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ORIFICE CLEARING MEANS

Filed Dec. 11, 1941

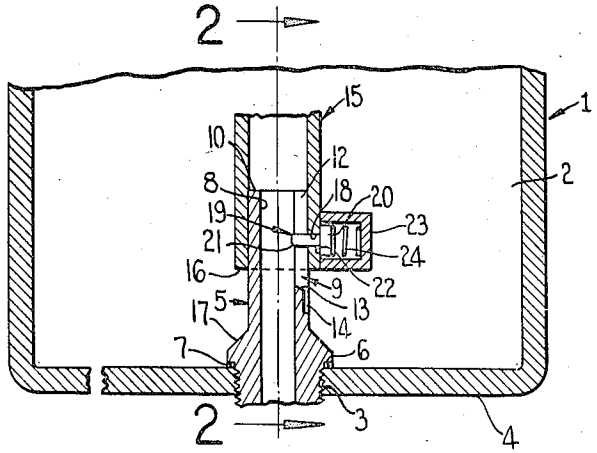


FIG-1

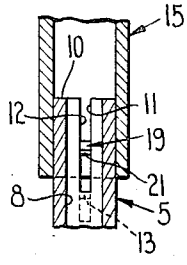


FIG-2

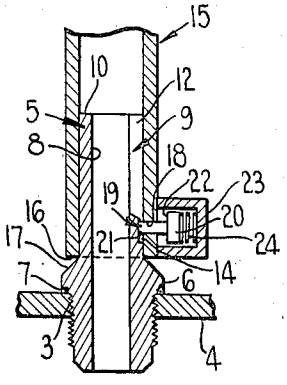


FIG-3

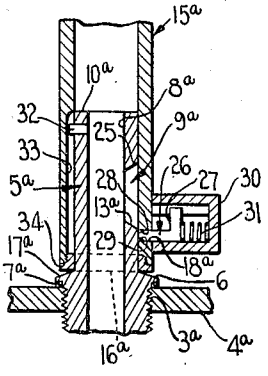


FIG-4

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ORIFICE CLEARING MEANS

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Application December 11, 1941, Serial No. 422,512

16 Claims. (Cl. 251—29)

This invention relates generally to means for cleaning or clearing a fluid flow controlling orifice and more particularly to such a means which is, among other uses, particularly adapted for use in combination with metering valves.

One object is to provide a simple and effective means for removing foreign matter which may adhere to the walls of or clog a fluid flow orifice.

Another object of this invention is to provide means cooperable with a metering valve for maintaining constant the flow area of the metering orifice for a given valve position.

Other objects will be apparent from a reading of the following specification.

The invention consists in the improved construction of and combination of parts, to be more fully described hereinafter and the novelty of which will be particularly pointed out and distinctly claimed.

In the accompanying drawing, to be taken as a part of this specification, there are fully and clearly illustrated several preferred embodiments of the invention in which drawing:

Figure 1 is a view in central vertical section of a portion of a fluid controlling means embodying the invention;

Fig. 2 is a detail view in section taken along the line 2—2 of Fig. 1 looking in the direction of the arrows;

Fig. 3 is a view similar to Fig. 1, but showing the controlling means in a closed position, and

Fig. 4 is a view in central vertical section of a portion of a controlling means embodying another form of the invention.

Referring to the drawing by characters of reference, the numeral 1 designates generally a casing having a liquid receiving chamber 2 with a screw-threaded outlet opening 3 through a bottom wall 4 of the casing 1. Screw-threaded within the outlet opening 3 and extending upwardly therefrom into the chamber 2 is a tubular wall outlet or port member 5 which has a shoulder 6 seating against and holding a gasket 7 against the wall 4 to prevent liquid flow from the chamber 2 around the member 5. The member 5 may project below or from the bottom wall 4 for connection of the chamber 2 to a discharge conduit. The hollow interior space or passageway 8 of the port member 5 is in communication with chamber 2 through an elongated metering orifice 9 which extends longitudinally of, and opens upwardly through, the upper end surface 10 of the member 5. The orifice 9 is preferably substantially rectangular or in the form of an open-end slot having spaced side walls 11 and 12 and a bevelled or downward and outward tapered or inclined lower end wall 13. The end wall 13 terminates outwardly in an elongated guide slot or recess 14 in the outer surface of the member 5. The slot 14 is of the same width as orifice 9 and opens at its upper end thereinto.

