Nov. 18, 1952 H. TEEGEN 2,618,249

TWO-CYCLE CRANKCASE COMPRESSION ENGINE

Filed April 12, 1950 2 SHEETS—SHEET 1

Fig. 1

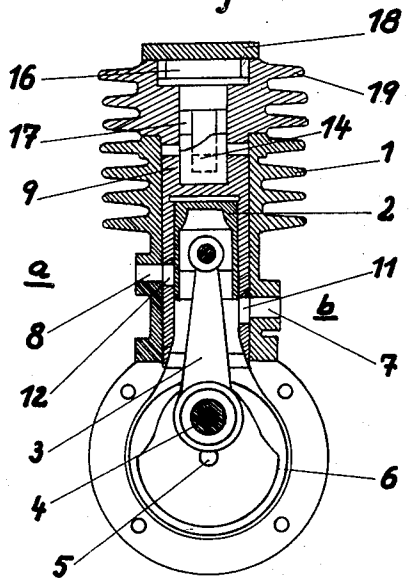
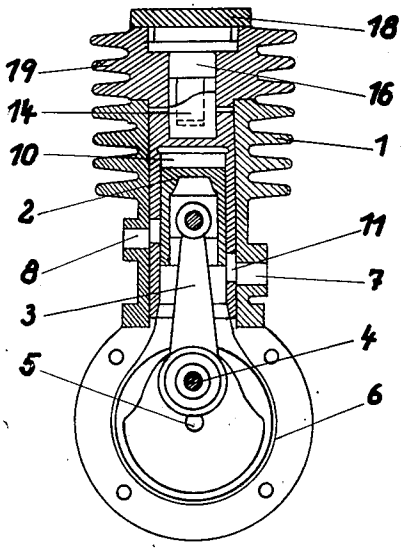


Fig. 2



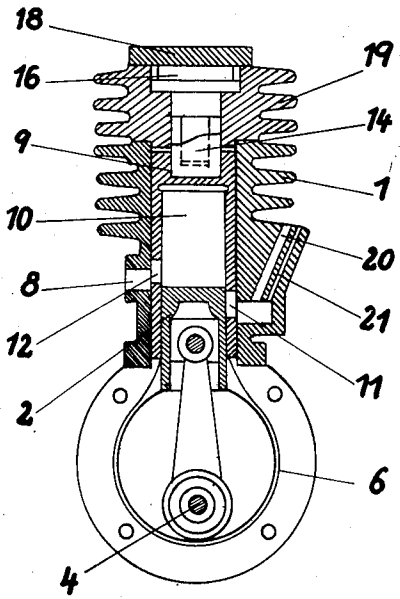
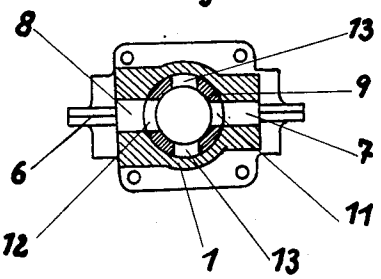


Fig. 3

Fig. 4



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TWO-CYCLE CRANKCASE COMPRESSION ENGINE

