

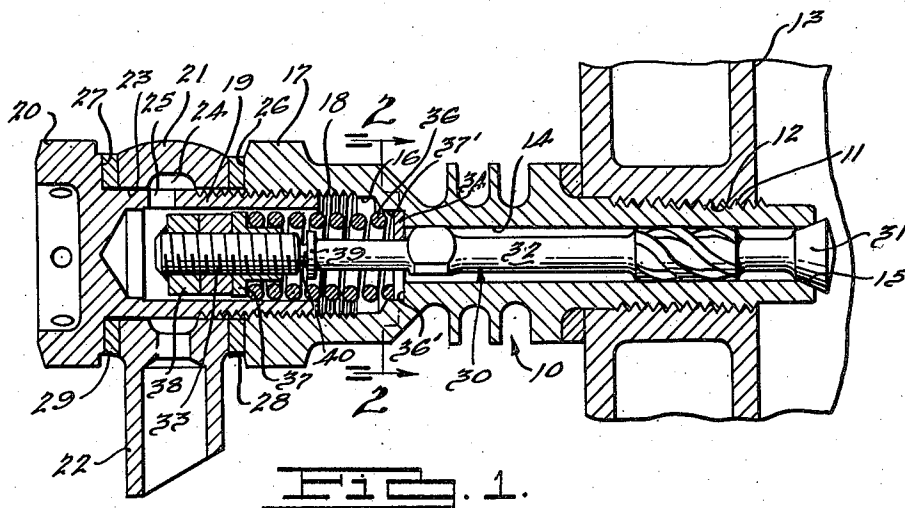
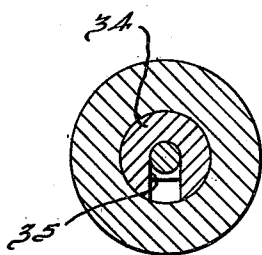
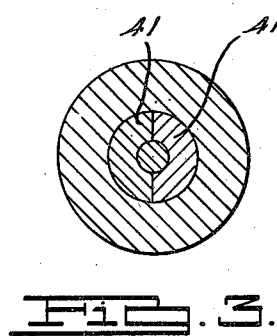
Oct. 26, 1948.

T. M. BALL

2,452,283

VALVE CATCHER

Filed May 15, 1944



INVENTOR.
Thomas M. Ball.
BY
Hamm & Hania

ATTORNEYS.

UNITED STATES PATENT OFFICE

2,452,283

VALVE CATCHER

Thomas M. Ball, Detroit, Mich., assignor to Chrysler Corporation, Highland Park, Mich., a corporation of Delaware

Application May 15, 1944, Serial No. 535,657

5 Claims. (Cl. 251-145)

1

This invention relates to an improved injection nozzle.

More particularly, the invention pertains to an improvement in the valve assembly of an injection nozzle of the type used in liquid fuel injecting systems of internal combustion engines.

One of the main objects of the invention is to provide means in an injection nozzle of this character to hold the valve and valve stem structure thereof against displacement from the nozzle and passage into the combustion space of an engine in the event the valve stem breaks during operation.

Other objects of the invention are to provide a valve and valve stem catcher of this kind which may be conveniently embodied in injection nozzles of generally conventional construction; to provide an abutment on the valve member of an injection nozzle and a cooperating abutment in the body structure of the nozzle which co-acts to positively hold a broken valve member against displacement from the nozzle and to provide a reduced or weakened section on the valve stem for assuring that, in the event of failure, the abutment will remain on the fragment of the valve member adjacent the nozzle outlet.

Illustrative embodiments of the invention are shown in the accompanying drawing, in which:

Fig. 1 is a longitudinal sectional view of an injection nozzle embodying the invention.

Fig. 2 is a transverse sectional view taken on the line 2-2 of Fig. 1.

Fig. 3 is a view similar to Fig. 2 but showing a modified form of the invention.

Valve members of injection nozzles of the above character are generally inserted during assembly through the outlet end of the nozzle and therefore all portions fixed on the stem part are necessarily small enough to pass through the nozzle passage. The valve member is normally held against outward movement by a spring which serves to bias the valve element toward its closed position. Such springs generally bear between the nozzle body and a spring seat which is held by nuts or other suitable means on a threaded section provided on the end of the valve stem remote from the valve element thereof. In operation of a nozzle of this kind, it is found that if the valve stem fails, failure occurs substantially at the end of the threaded section closest to the valve element. The forward valve element bearing portion of the stem is, as a result of such failure, projected out of the nozzle passage and into the combustion chamber of the cylinder head of an engine where it causes extreme damage to the moving parts of the engine, such as the piston and connecting rod, as well as the cylinder block and cylinder head.

