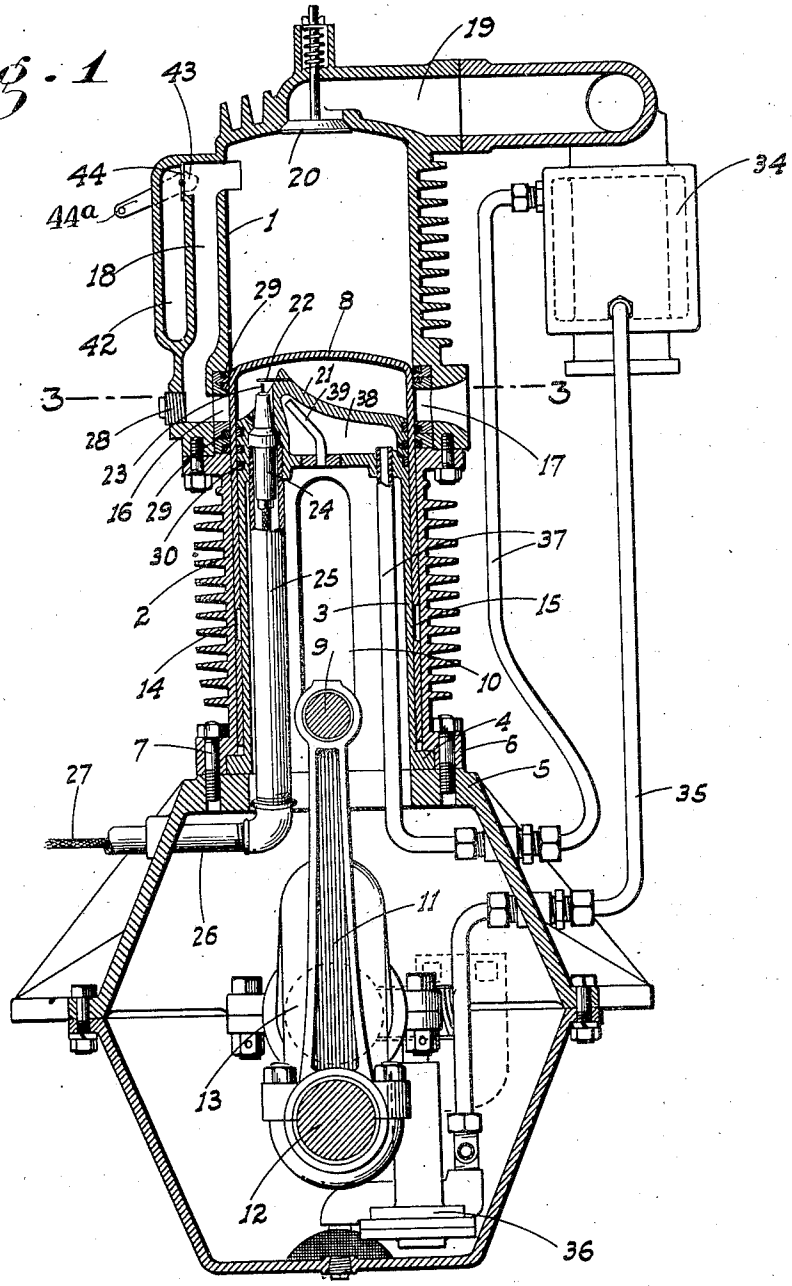
May 7, 1935. E. M. TUCKER 2,000,108

TWO-CYCLE GAS ENGINE

Filed Feb. 29, 1932 3 Sheets-Sheet 1

Fig. 1