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Fig. 7

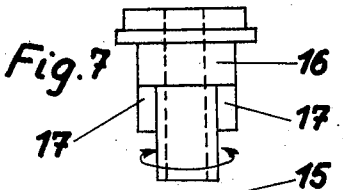


Fig. 8

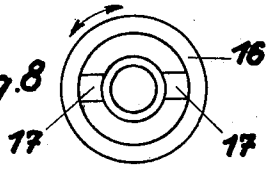


Fig. 5

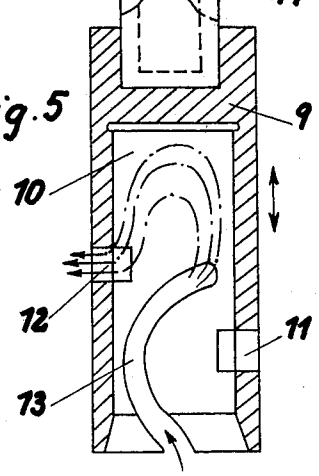


Fig. 6

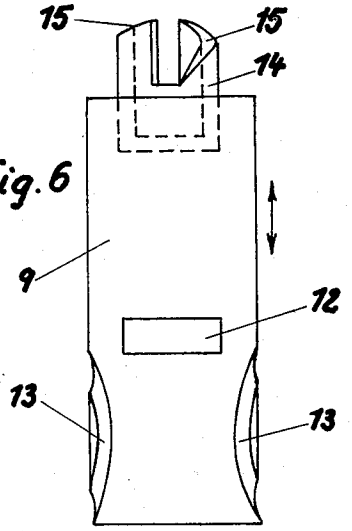


Fig. 9

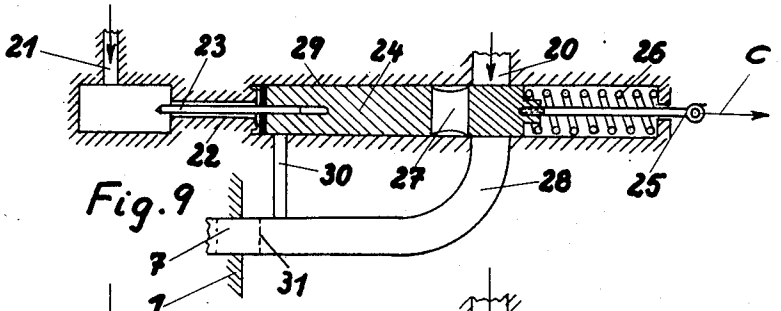
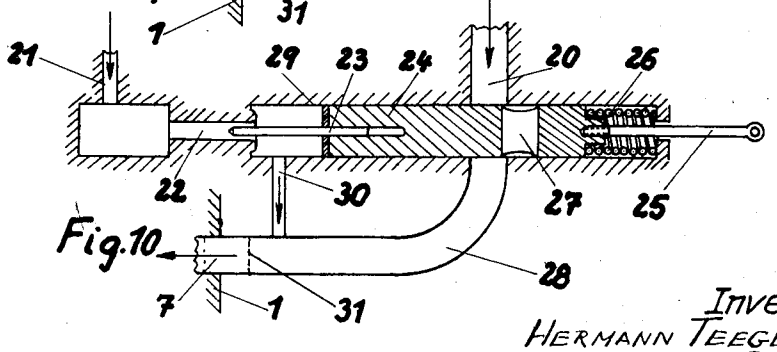


Fig. 10



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TWO-CYCLE CRANKCASE COMPRESSION ENGINE

Hermann Teegen, Bielefeld, Germany

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6 Claims. (Cl. 123—48)

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The invention relates to a new design and a respective equipment for the operation of two-stroke internal combustion engines.

There are conventional designs for the operation of two-stroke internal combustion engines, applying highly volatile fuels, a comparatively low compression and electrical ignition, for instance ignition plugs. Furthermore, we know two-stroke internal combustion engines working with fuels of difficult volatility, the so-called diesel fuels. For operation, air is sucked in and pressed into the combustion chamber, where it is compressed to a comparatively high degree, at the end of which process the fuel is injected through nozzles. For this purpose it is necessary to use special fuel pumps which press the fuel under high pressure into the compressed air.

The subject of our invention, however, is a third new design characterized in the way that fuel and air are carried directly into the crank case. The parts of the engine moving in the crank case function as atomizers of the fuel. The mixture of fuel and air passes from the crank case into the combustion chamber. There it is brought to self-ignition by a sufficiently high compression. The engines working according to this design, in comparison with those internal combustion engines working according to the above-mentioned two conventional designs, show the advantage that, the necessary amount of compression having been reached, self-ignition will take place in all parts of the compression chamber at almost the same time. The designs applying electrical ignition make the ignition start from the spark plug as ignition point and expand from there globularly to all parts of the combustion chamber. In engines of the diesel principle the combustion starts locally from the fuel injection nozzle and stretches temporally over the period of the injection process. The well-known motor knocking of the conventional types caused by superimposition of pressure waves is entirely avoided by the design here claimed, as the ignition will take place simultaneously in all parts of the combustion chamber after the necessary compression has been reached.

When operating according to our invention, it is of advantage to let the fuel-air mixture, on its way from crank case to combustion chamber, pass along the piston in close touch with its surface. The warming of the fuel-air mixture is continued on its way to the combustion chamber by means of heat exchange, on the other hand the piston is permanently cooled, in consequence

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whereof the piston will never become too warm and will never jam in the cylinder.

