

March 18, 1952

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INTERNAL-COMBUSTION ENGINE

Filed April 9, 1948

3 Sheets-Sheet 1

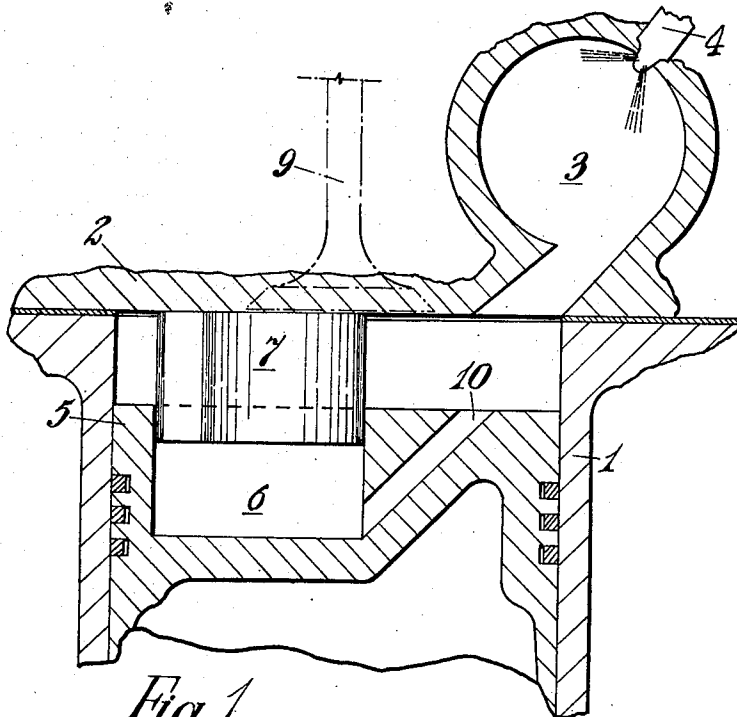


Fig. 1.

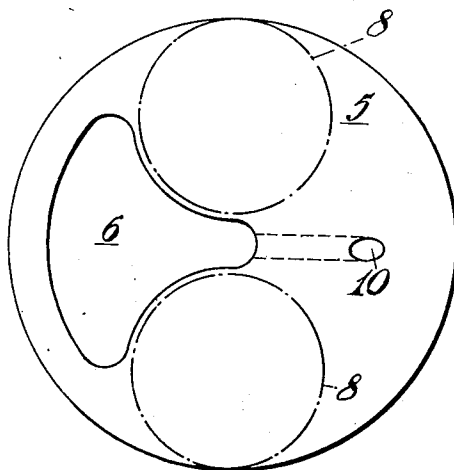


Fig. 2.

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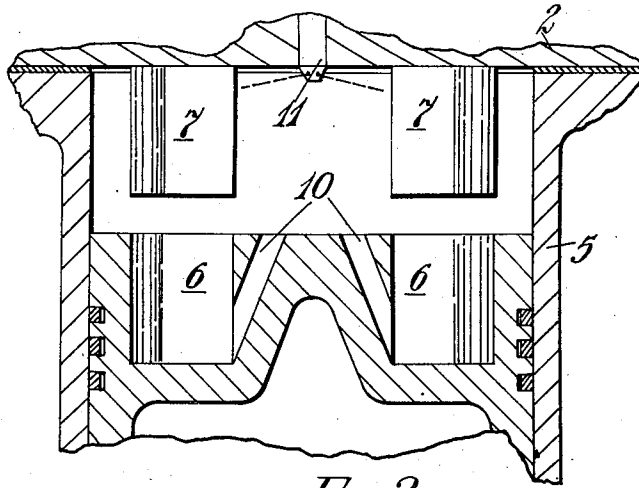


