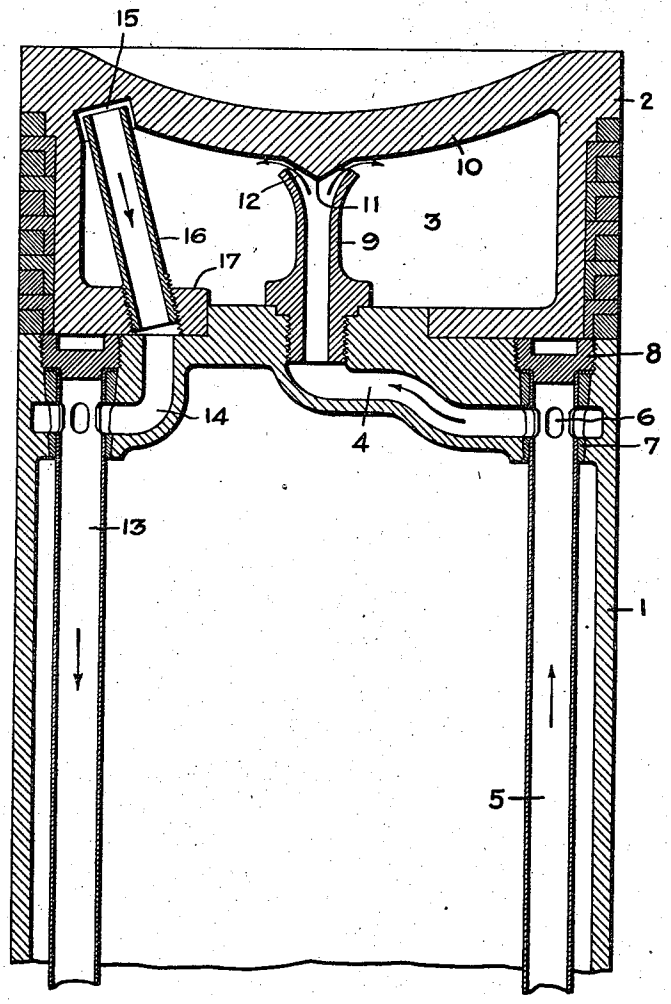
W. E. VER PLANCK.

PISTON COOLING MEANS.

APPLICATION FILED DEC. 26, 1913.

1,157,347. Patented Oct. 19, 1915.



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UNITED STATES PATENT OFFICE.

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PISTON-COOLING MEANS.

1,157,347. Specification of Letters Patent. Patented Oct. 19, 1915.

Application filed December 26, 1913. Serial No. 808,707.

To all whom it may concern:

Be it known that I, WILLIAM E. VER PLANCK, a citizen of the United States, residing at Erie, county of Erie, State of Pennsylvania, have invented certain new and useful Improvements in Piston-Cooling Means, of which the following is a specification.

The present invention relates to piston cooling means and has for its object to improve their construction.

In the accompanying drawing is shown, in vertical section, a piston illustrating one of the embodiments of my invention.

1 indicates the main body of the piston and 2 the removable head therefor, the latter containing a chamber 3 to which water, oil or other cooling liquid is admitted. The body is provided with a cored passage 4 at one end to which liquid is admitted by the tube or pipe 5. The tube has ports 6 at its upper end and surrounding said end is a tapered and ported thimble or bushing 7. The tube is flanged over the thimble and both are secured in place by the nut 8. Owing to the taper of the thimble the joint around the tube can be made fluid tight.

Screwed into the main body of the piston or other suitable part where it can communicate with the supply of liquid entering the passage 4 is a device 9 which for convenience may be termed a nozzle. The upper end of the nozzle is divergent; that is to say, flares outwardly. Situated directly in line with the nozzle and carried by the under side of the wall 10 of the head is a conical projection 11 that extends into the nozzle, there being a small annular space 12 between the two through which the cooling liquid flows with relatively high velocity in a substantially tangential direction and along the under surface of the wall 10, as indicated by the arrows. The nozzle is located in the axis of the piston since by so doing one nozzle will suffice to effectively discharge the cooling fluid and maintain an active circulation in the chamber 3. My invention is not, however, limited to one nozzle unless so specifically stated in the claims.

The means for carrying off the liquid after it has acted to cool the piston will now be described.

Located within the body of the piston and diametrically opposite the inlet tube 5 is an outlet tube 13. This tube is secured in place by means similar in construction to those described for holding the tube 5. The tube is in communication with a passage 14 cored in the upper end of the main body of the piston. In order to carry off the liquid, such as oil, from the chamber 3 and at the same time avoid the formation of an air or vapor pocket, a small recess 15 is formed in the wall 10 near its periphery. Into this recess extends a short piece of tube 16 that is supported by the annular flange 17 of the head. The tube is so positioned that a free space is provided around its end through which the liquid flows. In such an arrangement a pump is necessary to force the cooling liquid into the pipe 5 and chamber 3, but since the pump may be made in a variety of ways I have not deemed it necessary to illustrate the same.