It has already been suggested to alter the compression in the conventional two-stroke internal combustion engines by provision of an axially shiftable cylinder bottom. According to the new design a way is shown in which, by alteration of the compression, the moment of ignition and simultaneously the control times of the engine can be regulated.

Another improvement of design and equipment can in certain cases be reached by additionally providing an atomizer before the inlet points of fuel and air into the crank case. It is possible, besides, to provide additional means of a better diffusion of the fuel, as described below.

As mentioned before, an alteration of the control times of the engine can be achieved simultaneously with the alteration of the compression. This can be managed by way of special control elements, or the alteration of the control times can be simultaneously effected by the regulating means of the alteration of the compression.

For the purpose of altering the compression, an intermediate part may be inserted between the piston and the cylinder block, which for instance has the shape of a cylinder liner shiftable with regard to the piston and provided with special inlet, outlet, and recess ports. The recesses for the transportation of the fuel-air mixture from the crank case to the combustion chamber may be arranged in the cylinder liner and shaped like spatially bent curves. On the one hand this results in a specially directed transportation of the fuel-air mixture into the combustion chamber. On the other hand it is of advantage to keep the recesses totally or partly open to the inside of the cylinder for the purpose of heat exchange between piston and fuel-air mixture. In their spatial curvature the recesses stretch over an utmost possible part of the cylinder circumference.

Finally the fuel and the air, or only one of them, can be introduced through warmed parts of the engine block, so that a prewarming will take place.

The invention finally relates to the arrangement and development of an additional atomizer for the air and the fuel. According to the invention, the operating positions of the atomizer in agreement with the opening process are arranged in series like this: no-load, partial-load, full-load, and starting position.

In a construction example the invention is shown in the drawings as follows:

Fig. 1 shows a longitudinal section through the internal combustion engine according to the invention, the adjustment being that of the greatest compression;

Fig. 2 shows the same longitudinal section, the adjustment being that of the smallest compression;

Fig. 3 shows an arrangement as in Fig. 2, the piston, however, being in the lower dead-center position;

Fig. 4 shows a cross-section through Fig. 1 along section line *a*—*b*;

Fig. 5 shows a longitudinal section of the cylinder liner used for the alteration of the compression;

Fig. 6 shows a left-hand side-view upon the cylinder liner as represented in Fig. 5;

Fig. 7 shows a side-view of the adjusting part to which the cylinder liner is attached;

Fig. 8 shows the same adjusting part in view from below;

Fig. 9 shows the element for the introduction of fuel and air, in the final position;

Fig. 10 shows the same element in the starting position for the engine.

1 is the cylinder block, 2 the piston with the connecting rod 3 on the crank pin 4 of the crankshaft 5 6 is the crank case. The cylinder block 1 has the inlet port 7 for the fuel and the air, and the outlet port 8 for the exhaust gases. Between the cylinder block 1 and the piston 2 is inserted a cylinder liner 9. It is axially shiftable in the cylinder block 1. By the over-pressure in the combustion chamber 10 it is pressed outwards (in the example shown, upwards) and is kept in a definite position as to the piston by a stop device, described hereinafter. The cylinder liner 9 has for instance the shape represented in Figs. 5 and 6. It is provided with an inlet port 11 for the air and the fuel, with an outlet port 12 for the exhaust gases, and with recesses 13 for the passing-over of the fuel-air mixture, compressed in the crank case, to the combustion chamber 10. There is a parallel function of the inlet port 11 with the inlet port 7 in the cylinder block on the one hand, and of the outlet port 12 with the outlet port 8 in the cylinder block 1 on the other hand. The piston passes with its bottom over the ports 12 and 8 respectively; with its rear end it passes over the inlet ports 7 and 11.