A tubular or sleeve valve member 15 having an internal diameter substantially equal to the external diameter of the member 5 is slidably fitted in telescoping relation on the upper end portion of the member for longitudinal reciprocal movement to control flow through the orifice 9. The lower end wall 16 of the member 15 is operable upon reciprocation of the member 15 to cover and uncover more or less of the orifice 9 thereby to regulate the flow area of the orifice 9 and to control the rate of flow of liquid from the chamber 2. The cylindrical upper end portion of member 5 terminates at its lower end below the recess 14 in an outwardly and downwardly tapered or flared annular shoulder 17 of substantially conical form providing a valve seat. The inner peripheral edge of the wall 16 acts upon extreme telescoping or downward movement of the member 15 to engage the valve seat 17 to assure the complete cut off of any flow of liquid from the chamber 2 through the orifice 9 to the passageway 8 which might occur due to clearance after wall 16 has passed below recess 14 and closed orifice 9.

The member 15 has adjacent its lower end wall 16 a polygonal aperture 18 therethrough which is rectangular and of a width substantially equal to the width of orifice 9. The aperture 18 is positioned for registry with the recess 14 when the wall 16 is seated on shoulder 17. Supported by the valve member 15, there is a polygonal orifice cleaning pin or member 19 which slidably fits and extends through and is guided within the aperture 18 and which has a head portion 20 external of the member 15. The pin 19 has at its inner end portion opposite to the head portion 20 a cam surface 21 for cooperation with the bevelled wall 13 to provide for movement of the pin 19 out of the orifice 9 so that the wall 16 can be seated on shoulder 17. A shoulder 22 formed at the intersection of the head portion 20 with the normal diameter portion of the pin 19 serves upon engagement with the member 15 to limit movement of the pin 19 radially inward so that the cam surface 21 is held for proper engagement with the wall 13. As shown, the inner end of the pin 19 with the shoulder 22 abutting the member 15 extends through the orifice 9 and slightly beyond the inner surface

of the tubular or port member 5 to insure complete cleaning of the orifice 9. The use of a polygonal pin 19 of a width equal to the width of orifice 9, provides cutting or scraping edge surfaces so that any foreign matter such as wax or gum which is deposited out from many fuel oils will be cut or sheared away from the walls of the orifice 9 upon reciprocal movement of the member 15. A cup-shaped cap member 23 having an inner diameter substantially equal to the external diameter of the head portion 20 has its open end or lip portion secured in fluid tight relation to the member 15 concentrically to, and in overlying relation with, the aperture 18 in any suitable manner such as by welding. A helical coil compression spring 24 is positioned within the cup-shaped member 23 and is held under compression between the end wall thereof and the head portion 20 to urge the pin 19 into the orifice 9 and the head portion 20 into its engaging relation with the member 15. Any desired means may be provided to limit upward movement of the valve member 15 so that the pin 19 will not be withdrawn upon upward movement from the orifice 9.

The operation of this form of the device is as follows: The invention is particularly adapted for use in metering valves for regulating the supply of oil fuel to a liquid fuel burner, and as such, the chamber 2 is a constant level liquid reservoir having the liquid level above the end wall 10 and maintained constant by any of the prior art devices. Upon longitudinal movement of the sleeve valve member 15 more or less of the area of the orifice 9 is exposed for liquid fuel flow and concurrently therewith the pin 19 slides up and down within the orifice 9 removing any lodged sediment or other foreign matter collecting on the walls thereof. During movement of the member 15 downward to tightly closed position, i. e. wall 16 in engagement with shoulder 17, the cam surface 21 of the pin 19 engages the bevelled wall 13 and forces the pin 19 outward against the inward force of the spring 24 so that the pin 19 can pass into the slot 14 thereby removing the foreign matter from the wall 13. Upon upward or valve opening movement of the member 15 the pin 19 will again scrap the walls of orifice 9 so that a clean orifice is presented for liquid flow thus assuring that at any given position of the member 15 with constant head pressure a predetermined substantially constant flow will always result. The reception of the pin 19 by the slot 14 acts to prevent rotational movement of the member 15 relative to the member 5 while the pin 19 is out of the orifice 9 thereby holding the pin 19 located for reentry into the slot or orifice 9 by the spring 24.

