Sept. 8, 1953 W. C. GLOVER, JR., ET AL 2,651,511

DEVICE FOR TEMPERING STEAM

Filed April 20, 1951

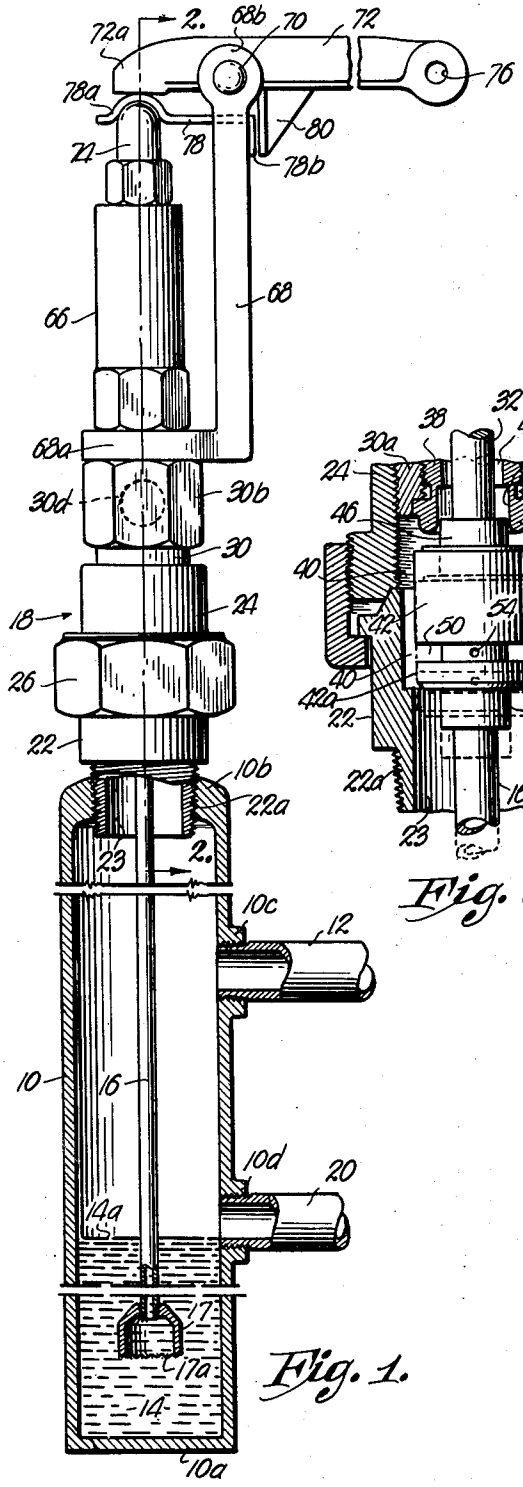


Fig. 1.

Fig. 3.

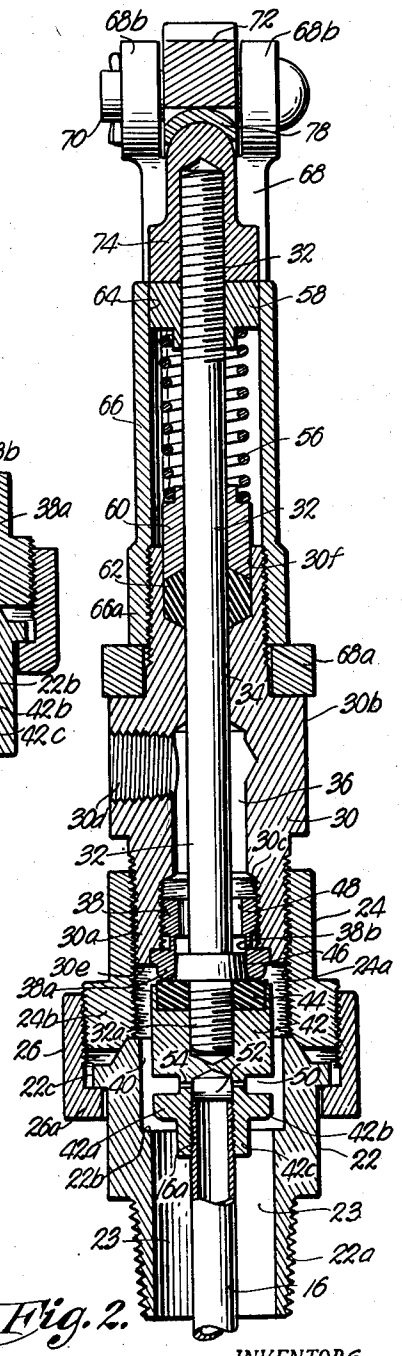


Fig. 2.

