April 25, 1961

R. C. BECK

2,981,279

VACUUM RELEASE VALVE

Filed Sept. 20, 1957

Fig. 1.

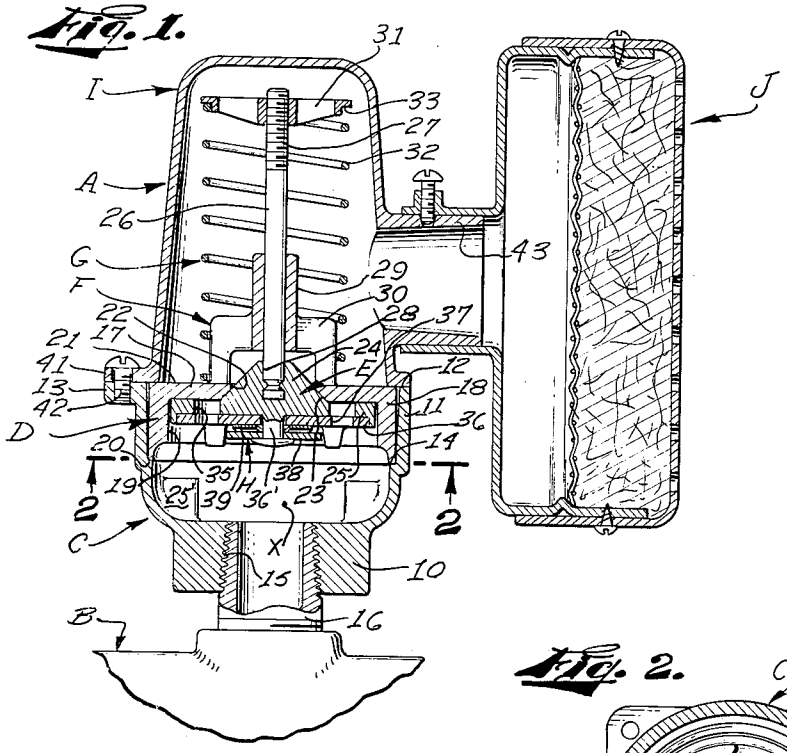


Fig. 2.

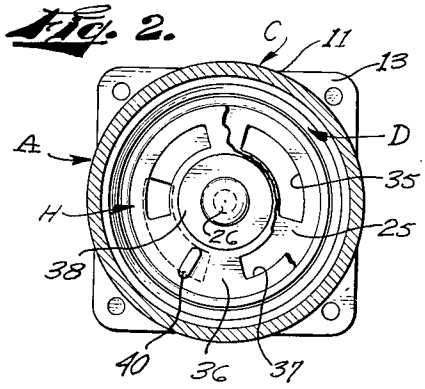


Fig. 3.

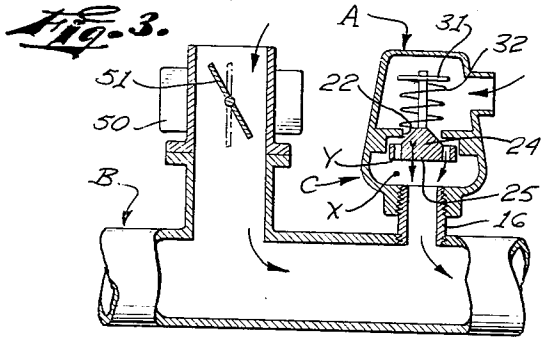
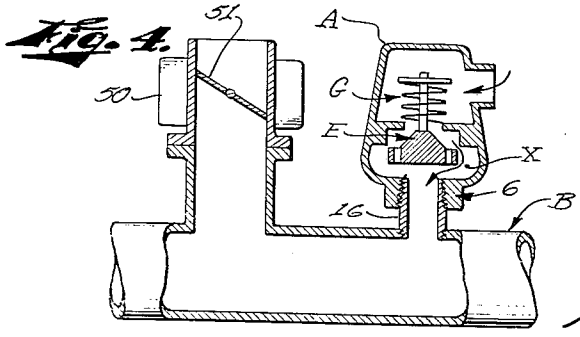


Fig. 4.



