Dec. 1, 1931. W. M. GOODWIN 1,834,836

POPPET VALVE FOR INTERNAL COMBUSTION ENGINES

Filed Oct. 27, 1930

Fig. 1.

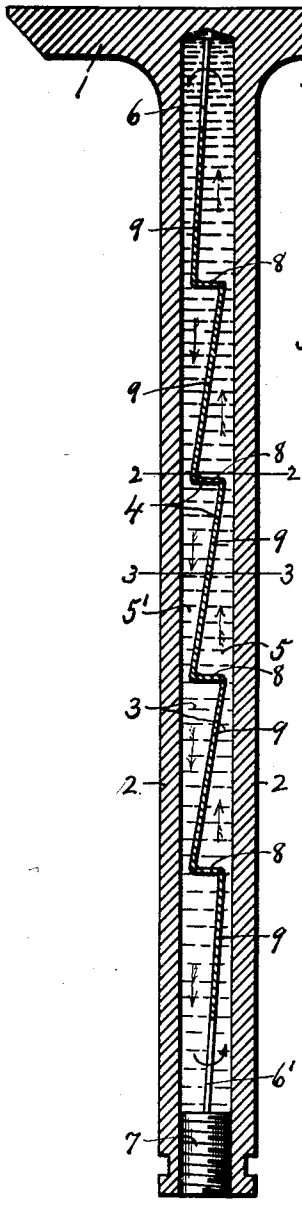


Fig. 2.

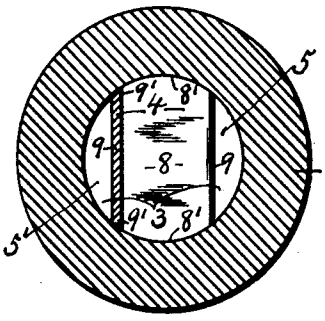


Fig. 3.

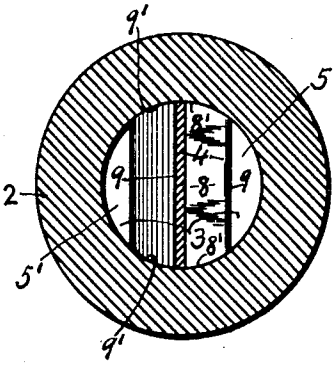


Fig. 5.

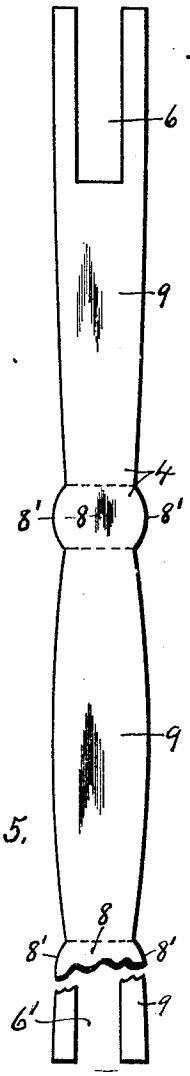
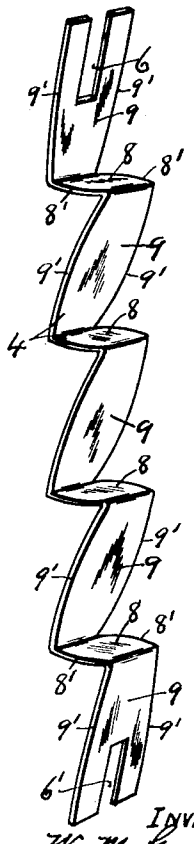


Fig. 4.



WITNESS

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Patented Dec. 1, 1931

1,834,836

UNITED STATES PATENT OFFICE

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POPPET VALVE FOR INTERNAL COMBUSTION ENGINES

Application filed October 27, 1930. Serial No. 491,552.

This invention relates to a poppet valve for internal combustion engines and analogous uses in which the valves are subject to more or less excessive heat, and refers more particularly to the means for cooling or preventing excessive heating of the valve.