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BY

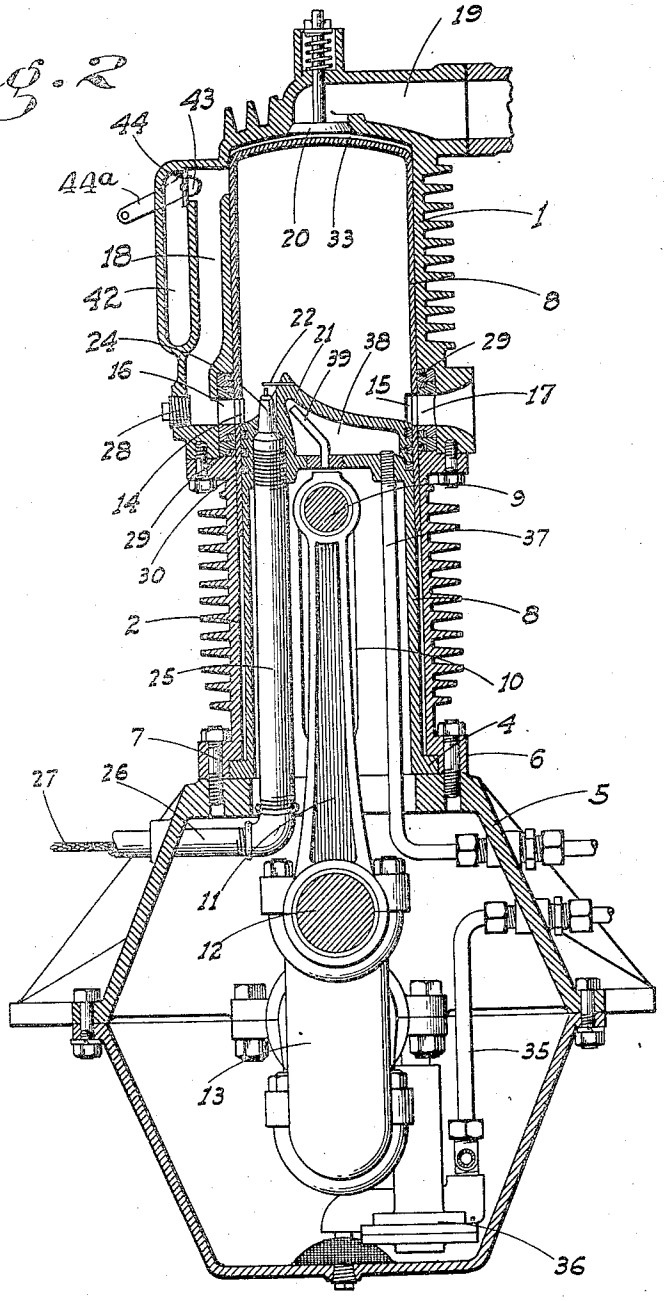
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Fig. 2