INVENTOR.
RUDOLPH C. BECK,
BY
AGENT.

United States Patent Office 2,981,279
Patented Apr. 25, 1961

2,981,279

VACUUM RELEASE VALVE

Rudolph C. Beck, Arcadia, Calif. (Die Cast Products, Inc., 621 W. Rosecrans Ave., Gardena, Calif.)

Filed Sept. 20, 1957, Ser. No. 685,143

9 Claims. (Cl. 137—480)

This invention has to do with a valve and is more particularly concerned with a vacuum release valve applicable to the intake manifold of an automotive internal combustion engine.

In the ordinary internal combustion engine in an automobile, or other similar vehicle, air is drawn through the carburetor, intake manifold and into the cylinders or combustion chambers of the engine upon the down stroke of the pistons therein. As the air is drawn through the carburetor, it siphons or draws fuel, such as gasoline, into the air stream to mix therewith and establish a combustible mixture of fuel and air. The rate of flow of air through the carburetor and intake manifold, and consequently, the vacuum or below atmospheric pressure established in the manifold, is governed or controlled by a suitable throttle valve arranged within the carburetor. When the engine is being slowed down the throttle valve is closed to shut off or restrict the supply of air. When this takes place, the pressure in the manifold drops considerably and due to the lack of air, a suitable fuel air mixture is not obtained and the motor slows down. When the manifold pressure drops in the manner set forth above, a considerable amount of raw gasoline is drawn from the carburetor and into the engine. This gasoline, due to the lack of air, is not properly burned, with the result that this fuel is, in effect, wasted and materially reduces the overall fuel efficiency of the engine.

An object of the present invention is to provide a vacuum release valve applicable to the intake manifold of an internal combustion engine of the character referred to, which valve is adapted to open when the throttle valve is closed and the manifold pressure drops and to thereby reduce the volume of air drawn through the carburetor and, as a result, reduce the quantity of gasoline drawn from the carburetor as the engine is slowed down.

By reducing the quantity of raw gasoline drawn into the cylinder of the engine when it is being slowed, the possibility of diluting the crank case oil with gasoline is proportionately reduced. Still further, by reducing the quantity of raw fuel in the manner set forth above, the tendency for the engine to backfire is eliminated.

Another object of the present invention is to provide a valve of the character referred to which, when opened by sub-atmospheric pressure, remains open until the pressure within the manifold has increased a predetermined amount.

A further object of my invention is to provide a valve of the character referred to which is adjustable to open and close in response to any desired pressures in the manifold to which it is related.

A feature of my invention is to provide a valve of the character referred to having a spring loaded poppet-type valve member provided with an inner primary sealing portion of limited cross-sectional area and an outer secondary sealing portion of greater cross-sectional area.

A feature of my invention is to provide a valve of the character referred to having means to vary the tension of the poppet or valve spring and thereby vary the pressure at which the valve opens.

It is further object of my invention to provide a valve of the character referred to having adjustable pressure release means associated with the secondary portion of the

poppet or valve member to vary and control the pressure at which the valve closes.

It is another object of my invention to provide a valve of the character referred to involving a minimum number of parts, each of which is both easy and economical of manufacture, a valve which is easy and economical to assemble and install, and a valve which is both highly effective and dependable in operation.

Another object of the present invention is to provide a valve adapted to reduce the manifold pressure of an engine when it is being slowed and to thereby reduce the tendency for the crank case oil to be drawn past the pistons and into the combustion chamber of the engine when it will burn and create carbon in the combustion chamber.

The various objects and features of my invention will be fully understood from the following detailed description of a typical preferred form and application of my invention, throughout which description reference is made to the accompanying drawings, in which:

Fig. 1 is an enlarged detailed sectional view of the valve provided by the present invention and showing it in its closed position.

Fig. 2 is a transverse sectional view taken as indicated by line 2—2 on Fig. 1.

Fig. 3 is a diagrammatic view of the valve provided by the present invention and showing it related to a manifold and carburetor and showing it in a partially opened position.