These valves are provided with tubular stems for receiving a cooling agent, preferably in liquid form or capable of conversion into liquid under heat, and the main object of the present invention is to provide means dependent upon the more or less rapid endwise reciprocation of the valve and the inertia of the cooling liquid to cause said liquid to automatically circulate from end to end of the valve stem.

One of the specific objects is to provide the interior of the stem and the opposite lengthwise channels by means of a partition having longitudinally spaced portions thereof offset at abrupt angles to the axis of the stem and to connect opposite edges of adjacent offset portions extending diagonally across said axis whereby the impulsive endwise movement of the valve in one direction relatively to the more or less inert liquid will cause said liquid to enter successive pockets formed by the offsets in one of the channels while the sudden movement of the valve in the opposite direction will cause the offset portions to feed the liquid in the several pockets at the corresponding side of the channel in the same direction, so that the repeated reciprocations of the valve will effect the circulation of the first-named channel onto the other channel where the offset portions facing the last-named channel will cause a positive feed of the liquid therein to the other end of the first-named channel, thus completing the cycle of circulation for each reciprocal movement of the valve.

Other objects and uses relating to the means for causing automatic circulation of the liquid through each channel and return through the other channel will be brought out in the following description.

In the drawings:—

Figure 1 is an enlarged longitudinal sectional view of a self-cooled valve embodying the various features of my invention.

Figures 2 and 3 are enlarged transverse sectional views taken respectively in the planes of lines 2—2 and 3—3, Figure 1.

Figure 4 is a perspective view of the detached zig-zag partition ready for insertion into the tubular stem of the valve.

Figure 5 is a face view of a portion of the sheet metal blank from which the zig-zag partition shown in Figure 4 is cut.

In order that the invention may be clearly understood I have shown a valve —1— as provided with a tubular stem —2— forming an inner lengthwise chamber —3— extending from end to end of the valve stem co-axial therewith and preferably of uniform diameter from end to end for receiving and retaining a cooling agent —*a*— which may be in the form of a liquid or a solid which is convertible into liquid under heat.

A longitudinally zig-zagged partition —4— is inserted into the cooling chamber —3— to extend from end to end thereof for dividing said chamber into opposite lengthwise channels —5— and —5′—, said partition being preferably made of sheet metal and arranged with its opposite lengthwise edges in close contact with the adjacent walls of the chamber —3— to form water-tight joints therewith.

The channels —5— and —5′— extend the full length of the partition —4— and chamber —3— and are connected at both ends through openings —6— and —6′— in opposite ends of the partition to form a complete circuit for the circulation of the liquid through both channels and from each channel to the other.

Both ends of the cooling chamber —3— are closed to retain the liquid therein, one of the closures as —7— at the end of the chamber —3— opposite the valve —1— consisting, in this instance, of a screw plug in threaded engagement with the adjacent walls of the chamber, as shown more clearly in Figure 1, said plug being removable to omit the insertion and removal of the partition when necessary for repairs or other requirements.

The opposite ends of the partition —4— preferably abut against the corresponding closed ends of the chamber —3— to hold said

partition against endwise movement in the cooling chamber.

The partition —4— is provided with longitudinally spaced offset portions or ledges —8— which, in this instance, are disposed in parallel planes at right angles to the axis of the valve stem, said partition being also provided with longitudinally spaced portions —9— extending diagonally across said axis and connecting opposite edges of adjacent ledges —8—.

As previously stated, the opposite longitudinal edges of the partition —4— are closely engaged with the adjacent walls of the chamber —3— while the opposite faces of the partition are arranged in equally spaced relation to the corresponding walls of the chamber to form the lengthwise channels —5— and —5′— which extend the entire length of the partition and communicate with each other at both ends of the chamber through the openings —6— and —6′—.

The opposite longitudinal edges of the steps or ledges —8— are curved at —8′— to conform to the curvature of the adjacent portions of the cylindrical walls of the cooling chamber —3—, the opposite longitudinal edges of the diagonal portions —9— of the partition being also curved or convexed outwardly to conform to the curvature of the adjacent portions of the walls of the chamber —3—.