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Fig. 3

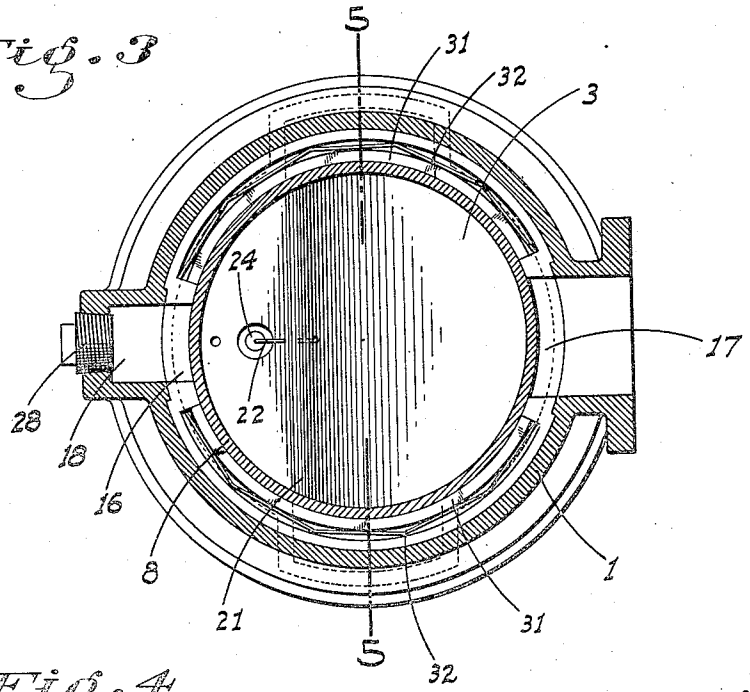


Fig. 4

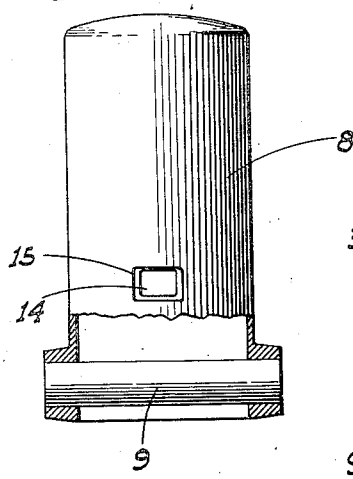
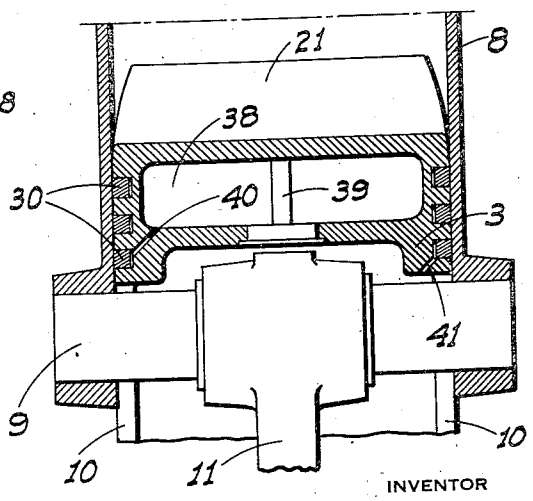


Fig. 5



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Patented May 7, 1935

2,000,108

UNITED STATES PATENT OFFICE

2,000,108

TWO-CYCLE GAS ENGINE

Emmitt M. Tucker, Sacramento, Calif., assignor to Tucker Diesel Motor Co. Ltd., a corporation of California

Application February 29, 1932, Serial No. 595,699

10 Claims. (Cl. 123—50)

This invention relates to two-cycle engines and particularly represents improvements over the engine shown in my Patent No. 1,891,510, dated December 20, 1932, the features of improvement in the present engine over the former particularly relating to the manner of cooling the cylinder head while at the same time heating the intake manifold; the mounting of the spark plug and the method whereby the points of the same are always kept clean; the provision of a shock absorbing air cushion for the piston at the end of the firing stroke; and sundry other refinements which will be apparent from the drawings and description now to follow.

These object I accomplish by means of such structure and relative arrangement of parts as will fully appear by a perusal of the following specification and claims.

In the drawings similar characters of reference indicate corresponding parts in the several views:

Fig. 1 is a transverse section of my improved engine with the piston at the beginning of the firing stroke.

Fig. 2 is a similar view with the piston at the end of the firing stroke.

Fig. 3 is a cross section on the line 3—3 of Fig. 1.

Fig. 4 is a side view detached of the sleeve piston partly in section.

Fig. 5 is a fragmentary transverse section on the line 5—5 of Fig. 3.

Referring now more particularly to the characters of reference on the drawings, the engine comprises an outer cylinder consisting of an upper intake and compression chamber 1 and a lower depending skirt 2 rigidly connected thereto; these two parts practically forming a single unit and having air cooling fins or being otherwise provided with heat transfer means.

Disposed concentric with and inside the skirt in clearance relation thereto is a hollow cylinder head 3 which is open on its lower end. At said end the head is provided with an outwardly projecting flange 4 which rests on top of the crank case 5 of the engine. The skirt of the cylinder also has an outwardly projecting base flange 6 resting on the crank case and which is internally recessed to engage the flange 4, as shown. Bolts 7 secure the flange 6 to the crank case and it will be seen by the above arrangement that the head is both held down and retained in centered relation to the skirt.