INVENTORS.
William C. Glover, Jr.
Edwin G. Stevens
BY Thos. E. Scofield
ATTORNEY.

Patented Sept. 8, 1953 2,651,511

UNITED STATES PATENT OFFICE

2,651,511

DEVICE FOR TEMPERING STEAM

William C. Glover, Jr., Lees Summit, and Edwin G. Stevens, Independence, Mo., assignors to Bill Glover, Incorporated, a corporation of Missouri

Application April 20, 1951, Serial No. 222,024

17 Claims. (Cl. 261—52)

1

This invention relates to steam processing apparatus, and more particularly to apparatus adapted to supply steam having different degrees of moisture content.

In certain mechanical and chemical processes, it is often desirable to have a constant steam supply, the moisture content of which can be varied from a relatively dry steam to one which is substantially saturated. The normal means by which this has been accomplished in the past has been to draw the tempering water from some part of the system where it has been collected as condensate and inject it into either the flow lines or a suitable mixing chamber when it is picked up by the relatively dry vapor. In systems where it is desirable to control both the rate of discharge of the tempered steam and the amount of temperating water added, the use of a complex arrangement of separate controls and valves is required; and even where the valves have been related to a single control, a complicated linkage involving considerable lost motion in correlating the timing is involved.

A primary object, therefore, of our invention is to provide a steam tempering device employing a single valving member which, at the will of the operator, may be positioned to obtain dry or tempered steam in the quantities and degrees of wetness desired.

Another object is to provide a valve device of novel construction, which is a simple, self-contained unitary structure adapted to be actuated by a single operating mechanism.

Still another object is to provide a device of this nature which can be easily connected to any steam supply system.

Other and further objects of our invention together with the features of novelty whereby the objects are achieved will appear in the course of the following description.

In the accompanying drawings which form a part of the specification and are to be read in conjunction therewith, and in which like reference numerals are employed to indicate like parts of the various views,

Fig. 1 is an elevational view partly in section, showing a device incorporating the features of our invention,

Fig. 2 is an enlarged sectional view taken along the line 2—2 in Fig. 1, in the direction of the arrows,

Fig. 3 is an enlarged fragmentary section of the valve assembly showing positions of the valving member for maximum flow of dry steam and for tempering.

2

An important use of tempered steam is in the dry cleaning industry wherein it is employed to remove spots from garments and in treating the nap or pile of fabrics. In this connection, the illustrated embodiment of our invention has been developed for use in a garment spotting machine of the type disclosed in the copending application of William C. Glover, Jr., Serial No. 150,504, filed March 19, 1950. It will be understood, of course, that the device is not limited to this use alone, being similarly adaptable to use in any process wherein it is desirable to vary the moisture content of steam.

Referring now to the drawing, and more particularly to Fig. 1, forming a reservoir for both dry steam and the tempering liquid is an elongated cylindrical vessel 10 having a closed bottom 10*a* and a thickened head 10*b*. This vessel, hereinafter referred to as the steam separator, is secured to any suitable support, such as the frame of the spotting machine (not shown), in the upright position illustrated in the drawing, and pressurized dry steam is supplied thereto from a suitable source through an inlet pipe 12 threadedly received in a neck-like opening 10*c* formed in the separator wall. Inasmuch as the outer surface of the separator is exposed to ambient air, a portion of the steam entering condenses out and is collected at the bottom of the separator as condensate volume 14. As will be made clear presently, this condensate serves as the source of tempering liquid for the device, being forced upward through a vertical tube 16 suspended centrally in the separator from inside a tempering valve housing (generally indicated by the numeral 18) connected to the upper end of the separator. An inverted cup-shaped intake housing 17 threadedly encircles the lower end of tube 16, and the bottom of the intake housing is covered by a suitable filter screen 17*a*.

The level 14*a* to which condensate may rise in the separator is controlled by an overflow pipe 20 connected to the separator through a second threaded neck-like opening 10*d* spaced below the inlet opening 10*c* and leading to a suitable drain or to the source of the steam supply.