It therefore follows, that the radius of curvature of the opposite edges of the ledges —8— will be substantially equal to the radius of the cooling chamber, while the radius of curvature of the opposite longitudinal edges —9′— of the diagonal portions —9— will be considerably longer than that of the ledges —8—, depending somewhat upon the length of the diagonal portions.

Operation

Assuming that the chamber —3— has been filled with a cooling agent either in liquid form or other matter convertible into liquid by heat and that the partition —4— has been secured in operative position within the chamber by the insertion of the plug —7—, and further assuming that the valve is reciprocally movable vertically by mechanism commonly employed in internal combustion engines, then at each upward or opening movement of the valve, with the partition —4— therein, relatively to the more or less inert body of liquid therein, the upper surface of the ledges —8— will act as pistons to force the overlying portion of the liquid upwardly through the channel —5— and cause it to overflow through the upper passage —6— into the upper end of the channel —5′—, the downward flow of the liquid in the channel —5′— being aided by gravity to cause the return of the liquid from the lower end of the channel —5′— through the passage —6′— and into the corresponding end of the up flow channel —5—.

On the other hand during the more or less rapid descent or closing of the valve —1— with the partition —4— therein, the lower faces of the ledges —8— will act as pistons to force the more or less inert oil liquid downwardly through the downflow channel —5′— and thence through the lower passage —6′— into the up flow channel —5— to assist in the up flow of the liquid through the channel —5— and its overflow through the passage —6— into the upper end of the downflow channel —5′—, thus completing the cycle of circulation which is repeated at each reciprocal movement of the valve.

Owing to the fact that the major portion of the valve stem —2— is considerably cooler than the valve head —1— it is evident that this up flow and return of the cooling agent through the channels —5— and —5′— will maintain a continuous flow of the cooled liquid from the lower end of the valve stem through the portion of the chamber adjacent the more highly heated valve head —1— for cooling the latter or at least maintaining its temperature to a safe and efficient degree.

The particular longitudinal zig-zag shape of the partition —4— forms a series of pockets in opposite sides thereof in which the capacity of each pocket of the channel —5— is gradually diminished from bottom to top of the diagonal portions —9—, while the pockets at the opposite side of the partition forming parts of the channel —5′— will be gradually diminished from top to bottom of each diagonal portion —9—, but owing to the fact that the lower and upper faces of each ledge —8— constitute pistons it is evident that any relative endwise reciprocal movement of the valve will cause the liquid to be positively fed upwardly through the channel —5— from bottom to top thereof, and then positively returned downwardly through the channel —5′— to the lower end of the channel —5— for recirculation after cooling.

The means shown and described for establishing an automatic circulation of the cooling agent through the tubular valve stem and return is particularly simple, practical and efficient in that such circulation is made dependent entirely upon the reciprocatory movement of the valve relatively to the cooling agent due to the inertia of the cooling liquid and to the fact that the upper and lower faces of the ledges —8— act as pistons for positively feeding the liquid in opposite directions through the channels —5— and —5′—.

It is evident, however, that some change may be made in the detail construction of the partition without departing from the spirit of this invention.

What I claim is:—

1. A poppet valve having a tubular stem containing a cooling agent, and a partition extending lengthwise of and within the stem and dividing the interior thereof into opposite lengthwise channels, said partition having longitudinally spaced portions thereof offset in planes at abrupt angles to the axis of the stem.

2. A poppet valve having a tubular stem containing a cooling agent, and a partition extending lengthwise of and within the stem and dividing the interior thereof into opposite lengthwise channels, said partition having longitudinally spaced portions thereof offset in planes at abrupt angles to the axis of the stem, the portions between the offset portions being extended diagonally across said axis.

3. A poppet valve having a stem provided with a lengthwise chamber closed at both ends against communication with the exterior of the valve and stem and containing a cooling agent, and a partition extending lengthwise of and within said chamber and dividing the latter into opposite lengthwise channels having corresponding ends at both ends of the chamber connected to each other to confine the circulation of the cooling agent wholly within the valve and stem.

In witness whereof I have hereunto set my hand this 24th day of October, 1930.

WILLIAM M. GOODWIN.