Slidable on the head and also in the cylinder so as to have a running fit with both is a sleeve or cylinder-piston 8, closed on its upper end. Said end of the piston is disposed between the head of the outer chamber 1 and the adjacent end of the head 3; the piston moving between these parts to within close distances of the same.

A wrist pin 9 is mounted in the piston toward its lower end which projects through vertical slots 10 cut in the opposite sides of the head 3. A connecting rod 11 of ordinary character depends from the pin and engages the crank 12 of the crank shaft 13 which is journaled in the crank case in the usual manner. The piston has opposed ports 14 and 15 on substantially the same level adapted to fully register with the adjacent ends of intake and exhaust ports 16 and 17 respectively only when the piston is at the uppermost end of its stroke, as shown in Fig. 2; these ports being uncovered by the movement of the piston on its opposite stroke. The port 16 communicates with the interior of the chamber 1 near the top by a by-pass 18, while the main intake passage 19 leads to the top of said chamber with a downwardly opening spring closed valve 20 normally closing the entrance from said intake passage to the chamber.

The top of the head 3 at the sides is on a level with the bottom of the ports 16 and 17, and intermediate said sides and near the intake port 16 the head is provided with an upward projection 21 which extends substantially parallel to the port and forms a baffle preventing a direct flow of gases between the ports 14 and 15. Mounted in the head is a spark plug which preferably consists of a fixed electrode 22 mounted in the baffle and projecting horizontally from the same toward the intake passage. This electrode cooperates with another electrode 23 mounted in an insulation core 24 which removably projects through the head from below. The core is formed with a shoulder intermediate its ends which is engaged and clamped in place by the upper end of a tubular member 25, whose lower end projects below the bottom of the head and is provided with a lateral extension 26 projecting through the adjacent side of the crank case. The cable 27 to the core electrode extends through the extension and tubular member.

In order that the spark points or electrodes may be seen and adjusted when necessary, the outer wall of the by-pass 18 in line with and opposed to the port 16 is provided with an opening normally closed by a plug 28. In this manner when the piston is positioned such that the port 14 registers with the port 16 the plug points are rendered accessible for adjustment by a screw driver or other tool upon the removal of the plug.

In order to prevent the escape of gases verti-

cally from between the chamber 1 and the piston and between the piston and the head 3, contracting rings 29 are provided in the chamber 1 above and below the intake and exhaust ports, and expansion rings 30 are mounted on the head adjacent its upper end. To prevent the horizontal passage of gases between the ports when the latter are covered by the piston, ring segments 31 are mounted in the member 1 in the horizontal plane of and on opposite sides of the ports, as shown in Fig. 3, which rings are pressed toward the piston by springs 32 in the ring grooves behind said rings.

In operation, when the piston is in its lowermost position, as shown in Fig. 1, the charge to be fired is confined between the head 3 and the adjacent end of the piston and the firing impulse of course causes the piston to travel upwardly. With such movement of the piston the fresh mixture which has been confined in the chamber 1 with the previous down stroke of the piston, is now compressed and is forced into the by-pass 18. As soon as the piston reaches the top of its stroke, the ports 14 and 16 register as previously stated and the fresh charge rushes into the piston. At the same time the exhaust ports register with each other so that the fired gases are discharged—an operation which of course is aided by the sudden inflow of the fresh mixture. With such inflow of the mixture it passes directly against the plug points which are thus kept constantly clean, and any slight particles of carbon which may have settled thereon during the previous stroke are immediately blown off so that there is little if any chance that the plug will become fouled.