Secured to the upper end of the separator 10 and projecting axially thereabove is the tempering valve housing which is seen in detail in Fig. 2. Forming the base element of the housing and having a slightly tapered lower end 22*a* threaded for insertion in a threaded axial opening in the head 10*b* of the separator 10 (see Fig. 1) is a sleeve member 22, the bore of which provides a steam flow passageway 23 communicating at its lower

end with the steam space in the separator. The upper end of sleeve 22 is counterbored approximately one-third of the bore length, providing an internal annular shoulder 22b, and a second sleeve 24 having a threaded bore 24a of substantially equal diameter with the counterbore axially abuts the upper end thereof. The sleeves are secured to one another by an external coupling nut 26 threadedly encircling the enlarged lower end 24b of sleeve 24 and provided with an inturned flange 26a which engages an annular shoulder 22c on the upper end of sleeve 22.

Screwed down substantially half-way into the bore 24a of the upper sleeve 24 is the threaded cylindrical lower end 30a of a relatively elongate valve body 30 having a continuous axial bore of varying size through which extends an axially movable valve stem 32. While, as indicated at 34, valve stem 32 is received in a sliding fit above the nut-shaped medial portion 30b of the valve body, the bore is enlarged therebelow to form an annular flow passageway 36 which flares at its lower end into an enlarged threaded counterbore 30c adapted to receive a valve seat member 38. Located intermediate the ends of the valve body and communicating with the upper end of flow passageway 36 is a lateral port 30d which is threaded to receive the end of a flexible hose line leading to a hand operated steam discharge nozzle or gun (not shown).

It will be noted that the bottom surface 30e of valve body 30 serves to define the upper end of a substantially cylindrical chamber 40 formed by the connecting bores of sleeves 22 and 24, the lower end of the chamber being defined by the annular shoulder 22b in the bore of the lower sleeve 22. Contained in chamber 40 and normally positioned to close the valve body bore is a cylindrical valving member 42 into the upper end of which is threadedly inserted the lower end 32a of valve stem 32.

Steam flow into the valve body bore is sealed off by an annular gasket 44 carried in a suitable recess formed in the upper end of the valving member, the gasket seating upwardly against an axially projecting annular bead 38a provided on the lower end of valve seat member 38. Directly above gasket 44, valve stem 32 has an integral enlarged shoulder or collar 46 which projects upwardly into the axial bore 38b of valve seat 38. It will be noted that collar 46 is slightly tapered from its base to its upper end, the base of the collar being designed to mate in a close fit with the bore 38b when the valve gasket 44 is seated against the valve seat bead 38a. The bore of the valve seat 38 above the portion 38b is cylindrical as indicated at 48, and provides a passageway communicating with the flow passageway 36 thereabove.

Examining now more in detail the particular construction of valving member 42, provided near the lower end thereof is a relatively deep annular groove 50 which gives the appearance of dividing the member into two sections, viz., a valve head above the groove and, therebelow, a relatively thin disk-like structure 42a having its beveled lower edge 32b spaced above shoulder 22b at the lower end of chamber 40. As will be more fully discussed in describing the operation of the device, disk 42a serves as a throttling surface for restricting steam flow into chamber 40 after the valve gasket 44 has been unseated, the diameter of the disk being only slightly less than the diameter of the bore of sleeve 22 below shoulder 22b. (See Fig. 3.) Formed on the bottom of the disk structure 42a and projecting downwardly for a short distance into flow passageway 23 is a short cylindrical section 42c of reduced diameter. An axial bore 52 extends upwardly through section 42c into the valving member, terminating slightly above the mid-point of the annular groove 50, and threadedly received therein is the upper end of tube 16, which, as has been hereinbefore described, extends downwardly through the separator into the condensate 14. A plurality of radial ducts 54 lead from the upper end of bore 52 into the annular groove 50, thus providing an open communication between chamber 40 and the interior of tube 16.

