

April 12, 1949.

F. G. TWITCHELL

2,467,060

REFLEX COOLED EXHAUST VALVE

Filed Sept. 4, 1946

2 Sheets-Sheet 1

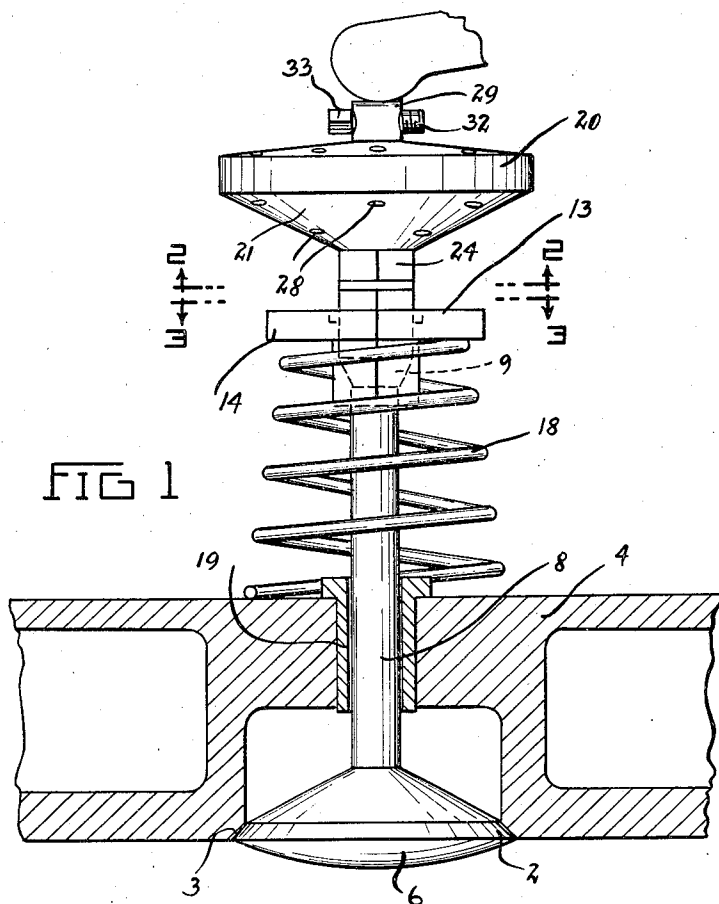


FIG 1

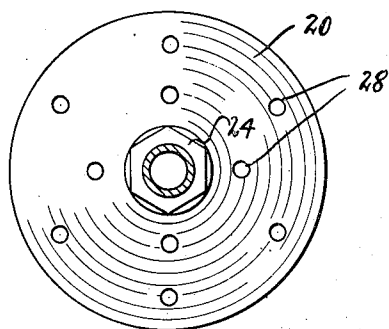


FIG 2

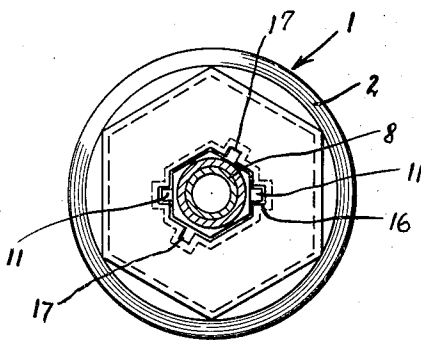


FIG 3 - Fremont G. Twitchell

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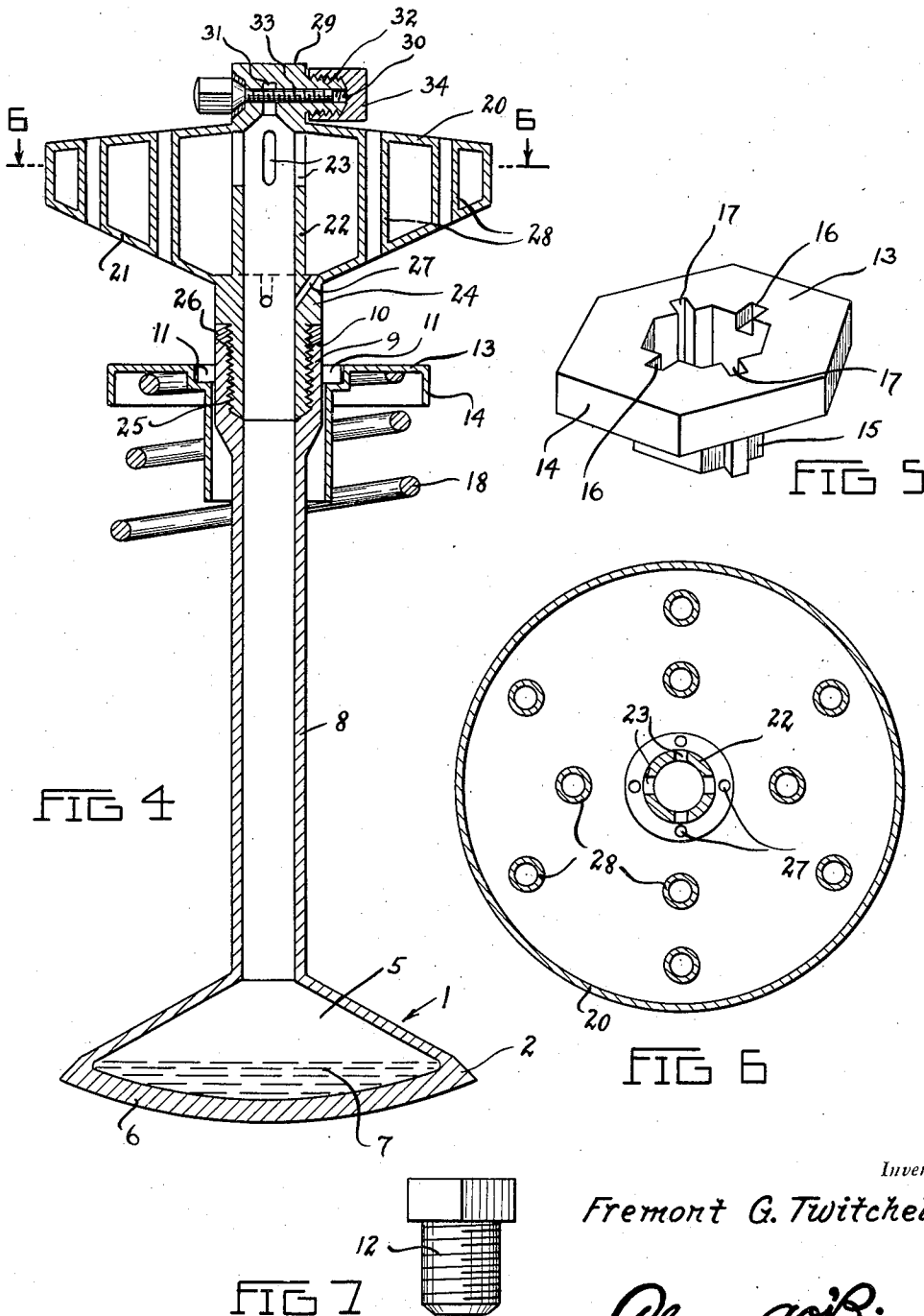
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2 Sheets-Sheet 2



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UNITED STATES PATENT OFFICE

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REFLEX COOLED EXHAUST VALVE

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3 Claims. (Cl. 123—177)

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This invention relates to improvements in reflex cooled exhaust valves.

An object of the invention is to provide an improved reflex cooled exhaust valve construction to be used in the exhaust systems of high output internal combustion engines.

Another object of the invention is to provide an improved self cooled exhaust valve construction for internal combustion engines.

A further object of the invention is to provide an improved mercury-cooled, self-contained exhaust valve construction for internal combustion engines.

Another object of the invention is to provide an improved exhaust valve construction for internal combustion engines which will include a hollow disc-shaped valve in which liquid mercury will be contained and a condenser therefor connected with said valve by means of a hollow valve stem.

Another object of the invention is to provide an improved hollow exhaust valve and connected condenser therefor, said valve being partially filled with liquid mercury and partially exhausted of air.

Another object of the invention is to provide an improved self-cooled, mercury-containing hollow exhaust valve for internal combustion engines which will be highly efficient in operation and relatively inexpensive to manufacture and produce.

Other objects will appear as the description proceeds.

In the accompanying drawings which form a part of this application,

Figure 1 is a vertical sectional view through a portion of an exhaust manifold showing the improved mercury-cooled self-contained exhaust valve incorporated therein;

Figure 2 is a sectional view taken on the line 2—2 of Figure 1;

Figure 3 is a sectional view taken on the line 3—3 of Figure 1;

Figure 4 is a vertical sectional view taken through the improved exhaust valve;

Figure 5 is a perspective view of the valve spring holding cap;

Figure 6 is a sectional view taken on the line 6—6 of Figure 4, and

Figure 7 is a front elevation of the valve stem plug.

Like characters of reference are used throughout the following specification and the accompanying drawings to designate corresponding parts.