Fig. 4 is a view similar to Fig. 3 and showing the valve open.

The valve construction A provided by the present invention is adapted to be related to the intake manifold B of an internal combustion engine (not shown), and involves, generally, a base C, a valve seat insert D engaged in and carried by the base, a poppet or valve member E related to the insert, guide means F carried by the insert and guiding the valve member, adjustable spring means G normally yieldingly urging the valve member closed, and adjustable pressure release means H related to the valve member E and adapted to permit the valve member to close when the pressure in the manifold reaches a predetermined amount. The construction is shown as further including a suitable bonnet I fixed to the base and retaining the insert, and a filter J.

The base C that I provide is a simple, upwardly opening cup-shaped member having a suitable flat, horizontally disposed, disc-shaped bottom **10** and a vertically disposed annular side wall **11**. The side wall **11** terminates at a flat, horizontally disposed top **12** and is provided with a plurality of circumferentially spaced, radially outwardly projecting ears **13** adapted to facilitate securing the bonnet I to the base, as will hereinafter be described.

The inner surface of the side wall **11** of the base is provided with an upwardly facing annular shoulder **14** intermediate its upper and lower ends, which shoulder is adapted to support the valve seat insert D in a manner that will hereinafter be described.

The bottom wall **10** of the base is of considerable thickness and is provided with a central threaded opening **15**.

The base C is connected to the engine intake manifold B by means of a suitable nipple **16** having one end threaded into the opening **15** in the bottom wall **11** of the base and having its other end engaged in a suitable opening provided in the manifold. The nipple **16** establishes open communication between the interiors of the base and the manifold.

The valve seat insert D is an inverted cup-shaped member and is shown as having a flat, horizontally disposed disc-shaped top wall **17** and an annular vertically disposed side wall **18** depending from the top wall to slidably enter the base C and defining a cylindrical bore **19**. The side wall **18** terminates at a flat, horizontally disposed

bottom edge 20, which edge engages the shoulder 14 in the base C and supports the insert therein with the uppermost or top surface 21 thereof flush with the top 12 of the base.

The bore 19 of the insert is of considerably lesser diametric extent than the interior of the base and is adapted to accommodate a portion of the valve member E as will hereinafter be described.

The top wall 17 of the insert D is provided with a central annular port 22 having a downwardly inclined valve seat 23 therein. The valve seat 23 is adapted to be engaged by and cooperate with a portion of the valve member E as will hereinafter be described.

With the above relationship of parts, it will be apparent that the insert D closes the upper or top end of the base C and establishes a valve chamber X.

The valve member E that I provide is a poppet-type valve member and is shown as including an upper primary portion 24 adapted to cooperate with the valve seat 23 in the top wall 17 of the valve insert D and a lower secondary portion 25 adapted to cooperate with the bore 19 of the valve insert and established by the side wall 18 thereof.

The upper primary portion 24 of the valve member E is cone-shaped and is adapted to normally project upwardly into the opening 22 in the top wall 17 of the insert D and to engage on the seat 23. The lower secondary portion 25 of the valve member is of simple disc shape and occurs within the bore 19 of the insert and normally occurs adjacent the bottom surface of the top wall 17 thereof, as clearly illustrated in Fig. 1 of the drawings.

The valve member E is further provided with a suitable central vertically disposed valve stem 26, which stem projects upwardly therefrom to cooperate with the guide means F and the spring means G, as will hereinafter be described.

The valve stem 26 is a simple rod-like element. The upper end portion of the stem is threaded, as at 27, and the lower end portion thereof is press-fitted or otherwise fixed in a suitable upwardly opening socket 28 provided in the upper end of the primary portion 24 of the valve member.

The guide means F provided by the present invention is shown as involving a central vertically disposed bearing sleeve 29 occurring above the insert D and slidably receiving the valve stem 26, and a plurality of circumferentially spaced supporting legs 30 fixed to and extending between the sleeve and the top wall 17 of the insert E.