Loosely encircling valve stem 32 above valve body 30 and exerting an upward thrust thereon to constantly urge valving member 42 toward its seated position is a coiled compression spring 56. The spring is retained at its upper end by a collar 58 threadedly secured to the valve stem near its upper end, and the lower end exerts a downward thrust on a second collar 60 slidably encircling the valve stem and also slidably received in the upper portion of an enlarged counterbore 30f formed in the upper end of valve body 30. A compressible annular packing 62 encircles the stem below packing collar 60, and the downward thrust of the spring serves to provide a proper seal around the stem at its entry into the stem guide portion 34 of the valve body.

Completely surrounding the spring assembly and slidably receiving the retaining collar 58 at its upper end as indicated at 64 is a generally cylindrical housing 66 threadedly attached at its lower end 66a to the upper end of valve body 30. Interposed between the bottom of the housing 66 and the upper surface of the nut-shaped medial portion 30b of the valve body is the collar-like base leg 68a of a generally L-shaped bracket 68, the vertical leg of which extends upwardly outside the spring housing 66. The upper end of bracket 68 is formed as a clevis having legs 68b, 68b and pivotally suspended therebetween on a suitable bolt 70 is a generally horizontal actuating lever 72, one end 72a of which overhangs a dome-like cap nut 74 secured to the end of the valve stem 32, and the other end of which is drilled as indicated at 76 for attachment to a suitable operating linkage.

Spaced below the actuating lever 72 and freely riding on bracket 68 between the clevis ears 68b, 68b, is a plate-like member 78, whose contoured outer end 78a is interposed between the operating lever and the top of cap nut 74. The opposite end of member 78 is turned downwardly as indicated at 78b and is disposed between the side of the bracket and a downwardly projecting spur 80 rigidly secured to the under side of the actuating lever. Inasmuch as during operation of the actuating lever some wear will take place between end 72a of the lever and the adjacent surface of member 78, the latter is preferably formed from stainless steel or a similarly wear-resistant material.

In use with a spotting machine adapted to be equipped with our invention, the free end of the actuating lever 72 is connected by a push-rod linkage (not shown) to a pedal at the bottom of the machine adapted to be operated by the foot of the operator, thus freeing his hands for manipulation of the steam gun and the fabric being treated.

In the operation of the device, steam from a suitable source is introduced under pressure into the separator 10 through inlet pipe 12. As here-

inbefore described, partial condensation takes place within the separator, the condensate collecting at the bottom and rising to level 14*a*, at which point excess condensate is disposed of through overflow pipe 20. The cup-shaped intake 17 connected to the bottom of tube 16 is wholly immersed in the condensate, and inasmuch as the pressure in valve chamber 40 is initially equal to that in the separator, condensate is also contained in tube 16 to level 14*a*, the steam pressure in valve chamber 40 being communicated to the interior of tube 16 through the radial ducts 54 in valving member 42.

Assuming that a steam gun such as is used in spotting machines of the type hereinbefore referred to is connected by a flexible line to discharge port 30*d* in valve body 30, either dry or tempered steam may be delivered to the gun by pivoting the actuating lever 72 about its axis to depress the valving member 42 against the action of spring 56. Whether dry or tempered steam is delivered to the gun depends on the extent of displacement of the valving member, as will be discussed hereinafter.

As may best be appreciated from Fig. 3, during the initial downward motion of valving member 42, valve gasket 44 is unseated and steam discharges from chamber 40 through an annular passageway formed between the tapered surface of collar 46 and the bore 38*b* of valve seat member 38. The rate of flow of the discharging steam is governed by the vertical position of collar 46 relative to bore 38*b*, increasing from a minimum at the point of unseating to a maximum when the valving member occupies the position indicated by the solid lines in Fig. 3. While, as shown therein, the upper end of collar 46 still is within bore 38*b*, the size of the opening therebetween is now sufficient to completely satisfy the discharge capacity of the steam gun, and any further downward movement of the washer will not result in an increased steam flow from the device.

Concurrently with collar 46 reaching the position shown in Fig. 3, the lower surface of the throttling disk 42*a* on the valving member reaches a position substantially level with the annular shoulder 22*b* at the bottom of chamber 40. While the size of the steam inlet opening to chamber 40 is now somewhat restricted in comparison with the size of the opening when the valving member is in normal position, it should be understood that this inlet still is capable of supplying steam to the chamber as fast as it is being exhausted at the upper end; consequently, the pressure in chamber 40 remains substantially equal to that in the separator. The condensate in tube 16 therefore still remains at level 14*a*, and dry steam is all that is discharged from the device.