In the form shown in Fig. 4 like parts to Figs. 1, 2 and 3 are designated by the same numerals with the exponent *a* added. In Fig. 4, the orifice 9^a does not open upwardly through the upper end surface of the port member 5^a but instead has an upper end wall 25 which is bevelled in a manner similar to the end wall 13^a, but inclines or slopes upward and outward so that upon upward movement of the valve member 15^a an orifice cleaning pin 26 will be forced outwardly to permit full regulation of the orifice 9^a. The pin 26 is somewhat similar to the pin 19 but is an L-shaped pin with a shoulder 27 formed at the jointure of its two arms. The pin 26 has upper and lower cam surfaces 28 and 29 respectively cooperable with the end walls 25 and 13^a. The short arm of the pin 26 serves as a guide member and is positioned external of the member 15^a and extends upward parallel to the longitudinal axis of the valve member 15^a. A hollow cap member 30, secured to the tubular valve member 15^a similarly to member 23, has a longitudinal guideway therein for receiving and reciprocally guiding the short arm of the pin 26. A helical coil compression spring 31 is positioned under stress intermediate the end wall of the member 30 and the pin 26 and acts to urge the pin 26 radially inward into the orifice 9^a. The pin 26 is preferably of such a length that with the shoulder 27 in engagement with the member 15^a, the inner end surface of the long arm of pin 26 extends through the orifice 9^a and slightly beyond the inner wall of the member 5^a. In lieu of the guide recess or slot 14, a guide pin 32 has been added to the member 5^a and extends radially outward therefrom and into a guideway or guide slot 33 extending longitudinally of and in the tubular member 15^a. The slot 33 cooperates with the guide pin 32 to prevent relative rotation of the members 5^a and 15^a so that the pin 26 is always aligned with the orifice 9^a and yet permits relative longitudinal reciprocal movement between the members 5^a and 15^a. A ring member 34 is screw-threaded into the lower end portion of the tubular member 15^a to form a continuous lower end wall 16^a for cooperation with the tapered portion 17^a. The ring member 34 closes the slot 33 so that upon downward movement of the member 15^a into seating position seepage or flow of fluid from the chamber 2 into the passageway 8^a will be prevented.

The operation of the form shown in Fig. 4 will be evident from the foregoing description of operation of the form shown in the other figures. The main difference being that the guide pin 32 and guide slot 33 hold the member 15^a against rotation relative to the member 5^a and the pin 26 in longitudinal alignment with the orifice 9^a. It will be noted further that the pin 26 is moved, by the end wall 25 as well as by the wall 13^a, radially outward against the spring 31 to clean either end wall.

It may now be seen that this invention provides a simple, economical and trouble free means for maintaining the valve orifice free from undesirable foreign material so that a given exposed opening of the orifice 9 or 9^a will always result with constant head pressure in a given predetermined liquid flow. This invention may furthermore be applied to an automatic as well as a manually operable valve apparatus and its cleaning action is automatic and positive.

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

1. In a fluid metering device, a valve port member having an elongated metering orifice with an end edge transverse to fluid flow, a movable valve member cooperable with said end edge and operable upon movement relative thereto to control the extent of the area of said orifice which is exposed for fluid flow, an orifice cleaning member movably carried by said movable valve member and extending into said orifice, said cleaning member substantially fitting the width of said orifice and being cooperable with the side walls and said end edge thereof upon movement of said movable valve member thereby to wipe foreign matter from the entire length of the fluid-contacted side wall portion of said orifice, and means to move said cleaning member across said end edge to clean said edge.

2. In a fluid metering device, a valve port member having a longitudinally extending metering

orifice for fluid flow, a movable valve member cooperable with said port member and operable upon longitudinal movement relative thereto to control the exposed area of said orifice for fluid flow, an orifice cleaning member, means for movably securing said cleaning member to said movable valve member and positioning said cleaning member for movement into and out of said orifice, said cleaning member substantially fitting the width of said orifice and cooperable therewith upon movement of said movable valve member to wipe foreign matter from said orifice, and means cooperable with said cleaning member upon movement of said valve member toward complete closure of said orifice to move said cleaning member out of said orifice.

3. In a fluid metering device, a valve port member having a longitudinally extending metering orifice for fluid flow, a movable valve member cooperable with said port member and operable upon longitudinal movement relative thereto to control the exposed area of said orifice for fluid flow, an orifice cleaning pin, means for movably securing said pin to said movable valve member and positioning said pin for movement into and out of said orifice, said pin substantially fitting the width of said orifice and cooperable therewith upon movement of said movable valve member to wipe foreign matter from said orifice, means cooperable with said pin upon movement of said valve member toward complete closure of said orifice to move said pin out of said orifice, and means cooperable with said pin upon closure of said orifice to hold said movable valve member against rotation movement relative to said port member.