It will be noted that when the piston arrives at the topmost point of its stroke it extends past the upper end of the by-pass 18 and approaches very close to the head of the chamber 1, thus forming a small enclosed air cushion chamber 33 as shown in Fig. 2. With the succeeding downward stroke of the piston the valve 20 is of course opened by the tendency to vacuum then set up and another charge is drawn into the chamber to be subsequently compressed as above described.

The upper end of the head 3, especially near the spark plug, tends to become very hot with the operation of the engine. In order therefore to both cool this top portion of the head 3 and at the same time heat the incoming mixture, I provide the following arrangement. The passage 19 is connected to a jacketed manifold 34. A conduit 35 is connected to the oil distributing line from the oil pump 36 of the engine and leads to the manifold jacket. Another conduit 37 leads from the jacket to an enclosed chamber 38 formed in the top of the head 3, the top of the chamber following the contour of the baffle 21. The discharge from the chamber is had by means of a tube 39 which extends upwardly into the chamber to adjacent the top of the baffle, as shown. The bottom of the tube is in alinement with the top oil hole in the connecting rod so that as the oil discharges into the head area below the chamber it will splash on the connecting rod when the latter is in its upper position and will lubricate its bearing with the wrist pin. While the engine is in operation therefore a constant circulation of oil is fed to the manifold, thereby imparting desirable heat to the same while being relatively cooled and this relatively cool oil is then fed to the head chamber to maintain the same in a relatively cool condition.

The lower ring 30 of the head should be kept floating in oil in order to retain the necessary pressure-tight fit with the sleeve 8. I therefore drill a passage 40 from the oil chamber 38 at the head to the lower ring groove so that said groove is constantly supplied by oil from the chamber. Another passage 41 is drilled from the opposite side of the groove through the bottom of the chamber in position to discharge onto the wrist pin 9 when the latter is at its uppermost position so as to lubricate the same. The upper rings are lubricated by the film of oil left on the sleeve wall by the lower ring.

The engine with a by-pass 18 of a certain size operates under very high compression which is valuable in certain conditions especially in airplane service especially at high altitudes. At low altitudes or on the ground however a lower compression is better. To enable the engine compression to be altered according to the needs I provide an auxiliary chamber 42 which is formed on the chamber or cylinder 1 outwardly of the by-pass 18 and communicating therewith by means of an opening 43 at the top. This opening is provided with a butterfly or similar valve 44 having a manually operable control arm 44a, so that said opening may be kept closed or opened to any extent necessary. When the necessity for a relatively low operating compression arises the valve 44 is opened. Some of the charge drawn into the chamber 1 through the valve 20 and subsequently compressed by the upward movement of the sleeve, is therefore diverted into the auxiliary chamber 42 instead of being all passed into the sleeve 8 when the latter reaches the top of its stroke. Only a portion of the total charge is thus delivered into the piston or sleeve, resulting in a lowered compression.

From the foregoing description it will be readily seen that I have produced such a device as substantially fulfills the objects of the invention as set forth herein.

While this specification sets forth in detail the present and preferred construction of the device, still in practice such deviations from such detail may be resorted to as do not form a departure from the spirit of the invention, as defined by the appended claims.

Having thus described my invention what I claim as new and useful and desire to secure by Letters Patent is:

1. In a gas engine, a fixed hollow head closed on top, a sleeve piston slidable on said head, a wrist pin secured to and extending from side to side of the piston below the top of the head, a connecting rod depending from the pin, a chamber formed in the head immediately under its top, means to feed oil to said chamber, and an outlet from said chamber in vertical alinement with the upper end of the connecting rod.

2. In a gas engine, a fixed hollow head closed on top, a sleeve piston slidable on said head, said piston being closed on top, means to reciprocate the piston, the piston having an intake port in one side projecting above the head when the piston is in a predetermined position relative to the head, a baffle projecting upwardly from the head in facing relation to and near the ported side of the piston, and a spark plug mounted in the head from below and projecting upwardly therethrough so that the electrodes of the plug are exposed on the port side of the baffle.

