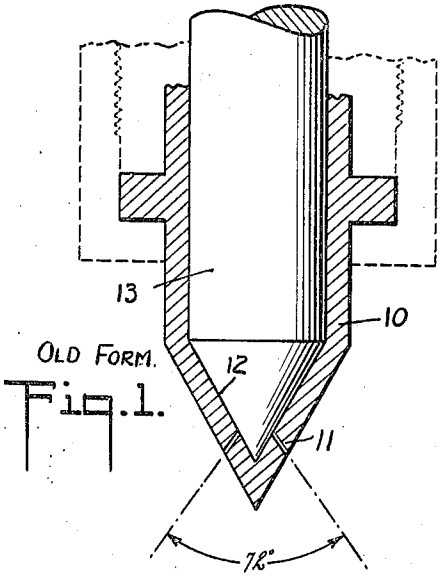
Jan. 26, 1937. R. H. HOADLEY 2,068,678

INJECTION VALVE TIP

Filed Feb. 9, 1935



OLD FORM.

Fig. 1.

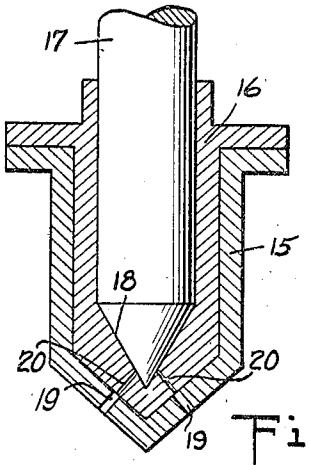


Fig. 3.

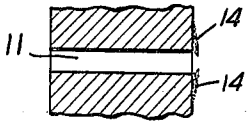


Fig. 2.

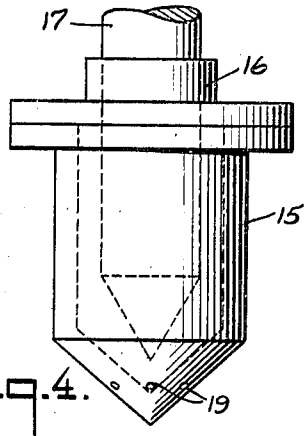


Fig. 4.

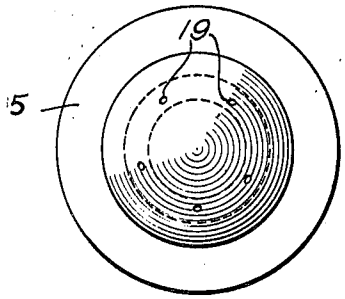


Fig. 5.

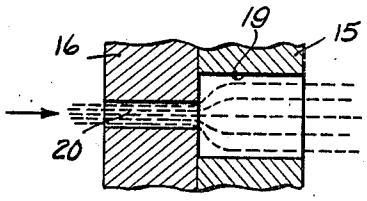


Fig. 6.

INVENTOR
Raymond H. Hoadley
BY
John M. Cole
ATTORNEY

Patented Jan. 26, 1937 2,068,678

UNITED STATES PATENT OFFICE

2,068,678

INJECTION VALVE TIP

Raymond H. Hoadley, Bronx, N. Y.

Application February 9, 1935, Serial No. 5,877

5 Claims. (Cl. 299—107.1)

The present invention relates to valve tips for Diesel engines.

In certain types of Diesel engines the fuel oil is injected through a nozzle at very high pressure produced by suitable pumps and under the control of valve gear. The valve tips heretofore in common use have been made of steel and have a hollow conical tip provided with a suitable number of very small fuel metering holes drilled through the tip to the seat for the valve stem, the holes being opened and closed by the valve. These tips lose efficiency very rapidly on account of the clogging of the nozzle holes, which appears to result from a carbon deposit formed by the incomplete combustion of the residual oil in the tip. The carbon forms a crust which interferes with the injection of fuel and may eventually clog the entire hole of the nozzle so that the engine does not receive the designed charge of fuel.

The present invention contemplates the provision of injection valve tips of an improved form and operation whereby the useful life of the tip is greatly extended, the power which may be had from the engine increased, and whereby the engine speed may be controlled through much wider limits than with ordinary nozzles.

In carrying out the invention, the tip is redesigned so that the fuel passes through nozzle openings of stepped cross section. The inner part of the nozzle opening is drilled to the small diameter to control the quantity of fuel admitted. This very small hole leads into a larger diameter passageway through which the jet is projected. These larger holes act as a shroud or sheath and protect the orifices from clogging by carbon.

The invention also contemplates the disposition of the nozzles so as to produce a flatter spray than has been customary whereby an improved combustion of the fuel takes place, and to produce a cushioning effect with no appreciable rise in temperature of exhaust gases.