The spring means G normally yieldingly urging the valve member to its normal or closed position is shown as including, a follower 31 threadedly engaged on the upper threaded portion 27 of the valve stem 26 and a compression spring 32 between the follower and the insert D. The follower 31 is a simple, wheel-like member and is provided about its outer periphery with a suitable annular spring seat 33. The compression spring 32 is a simple, helical spring engaged about the stem 26 and the guide means F and has its upper end engaged in the spring seat 33 in the follower 31 and has its lower end seated on the top surface of the insert D.

With the above relationship of parts, it will be apparent that the spring G normally yieldingly urges the valve member upwardly to its normal or unactuated position and where the upper primary portion thereof engages and seals on the seat 23 in the top wall 17 of the valve insert D.

In operation, when the pressure in the manifold B and in the chamber X of the valve A drops, say, for example, to minus fifteen inches of mercury, the upper primary portion 24 of the valve member E is shifted out of engagement with the seat 23 and against the resistance of the spring 32. When the upper primary portion 24 of the valve member is unseated, the larger diameter, lower secondary portion 25 of the valve is exposed to atmospheric pressure and is shifted downwardly thereby

and out of engagement in the bore 19 of the insert D, as clearly illustrated in Fig. 4 of the drawings. The valve member E will remain in this open position and allow for the free flow of air therethrough and into the manifold B until the pressure in the manifold rises to a predetermined amount, say, for example, five inches of mercury, at which point the spring 23 overcomes the force of atmospheric pressure actuating upon the valve member and closes the valve.

It will be apparent from the above, that due to the difference in size or cross-sectional area of the primary and secondary portions 24 and 25 of the valve member E, considerably greater variations between atmospheric and manifold pressure must be present to unseat the primary portion 24 of the valve member and initially open the valve than is required to maintain the valve open, with the result that once the valve is open, it does not close again until the pressure in the manifold has raised to a predetermined amount.

It will be further apparent that by suitably adjusting the spring means G as by advancing or retracting the spring follower 31 on the stem 26, the resistance of the spring can be varied so that a greater or lesser force is required to open the valve. By so adjusting the spring means G, the valve construction A can be advantageously adjusted for the particular engine to which it is related.

In the form of the invention illustrated, I have shown suitable stop lugs 25' provided in the base C, which lugs serve to limit the downward movement of the valve member E in the base.

The adjustable pressure release means H related to the valve member E is adapted to control or vary the pressure at which the valve closes and is shown as involving one or more ports 35 in the lower secondary portion 25 of the valve member E, and an adjustable closure member 36 carried by the valve member and controlling the flow of air through the ports.

In the particular case illustrated, I have shown the valve member as having two circumferentially spaced arcuate slot-like ports 35 therein. The closure member 36 is shown as a simple disc-shaped member pivotally carried on a pin-like projection 36' depending from the bottom side of the valve member, and having a pair of circumferentially spaced, arcuate slot-like ports or apertures 37 therein adapted to register with the ports 35 in the valve member. The valve member 36 is retained on the pin 36' by means of a washer 38, which washer is held against displacement from the pin 36' by suitably staking or pinning over the lower terminal end thereof.

In practice, an annular spring washer 39 is engaged between the washer 38 and the closure member 36 to yieldingly urge the member into bearing engagement on the under or bottom side of the valve member and to hold it in set position relative thereto.

The closure member 36 is shown as being further provided with suitable finger or tool engaging lugs 40, which lugs depend therefrom and facilitate rotating the said closure member relative to the valve member E.

With the above relationship of parts, it will be apparent that by rotating the closure member 36 relative to the secondary portion 25 of the valve member E and thereby shifting the ports 35 and apertures 37 into and out of register with each other, the effective cross-sectional area of the said secondary portion of the valve member E can be advantageously varied and so that the valve can be made or set to close at any desired or predetermined manifold pressure.