4. In a liquid flow controlling device, a supporting member, a first tubular member carried by said supporting member and having an elongated slot longitudinally of and extending through a side wall thereof, a second tubular member reciprocably movable relative to said first tubular member and operable to telescope over said first tubular member thereby to cover and uncover said slot, said second tubular member having an aperture therethrough aligned with said slot, a pin member reciprocably held in said aperture and extending into said slot, one end portion of said slot having a tapered portion engageable by said pin member and acting upon continued movement of said second tubular member subsequent to engagement of said pin member with said tapered portion to move said pin member within said aperture and out of said slot.

5. In a liquid flow controlling device, a supporting member, a first tubular member carried by said supporting member and having an elongated slot longitudinally of and extending through a side wall thereof, a second tubular member reciprocably movable relative to said first tubular member and operable to telescope over said first tubular member thereby to cover and uncover said slot, said second tubular member having an aperture therethrough aligned with said slot, a pin member reciprocably held and guided for reciprocable movement in said aperture and extending into said slot, and a cam surface portion on said pin member, one end portion of said slot having a tapered portion engageable by said pin member cam portion and acting upon continued movement of said second tubular member subsequent to engagement of said pin member cam portion with said tapered portion to move said pin member within said aperture and out of said slot.

6. In a liquid flow controlling device, a supporting member, a first tubular member carried by said supporting member and having an elongated slot longitudinally of and extending through a side wall thereof, a second tubular member reciprocably movable relative to said first tubular member and operable to telescope over said first member thereby to cover and uncover said slot, said second tubular member having an aperture therethrough aligned with said slot, a pin member reciprocable in said aperture and extending into said slot, resilient means carried by said second tubular member and acting to urge said pin member into said slot, and means limiting movement of said pin member by said resilient means, one end portion of said slot having a tapered portion engageable by said pin member and acting upon continued movement of said second tubular member subsequent to engagement of said pin member with said tapered portion to move said pin member within said aperture and against the force of said resilient means and out of said slot.

7. In a fluid flow metering apparatus, a casing including a chamber for fluid having an outlet, a valve port member positioned within said outlet and extending into said chamber, said port member having a passageway including an elongated orifice through a side wall thereof connecting said outlet with the interior of said chamber below the fluid level thereof, a reciprocal member having a portion adapted upon reciprocation to cover and uncover said orifice for determining the fluid flow from said chamber through said outlet, an orifice cleaning member movable relative to and carried by said reciprocal member and adapted upon reciprocation of said reciprocal member to register with and move into said orifice, and means to move said cleaning member into said orifice upon registration of said cleaning member with said orifice, said cleaning member having a dimension substantially equal to the width of said orifice so that upon reciprocation of said reciprocal member said cleaning member will wipe the sides of said orifice thereby to remove any lodged foreign matter which might interfere with fluid flow therethrough.

8. In a fluid flow metering apparatus, a casing including a chamber for fluid having an outlet, a valve port member positioned within said outlet and extending into said chamber, said port member having a passageway including an elongated orifice through a side wall thereof connecting said outlet with the interior of said chamber below the fluid level thereof, said orifice having walls and having an end edge which is initially uncovered and across which the fluid flows, a reciprocal member having a portion adapted upon reciprocation to cover and uncover said orifice for determining the fluid flow from said chamber through said outlet, an orifice cleaning member movable relative to and carried by said reciprocal member and adapted upon reciprocation of said reciprocal member to register with and extend into said orifice, said cleaning member being positioned out of said orifice when said reciprocal member closes said orifice, means to move said cleaning member into said orifice to clean the initially uncovered end edge of said orifice upon movement of said reciprocal member to uncover said orifice, and shearing edge portions on said cleaning member and cooperable with the walls of said orifice so that upon reciprocation of said reciprocal member said shearing edge portions will remove any lodged foreign matter which

might interfere with fluid flow through said orifice.