Other and further objects of the invention will appear as the description proceeds:

The accompanying drawing shows, for purposes of illustrating the present invention, one of the many embodiments in which the invention may take form, it being understood that the drawing is illustrative of the invention rather than limiting the same. In the drawing:

Fig. 1 illustrates in section and at an enlarged scale a typical valve tip such as heretofore in use;

Fig. 2 is a fragmentary view at a still further enlarged scale showing the orifice in common use and illustrating how it is clogged by carbon;

Fig. 3 is a view similar to Figure 1 of the preferred form of tip embodying the present invention;

Figs. 4 and 5 are side and end elevational views of the tip shown in Figure 3; and

Fig. 6 is a fragmentary enlarged view through the orifice of the tip of Figure 3.

The common valve tip of Figures 1 and 2 is in the form of a single piece of steel 10 turned to the shape shown and drilled to provide a number of orifices 11, which meter the fuel and lead to a valve seat 12. These orifices are opened and closed by a valve stem 13 and suitable gear not shown. The orifices are in the form of small holes of from 0.008 inch to 0.015 inch in diameter depending on horse power of engine. These tips usually have a conical point of an angle of about 60° and the orifices are drilled at an angle of about 72° to 75° with face of tip, with the result that the spray from the tip is confined into a narrow cone of about 72°. Examinations of tips which have seen service usually shows a heavy, hard carbon deposit or crust about the nozzle opening. This is indicated at 14 in Figure 2. It appears to come from the burning or breaking down of the exposed surface of the droplet oil which is held in the orifice of the nozzle. The engine power and ease of starting and handling is seriously impaired. Due to the clogging of the orifices the cylinders work unevenly. This promotes a smoky exhaust due to poor and incomplete combustion. The building up of this carbon deposit is progressive and it interferes with the discharge of the fuel, both as to quantity and its atomization.

In the construction of Figure 3, embodying the present improvements, the valve tip is made of two turnings. The outer one or shroud 15 is of bronze which has high thermal conductivity and is therefore quickly cooled by the air taken into the cylinder. It therefore expands and contracts with each cycle. The inner member 16 is of steel for strength. These members are made accurately to size so that when the steel insert is forced into the sheath the joint is oil tight. The steel liner 15 is adapted to receive the valve stem 17 and has a seat 18 for the valve stem. The end of the tip is turned to have a cone of 100°.

The outer sheath is provided with a plurality of comparatively large holes, about $\frac{1}{8}$ inch in diameter as indicated at 19. These holes are preferably drilled before the steel insert is forced in place. The fuel orifices 20 are drilled very carefully so as to proceed from the centers of the larger holes. These orifices are of the proper

diameter for the quantity of fuel they are to supply and are preferably drilled at about 50° to the tip axis. The spread of the jet is therefore approximately 50° from the axis of the tip. This spreads the jets further from the axis than usual and produces a widely spreading fan-like flame. It avoids the sudden blow to which the pistons and connected parts are usually subjected and has been found to materially reduce the noise of the engine and the wear on the bearings.

The stepped orifice is similar to a mouthpiece or pipe having a sudden enlargement. There is sinuous flow along the pipe, the stream suddenly enlarging to fill the pipe. The fuel is, however, sprayed out without loss of volume or material loss of energy, except for eddy motions. Whatever fuel is left in the passage after an explosion, with any contamination by carbon, is washed away by the next charge so that clean oil is always being passed over the surfaces.

Experience with the fuel tips herein described show that the engine operation is greatly improved, both as to maximum power available and flexibility of control. The exhaust gases are clear and free of smoke or soot, and the exhaust temperature low. While of general use in Diesel engines, they have been found to be of especial advantage for use on marine engines where it is important to avoid shut down for repairs, and where maneuverability of the ship is necessary.

It is obvious that the invention may be embodied in many forms and constructions within the scope of the claims, and I wish it to be understood that the particular form shown is but one of the many forms. Various modifications and changes being possible, I do not otherwise limit myself in any way with respect thereto.

What is claimed is:

1. In a Diesel engine, an injection valve tip having an insert provided with small diameter orifices through which the fuel is injected into the cylinder and an outer sheath provided with means about the orifices to prevent the incomplete combustion of fuel adjacent the orifices whereby clogging of the orifices by carbon is prevented.

2. A Diesel engine injection tip having an outer sheath and an insert, the insert having small diameter fuel metering passages, the sheath having co-axial perforations of substantially larger diameter to provide it with cylindrical openings which shroud and protect each of the fuel passages.

3. A tip as claimed in claim 2, characterized in that the insert is of hard metal to withstand the action of the valve stem and the sheath is of a metal having a greater temperature conductivity.

4. A tip as claimed in claim 2, wherein the sheath perforations are approximately six times the diameter of the metering passages.

5. A Diesel engine injection tip having an outer bronze sheath and a steel insert, the insert having small diameter fuel metering passages, the sheath having co-axial performations of substantially larger diameter to provide it with cylindrical openings which shroud and protect each of the fuel passages.

RAYMOND H. HOADLEY.