The bonnet I of the valve construction that I provide is a simple, inverted, cup-like shell member adapted to freely receive the portions of the construction which project upwardly beyond the top 12 of the base A and is provided at its lower or bototm edge with circumferentially spaced tabs 41, which tabs overlie the ears 13 on the base C. Suitable screw fasteners 42 are engaged

through the tabs 41 and ears 13 to releasably secure the bonnet to the base. The lower end of the bonnet is slightly less in inside diametric extent than the outside diameter of the valve seat insert D, with the result that the bonnet overlies the outer peripheral portion of the insert E and holds it engaged in working position in the base C.

In addition to the foregoing, the bonnet I is further provided with a suitable inlet duct 43, which duct projects laterally therefrom and connects with a suitable filter J, as clearly illustrated in Fig. 1 of the drawings.

In practice, the filter J can vary widely in form and construction and since it does not effect the novelty of the present invention, I will not burden this application with further detailed description of the particular filter construction that I have illustrated.

In Figs. 3 and 4 of the drawings, I have diagrammatically illustrated a carburetor 50 related to the manifold B, which carburetor is shown as having a conventional throttle valve 51 engaged therein.

When the throttle valve 51 is closed in the manner illustrated in Fig. 4 of the drawings, and for the purpose of slowing down the engine to which the construction is related, the valve A opens in the manner illustrated and as previously set forth.

When the throttle valve 51 is fully or partially closed in the manner illustrated in Fig. 3 of the drawings and for the purpose of slowing down the engine to which the structure is related, the valve member can shift in the direction indicated by the arrow Y to an open position and will close again when the pressure in the manifold reaches a predetermined amount.

When the engine to which the construction that I provide is being slowed down and the valve A is fully or partially open, in the manner illustrated in Figs. 3 and 4 of the drawings, it will be apparent that a considerably lesser volume of air is drawn through the carburetor than is usual, with the result that considerably less gasoline is consumed.

It will be apparent from the foregoing that I have invented an extremely simple and practical vacuum release valve applicable to the intake manifold of an internal combustion engine, which valve is effective to materially reduce the quantity of gasoline drawn through the carburetor of the engine construction when the engine is being slowed down.

Having described only a typical preferred form and application of my invention, I do not wish to be limited or restricted to the specific details herein set forth, but wish to reserve to myself any modifications or variations that may appear to those skilled in the art and fall within the scope of the following claims.

Having described my invention, I claim:

1. A vacuum release valve of the character referred to including, an elongate, vertically disposed upwardly opening cup-shaped base having an outlet opening in its bottom, a valve seat in the base in spaced relationship from the bottom thereof and having a downwardly opening bore and a central vertical inlet opening of reduced diameter, a vertically shiftable valve member having a primary portion engageable in the inlet opening of the valve seat and a secondary portion with flow control ports therein engageable in the bore, a closure shiftably carried by the valve member and having ports to be shifted into and out of register with the ports in the valve member to vary the effective area of the valve member, and spring means normally yieldingly urging the valve member upwardly with the primary portion thereof in seated engagement in the inlet opening.

2. A vacuum release valve of the character referred to including, an elongate, vertically disposed upwardly opening cup-shaped base having an outlet opening in its bottom, a valve seat in the base in spaced relationship from the bottom and having a downwardly opening bore and a central vertical inlet opening of reduced diameter, a

vertically shiftable valve member having a primary portion engageable in the inlet opening of the valve seat and a secondary portion engageable in the bore, spring means normally yieldingly urging the valve member upwardly and with the primary portion thereof in seated engagement in the inlet opening, and pressure release means related to the secondary portion of the valve member and operable to vary the effective cross-sectional area of said second portion of the valve member.

3. A vacuum release valve of the character referred to including, an elongate, vertically disposed upwardly opening cup-shaped base having an outlet opening in its bottom, a valve seat insert in the base in vertical spaced relationship from the bottom of the base and having a downwardly opening bore, a central vertical inlet opening of reduced diameter and an annular, downwardly disposed valve seating surface surrounding said inlet opening, a vertically shiftable valve member having an upwardly convergent cone-shaped primary portion projecting upwardly through the inlet opening in the valve seat and engageable on said seating surface and a disc-shaped secondary piston portion with air bleed ports engaged in the bore and spring means normally yieldingly urging the valve member upwardly with the primary portion thereof in seated engagement in the inlet opening, and means to vary the effective area of the secondary piston including, said ports in the secondary piston and an apertured plate shiftably carried by the said piston to overlie the ports therein.