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In carrying out the invention there is provided a hollow disc-shaped valve generally denoted by the reference numeral 1, the same being formed with a circumferential seat surface 2 adapted to engage and seat on the valve seat 3 formed in the exhaust manifold 4 to control the flow of exhaust gasses therethrough. The hollow valve 1 is formed with a valve cavity 5 having a rounded lower end in which liquid mercury 7 is adapted to be placed to fill approximately one-third of said cavity.

A hollow valve stem 8 is formed integrally with the valve 1 and is enlarged at its upper end to form the internally threaded socket 9 which is provided with the inwardly inclined seat 10 in its upper end. Oppositely disposed pins 11 are supported by the socket 9 for holding the valve spring cap, later to be described. When the valve is disassembled, the valve stem plug 12 illustrated in Figure 7 of the drawings will be screwed into the socket 9 to prevent loss of the mercury from said valve cavity.

The valve spring cap 13 is formed with a depending annular peripheral flange 14 and with a central hexagonal shaped collar 15 having oppositely disposed seats 16 formed at its upper end. Oppositely disposed vertical slots 17 are formed in the sides of said collar 15 to permit the pins 11 to pass upwardly therethrough, and to seat in said oppositely disposed seats 16 when the valve spring 18 is disposed about the valve stem 8 between the cap 13 and the top of the exhaust manifold 4. A guide bushing or collar 19 will be disposed through the exhaust manifold to form a bearing for the valve stem 8.

The cooling condenser 20 is formed with a cylindrical hollow body having a downwardly and inwardly sloping bottom 21 and a central tube section 22 in which the vapor ports 23 are formed. The upper part 24 of the valve stem is formed integrally with the condenser 20 and is reduced at its lower end and externally threaded at 25 to be screwed into the internally threaded upper end of the lower valve stem section, to be sealed by a copper gasket 26 disposed between said sections of the valve stem.

Condensate return ports 27 are formed through the valve stem portion 24 and serve to drain the cooled mercury back through the hollow valve stem into the valve cavity after being cooled in the condenser 20.

A plurality of vertical cooling tubes 28 are formed through the condenser 20 to allow the air to pass therethrough to cool the mercury vapor which passes from the valve cavity into said

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condenser when said valve is in operation. If desired, a stream of oil may be pumped by the oil pressure system to the condenser to cool the same.

The upper end of the condenser 20 is formed into a tappet face 29 and is transversely bored at 30 to connect with the vertical passage 31 from the condenser 20. The threaded stem 32 is provided for attaching a vacuum pump when the threaded vacuum seal plug 33 is unscrewed. When the air in the valve has been exhausted to desired amount, the mercury already being in the valve cavity, the plug 33 will be closed and a brass vacuum seal cap 34 will be screwed on said threaded stem 32.

From the foregoing description, it will be apparent that when heated, part of the mercury in the valve cavity will vaporize and pass through the hollow valve stem to the condenser, where it condenses and passes back to the valve cavity. The correct amount of mercury is determined, as well as the degree of vacuum so that there will always be some liquid mercury in said valve cavity.

While the preferred embodiment of the instant invention has been illustrated and described, it will be understood that it is not intended to limit the scope of the invention thereto, as many minor changes in detail of construction may be resorted to without departure from the spirit of the invention.

Having thus described my invention what I claim as new and desire to secure by Letters Patent of the United States is:

1. An exhaust valve comprising a valve head having a cavity formed therein, a liquefiable coolant in said cavity, a hollow stem formed integrally with said head, a hollow cooling condenser formed at the opposite end of the stem, cooling tubes disposed in said condenser, condensate ports communicating with the condenser and the valve stem, a tappet face formed on the upper end of the condenser having a threaded stem formed on one end, a transverse bore in said

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face communicating with a vertical passage constructed and arranged in the condenser, a vacuum seal plug in said bore and a vacuum seal cap detachably secured on said stem, whereby a portion of the air may be evacuated from said valve.

2. An exhaust valve comprising a valve head having a cavity formed therein, mercury in said cavity, a hollow stem formed integrally with the head, a hollow cooling condenser disposed at the opposite end of the stem, cooling tubes vertically positioned therein, condenser ports communicating with the condenser and valve stem and valve means for selectively exhausting a portion of the air from said valve, said means being formed integrally with the condenser.

3. An exhaust valve comprising a valve head having a cavity formed therein, mercury in said cavity, a lower and upper connected hollow stem connected therewith, a hollow cooling condenser detachably secured at the opposite end of the stem, cooling tubes vertically positioned therein and means for exhausting a portion of the air from said valve, said means being formed integrally with the condenser, wherein said means includes an integrally formed valve disposed above said condenser and having a tappet face formed thereon.

FREMONT G. TWITCHELL.

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