

July 5, 1938.

F. F. MURRAY

2,122,484

COOLED VALVE

Filed March 25, 1935

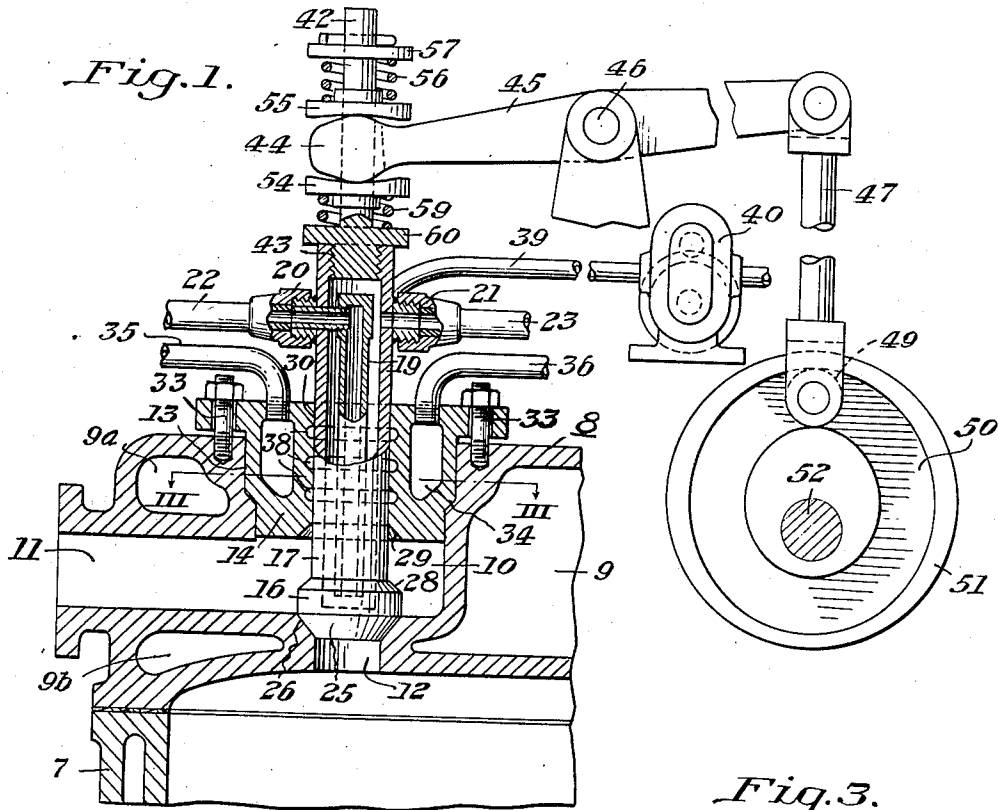
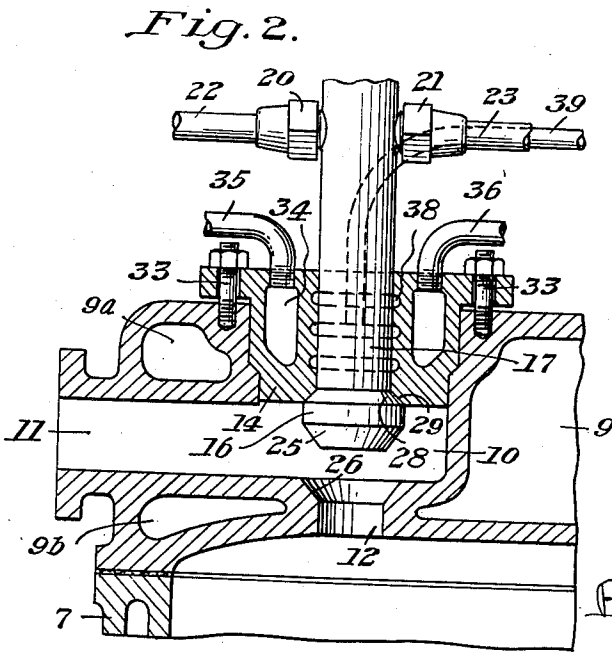
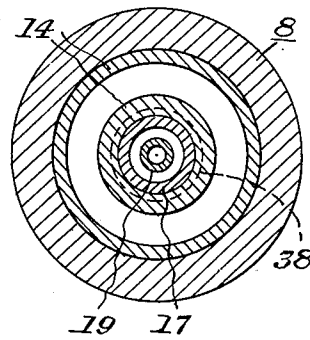


Fig. 3.



INVENTOR
Frederick F. Murray
by
Byrnes, Stebbins & Blenko
his attorneys

UNITED STATES PATENT OFFICE

2,122,484

COOLED VALVE

Frederick F. Murray, Pittsburgh, Pa.

