Feb. 7, 1961 T. H. BOOSINGER ET AL 2,970,772

FUEL NOZZLE ANTI-COKING CAP

Filed April 14, 1960

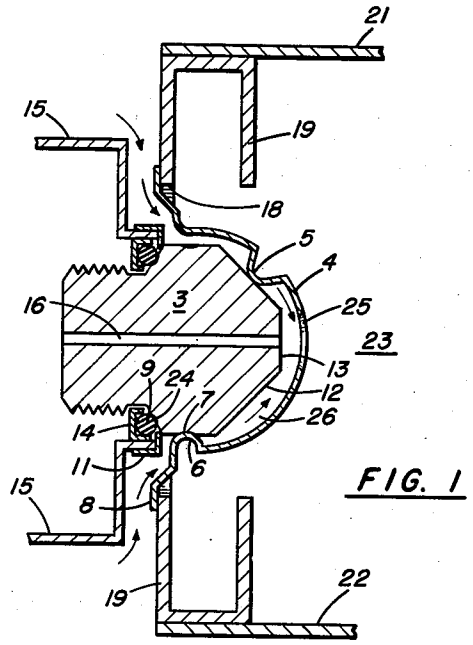


FIG. 1

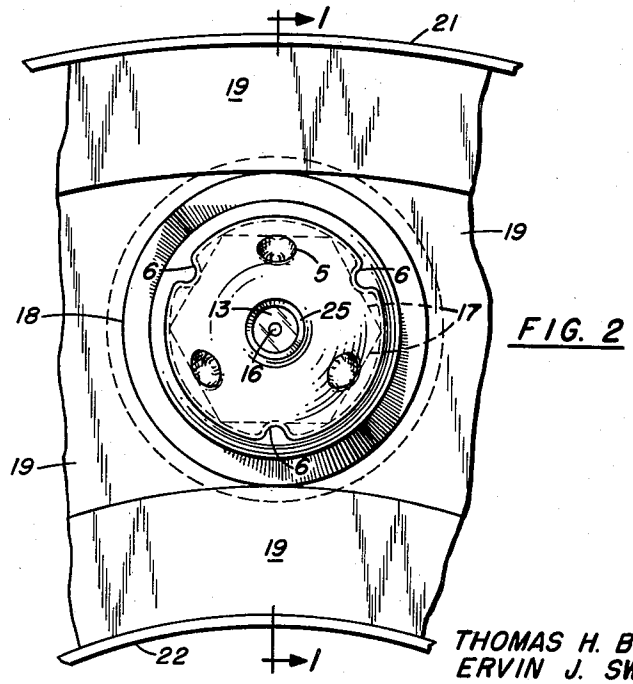


FIG. 2

Inventors
THOMAS H. BOOSINGER
ERVIN J. SWEET

By R. I. Tompkins
Attorney

United States Patent Office 2,970,772 Patented Feb. 7, 1961

2,970,772

FUEL NOZZLE ANTI-COKING CAP

Thomas H. Boosinger, Kansas City, Kans., and Ervin J. Sweet, Hamilton, Ohio, assignors, by mesne assignments, to the United States of America as represented by the Secretary of the Navy

Filed Apr. 14, 1960, Ser. No. 22,378

4 Claims. (Cl. 239—105)

The present invention relates to a fuel nozzle anti-coking cap and more particularly to a fuel nozzle anti-coking cap which provides a positive flow of air over the nozzle tip to scrub off coke deposits which have a tendency to build-up after a prolonged period of operation.

Prior art methods of combatting this problem have, to a large extent, consisted of providing a secondary air passage which required additional machining of the nozzle head or providing a secondary air supply. Other methods, such as threading a shield or shroud of some type to the nozzle head to direct air over the tip of the nozzle head, have been employed. These methods, also, require the cutting of threads on the nozzle head and also threading the air shield to mate therewith.

The instant invention solves the coking problem by employing a simple anti-coking cap which is adaptable to most nozzle heads presently in use. The nozzle cap has a plurality of aligning dimples which engage an equal number of detents in the nozzle head and aligns the cap with respect to the nozzle head until it is fixedly secured in its proper place by the combustion liner header when the liner header is installed.

It is to be noted that the only machining required of the nozzle head is the machining of six slight detents and the present invention is readily adaptable to presently used air supply systems without any modification whatsoever.

An object of the present invention is the provision of a fuel nozzle anti-coking means.

A further object of the present invention is the provision of an anti-coking cap which is adaptable to fuel nozzle heads presently in use.

A further object of the present invention is the provision of a simple anti-coking cap which provides a positive flow of air over the tip of the fuel nozzle head to scrub off coke formations and prevent distortion of the fuel spray pattern which may result therefrom.

Other objects and many of the attendant advantages of this invention will be readily appreciated as the same becomes better understood by reference to the following detailed description when considered in connection with the accompanying drawings wherein:

Fig. 1 shows a section of a preferred embodiment of the invention taken on line 1—1 of Fig. 2.

Fig. 2 shows an end view of the device with the liners and headers in place.