In order to make an alteration of the combustion chamber 10 and thus of the compression possible to one's liking, the liner 9, as mentioned before, is axially shiftable. A cam plate 14 is fixed at its upper end, with two equal cams 15 displaced to each other by 180 degrees. The cam plate 14 is solidly inserted in the cylinder liner 9. By the over-pressure in the interior of the cylinder liner 9, i. e. in the combustion chamber 10, the liner, which, moreover, is secured against rotation by a wedge (not shown in the drawings) or something of the kind, is pressed against an adjusting part 16. The adjusting part 16 is rotatable about its axis and has two stops 17 functioning together with the cams 15. Cam 15 leans against these stops 17 which, the adjusting part 16 being turned, will wander in an angle range of about 120 degrees. The adjusting part 16 can be turned in this angle range from without. Any of the conventional means may be used for this purpose. A Bowden wire for instance may be applied. In order to prevent the adjusting part 16 from being pressed to the outside, it is made to lean with its front surface against a closing disc 18 which is attached to the upper end of an extended part of the block 19.

The introduction of fuel and air can, as proved by the operation of the engines, take place immediately through the port 7. At the upper dead center position of the piston 2, the fuel and the air enter into the crank case 6, in which a partial vacuum was produced at the preceding active stroke. While going downwards into the lower dead center position, the piston 2 passes with its bottom over the upper ends of the recesses 13, so that the fuel atomized in the crank case 6 and the precompressed and the preheated fuel-air mixture can enter into the combustion chamber 10. The recesses 13, as is shown in Figs. 5 and 6, stretch over an utmost possible range of the cylinder liner 9. Thus the fuel-air mixture to a large extent comes in contact with the piston 2. The fuel-air mixture, on its way through the recesses 13, in result of heat exchange is warmed by the piston jacket 2. At the same time, vice versa, the piston 2 is permanently cooled. At the next upward stroke of the piston, the fuel-air mixture in the combustion chamber 10 is compressed to such a degree as to let it come to self-ignition. Then the piston 2 goes down again. According to the two-stroke principle, every upward stroke of the piston 2 leads to the compression, and every downward stroke of the piston 2 to the combustion of the fuel-air mixture.

During this process the cylinder liner 2 with the cams 15 leans permanently against the stops 17 of the adjusting part 16, as the pressure prevailing in the combustion chamber even during the downward stroke of the piston urges the liner 2 upward and will raise it from a lower position when an adjustment of the part 16 permits such shift of the liner. According to the respective adjustment of the adjusting part 16 the compression can be regulated at one's liking with regard to the starting process, the no-load or the full-load position. The cams 15 show an essential rise in the no-load range, so that a slight turn in the starting phase may lead to great changes of a low compression, while in the working range proper the cams 15 show a flatter course, so that in the full-load range the compression may be more finely regulated.

In the starting phase the compression at first is reduced, but then greatly raised. As soon as the engine is set in motion, the compression, according to the operating conditions, can be regulated by a respective turning of the adjusting part 16.

With the adjustment of the compression by the cylinder liner 9 is associated a simultaneous alteration of the control times, as the inlet ports 11 and 12 and, furthermore, the recesses 13 are at once axially shifted. These shiftings take place in accordance with the expected increase of output of the engine. It is also possible to move the cylinder liner 9 and the control ports 11 and 12 separately and, by appropriate coupling parts, to transmit the desired motion from the adjusting part 16 upon the control elements 11, 12, 13.

In Fig. 3 it is shown, besides, how the air, before entering into the crank case 6, can be introduced through an air-inlet port 20, and the fuel, respectively, through an inlet port 21. These ports in the shape of recesses pass through the cylinder block 1, thus permitting the fuel and the air to be pre-warmed. The recesses 20 and

21 can also be made to pass along the cylinder block 1. The chief thing is only that the fuel, or the air, or both simultaneously, must be warmed.

In Figs. 9 and 10, finally it is shown how the fuel and the air are regulated by a special atomizer which can be inserted in front of the inlet port 7 of the engine. 20 again is the recess for air admission, and 21 the recess for fuel admission. In the nozzle 22 there is, axially shiftable a spindle 23, which is solidly attached to an axially shiftable piston 24. The piston 24 is axially shifted by a rod device 25, and passed into the closing position by a spring 26 (Fig. 9). Moreover, the piston 24 has an air-passageway 27, which can make the air-inlet port 20 communicate with the mixing recess 28. The mixing recess 28 leads to the inlet port 7 of the cylinder block. Besides, the cylinder chamber 29, in which the piston 24 shifts, communicates with the mixing recess 28 by means of an intermediate recess 30.

