April 9, 1935. J. A. MOULD 1,997,071

INTERNAL COMBUSTION ENGINE

Filed July 11, 1931

FIG. 1.

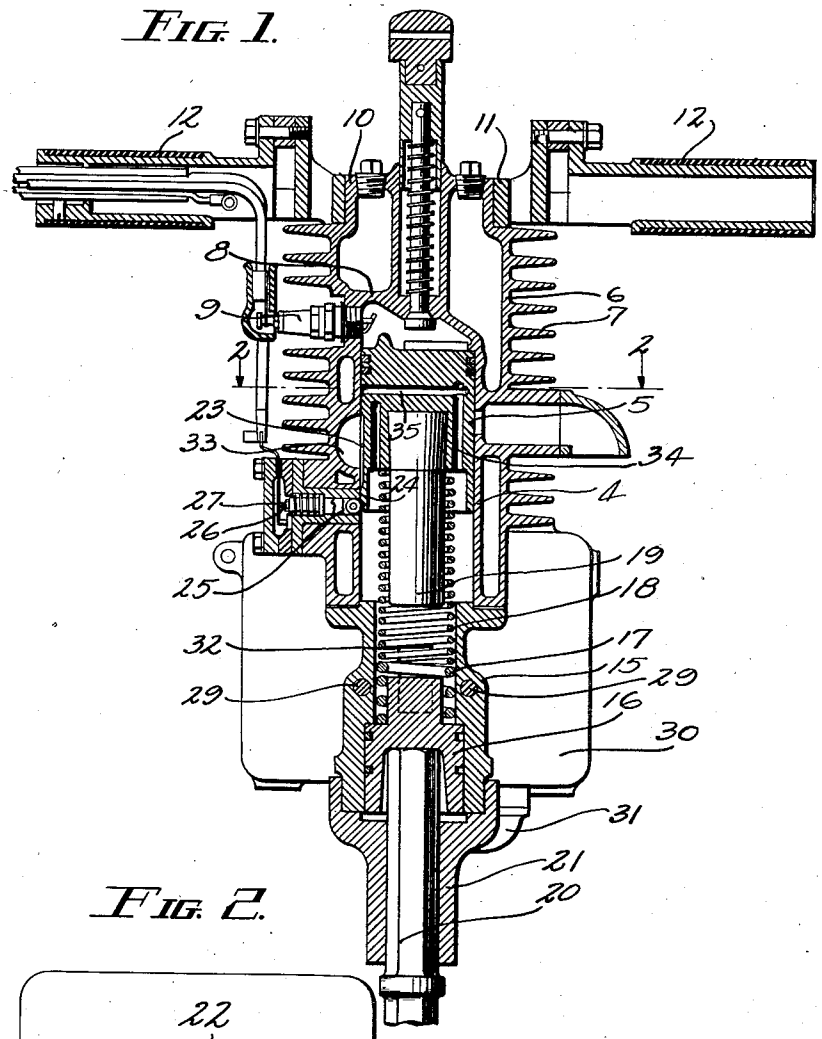
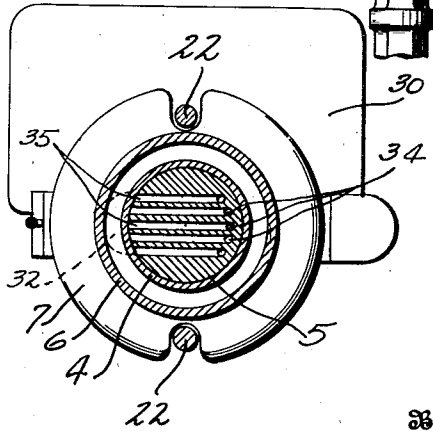


FIG. 2.



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INTERNAL COMBUSTION ENGINE

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Application July 11, 1931, Serial No. 550,187

5 Claims. (Cl. 123—7)

This invention relates to improvements in internal combustion engines. It has particular reference to two cycle engines and to an internal combustion hammer construction, although there are features subject to wide application.

The object of the invention is to provide a piston which will function satisfactorily in an internal combustion hammer. With this object in view it is desirable to produce a piston of light weight because a piston relatively light as compared with the total weight of the tool will actually deliver a harder blow than a heavier piston. Furthermore it is desirable to minimize heat conduction to the piston for the protection of the supporting spring and the parts therebeneath in the tool and to preserve the film of lubricant between the piston and the cylinder. Accordingly the piston is preferably provided with internal cavities certain of which may be made to produce an additional cooling effect by serving as transfer passages for conducting to the combustion chamber the mixture of gases compressed beneath the piston. By sub-dividing the cavities into a number of passages of comparatively small cross section the cooling effect of the gases is multiplied, the heat conductivity of the of the piston is reduced and the passages tend to intercept broken pieces of piston springs and thus to prevent broken springs from reaching the combustion chamber.

In the drawing:

Figure 1 is a vertical axial section through a two cycle gasoline engine embodying this invention as it appears incorporated in a two cycle combustion hammer.

Figure 2 is a transverse section taken in the plane indicated at 2—2 in Figure 1.

Like parts are identified by the same reference characters throughout the several views.

In accordance with disclosure of my co-pending application entitled "Internal combustion hammer" filed July 11, 1931, Serial No. 550,188, the cylinder casting 4 is integral throughout the path of movement of the piston 5 and may include integrally a jacket 6 provided with radiating fins 7. The cylinder casting includes integrally a head portion 8 into which a spark plug 9 of conventional design has access. A shouldered extension 10 of the cylinder casting receives a ring 11 to which handles 12 are attached.