9. In a fluid flow metering apparatus, a casing including a chamber for fluid having an outlet, a valve port member positioned within said outlet and extending into said chamber, said port member having a passageway including an elongated orifice through a side wall thereof connecting said outlet with the interior of said chamber below the fluid level thereof, a reciprocal member having a portion adapted upon reciprocation to cover and uncover said orifice for determining the fluid flow from said chamber through said outlet, an orifice cleaning pin carried by said reciprocal member and adapted upon reciprocation of said reciprocal member to register with an extend into said orifice, said pin having a dimension substantially equal to the width of said orifice so that upon reciprocation of said reciprocal member said pin will wipe the sides of said orifice thereby to remove any lodged foreign matter which might interfere with fluid flow therethrough, and means to move said pin out of said orifice upon engagement thereof with one end wall of said orifice to permit continued movement of said reciprocal member.

10. In a fluid flow metering apparatus, a first tubular member interposed in the flow path of a fluid and having a longitudinally extending elongated flow orifice in its side wall, a second tubular member adapted to telescope over said first tubular member and being longitudinally moveable to cover and uncover said flow orifice, a radially extending cleaning member movable into and from said orifice and carried by said second tubular member and adapted to register with and move into said orifice upon longitudinal movement of said second tubular member, and means separate from said flow orifice and operable to prevent rotational movement of said second tubular member about said first tubular member to maintain said cleaning member in aligned position with said orifice.

11. In a fluid flow metering apparatus, a first tubular member interposed in the flow path of a fluid and having a longitudinally extending elongated flow orifice in its side wall, said orifice having spaced end walls and spaced side walls, a second tubular member adapted to telescope over said first tubular member and being longitudinally moveable to cover and uncover said flow orifice, a radially extending cleaning pin carried by said second tubular member and adapted to register with and extend into said orifice upon longitudinal movement of said second tubular member, resilient means urging said pin into said orifice, one of said orifice end walls being bevelled, said pin being engageable upon longitudinal movement of said second tubular member in one direction with said one end wall and upon continued longitudinal movement in said one direction being moved by said end wall against the force of said resilient means out of said orifice, and means to prevent rotational movement of said second tubular member about said first tubular member to maintain said pin in aligned position with said orifice.

12. In an orifice cleaning means, a wall member having an orifice, a reciprocal supporting member in cooperable sliding engagement with said wall member, a cleaning member movably carried by said supporting member and reciprocal transversely thereto, means to move said cleaning member into said orifice upon movement of said cleaning member into registry with said orifice by movement of said supporting member, and means to move said cleaning member out of said orifice upon movement by said supporting member of said cleaning member out of registry with said orifice.

13. In an orifice cleaning means, a wall member having an orifice, a reciprocal supporting member in cooperable sliding engagement with said wall member, a cleaning member movably carried by said supporting member and reciprocal transversely thereto, means to move said cleaning member into said orifice upon movement of said cleaning member into registry with said orifice by movement of said supporting member, and means to move said cleaning member out of said orifice upon movement by said supporting member of said cleaning member out of registry with said orifice, said last-named means comprising an inclined orifice end wall engageable by said cleaning member.

14. In an orifice cleaning means, a wall member having an orifice, a reciprocal supporting member in cooperable sliding engagement with said wall member, a cleaning member movably carried by said supporting member and reciprocal transversely thereto, means to move said cleaning member into said orifice upon movement of said cleaning member into registry with said orifice by movement of said supporting member, means to move said cleaning member out of said orifice upon movement by said supporting member of said cleaning member out of registry with said orifice, and means to hold said cleaning member in alignment with said orifice upon movement of said cleaning member out of said orifice.

15. In a fluid metering device, a valve port member and a valve member in reciprocal sleeved relation, one of said members having an elongated metering orifice with an end portion having an end wall, the other of said members being cooperable with said end portion and said end wall to control flow through said orifice, an orifice cleaning member cooperable with said end portion and said end wall and being constructed and arranged to move with a shearing action across said end wall, and means operable upon relative movement of said valve and port members for uncovering said orifice end portion to move said cleaning member across said end wall thereby to remove foreign matter from said end wall.

16. In a fluid metering device, a valve port member and a valve member in reciprocal sleeved relation, one of said members having an elongated metering orifice with an end portion having an end wall, the other of said members being cooperable with said end portion and said end wall to control flow through said orifice, an orifice cleaning member positioned out of said orifice and carried by the said other of said members, said cleaning member being cooperable with said end portion and said end wall and being constructed and arranged to move with a shearing action across said end wall, and automatically acting means urging said cleaning member toward said orifice and operable upon initial registration of said cleaning member and said orifice end portion to move said cleaning member across said end wall thereby to remove foreign matter from said end wall as said port and valve members are relatively moved for uncovering said orifice end portion.

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