a ported cylinder of a piston, a pair of segmental, arc-shaped slide valves controlling respectively the admission and exhaust ports, each valve being exposed to the seating pressure of the cylinder, valve moving means for each valve contained in a chamber and each engaging its valve through an opening of the valve seat, said chambers being protected against the entrance of external air, and means providing communication between the admission conduit of the engine and each of said chambers, thereby tending to equalize the pressure in said chambers and the cylinder on the suction stroke of the engine.

3. In an internal combustion engine, the combination with a ported cylinder, of a piston, a pair of segmental arc-shaped slide valves, controlling respectively the admission and exhaust ports, valve-moving means for each valve engaging the valve through a chamber separate from the cylinder space and valve port, and means providing for communication between the admission conduit of the engine and each of said chambers.

4. In an internal combustion engine, the combination with a ported cylinder, of a piston, a pair of slide valves controlling respectively the admission and exhaust ports, valve-moving means for each valve engaging its valve through a chamber separate from the cylinder space and the valve port, and means opening communication between the admission conduit of the engine and each of said chambers.

5. In an internal combustion engine, the combination with a cylinder, of a piston, a pair of slide valves controlling each a port and exposed to a space apart from the cylinder space over the controlled port, and means for equalizing the pressure in each of said spaces and the cylinder space on the suction stroke of the engine.

6. In an internal combustion engine, the combination with a ported cylinder of a piston, a slide valve controlling a cylinder port, the pressure in the cylinder serving to hold the valve to its seat, and an opening in the valve seat in addition to the port, said opening being covered by the valve and communicating with a chamber, and the latter being protected against the entrance of external air.

7. In an internal combustion engine, the combination with a ported cylinder having an admission conduit, of a piston, a slide valve controlling a cylinder port, the pressure in the cylinder serving to hold the valve to its seat, an opening in the valve seat in addition to the port, said opening communicating with a chamber, and a connection between the chamber and the admission conduit of the engine.

8. In an internal combustion engine, the combination with a ported cylinder of a piston, a slide valve controlling a cylinder port, the pressure in the cylinder serving to hold the valve to its seat, an opening in the valve seat in addition to the port opening, said opening communicating with the chamber, and means for equalizing the pressure in said chamber and said cylinder on the suction stroke of the engine.

9. In an internal combustion engine, the combination with a ported cylinder of a piston, a slide valve controlling a cylinder port, the pressure in the cylinder serving to hold the valve to its seat, an opening in the valve seat in addition to the port opening, said port opening communicating with a chamber, and means for equalizing the pressure in said chamber and in said cylinder on the suction stroke of the engine.

10. In an internal combustion engine, the combination with a ported cylinder, a piston, a slide valve controlling a cylinder port, the pressure in the cylinder serving to hold the valve to its seat, moving means for the valve engaging the valve through a chamber having an opening in the valve seat, said valve covering said opening said chamber being protected against the entrance of external air.

11. In an internal combustion engine, the combination with a ported cylinder of a piston, a slide valve controlling a cylinder port, the pressure in the cylinder serving to hold the valve to its seat, moving means for the valve engaging the latter through a chamber having an opening in the valve seat, and means providing for communication between the said chamber and the admission conduit of the engine.

12. In an internal combustion engine, the combination with a ported cylinder of a piston, a slide valve controlling a cylinder port, the pressure in the cylinder serving to hold the valve to its seat, moving means for the valve engaging the latter through a chamber having an opening in the valve seat, and means for equalizing the pressure in the said chamber and in said cylinder on the suction stroke of the engine.

13. In an internal combustion engine, the combination with a ported cylinder of a piston, a segmental arc-shaped slide valve controlling a cylinder port, the pressure in the cylinder serving to hold the valve to its seat, an opening in the valve seat in addition to the port, said opening communicating with a chamber and a connection between said chamber and the admission conduit of the engine.

14. In an internal combustion engine, the combination with a ported cylinder of a piston, a segmental, arc-shaped slide valve controlling a cylinder port, the pressure in the cylinder serving to hold the valve to its seat, an opening in the seat in addition to the port, said opening communicating with a chamber and the latter protected against the entrance of external air.

15. In an internal combustion engine, the combination with a ported cylinder having an admission conduit, of a piston, an arc-shaped slide valve controlling a cylinder port, valve moving means engaging the valve through a chamber separate from the cylinder space and the controlled port, and means providing for communication between the said chamber and the admission conduit in the chamber.

16. In an internal combustion engine, the combination with a ported cylinder having an admission conduit, of a piston, a slide valve controlling a cylinder port, valve-moving means engaging the valve through a chamber separate from the cylinder space and the controlled port, said chamber being protected against the entrance of external air and having an opening covered by said valve through which opening said valve moving means passes.

17. In an internal combustion engine, the combination with a ported cylinder having an admission conduit of a piston, a slide valve controlling a piston port, valve-moving means engaging the valve through a chamber separate from the cylinder space and the controlled port, and means for equalizing the pressure between the chamber and the cylinder space on the suction stroke of the piston.

18. In an internal combustion engine, the combination with a ported cylinder, of a piston, a slide valve controlling a port and exposed to a space apart from the cylinder space and the controlled port, and means providing communication between said space and the admission conduit of the engine.

19. In an internal combustion engine, the combination with a ported cylinder, of a piston, a slide valve controlling a port and exposed to a space apart from the cylinder space and the controlled port, and means tending to balance the pressure in said space and the cylinder on the suction stroke of the engine.

20. In an internal combustion engine, the combination with a ported cylinder of a piston, an arc-shaped slide valve controlling a port and exposed to a space apart from the cylinder space and the controlled port, and means providing communication between said space and the admission conduit of the engine.

21. In an internal combustion engine, the combination with a cylinder having an exhaust port, a slide valve controlling the same, said valve being exposed to a space apart from the cylinder space and the exhaust port, and means providing for communication between the said space and the admission conduit of the engine.

22. In an internal combustion engine, the combination with a cylinder having an exhaust port, a slide valve controlling the same, said valve being exposed to a space apart from the cylinder space and the exhaust port, and means for balancing the pressure in the said space and the cylinder on the suction stroke of the engine.

23. In an internal combustion engine, the combination with a ported cylinder of a piston, a slide valve controlling a cylinder port, said valve being seated by the pressure in the engine cylinder during compression and working strokes, and means for balancing the pressure on opposite sides of said valve during the suction stroke.

24. In an internal combustion engine, the combination with a ported cylinder of a piston, a slide valve controlling a cylinder port, said valve being seated by the pressure in the engine cylinder during compression and working strokes, and means for adjusting the gaseous pressure on opposite sides of the valve to prevent the lifting of the valve off its seat during the suction stroke.

25. In an internal combustion engine, the combination with a ported cylinder of a piston, a pair of arc-shaped slide valves,

controlling ports therein, said valves being seated by the pressure in the engine cylinder during compression and working strokes, and means for adjusting the gaseous pressure on opposite sides of the valves to prevent the lifting of the valves from their seats during the suction stroke.

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

ADOLPH ROSNER.

Witnesses:
A. L. RIKER,
A. C. SCHULZ.