Fig. 3

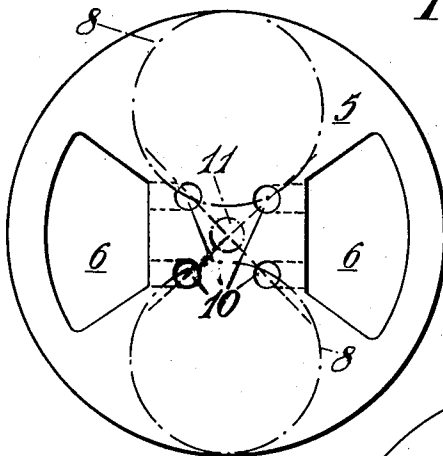
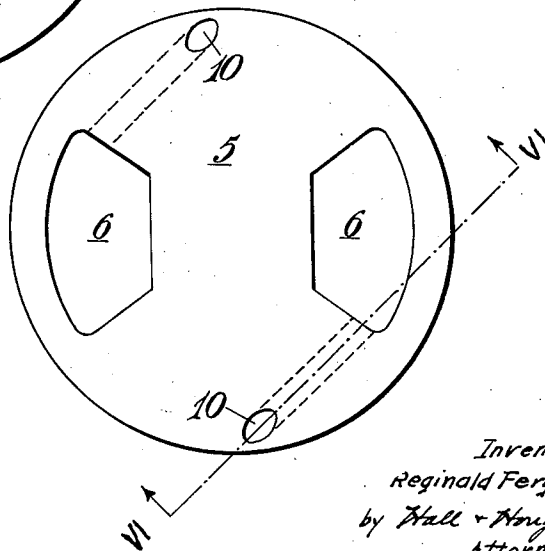


Fig. 4

Fig. 5



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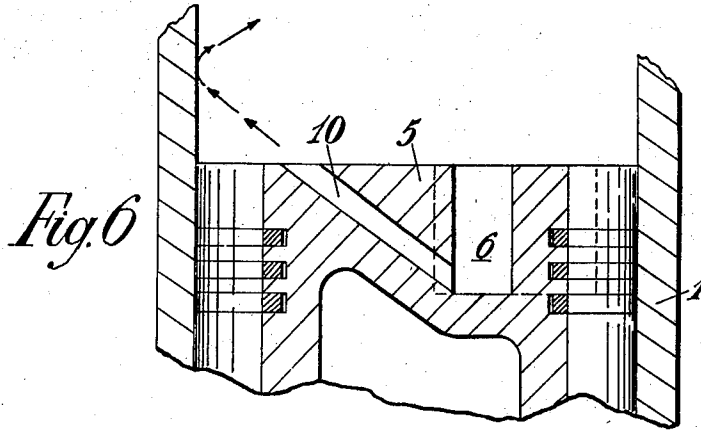
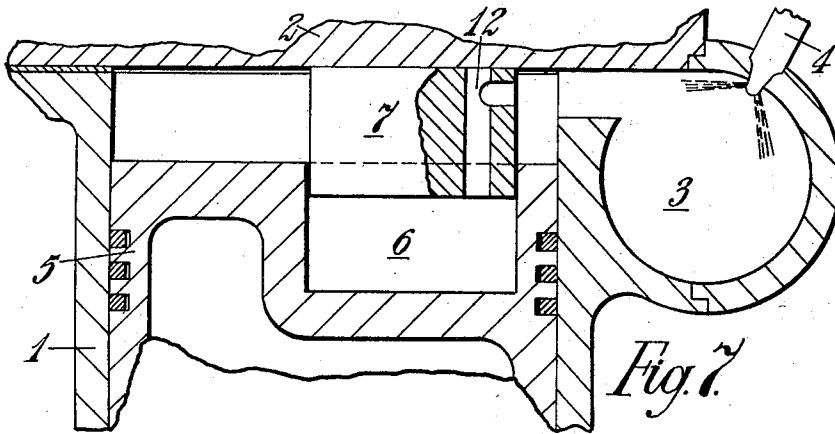
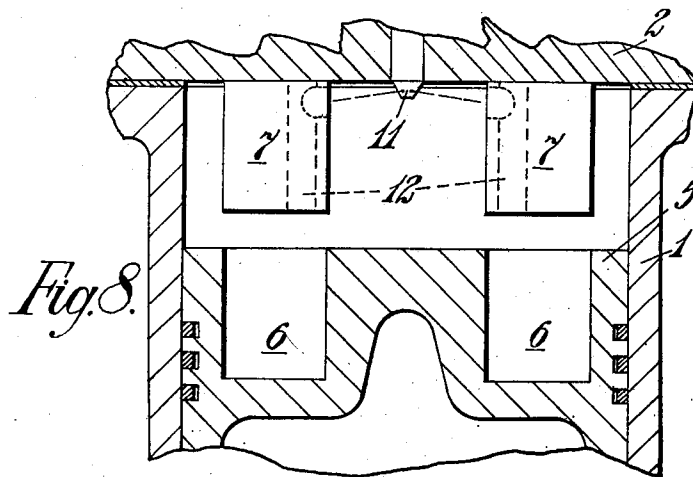
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3 Sheets-Sheet 3



