

July 31, 1962

S. MEURER

3,046,959

COMBUSTION CHAMBERS FOR PISTONS

Original Filed June 9, 1958

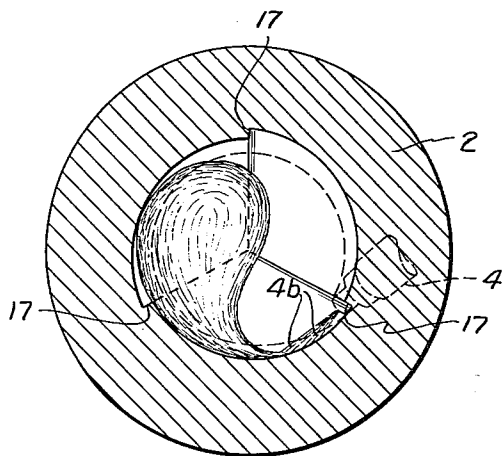


*Fig. 1*

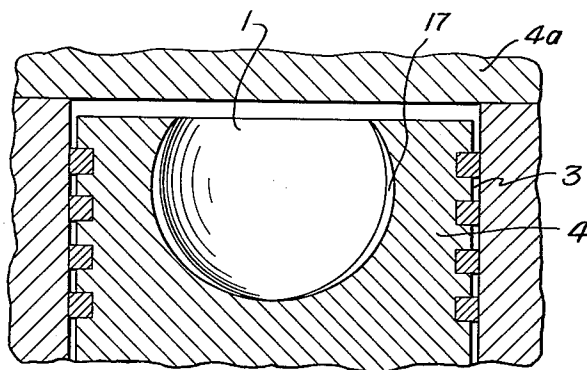


*Fig. 2*

INVENTOR

*Siegfried Meurer*

BY

*Bailey, Stephens & Huettig*  
ATTORNEYS

1

3,046,959

## COMBUSTION CHAMBERS FOR PISTONS

Siegfried Meurer, Nurnberg, Germany, assignor to Maschinenfabrik Augsburg-Nurnberg A.G., Nurnberg, Germany

Original application June 9, 1958, Ser. No. 740,908, now Patent No. 2,975,773, dated Mar. 21, 1961. Divided and this application Dec. 8, 1960, Ser. No. 74,652

Claims priority, application Germany July 6, 1957

3 Claims. (Cl. 123-32)

This invention relates to combustion chambers for pistons. In particular, the invention is directed to combustion chambers for self-ignition engines.

This application is a division of my application Serial No. 740,908, filed June 9, 1958, for "Combustion Chambers for Pistons," now Patent 2,975,773, issued Mar. 21, 1961.

The piston of this invention is designed to operate in self-ignition engines such as disclosed in U.S. Patent No. 2,907,308. In such engine, the liquid fuel is injected into a hollow combustion chamber in the piston. The injection is made in such a way that the major portion of the fuel travels over a short free path and is applied immediately to the wall of the combustion chamber. After striking the chamber wall, the fuel spreads out as a film over a part of the wall. The remaining minor portion of the fuel is atomized directly in the air in the chamber and is self-ignited for igniting the fuel vaporized from the film of fuel. Combustion air is swirled over the film of fuel to vaporize the same.

In these engines, it is desirable to have the fuel cover as much as possible of the chamber wall. If the chamber, as in former pistons, is spherical or ellipsoidal and the fuel strikes the wall at a sharp angle, the fuel is spread as a film in a satisfactory manner. Because of the kinetic energy of the fuel, it has a tendency to spread peripherally about the wall of the combustion chamber. However, in these chambers, the spreading of the fuel is handicapped by the concave curve of the spherical or ellipsoidal chamber. Such chamber forms act in the nature of a groove with the fuel tending to flow along the bottom thereof and not completely spread out.

The object of this invention is to produce a combustion chamber formed as a body of rotation and having a shape such that the fuel will spread out evenly in all directions on the wall of the chamber.