In internal combustion engines, especially those operating with crude oil on the high compression cycle and having large diameter pistons, as in the present case, it is necessary to cool them in order to prevent carbonization of the lubricating oil and also to reduce the effects of distortion, due to temperature changes. The heads of such pistons get very hot and unless the pressure of the liquid in the cooling chamber is very high, that portion of the liquid adjacent the top wall of the head particularly will enter what is commonly known as the spheroidal state, and a more or less complete layer of vapor will be formed between the body of liquid in the cooling chamber and the head which acts in a large measure to prevent the free transfer of heat from the wall or walls to the liquid. This vapor also acts to retard the action of the circulating pump. An analogous action may be noticed when a small quantity of water is permitted to fall on a very hot stove. Experiment has demonstrated that a heavy pressure is required to force the liquid into boiling contact with the metal under these conditions while a relatively small pressure will cause it to move along said metal. It is also well known that a rapidly moving body of liquid is capable of carrying off more heat in a given time than a slowly moving body. My invention is chiefly based upon the utilization of these two latter principles, it being practically out of the question to maintain such a high pressure in the chamber 3 of a rapidly reciprocating piston as to prevent with certainty

the cooling liquid from entering the spheroidal state along the surface of wall 10.

As the cooling liquid is discharged through the annular orifice 12 under relatively high velocity it sweeps along the under side of the wall 10 and prevents the formation of vapor around the central part of said wall which is naturally the hottest part. In the event, however, of the formation of a small amount of vapor it will be swept along with the liquid and thus be prevented from forming a heat insulator. As the liquid moves rapidly along said wall it absorbs and carries off a large amount of heat. The jet action of the issuing stream of liquid also sets up an active circulation in the chamber from the center toward the side walls. The pump mechanism should be of such character as to keep the chamber 3 filled at all times and hence as the liquid flows into the chamber from the nozzle a corresponding amount leaves it by way of the tubes 16 and 13. By locating the recess 15 at the highest point in the chamber 3 any air or vapor that may be formed will naturally flow thereto and be carried off along with the cooling liquid.

From the foregoing it will be seen that I avoid the necessity of having the cooling liquid under high pressure and at the same time provide for a very active circulation thereof in the chambered head, thereby obtaining the maximum cooling effect. By using a relatively low pressure for the cooling liquid I avoid the troubles incident to high pressure pumps, packings, etc.

In accordance with the provisions of the patent statutes, I have described the principle of operation of my invention, together with the apparatus which I now consider to represent the best embodiment thereof; but I desire to have it understood that the apparatus shown is only illustrative, and that the invention can be carried out by other means.

What I claim as new and desire to secure by Letters Patent of the United States, is,—

1. In combination, a piston having a chamber, a wall of which is adapted to be heated, a pipe projecting into the chamber for discharging a cooling liquid under relatively high velocity thereinto, means carried by a wall of the chamber for distributing the liquid over the surface of the heated wall, and conduit means for conveying liquid to the pipe and conveying it from the chamber.

2. In combination, a piston having a chamber, one wall of which is adapted to be heated, said wall having a conical projection, a nozzle in the chamber which has a diverging discharge portion that embraces said projection, there being a small annular space between the two and through which liquid is discharged, a conduit for conveying liquid to the nozzle, and a conduit for conveying liquid from the chamber.

3. In a combination, a piston having a chamber, one wall of which is adapted to be heated, said wall having a conical projection, a nozzle located in the axis of the piston and in the chamber which has a diverging discharge portion that embraces said projection, there being a small annular space between the two and through which liquid is discharged, a conduit conveying liquid to the nozzle, and a conduit conveying liquid from the chamber.

4. In a combination, a piston having a chamber, one wall of which is heated during the firing stroke, a nozzle that discharges cooling liquid tangentially along one face of the wall, a recess formed in the wall, a tube that enters the recess and receives liquid therefrom, said recess being in communication with the chamber, a conduit for conveying liquid to the nozzle, and a conduit that receives liquid from the tube and conveys it to a point outside of the piston.

5. In combination, a piston having a chamber, one wall of which is adapted to be heated, said wall having a conical projection, a nozzle in the chamber which has a diverging discharge portion that embraces said projection, there being a small annular space between the two and through which liquid is discharged, a recess formed in said wall, a tube of lesser diameter than the recess which projects thereinto and is adapted to receive liquid from the chamber, a conduit for conveying liquid to the nozzle, and a conduit that receives liquid from the tube and conveys it to a point outside of the piston.

6. In combination, a piston having a chamber, one wall of which is adapted to be heated, a pipe carried by the opposite wall and located in the axis of the piston, said pipe terminating in a nozzle like end adjacent the wall which is heated so as to spread liquid thereover, and a conduit for conveying liquid from the chamber.

7. In combination, a piston having a chamber, one wall of which is adapted to be heated, a pipe carried by the opposite wall and located in the axis of the piston, means carried by the end of said pipe and arranged adjacent the wall adapted to be heated which acts to spread liquid over the surface thereof, and a conduit for conveying liquid from the chamber.

In witness whereof, I have hereunto set my hand this 19th day of December, 1913.

WILLIAM EVERETT VER PLANCK.

Witnesses:
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