4. A vacuum release valve of the character referred to including, an elongate, vertically disposed upwardly opening cup-shaped base having an outlet opening in its bottom, a valve seat insert in the base in vertical spaced relationship from the bottom of the base and having a downwardly opening bore, a central vertical inlet opening of reduced diameter and an annular, downwardly opening seating surface, a vertically shiftable valve member having an upwardly convergent cone-shaped primary portion projecting upwardly through the inlet opening in the valve seat insert and engageable on said seating surface and a disc-shaped secondary piston portion engageable in the bore, spring means normally yieldingly urging the valve member upwardly with the primary portion thereof in seated engagement in the inlet opening, and pressure release means related to the secondary portion of the valve member and operable to vary the effective cross-sectional area of said second portion of the valve member.

5. A vacuum release valve of the character referred to including, an elongate, vertically disposed upwardly opening cup-shaped base having an outlet opening in its bottom, a valve seat in the base in spaced relationship from the bottom and having a downwardly opening bore and a central vertical inlet opening of reduced diameter, a vertically shiftable valve member having a primary portion engageable in the inlet opening in the valve seat and a secondary portion engageable in the bore in the valve seat, spring means normally yieldingly urging the valve member upwardly and with the primary portion thereof in seated engagement in the inlet opening, and pressure release means related to the secondary portion of the valve member and operable to vary the effective cross-sectional area of the said second portion of the valve member, said pressure release means including a port in the secondary portion of the valve member, a closure plate shiftably carried by the valve member and adapted to be shifted into and out of engagement with the port.

6. A vacuum release valve of the character referred to including, an elongate, vertically disposed upwardly opening cup-shaped base having an outlet opening in its bottom, a valve seat insert in the base in vertical spaced relationship from the bottom of the base and having a downwardly opening bore and a central inlet opening of reduced diameter, a central annular, downwardly disposed valve seating surface surrounding said inlet open-

ing, a vertically shiftable valve member having an upwardly convergent cone-shaped primary portion projecting upwardly through the inlet openings in the insert and engageable on said seating surface in the insert and a disc-shaped secondary piston portion engageable in the bore in the insert, spring means normally yieldingly urging the valve member upwardly with the primary portion thereof in seated engagement on the valve seating surface, and pressure release means related to the secondary portion of the valve member and operable to vary the effective cross-sectional area of the said second portion of the valve member, said pressure release means including a port in the primary portion of the valve member, a closure plate shiftably carried by the valve member and adapted to be shifted into and out of engagement with the port.

7. A vacuum release valve of the character referred to including, an elongate, vertically disposed upwardly opening cup-shaped base having a flat, horizontally disposed bottom wall with a central threaded outlet opening and a vertically disposed annular side wall with an upwardly facing annular shoulder about its inner periphery and above the bottom wall, a valve seat insert having a central vertical inlet opening extending therethrough and a downwardly opening cylindrical bore, and a downwardly facing inclined valve seating surface concentric with and surrounding the inlet opening, said insert being engageable in the base with the lower portion thereof seated on the shoulder in the base, a vertically shiftable valve member having an upwardly projecting primary portion adapted to shift into and out of the inlet opening in the insert and into and out of sealing engagement with said valve seating surface, a secondary piston portion below the primary portion and adapted to shift longitudinally in the bore in the insert, guide means for the valve member and including, a valve stem projecting upwardly from the primary portion of the valve member, a bearing sleeve, mounting means supporting the sleeve above the insert and slidably receiving the stem, said mounting means including legs fixed to and extending between the sleeve and the insert, spring means normally yieldingly urging the valve member upwardly and into sealing engagement with the insert and including, a spring follower engaged on the upper end of the stem and a compression spring between the follower and the top wall of the insert, and pressure release means related to the valve member and including ports in the secondary portion of the valve member, a cover plate pivotally carried by the valve member to occur adjacent the said secondary portion thereof and provided with apertures to be shifted into and out of register with the ports in the valve member and to thereby vary the effective cross-sectional area of the secondary portion thereof.