Application March 25, 1935, Serial No. 12,846

7 Claims. (Cl. 123—177)

This invention relates to a valve useful for controlling the discharge of hot fluid, and more particularly for controlling the discharge of products of combustion at high temperature, such as is incident to the operation of starting a Diesel engine in accordance with the invention disclosed and claimed in my application filed May 29, 1931, Serial No. 540,850, patented March 26, 1935, No. 1,995,320.

One object of my invention is to improve the operation of and impart longer life to a valve used in such a relation.

In the drawing which is merely illustrative of one embodiment which my invention may assume,

Fig. 1 is an axial sectional view of such valve mechanism, the actuating mechanism for the valve being diagrammatically illustrated;

Fig. 2 is a detail view of a portion of the mechanism shown in Fig. 1 with the valve at the end of its opening stroke; and

Fig. 3 is a transverse section on the line III—III of Fig. 1.

In accordance with the construction set forth and claimed in the above-entitled application, a Diesel engine may be started by burning a combustible charge in one cylinder and actuating a piston in said cylinder so as to displace the hot products of combustion past a discharge valve into the Diesel cylinder to there expend their force. In the operation of such starting mechanism, the discharge valve is subjected to intense heat; and it is difficult to keep this discharge valve in operation over extended periods even with the best materials now available. The strength of even the best steels rapidly diminishes with high temperatures, and even the heat-resisting alloys lose a part of their strength when heated above 1600 to 1700° F. An even more serious difficulty is the relatively rapid destruction of these materials under the trying conditions to which such a discharge valve is subjected.

In accordance with my invention, I both cool the parts of the valve mechanism, and provide such a construction as to limit the extent to which the valve is exposed to the hot gases to a minimum.

In the preferred embodiment disclosed in the drawing of the present application, a wall of the cylinder or chamber in which the combustible mixture is burned is indicated at 7. The head in general is indicated by the numeral 8 and is provided with water jackets as indicated at 9, 9a, and 9b. A discharge chamber 10 is provided in this head, the hot gases discharged into this

chamber passing to their point of use through the passage 11. The hot gases are discharged into the chamber 10 by way of a port 12 provided in one wall of the chamber 10. An opening 13 is formed in the opposite wall for receiving a guide member 14.

The valve for controlling discharge through the port 12 in addition to the head 16 is provided with a stem 17. It will be noted that the latter is in cross section substantially as large as the flow opening through the port 12. The provision of a large stem for the valve in proportion to the flow opening through the port is a factor in making it possible for the valve to stand up under the destructive conditions here present. For one thing, the stem is large enough so that cooling fluid may be readily circulated through the same. For this purpose, the stem is made hollow, and cooling fluid is caused to flow downwardly through an inner tube 19 to the lower end of the stem 17 where it is discharged to rise through the hollow interior of the stem. It is an important advantage to have a thin walled hollow stem. The inertia of the entire valve should be kept as low as possible, yet the pressure against which the valve is held seated may be so great as to require considerable strength in the valve stem. By increasing the outer diameter of the stem and making the stem hollow, and preferably by reducing the prevailing wall thickness of the stem below the interior diameter of the hollow stem, it is possible to attain a high ratio of strength of stem relative to the mass thereof.

The inlet connection 20 and the outlet connection 21 for the cooling fluid are both connected to flexible conduits such as hoses 22 and 23 respectively. In the embodiment shown, the head 16 is integral with the stem 17, and the bore of the stem 17 is continued into the head 16 so that the cooling fluid, as it is discharged from the inner tube 19, cools the head 16. If it is desired that the head 16 operate at a higher temperature, the inner tube 19 and the hollow interior of the stem may be terminated short of the head 16.

The head 16 is provided with a seating face 25 for engaging the seat 26 which surrounds the port 12, and is also provided with a seating face 28 which surrounds the stem 17. When the valve 16 is lifted to fully open position, the face 28 surrounding the stem 17 engages a seat 29 on the guide 14 so as to seal the opening 30 in the guide 14 within which the stem 17 is reciprocable. Accordingly, when the valve is fully opened, the stem of the valve is fully protected from the ef-

fect of the hot gases discharging by way of the conduit 11.

The guide member 14, which is received within the opening 13 and secured therein by studs and nuts 33, is a separate member from the head and, therefore, is renewable. This guide member is cooled, being provided with a jacket or chamber 34 within which cooling fluid may be circulated by way of inlet and outlet pipes 35 and 36. The bore 30 within which the stem 17 is reciprocable is provided with oil grooves 38 for lubricating the stem. A conduit 39 supplies oil to one of these grooves under the pressure of a pump 40 of suitable construction. For instance, this pump may be a gear pump which supplies lubricant under a predetermined pressure to the intermediate oil groove in the guide member 14.