I have found that displacement of a broken valve stem from the nozzle may be avoided in a nozzle of conventional construction without varying its structure in any way. In the form of the

2

invention illustrated in Figs. 1 and 2 of the drawing, the nozzle illustrated comprises a tubular body portion, generally designated by the numeral 10, having a forward end provided with external threads 11 by which the body portion is mounted in a threaded aperture 12 of a cylinder head 13. The body portion 10 has a forward passage section 14 provided at its outlet end with a valve seat 15, and a rearward passage section 16 provided by an enlarged coupling element 17 located at the end of the body portion 10 remote from the valve seat 15. The coupling element 17 is provided with internal threads 18 in which is threaded a hollow plug 19 having an enlarged head 20 at its outer end. The threaded stem portion of the plug 19 extends outwardly beyond the fitting element 17 of the nozzle body so as to accommodate a coupling head 21 of a fluid supply conduit 22. The coupling head 21 has a bore 23 for receiving the stem portion of the plug 19 and it is provided with an annular groove 24 which communicates with the interior of the plug and the nozzle passage through one or more ports 25 formed in the wall of the stem portion of the plug. The coupling element 21 of the conduit 22 is disposed between adjacent faces 26 and 27 on the end of the nozzle body 10 and head 20 of the plug 19, the sealing washers 28 and 29 being provided between adjacent faces of the coupling element 21, and faces 26 and 27, respectively. When the plug 20 is tightly screwed into the nozzle body, it holds the coupling element 21 of the conduit 22 in liquid tight sealed relationship with respect to the nozzle body.

A valve member, generally designated by the numeral 30, is disposed in the nozzle body and provided with the valve element 31 which is adapted to seat upon the valve seat 15 at the forward end of the nozzle body. This valve element includes a stem portion 32 and a threaded section 33, all portions of which are of small enough diameter to accommodate insertion of the valve stem through the outlet end of the forward passage section 14. The valve member is normally thus inserted into the nozzle body prior to assembly of the conduit 22 and plug 20 on the nozzle body. A C washer 34 is then introduced into the end of the bore in the coupling element 17 which is of sufficient diameter to accommodate passage of the washer between the threaded section 33 of the valve stem and the threads 18 while the side faces of the washer are disposed substantially parallel to the longitudinal axis of the valve member. After the washer has been moved into the nozzle body to a location beyond the forward end of the threaded section 33, it may be turned to bring its side faces into substantially normal relationship with respect to the axis of the valve element while at the same time inserting the valve stem

into the passage 35 of the C washer. The C washer may be then pressed forwardly into a cylindrical bore 37 of slightly larger diameter than the washer and against a shoulder 36' at the end of the latter bore.

After insertion of the C washer 34, a spring 36 is disposed in the counterbore 16 of the coupling element 17. A valve seat element 37 is then disposed on the threaded section 33 and held against leftward movement, as viewed in Fig. 1, by a pair of nuts 38, which are threaded on the end portion of the threaded section 33. The nuts 38 may be adjusted to suitably predetermine the initial compression of the spring 36 and the force by which the latter urges the valve element 31 towards its closed position. The right end of the spring 35, as viewed in Fig. 1, bears against the C washer 34, firmly holding it against the shoulder 36'.

The passage 35 of the C washer is of sufficient size to accommodate relative shifting of the valve stem therein but is not large enough to accommodate passage of a flange 39 provided on the valve stem slightly in advance of the forward end of the threaded section 33. The flange 39 thus serves as an abutment for engaging the C washer 34 to positively hold the forward section of the valve member from displacement from the nozzle in the event of failure where failure usually occurs, that is, immediately adjacent the forward end of the threaded section. If desired, the valve stem may be reduced immediately in advance of the forward end of the threaded section 33 by forming a groove 40 in the valve stem in order to predetermine the location at which breakage will occur in the event of valve failure.

In the form of the invention shown in Fig. 3, the nozzle structure is identical to that illustrated in Fig. 1 but in place of using a C washer as an abutment member for contacting the flange 39 in the event of failure of the valve stem at a location between the flange and the threaded section 33, a split washer 41 is disposed adjacent the shoulder 36'. The complementary sections of the split washer 41 are provided with complementary semi-circular notches for receiving the stem portion of the valve member. These washer sections may be individually inserted in the coupling element end portion 17 of the nozzle body and arranged adjacent the shoulder 36' prior to assembly of the spring 36, valve seat element 37, and nuts 38 on the valve member.

In the event of failure of the stem portion of the valve member at the location where failure normally occurs either in the presence or absence of the groove 40, the flange 39 abuts the C washer 34 shown in Fig. 2 or the split washer 41, shown in Fig. 3, and holds the forward part of a broken valve member against passage into the engine with which the nozzle is associated, thus obviating severe and extensive damage which has been found to occur when the valve member of an injection nozzle breaks. This precaution can be taken with applicant's improved nozzle structure without requiring radical change or revision of the nozzle design and without interfering with the normal practice of assembling a valve member of a nozzle of this kind through the outlet end of the latter.

Although but several specific embodiments of the invention are herein shown and described, it will be understood that various changes in the sequence of operations, steps and materials employed may be made without departing from the spirit of the invention.

