An improved, replaceable, relief valve for use with a diesel engine cylinder, to permit venting of the compression chamber of any accumulated water or other liquid before starting when the engine is turned by hand, is provided by a simplified and inexpensive construction that includes a tubular flow body carrying a handled cam means that permits opening or relief of the valve without need of a special wrench separate from the valve, and use of simple valve and biasing elements within the tubular body through which the valve may be selectively closed.
LEVER ACTUATED CYLINDER HEAD TEST VALVE

BACKGROUND OF THE INVENTION

It is known to provide a relief valve to selectively vent the cylinder chamber of a diesel engine of accumulated water or other liquid when the engine is turned by hand prior to start up of the engine. It is typical construction for a diesel engine (such as the 645 Series of the Electro-Motive Division of General Motors Corp.) to provide a bleed passageway from the dome of the diesel engine cylinder to an elongated sleeve in which it is positioned a selectively operable cylinder test valve of the needle valve-seat type, which requires a special wrench to selectively manipulate the valve between open and closed positions.

It has heretofore been suggested to provide a manually actuated combination test and safety valve for a diesel engine, such as in U.S. Pat. No. 2,922,436, wherein discharge from the compression cylinder is controlled by a valve member movable between spaced opposed-valve seats, and a separate gas-receiving passage is provided in the engine body to communicate with the bleed passageway from the cylinder when the valve member is unseated from its normally closed position by pressure in the cylinder. Other diesel engine relief valves, such as in U.S. Pat. Nos. 1,254,104 and 1,254,780, also provide for selective manual control of the valve. However, all such constructions require special adaptation of the valve to the engine body and either fail to protect the spring bias means thereof from exposure to hot gases or utilize gas by-pass means which limit their economy, flexibility and convenience.

Where special wrenches are required, the absence of the wrench may be critical to whether the engine is properly vented prior to a start up test, because a workman may fail to effect the test if the necessary wrench is unavailable.

Therefore, it is an object of this invention to provide a simplified test and safety valve that is of greater convenience and utility in that it is equipped with its own handle for selective opening or closing of the valve, and which improved valve may be substituted upon existing diesel engines without requiring additional expense of modification of the engine or the mounting for the valve.

Another object of this invention is to provide a spring-biased test and safety valve for a diesel engine cylinder that is characterized by simplicity and inexpensiveness of construction, and economy of arrangement of parts so as to permit venting of hot gases therethrough while providing protection to the spring means so as to extend the operational life of the valve.

SUMMARY OF THE INVENTION

An improved combination relief and test valve is provided for simple and economical replacement of a standard needle-type test valve of a diesel engine cylinder that normally requires a special tool for actuation thereon. The improved valve includes an elongated tubular body adapted at one end for securement in place of the usual needle valve body and at the other end carries a levered cam for coaction with valve means within the tubular valve body. Valving means within the body provide a spring-biased, elongated, needle-type valve rod that is spaced from the body to provide a relief passage in and through the body that is arranged to substantially prevent exposing the spring means to deteriorating temperatures of gases that may be vented through the valve.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a fragmentary, vertical sectional view showing a portion of a diesel engine cylinder with the test valve mounted to the engine;

FIG. 2 is a sectional view of a test valve in the closed position, taken substantially along its longitudinal axis;

FIG. 3 is an exploded perspective view of the mounting for the handle for operating the valve;

FIG. 4 is a cross-sectional view taken substantially along line 4—4 of FIG. 2 which shows the body portion of the valve;

FIG. 5 is a view similar to FIG. 2 showing a modified embodiment of the test valve;

FIG. 6 is a cross-sectional view taken substantially along line 6—6 of FIG. 5 which shows a slotted head portion for the valving member.

DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring now to the drawings, FIG. 1 shows a fragment of a diesel engine 10 having body portions 12 and 14, the dome 16 of a cylinder 18, and a bleed passageway 20 leading from the cylinder dome 16 to a sleeve 22 extending between body portions 12 and 14. The sleeve 22 is provided at its inner or upstream end with a tapped section 24, and an annular shoulder 26 spaced downstream thereof. As shown in FIG. 1, the valve 30 of this invention is positioned in sleeve 22.

As seen in FIG. 2, the valve 30 includes a tubular body 32, a packing nut 34, elements internally of tubular body 32, and a handled, or levered cam 36.

More particularly, body 32 is elongated and is formed at its upstream end with external threads 38 adapted to screw into tapped section 24. At its downstream end, body 32 is provided with spaced ear means 40, in the form of a pair of bored, spaced ears adjacent the downstream end of the longitudinal bore of the body and adapted to journal therein a pivot pin 42 that is adapted to be retained in assembled position by spaced head 42a and a snap ring 42c that enters groove 42d in pin shank 42b. The shank 42b is a length to extend through both ears 40 and abutments 42a and 42c are adapted to engage the outer surfaces of ears 40.

A central portion of body 32 is provided with external threads 44 for screw cooperation with internal threads provided on ferrule-like packing nut 34. Downstream of the threads 44 there is provided a vent means which is in the form of three circumferentially spaced, inclined bores 46 that extend outwardly and downstream and terminate at their outlet ends upstream of a hex-nut section 48 from which the ears 40 project axially downstream.