3. In a gas engine, a fixed hollow head closed on top and open on the bottom, a sleeve piston

slidable on said head, a spark-plug core removably seated in the head and projecting upwardly through the top from the interior of said head adjacent one side, the core having a shoulder intermediate its ends, and a tubular member surrounding the core below and engaging the shoulder, said member being removably secured in the top of the head and depending to a point below the bottom of the same.

4. In a gas engine, a fixed head, a sleeve piston slidable on said head, said piston being closed at its end opposite the head, means to reciprocate the piston, the piston having an intake port in one side disposed beyond the head when the piston is in a predetermined position relative to the head, an intake passage extending at right angles to the port and adapted at one end to register with the port when the latter is in said predetermined position, a spark plug mounted in the head just inwardly of the port and whose electrodes are disposed in the plane of the port area when in said position, and a removable plug in the outer wall of the passage in alinement with and in facing relation to the port registering end of the passage.

5. In a gas engine, a fixed hollow head closed on top, a sleeve piston slidable on said head, said piston being closed on top, means to reciprocate the piston, the piston having an intake port in one side projecting above the head when the piston is in a predetermined position relative to the head, an intake passage one end of which is positioned to register with the port when the latter is in said predetermined position, a spark plug mounted in the head and whose electrodes project into the horizontal plane of said end of the passage, and means provided with the passage to render said electrodes accessible from outside the engine without removing the spark plug from the same.

6. In a two-cycle gas engine, a fixed head, a sleeve piston slidable on said head and closed on top, a cylinder mounted in a fixed position about said piston, the latter having opposed and horizontally alined intake and exhaust ports, passages in said member to communicate with said ports simultaneously, and packing rings mounted in the member to the sides of and on a level with the port communicating ends of the passages.

7. A two-cycle gas engine comprising a fixed head, a piston slidable thereon, a compression chamber in which the piston is slidable, said chamber being closed on its outer end and the piston being closed on that end which is disposed between the head and the closed end of the chamber, a valve closed intake to the head of the chamber, a port in one side of the chamber just beyond the head, the piston having a port to register with the chamber port when the piston is at the outer end of its stroke, a by-pass between the chamber port and the side of the chamber near its outer end, and means to reciprocate the piston; said piston at the end of its outward stroke approaching close to the head of the chamber and closing the adjacent end of the by-pass.

8. In a two-cycle gas engine, a fixed head, a sleeve piston slidable on said head and closed at its outer end, a cylinder mounted in a fixed position about said piston, the latter having opposed intake and exhaust ports, means to draw a charge of mixture into the cylinder with the movement of the piston toward the head, said mixture being compressed with the outward movement of the piston, a by-pass from the cylinder adjacent its outer end to an opposite termination in the cylinder to aline with the intake port when the piston is at the outer end of its stroke, and means controllable at will to divert some of the compressed charge from the by-pass.

9. In a two-cycle gas engine, a fixed head, a sleeve piston slidable on said head and closed at its outer end, a cylinder mounted in a fixed position about said piston, the latter having opposed intake and exhaust ports, means to draw a charge of mixture into the cylinder with the movement of the piston toward the head, said mixture being compressed with the outward movement of the piston, a by-pass from the cylinder adjacent its outer end to an opposite termination in the cylinder to aline with the intake port when the piston is at the outer end of is stroke, an auxiliary chamber having an opening communicating with the by-pass, and a manually operable valve in said opening.

10. In a gas engine having a fixed head, a sleeve piston slidable on said head and closed on top and means to reciprocate the sleeve piston, the sleeve piston having an intake port for fuel mixture in one side and projecting above the head when the sleeve piston is in a predetermined position relative to the head; a spark plug mounted in the head near the side of the same closest to the port and whose electrodes are positioned to be swept by the relatively cool incoming mixture immediately upon such mixture leaving the port.

EMMITT M. TUCKER.