The operation of this atomizer is as follows. When the piston 24 is in the position acco.ding to Fig. 9, the fuel admission and the air admission are interrupted. When the piston 24 is moved outward in the direction of the arrow C, contrary to the effect of the spring 26, the spindle 23 releases the fuel supply more and more. Furthermore, a growing amount of air can pass to the mixing recess 28 by way of the air-inlet port 20 through the perforation 27. In this manner the full-load position is reached by way of the no-load position. For the purpose of starting, the piston 24 must be entirely pulled out to the right hand according to the arrow C. Thus only a slight amount of air can pass from the recess 20 to the mixing recess 28, while the spindle 23 releases the fuel supply to the largest extent. So a fuel-air mixture enriched with fuel enters into the engine for the purpose of starting.

Thus the subject of the invention shows the following succession of the various operating positions: no-load, partial-load, full-load, and starting position. The latter simplifies the starting operation of the engine extremely. After the engine has been set in motion, the piston 24, by way of the full-load position, must be returned into the desired no-load position. For the operation of the rod device 25 according to the direction of the arrow C any kinds of operating elements may be used, for instance a Bowden wire. Finally, it is possible to insert elements like sieves, baffle plates 31, favouring the tearing of the fuel, between the fuel recess 30 and the cylinder block 1 or the crank case 6. It makes no difference whether these sieves 31 are placed more towards the fuel-inlet side or more towards the crank case.

What I claim is:

1. In a two-stroke internal combustion engine with a self-ignition including a crank case and a piston, a headed cylinder stationary with respect to said crank case, a cylindrical liner in which said piston is reciprocable, said liner including a closed head and being axially shiftable in said cylinder, and a cam device including two members, the first one of said members being movably held in said cylinder head and adjustable from the outside, the second member being secured to the head of said liner, one of said members having a cam face engaged by said other member constituting a cam follower, and said cam face being non-uniformally sloped so as to cause a non-uniform axial shift of said liner upon a uniform adjustment movement of said first member.

2. A device as claimed in claim 1, said cam face being sloped more steeply in that portion which is engaged by the other member when the liner is near its position closest to the cylinder head, than in the portion engaged when the liner is near an opposite end position.

3. A device as claimed in claim 1, said first member being an element rotatable about the axis of said cylinder and including a downward directed eccentric projection, and said second member projecting upwards from said liner and having a cam face engaged by said projection of said first member, one portion of said cam face being more steeply sloped than another portion thereof.

4. In a two-stroke engine with self-ignition including a stationary cylinder, a cylindrical liner having a closed head and being axially shiftable in said cylinder and a piston reciprocable in said liner, first means to adjust the position of said liner in said cylinder thereby to vary the combustion chamber, and second means to admit to said engine a combustible mixture adjusted according to the adjusted liner position, said second means comprising a first member in a controlling relationship to an air admission passage, a second member in controlling relationship to a fuel admission passage, and a connection of said members whereby in a first end position of said members both said admission passages are closed, in a second end position of said members said fuel admission passage is fully open and said air admission passage is slightly open, and in an intermediate position said air admission passage is fully open and said fuel admission passage is partly open.

5. A device as claimed in claim 4, said second means comprising a slide valve controlling said air admission passage, and a needle valve controlling said fuel admission passage, means to conduct fuel having passed said needle valve into the current of air having passed said slide valve, and a third passage to admit the fuel-air mixture to said engine.

6. A device as claimed in claim 5, further comprising means partly obstructing the flow of the mixture in said third passage so as to tear up the fuel in said mixture.

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REFERENCES CITED

The following references are of record in the file of this patent:

UNITED STATES PATENTS

Number	Name	Date
808,336	Bogert	Dec. 26, 1905
882,401	Melhuish	Mar. 17, 1908
943,598	Hovey	Dec. 14, 1909
1,125,375	Newton et al.	Jan. 19, 1915
1,125,376	Newton et al.	Jan. 19, 1915
1,195,070	Nelson	Aug. 15, 1916
1,289,006	Rowell	Dec. 24, 1918
2,583,499	Teegen	Jan. 22, 1952

FOREIGN PATENTS

Number	Country	Date
5,100	Great Britain	Mar. 1, 1911
129,373	Switzerland	Dec. 17, 1928
884,757	France	May 8, 1943