In accordance with the invention, the combustion chamber has an interrupted wall surface. A chamber so constructed has been found to improve the cold starting of an engine. This is because of the sudden change given the direction of the spreading fuel over the interrupted or irregular surface. The fuel at this point is momentarily detached from the wall. Consequently, the air swirling across the separated fuel atomizes the fuel which is of special advantage for high boiling point fuels.

A periodical momentary separation of the fuel from the film on the combustion chamber wall, which in connection with secondary swirls to atomize the fuel, can be obtained by a stepped wall surface with the steps extending transversely to the direction of both the injected fuel and the air swirl in the chamber. These steps lie parallel to the longitudinal axis of the cylinder. These steps produce an irregularity on the combustion chamber wall so that a re-separation of the film of fuel can occur. In passing over the stair-like steps, the fuel which flows along the wall and forms a film travels a short distance through the air and then again makes contact with the wall of the chamber. The fuel momentarily separated from the wall is mixed with the secondary air swirls formed by the steps and brings about the desired atomiza-

2

tion of the fuel, which is of especial advantage when low boiling point fuels are used. The fuel is injected into the combustion chamber adjacent one or more of the stair-like steps.

The means by which the objects of the invention are obtained are described more fully with reference to the accompanying drawings, in which:

FIGURE 1 is a plan view of a piston with the combustion chamber therein; and

FIGURE 2 is a cross-sectional view of the piston of FIGURE 1 positioned in an engine cylinder.

As shown in FIGURES 1 and 2, the combustion chamber 1 is positioned in the piston head of piston 2, the chamber being coaxial with the axis of piston 2 and cylinder 3. A nozzle 4 is inclined in the cylinder head 4a above the combustion chamber. The major portion of the injected fuel is applied to the combustion chamber wall by several fuel jets 4b which are directed at a sharp angle toward the wall and form a film thereon. This film is vaporized from the wall and mixed with the air swirling in the chamber to produce a combustible fuel mixture. The minor portion of the fuel is atomized immediately in the air swirling in the chamber. This atomizing is accomplished by either deflecting a part of the injected fuel into the air or by a special ignition jet, not shown. As the fuel leaves the nozzle, it has a kinetic energy which moves the fuel circumferentially around and upon the combustion chamber wall.

The momentary separation of the film being applied to the wall as shown in FIGURES 1 and 2 is increased by step-like projections 17 formed in the wall. These steps form an irregular wall surface with the separation of the fuel film occurring at the interruptions. The fuel spreading along the chamber wall is intercepted by the air swirl during the time it passes step 17 and then contacts the chamber wall. The secondary air swirls formed at these steps mix with the fuel separated from the wall to atomize the fuel, which is very desirable with fuels having a high boiling point. Nozzle 4, through which the fuel is injected into chamber 1, is preferably mounted close to one of the steps 17. Fuel jets 4b have the direction of nozzle 4. Steps 17 are directed parallel to the axis of chamber 1 and transversely of the direction of the fuel jets and the direction of the air swirl.

Having now described the means by which the objects of the invention are obtained,

I claim:

1. In a piston having a combustion chamber for receiving a film of fuel injected upon the wall of the chamber, said fuel being then vaporized and burned, the improvement comprising a downwardly directed combustion chamber extending from the top of the piston into the piston body, said chamber having a stepped wall surface with the steps extending from the top to the bottom of said chamber and transversely of the direction of both the injected fuel and the air swirl in said chamber.

2. In a piston as in claim 1, said steps being parallel to the longitudinal axis of said piston.

3. In a piston as in claim 1, at least one of said steps being positioned adjacent the point where the injected jet of fuel strikes the combustion chamber wall.

### References Cited in the file of this patent

#### UNITED STATES PATENTS

|           |         |                |
|-----------|---------|----------------|
| 2,762,348 | Meurer  | Sept. 11, 1956 |
| 2,947,292 | Bottger | Aug. 2, 1960   |

#### FOREIGN PATENTS

|         |               |               |
|---------|---------------|---------------|
| 408,873 | Italy         | May 13, 1953  |
| 807,712 | Great Britain | Jan. 21, 1959 |