The interior of tubular body 32 is formed to provide, in sequence extending downstream, an upstream bore 50a, a constricted choke bore 50b terminating at a frusto-conical valve seat 50c that flares outwardly to merge with an enlarged and elongated downstream bore section 50d that enters a further enlarged, downstream bore section 50e which communicates with the upstream ends of inclined vent bore 46. The enlarged di-
ameter of bore sections 50d and 50e are greater than the diameter of entry bore 50a. Within body 32 is positioned an elongated valve stem 52 whose upstream end provides a needle-like, tapered valve section 52c that is adapted to sealingly seat against valve seat 50c, an elongated uniform shank portion 52d located substantially coaxially of and movable axially within bore section 50e. Head section 52e has a reduced stud 52f extending downstream therefrom. Within bore section 50e there is a slidable cam follower 54 whose downstream end engages cam 36 and whose upstream end carries a reduced central stud 54a that is spaced from head section 52e. An elongated core compression spring 56 is positioned between head section 52a and cam follower 54 with studs 52f and 54a serving as spring keepers that enter coaxially of the spring coils but are spaced from each other. The cam 36 is in the form of an enlargement of the pivotally mounted knuckle portion of handle 36a. The cam 36 has two surfaces 36b and 36c adapted to engage cam follower 54. Surface 36c is semi-circular and is closer to the center of pivot pin 42 than is the flattened closed-valve-position surface 36b.

In the form of device shown in FIG. 2 there is a flow passageway for gas from valve seat 50c to vent passageways 46 defined in part as an annular space between valve stem 52 and the wall of bore 50d. The flow passageway is supplemented by longitudinal flutes 51 defined in and extending along shank 52d and located radially outwardly of the sealing surface of valve seat 50c. The cross-sectional area of the flow passageway downstream of valve seat 50c is greater than the cross-sectional area of the constricted passageway 50b.

In the form of device shown in FIG. 3, instead of two different bore sizes 50d and 50c the downstream bore 50d' is of uniform dimension but the valve stem 52' is modified by providing a shank section 52b' that is of a diameter substantially smaller than the wall of bore 50d', and providing a head 52e' of substantially the same diameter as the bore 50d' is provided with circumferentially spaced grooves 53 and slidily cooperates with the wall of bore 50d' to maintain substantial coaxial relationship while still providing for flow from valve seat 50c to vents 46'. In both forms of device the packing nut 34 will, in the combination seen in FIG. 1 be operative to compress an annular packing, or gland 60, against annular shoulder 26 to form a seal with sleeve 22 upstream of the vent means 46.

It will be appreciated that changes and modifications can be made to the embodiments disclosed herein without departing from the spirit and scope of this invention.

What is claimed and desired to be secured by Letters Patent of the United States is:

1. An improved valve for use in the combination of a diesel engine cylinder having a bleed passageway extending therefrom to an elongated sleeve that is tapped at the end thereof adjacent said bleed, the sleeve providing an annular shoulder therein spaced from said tapped end, and a selectively openable and closable test valve for screw-type securement in said sleeve; said improved valve comprising, in combination: an elongated tubular body for receiving and conveying flow from the bleed passageway, said body being exteriorly threaded at its upstream end to adapt the body for selective connection to the tapped end of the sleeve, the downstream end of the body being provided with ear means adjacent the longitudinal bore of the body, a pivot pin on said ear means, a central section of the outer surface of the body between the body's ends being threaded and carrying, for screw adjustment thereon, an annular packing nut that is adapted to cooperate with the annular shoulder of the sleeve to prevent leakage between the body and the sleeve; the internal bore of the tubular body defining an upstream flow construction terminating at its downstream end in a frusto-conical valve seat that merges with an enlarged bore downstream of the valve seat, vent means through the wall of the tubular body at a location downstream of both said valve seat and said central threaded section; flow control means in the enlarged bore of the tubular body including an elongated valve stem the upstream end of which is tapered to adapt said end for sealing engagement with the frusto-conical valve seat, and the downstream end of the valve stem having an enlarged head concentric with the stem, means on the valve stem and tubular body for centering the stem relative to the tubular body and the valve seat, a cam follower slidably positioned in the downstream end of the body's enlarged bore and spaced from the headed end of the valve stem, compression spring means compressed between the cam follower and valve stem, and a handled cam means pivotally mounted on the pivot pin and engaging the cam follower and movable selectively through said handle to alternate positions to vary the force developed by the spring means against the valve stem.

2. An improved valve as in claim 1 wherein the compression spring means is an elongated coil spring, and the cam follower and valve stem have reduced studs thereon extending toward but spaced from each other to serve as keepers for the coil springs.

3. An improved valve as in claim 1 wherein the vent means communicates with the region within the tubular body that is located between the spaced cam follower and the headed end of the valve stem.

4. An improved valve as in claim 1 including longitudinal flow passageways means in the valve stem for communicating downstream flow from the valve seat to the vent means.

5. An improved valve as in claim 4 wherein the headed end of the valve stem is provided with longitudinal flow passageways therein.

6. An improved valve as in claim 4 wherein the elongated shank of the valve stem is longitudinally fluted.

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