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UNITED STATES PATENT OFFICE

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INTERNAL-COMBUSTION ENGINE

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In Great Britain December 18, 1947

1 Claim. (Cl. 123—32)

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This invention relates to internal combustion engines and particularly engines of the diesel or compression ignition and other engines of the fuel injection type.

The object of the invention is to provide an improved construction of engine of this type in which in particular a more effective mixture of fuel introduced into the cylinder as a jet or spray with air is effected.

According to the invention, in the head of the cylinder there is provided an element which in effect is a spigot and in the crown of the piston there is provided a recess of substantially corresponding form into which the spigot will enter and thus function as a secondary compression chamber and one or more passages extending from the base of the recess to the outer surface of the crown through which the comburent gas entering the recess will be driven outward towards the position at which fuel is introduced into the cylinder.

The spigot and recess may be regarded as constituting a secondary piston and piston chamber.

In some cases the passage or passages may be provided in the spigot.

In certain cases the passage or passages are formed so that the gas so driven outward will be caused to impinge upon the jet of fuel, such being the case for example where the fuel is introduced directly into the cylinder.

Alternatively, the passage or passages may be directed to the point where the fuel enters the cylinder from a precombustion chamber.

The spigot element may be of any appropriate form which in some cases may be dictated by the form and shape and position of the valves whereby air is admitted to the engine cylinder.

For instance, where there are provided two valves of the mushroom head type and these are located in the vicinity of the spigot, the latter is formed with channels or recesses into which the valves may enter and where necessary or desirable recesses may be furnished in the crown of the piston for the like purpose.

The number and dimensions, shape and direction of the passages leading from the recesses in the crown of the piston to the outer face thereof may be varied as desired.

For instance, the passages may be arranged or positioned so that the entry of the spigot into the socket forces the air or gas entrapped therein in an outward direction towards the wall of the piston adjacent to its head so that the gas issuing will be caused to impinge upon or flow tangentially with respect to a jet of fuel located in

the central portion of the piston head in the latter case to cause a swirl.

The number of recesses in the crown or piston and the number of spigots may also be varied.

As indicating the advantages which may be secured by the present invention a compression ignition engine incorporating a precombustion chamber operating at a normal compression ratio of 16:1 was modified by securing to the cylinder head a plain cylindrical plug forming a spigot and providing a correspondingly formed recess in the crown of the piston which resulted in a reduction of the compression ratio of 12.8:1.

On test it was found that using the standard cylinder head with a standard piston so as to give a compression ratio of 12.8:1 with a fuel set for 1 pint per 200 seconds at 2000 R. P. M. corresponding with 38.0 B. H. P., the fuel consumption amounted to 0.472 pint per brake horse power hour, whereas with the plug or spigot and the socket piston at a like speed of 2000 R. P. M. the power output was equivalent to 40.4 brake horse power, while the fuel consumption was reduced to 0.445 pint per brake horse power hour.