Referring now to the drawings, wherein like reference characters designate like or corresponding parts throughout the several views, there is shown in Fig. 1, which illustrates a preferred embodiment, a fuel injection nozzle head 3, which is connected to a source of fuel supply (not shown), projecting into a combustion chamber 23 through the opening 18 formed in the header 19.

The fuel injection nozzle head 3 is provided with a fuel passage 16, nozzle hex portions 17, a nozzle cone portion 12 and a tapered annular O-ring seat 24. Each of the hex portions 17 is provided with a slight detent 7, and while the cap 4 requires only three detents, three additional detents 7 are provided so as to eliminate the need of locating three "particular" detents to match the three dimples 6 in attaching the cap 4 to the nozzle head 3.

The anti-coking nozzle cap 4 is provided with an outlet or aperture 25 which is of larger diameter than, and in alignment with, the fuel passage 16 so that there will not be any interference with the fuel spray pattern as it enters the combustion chamber 23. In addition, the cap 4 is provided with three aligning dimples 5 that are located near the outlet 25 which provide spacing as at 26 between the cap 4 and the cone portion 12 and also assist in the aligning of the cap 4 on the nozzle head 3 by contact of the dimples 5 on the cone portion 12, which are spaced 120° apart, on the nozzle cone portion 12. The cap 4 is further provided with a set of securing dimples 6 which, when placed over the detents 7 in the hex portion 17 in the nozzle head 3 will securely fasten the cap 4 to the nozzle head 3. The cap 4 is also provided with a flange 8 that serves as an air guide and air seal and also helps to securely fasten the cap 4 in its permanent position by engagement of the flange 8 with the inner periphery of the header 19. Attached to the header 19 are a pair of cylindrical liners 21 and 22 which are fixedly secured to the header 19. These liners 21 and 22 provide walls for the combustion chamber 23.

The air guide 15 is provided with a crush washer 14 which is integrally attached to it. A lock washer 11 is placed over the nozzle head 3 and O-ring 9 is placed on the O-ring seat 24 of the nozzle head 3 between the crush washer 14 and the lock washer 11 so that there will not be any leakage of air between the crush washer 14 and the nozzle head 3.

When the cap 4 is assembled on the nozzle head 3 and the header 19 is brought into proper position with respect to the cap flange 8, a portion of the air which is supplied to the combustion chamber will follow the path shown by the arrows and enter into the space between the cap 4 and the nozzle head 3 as shown at 26 of Fig. 1. As the air approaches the tip of the nozzle head 3 it flows between the aligning dimples 5, and as the air passes through adjacent dimples 5, there is a sudden velocity increase due to the reduction in flow area caused by the presence of dimples 5 in the cap 4. After passing through this reduced flow area between the aligning dimples 5, the air is then directed toward the nozzle face 13, whereby the scrubbing action of the air under increased velocity over the face 13 prevents the carbon deposits from building up and distorting the fuel spray pattern.

Fig. 2 shows an end view of the device with the nozzle head 3 and cap 4 in position with respect to the header 19. Also shown are the three aligning dimples 5 and the three securing dimples 6.

Obviously many modifications and variations of the present invention are possible in the light of the above teachings. It is therefore to be understood that within the scope of the appended claims, the invention may be practiced otherwise than as specifically described.

What is claimed is:

1. The combination of a combustion chamber, an anti-coking cap and a fuel injection nozzle, said fuel injection nozzle comprising a fuel injection nozzle head with a fuel passage therethrough and an anti-coking cap releasably attached thereto, said nozzle head having a hexagonal portion and a cone portion, a detent in each face of said hexagonal portion, a first air guide operatively connected to said nozzle head, a second air guide, said second air guide formed by a flange and an inner radial portion of said air cap, a plurality of securing dimples in said cap engaging said hexagonal portion of said nozzle head, a plurality of aligning dimples in said cap engaging said cone portion of said nozzle head, said aligning dimples being spaced in such a manner as to constitute a reduced

flow area thus causing the velocity of the air in that area to increase just prior to its striking the face of the nozzle, an outlet in said cap which is in axial alignment with said fuel passage, said cap being imperforate except for said outlet opening, sealing means and fuel supply means operatively connected to said nozzle head, air passage means formed by said air guides for supplying air to said nozzle head, said anti-coking cap directing the flow of air under increased velocity over the face of the nozzle head whereby the products of combustion are prevented from adhering thereto.

2. The combination as claimed in claim 1 wherein said sealing means comprises an O-ring seat formed on the nozzle head, a lock washer, a crush washer and an O-ring on said O-ring seat positioned between said lock washer and said crush washer; said O-ring being compressed into

a sealing position when the nozzle head is brought into proximity with the crush washer.

3. The combination as claimed in claim 2 wherein said air passage means is partially formed by the area between said anti-coking cap and said nozzle cone portion due to the presence of said aligning dimples which hold the cap a predetermined distance from said nozzle head.

4. The combination as claimed in claim 1 wherein each of said aligning dimples is spaced 120° from the adjacent dimples.

References Cited in the file of this patent

UNITED STATES PATENTS

2,774,629	Noon et al.	Dec. 18, 1956
2,928,607	Shames et al.	Mar. 15, 1960