An extension 42 is threaded at 43 into the upper end of the stem 17; and is received within the forked end 44 of a lever 45 pivoted, as diagrammatically illustrated in Fig. 1, at 46. A cam link 47 is pivoted to the other end of the lever 45, and carries at its lower end a roller 49 which travels in a groove 50 in a rotating cam 51. This cam is secured on a driven shaft 52, the groove being of suitable shape to effect rapid lifting and closing of the valve. Obviously, by varying the groove, the movements of the valve may be varied to suit requirements. Moreover, other actuating mechanism for reciprocating the valve may be substituted for that shown. For instance, the cam actuation of the valve may directly contact the end of the valve stem (or an extension thereof) as is customary where a powerful force should be exerted in seating the valve.

The forked end 44 of the lever 45 is preferably provided with rounded bearing surfaces to bear against cooperating washers 54 and 55. A light coil spring 56 is maintained under compression between the upper washer 55 and a retaining washer 57, while a relatively heavy coil spring 59 is positioned between the lower washer 54 and the flange 60 which surmounts the threaded portion of the extension 42. This arrangement provides cushioning means in the connection between the lever 45 and the stem 17 for cushioning the opening stroke of the valve, and also the closing stroke of the valve. It is necessary to hold the valve seated over the port 12 with considerably greater force than is necessary in seating the valve against the seat 29, and therefore the spring 59 is preferably made a considerably heavier spring than the spring 56.

There is considerable advantage to a construction such as that shown in which double seating is effected, as this avoids exposure of the valve stem to the hot gases discharging from the port 12 through the conduit 11. A construction following my teaching is favorable for long life of the valve, since adequate cooling is provided to prevent excessively high temperature of most of the parts of the valve. Where the stem and head of the valve are quite small, as in a small installation, these parts may both be economically made of expensive alloy which will withstand high temperatures. If, due to the size of the parts, it is desired to form only the head 16 of a costly alloy, the same may be formed separate from the stem and fixed thereto, as by welding.

The positive actuation of the valve in both directions is of advantage, as more reliable control of the movements of the valve is thereby obtained.

No particular coolant has been specified, it being possible to use a number of different fluids.

Water is the cheapest and can readily be supplied through rubber hoses. If desirable, mercury may be used as the coolant.

The removable guide member 14 has considerable advantage not only in permitting access to the interior of the discharge member 10 for purposes of inspection, but also because it permits this guide member 14 to be renewed if its effectiveness is destroyed by the hot gases.

While I have illustrated and described the embodiment of my invention which I at present prefer, it will be understood that the details of the construction are subject to modification in accordance with the principles of my invention and within the scope of the following claims.

I claim:

1. Valve mechanism for controlling the discharge of hot fluid comprising a valve provided with a stem and a face surrounding the stem adapted to engage a valve seat, a guide for the stem having an opening in which the stem is reciprocable, said guide affording a seat engageable by said face when the valve is fully retracted to seal said opening, means for reciprocating the stem, and cushioning means in the connection between the reciprocating means and the stem for cushioning the opening stroke of the valve.

2. Valve mechanism for controlling the discharge of hot fluid comprising a valve provided with a stem and a face surrounding the stem adapted to engage a valve seat, a guide for the stem having an opening in which the stem is reciprocable, said guide affording a seat engageable by said face when the valve is fully retracted to seal said opening, means for reciprocating the stem, and cushioning means in the connection between the reciprocating means and the stem for cushioning the closing stroke of the valve.

3. Valve mechanism for controlling the discharge of hot fluid comprising a valve provided with a stem and a face surrounding the stem adapted to engage a valve seat, a guide for the stem having an opening in which the stem is reciprocable, said guide affording a seat engageable by said face when the valve is fully retracted to seal said opening, means for reciprocating the stem, and cushioning means in the connection between the reciprocating means and the stem for cushioning both the opening and the closing strokes of the valve.

4. Valve mechanism for controlling the discharge of hot fluid comprising a valve provided with a stem and a face surrounding the same adapted to engage a valve seat, a guide for the stem having an opening in which the stem is reciprocable, and means for thrusting the valve in both directions, said guide affording a seat engageable by said face when the valve is fully retracted.

5. Valve mechanism for controlling the discharge of hot fluid comprising a valve provided with a stem and a face surrounding the same adapted to engage a valve seat, a guide for the stem having an opening in which the stem is reciprocable, means for urging the valve in both directions, and cushioning means in the connection between the actuating means and the stem for cushioning the opening stroke of the valve, said guide affording a seat engageable by said face when the valve is fully retracted.

6. A valve for a combustion chamber exhaust port provided with a valve seat comprising a head having a face adapted to engage said seat, a reciprocable stem on which said head is carried, a guide in which said stem reciprocates, a valve seat

on said guide, and a face on said head adapted to engage said last-mentioned seat when said stem is retracted to move the first-mentioned face away from its seat.

5 7. The combination of an internal combustion engine element with a discharge port therein and having a valve seat formed around said port and

a guide spaced from said port, and having a valve seat thereon opposite the first mentioned seat, of a valve stem reciprocable in said guide and a head carried thereon having faces for cooperating alternately with said seats.

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FREDERICK F. MURRAY.