The advantage therefore was an increase in brake horse power of 6.3% and a saving in fuel of 6.7%.

A further test with fuel set for 1 pint per 267 seconds at 1500 R. P. M. gave without the spigot and socket arrangement a power output of 30.3 brake horse power with a fuel consumption of 0.442 pint per brake horse power hour. With a spigot provided at the head of the piston cylinder and a recessed piston at 1500 R. P. M., the power output was 31.5 B. H. P. and the fuel consumption was 0.428 pint per brake horse power hour showing an increase in brake horse power of 4.0% and a saving in fuel of 3% by the employment of the plug and socket arrangement.

In addition to the advantages arising from the increased power output and the saving of fuel, it was found that the engine when furnished with a spigot in the head of the cylinder and a correspondingly formed recess in the crown of the piston ran much more smoothly or with less "diesel knock," such smoother running being in part at least evidenced by the residual combustion markings within the recess.

Further, it may be pointed out that whereas when the engine was running without the spigot and recessed piston, the exhaust was consistently dirty, whereas when a spigot was provided in the head of the cylinder and a piston having correspondingly formed recesses was used, the exhaust was recorded clear throughout the tests.

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The invention will be described further in detail and by way of example with reference to the accompanying drawings, in which:

Figure 1 is a fragmentary view of an engine cylinder head showing a piston in accordance with the invention therein,

Figure 2 is a plan view of the piston head,

Figure 3 is a fragmentary view showing a cylinder head and the crown of a piston in accordance with the invention,

Figure 4 being a plan view of the piston,

Figure 5 is a plan view of another construction of piston in accordance with the invention,

Figure 6 is a fragmentary view of a cylinder and piston in elevation, partly in section, on a plane indicated by the line VI—VI of Figure 5 viewed in the direction of the arrows,

Figure 7 is a fragmentary view of a further construction in accordance with the invention, and

Figure 8 is a view of yet another construction. In all of the figures, 1 is the wall of the cylinder, 2 the head thereof which in the constructions shown in Figures 1 and 7 are provided with precombustion chambers 3 into which fuel is injected by way of a nozzle 4.

In all of the figures the crown of the piston 5 is provided with a recess or recesses 6 co-operating with spigot elements 7 provided in the cylinder head and in some cases additional recesses 8 for the faces of the mushroom valves such as 9 illustrated in Figure 1.

In the case of the construction illustrated by Figures 1-6, from a position adjacent to the base of the recess there is furnished a passage 10 or a plurality of such passages leading through the crown of the piston.

The direction of these passages may be varied as desired.

In the case on the construction shown in Figure 1, the passage is formed so as promote the injection of air into the precombustion chamber 3.

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In the case of the construction shown in Figures 3 and 4, the passages are directed to the cylinder head so as to promote the projection of the air or the comburent gas on to a jet 11.

In the case of the construction shown in Figures 5 and 6, the passages are so formed as to promote a swirling action.

In all of the constructions described in detail above, the passages as will be observed have been provided in the crown of the piston but in the case of the constructions shown in Figures 7 and 8 equivalent passages 12 are furnished in the spigots provided on the cylinder head.

I claim:

15 An engine of the fuel injection type, in which in the head of the cylinder there is provided at least one element which in effect is a spigot and in the crown of the piston there is provided a corresponding number of recesses of substantially corresponding form into which the spigot will enter and thus function as a secondary compression chamber and at least one or more passages extending from the base of the recess to the outer surface of the crown of the piston 20 through which the comburent gas entering the recess will be driven outward into the space between the piston crown and the cylinder head, and means for injecting fuel into said last named space at a position toward which said passages 25 direct said comburent gas.

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