I claim:

1. A fuel injection nozzle including a tubular body portion having a passage comprising a forward portion provided with an outlet at its extremity and a rearward portion of larger cross section than said forward portion and having a shoulder between said portions, a valve member in said passage including a valve head part for closing said outlet and a stem part having an enlargement intermediate the ends of said stem part and located in said rearward portion of said passage, said valve member being insertable into said nozzle body portion through said outlet and forward portion of said passage, a spring disposed in the rearward portion of said passage and surrounding said stem part and cooperating with the end of said stem part opposite said valve head part for normally urging said valve toward a closed position and an abutment member adapted to be arranged in embracing relationship with respect to a portion of said stem between said head part and said enlargement while said stem is disposed in said passage and to be engaged between said shoulder and said spring for providing a replaceable seat for the latter, said abutment member being normally held by said spring in fixed relation with respect to said tubular body portion and being engageable with said enlargement for holding the portion of said valve member in advance of said enlargement against displacement from said nozzle body in the event of failure of said stem part between said enlargement and the end thereof opposite from said valve head part.

2. A fuel injection nozzle including a tubular body portion having a passage comprising a forward portion provided with an outlet at its extremity and a rearward portion of larger cross section than said forward portion and having a shoulder between said portions, a valve member in said passage including a valve head part for closing said outlet and a stem part having an enlargement intermediate the ends of said stem part and located in said rearward portion of said passage, said valve member being insertable into said nozzle body portion through said outlet and forward portion of said passage, and an abutment member for providing a spring seat adapted to be arranged in embracing relationship with respect to a portion of said stem between said head part and said enlargement while said stem part is disposed in said passage and to engage said shoulder, a spring seat on the end of said stem part on the side of said enlargement opposite from said head part, and a spring bearing between said seat and said abutment member normally urging said valve member toward its closed position and holding said abutment member in contact with said shoulder and against movement relative to said tubular body, said abutment member being engageable with said enlargement in the event of failure of said stem part between said enlargement and the spring seat for holding the portions of said valve member in advance of said enlargement against displacement from said nozzle body.

3. A fuel injection nozzle including a tubular body portion having a passage provided with an outlet at one extremity, a shoulder in said passage spaced inwardly from the other extremity thereof, a valve member in said passage including a valve head part for closing said outlet and a stem part including a threaded section at the end portion of said stem part remote from said valve head part, an abutment surface extend-

5

ing outwardly transversely with respect to said stem adjacent the inner end of said threaded section, a spring in said passage and cooperating with the threaded stem section for urging said valve toward closed position, and an abutment member providing a seat between said shoulder and spring and having a passage for accommodating insertion thereof on said stem while the latter is disposed in said nozzle body portion, said passage being smaller than said abutment surface and said abutment member being engageable with the latter for holding a portion of said valve member against displacement from said nozzle body portion in the event of failure of said valve stem between the abutment surface and the threaded section of said stem.

4. A fuel injection nozzle including a tubular body portion having a passage provided with an outlet at one extremity, a shoulder in said passage spaced inwardly from the other extremity thereof, a valve member in said passage including a valve head part for closing said outlet and a stem part including a threaded section at the end portion of said stem part remote from said valve head part, an abutment surface extending outwardly transversely with respect to said stem adjacent the inner end of said threaded section, a spring seat element on said threaded section, a C washer on said stem adjacent said shoulder engageable by said abutment surface and providing a spring seat on said housing, and a spring bearing between said C washer and said spring seat element, said C washer being adapted to engage said abutment surface to hold the portion of said stem carrying said valve head against a displacement from said nozzle body portion in the event of failure of said stem at a location between said abutment surface and the spring seat element.

5. A fuel injection nozzle including a tubular body portion having a passage provided with an outlet at one extremity, a shoulder in said passage spaced inwardly from the other extremity

6

thereof, a valve member reciprocably mounted in said passage including a valve head part for closing said outlet and a stem part including a threaded section at the end portion of said stem part remote from said valve head part, a flange extending outwardly from said stem at a location between said threaded section and said shoulder, said stem being grooved at a location between said threaded section and said flange for predetermining the location of fracture in the event of failure of said stem, and an abutment member adjacent said shoulder having a passage for accommodating insertion thereof on said stem while the latter is disposed in said nozzle body portion, said passage being smaller than said flange and said abutment member being engageable with the latter for holding the portion of said stem in advance of said grooved part against displacement from said nozzle body portion in the event of failure of said valve stem at said groove.

THOMAS M. BALL.

REFERENCES CITED

25 The following references are of record in the file of this patent:

UNITED STATES PATENTS

Number	Name	Date
30 187,022	Loughridge	Feb. 6, 1877
592,434	Niebling	Oct. 26, 1897
762,406	Herrick	June 14, 1904
770,088	Moore	Sept. 13, 1904
1,120,546	Ruwell	Dec. 8, 1914
35 1,577,473	Latta	Mar. 23, 1926
1,934,580	Woolson	Nov. 7, 1933
2,255,203	Wiegand	Sept. 9, 1941
2,255,404	White	Sept. 9, 1941
40 2,314,218	Jimerson	Mar. 16, 1943

FOREIGN PATENTS

Number	Country	Date
74,318	Austria	Apr. 10, 1918