The lower end of the cylinder casting is, in the present device, not provided with any crank case, but instead is closed by an anvil guide member 15 in which the anvil 16 has a limited reciprocating movement. The anvil is preferably provided with packing rings to make gas tight the portion of the cylinder below piston 5. A relatively heavy spring 17 is seated on the anvil and supports a relatively lighter spring 18 surrounding hammer 19 carried by piston 5 and seating against the piston proper.

While it may be possible to use a single spring for the support of the piston, the requirements as to temper and size of wire would be even more exacting where a single spring is used than is the case where two springs are employed. The piston springs are treated more fully in a companion application. It is sufficient to state here that they must be exceptionally hard. Spring 18 in and of itself is adequate for the support and return of the piston while spring 17 provides not merely a resilient and shock absorbing mounting but also, by reason of its preferably increased stiffness, is capable of maintaining the spring load on spring 18 notwithstanding a slight "set" which spring 18 takes when the tool is first put into use.

The anvil 16 is socketed to receive the end of tool 20 which is retained in member 21. The anvil guide 15, tool retaining member 21 and ring 11 are preferably made of steel held in clamping engagement upon the cast iron cylinder casting 4 by means of tension rods 22, in accordance with the disclosure of my co-pending application aforesaid.

For ignition timing the piston 5 is longitudinally grooved at 23, the groove being provided with a cam nose 24. A cam follower 25 rides in the groove and is acted upon by nose 24 to actuate its moving contact 26 into engagement with a spring supported contact 27 thereby closing the ignition circuit.

The anvil guide member 15 is provided with bolts 29 mounting fuel tank 30 which carries a carburetor 31, the detailed construction of which is immaterial to the present invention. The charge is admitted to the sub-piston compression space in cylinder 4 through a port 32 in the anvil guide member 15 and thence upwardly through the anvil guide member into the lower end of the cylinder casting.

In accordance with usual two cycle engine practice the charge is first compressed below the piston and at or near the end of the expansion stroke of the piston a port is uncovered by the piston to transfer the charge into the working cylinder. Whereas ordinarily the transfer passage is wholly formed within the cylinder and is fully exposed to gas compressed beneath the piston during the expansion stroke, in the present device the only

portion of the transfer passage which is formed within the cylinder casting is a recess at **33**. The rest of the transfer passage is within the piston itself and comprises one or more vertical ducts **34** extending upwardly through the piston along the side remote from recess **33** and communicating with horizontal ducts **35** leading in the direction of recess **33**. The use of a plurality of ducts is preferred because it gives mass and strength to the piston in a cellular construction which minimizes heat conductivity while at the same time giving a very substantial area of transfer passage.

The arrangement shown not only reduces heat conduction through the piston but also has a definite cooling effect on the piston attributable to the passage therethrough of the combustible mixture. A portion of the fuel used in carbureting the air of the mixture is vaporized and this has a definite cooling effect on the charge. The further vaporization of additional quantities of fuel upon contact with hot surfaces of the piston results in further absorption of heat therefrom. In an internal combustion hammer it is very important to limit heat transfer through the piston to preserve lubrication, to protect the spring and to avoid excessive heating of the liquid fuel in tank **30**.

The cylinder wall recess **33** is completely closed by the piston in the compression position thereof. Its extent is barely sufficient to maintain communication across the piston head between ducts **35** and the firing chamber. Obviously gas compressed in the sub-piston portion of the cylinder is not even admitted to recess **33** until ducts **35** register therewith and is not admitted to the firing chamber until the piston head clears recess **33**.

The foregoing disclosure will also make it apparent that, if the passages **35** were not provided, heat would be more readily conducted from the piston head to the socket connection. Consequently, the passages not only limit the heat conducting area but also increase the heat radiating area.

The fact that the gas transfer passages through the piston are subdivided to small cross section minimizes the possibility of a spring fragment reaching the combuston chamber where it would score the cylinder walls.

I claim:

1. In an engine the combination with a cylinder having a combustion chamber and a sub-piston compression space, of a piston reciprocable in the cylinder and provided with a transfer passage leading toward the head of the piston and thence across the piston beneath the head, said cylinder having transfer passage means disposed to provide communication in the course of piston reciprocation between the piston passage and the combustion chamber, said passages limiting the heat conducting area and increasing the heat radiating area.

2. In an engine the combination with a cylinder having a transfer recess in its wall, of a piston having in closer proximity to its head than the axial extent of said recess a plurality of transverse ducts extending through the piston and thence opening axially to the end of the piston remote from its head, said passages limiting the heat conducting area and increasing the heat radiating area.

3. In an internal combustion engine a piston provided beneath its head with a plurality of transverse bores crossing the piston from one side thereof and thence opening to the end of the piston remote from its head adjacent the other side thereof, said passages limiting the heat conducting area and increasing the heat radiating area.

4. An internal combustion hammer piston provided beneath its head with a plurality of transverse bores crossing the piston from one side thereof, said piston having axially disposed passages adjacent one side and communicating with said transverse bores.

5. In an internal combustion engine, the combination with a cylinder having a recessed wall, of a hammer piston reciprocal in the cylinder and provided with a plurality of transverse passages registrable with the recess and extending across the piston beneath its head to points adjacent the other side of the piston, said piston having axially disposed passages communicating with the transverse passages and positioned in the side of the piston remote from said recess.

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