8. A vacuum release valve of the character referred to including, an elongate, vertically disposed upwardly opening cup-shaped base having a flat, horizontally disposed bottom wall with a central threaded outlet opening and a vertically disposed annular side wall with an upwardly facing annular shoulder about its inner periphery and spaced below the top thereof, an inverted cup-shaped valve seat insert having a flat horizontally disposed top wall with a central inlet opening therein and a vertically disposed annular side wall having a flat bottom edge and defining a cylindrical bore, said top wall having a downwardly facing inclined valve seating surface concentric with and surrounding the inlet opening therein, said insert being engageable in the base with the bottom edge thereof seated on the shoulder therein, a vertically shiftable valve member having an upwardly convergent conical primary portion adapted to shift into and out of the inlet opening in the insert and into and out of sealing engagement with said valve seating surface, a disc-shaped secondary piston portion below the primary portion and adapted to shift longitudinally in and into and out of engagement in the bore in the insert, guide means for the valve member and including, a valve stem projecting upwardly from the primary portion of the valve member, a bearing sleeve above the insert and slidably receiving the stem, legs fixed to and extending between the sleeve and the insert to support the sleeve in fixed position, adjustable spring means normally yieldingly urging the valve member upwardly and into sealing engagement with the insert and including, a spring follower threadedly engaged on the upper end of the stem and a compression spring between the follower and the top wall of the insert, and adjustable pressure release means related to the valve member and including ports in the secondary portion of the valve member, a cover plate pivotally carried by the valve member to occur adjacent the said secondary portion thereof and provided with apertures to be shifted into and out of register wtih the ports in the valve member to vary the effective cross-sectional area of the secondary portion thereof.

9. A vacuum release valve of the character referred to including, an elongate, vertically disposed upwardly opening cup-shaped base having a flat, horizontally disposed bottom wall with a central threaded outlet opening and a vertically disposed annular side wall with a flat top and an upwardly facing annular shoulder about its inner periphery and spaced below the top thereof, an inverted cup-shaped valve seat insert having a flat, horizontally disposed top wall with a central inlet opening therein and a vertically disposed annular side wall having a flat bottom edge and defining a cylindrical bore, said top wall having a downwardly facing inclined valve seating surface concentric with and surrounding the inlet opening therein, said insert being engageable in the base with the bottom edge thereof seated on the shoulder therein and so that the top wall of the insert is flush with the top of the base, a vertically shiftable valve member having an upwardly convergent conical primary portion adapted to shift into and out of the inlet opening in the insert and into and out of sealing engagement with said valve seating surface, a disc-shaped secondary piston portion below the primary portion and adapted to shift longitudinally in and into and out of engagement in the bore in the insert, guide means for the valve member and including, a valve stem projecting upwardly from the primary portion of the valve member, a bearing sleeve above the insert and slidably receiving the stem and legs formed integrally with and extending between the sleeve and the insert, adjustable spring means normally yieldingly urging the valve member upwardly and into sealing engagement with the insert and including, a spring follower threadedly engaged on the upper end of the stem and a compression spring between the follower and the top wall of the insert, adjustable pressure release means related to the valve member and including ports in the secondary portion of the valve member, a cover plate pivotally carried by the valve member to occur adjacent the said secondary portion thereof and provided with apertures to be shifted into and out of register with the ports in the valve member to vary the effective cross-sectional area of the secondary portion thereof, an inverted cup-shaped bonnet with an inlet opening engageable with the top of the insert and housing the portions of the construction projecting above the base, and fastening means releasably securing the bonnet to the base.

References Cited in the file of this patent

UNITED STATES PATENTS

1,156,872	Atwood	Oct. 19, 1915
1,260,663	Gould et al.	Mar. 26, 1918
1,443,675	Bowler	Jan. 30, 1923

FOREIGN PATENTS

62,045	Austria	Nov. 10, 1913