To supply tempered steam to the discharge gun or nozzle, the operator need only depress the valving member below the position shown by solid lines in Fig. 3. The size of the steam inlet into chamber 40 is gradually reduced as the beveled lower edge 42*b* of the throttling disk 42*a* moves past shoulder 22*b*, and steam is discharged from the upper end of the chamber faster than it is being supplied, thus resulting in a decreasing pressure in chamber 40. Inasmuch as the pressure in the separator remains at a relatively higher value, the condensate is forced upwardly through tube 16 and discharged through ducts 54. The condensate is picked up by the steam flowing through the chamber, and is carried to the steam gun where it may be directed over the fabric being treated.

The amount of water mixed with the steam depends on the position of the throttling disk 42*a* relative to shoulder 22*b*, the major variation taking place through a displacement represented by the width of the beveled edge 42*b* of the disk. However, even after the upper edge of the beveled surface reaches an equal level with the shoulder, some additional throttling is obtained as the disk portion 42*a* moves downwardly into flow passageway 24 to the position shown by the broken lines in Fig. 3. This is primarily due to an increased friction loss in the flowing steam which results from the lengthening of the annular passageway formed between the periphery of disk 42*a* and the wall of flow passageway 24.

In connection with the throttling of steam flow into chamber 40, it is important to note that while the range through which tempered steam is obtained represents a relatively small displacement of valving member 42, the length of the actuating lever 72 is such that an appreciably greater displacement of the operating linkage (and foot pedal) will be required. Thus an operator may, without being required to exercise undue sensitivity, accurately position the valving member to obtain the steam quality desired.

From the foregoing it will be seen that this invention is one well adapted to attain all of the ends and objects hereinabove set forth together with other advantages which are obvious and which are inherent to the invention.

It will be understood that certain features and subcombinations are of utility and may be employed without reference to other features and subcombinations. This is contemplated by and is within the scope of the claims.

As many possible embodiments may be made of the invention without departing from the scope thereof, it is to be understood that all matter herein set forth or shown in the accompanying drawings is to be interpreted as illustrative and not in a limiting sense.

Having thus described our invention, we claim:

1. Apparatus of the character described, comprising a pair of chambers disposed one above the other with a restricted vertical passageway therebetween, the lower one of said chambers comprising an enclosed vessel having a source of steam under pressure connected to the upper portion thereof, whereby condensate is adapted to collect in the lower portion of the vessel, means for limiting the maximum level which the condensate can attain in said vessel, the upper chamber having an outlet port restricted in size relative to said passageway, whereby steam can pass from said lower chamber through said passageway into the upper chamber and escape through said port, a valving member in one of said chambers normally spaced vertically from said passageway but movable toward said passageway to throttle said flow of steam into the upper chamber, a vertical conduit extending through said valving member and passageway and secured to said valving member to move therewith, the upper end of said conduit opening into said upper chamber and the lower end of the conduit being immersed in the condensate in the lower chamber.

2. Apparatus of the character described, comprising a pair of chambers disposed one above the other with a restricted vertical passageway therebetween, the lower one of said chambers

comprising an enclosed vessel having a source of steam under pressure connected to the upper portion thereof whereby condensate collects in the lower portion, means for limiting the maximum level which the condensate can attain in the vessel, the upper chamber having an outlet port restricted in size relative to said passageway, a normally seated valve associated with said port and having integral therewith a throttling member normally spaced vertically from said passageway, means for moving said valve vertically to unseat same and optionally continuing said movement to advance said member into throttling relation to said passageway, said valve effective upon being unseated to permit steam to flow from the upper portion of said lower chamber through said passageway into the upper chamber and escape through said port, and said throttling member adapted upon said continued movement to restrict the flow of steam through said passageway, a vertical conduit extending through said throttling member and passageway and secured to the throttling member to move therewith, the upper end of the conduit opening into said upper chamber and the lower end of the conduit being immersed in the condensate in the lower chamber.

3. Apparatus of the character described, comprising a pair of chambers disposed one above the other with a restricted vertical passageway therebetween, the lower one of said chambers comprising an enclosed vessel containing a liquid and, above the surface of the liquid, a fluid under pressure, the upper chamber having an outlet port restricted in size relative to said passageway, whereby fluid can pass from the upper part of the lower chamber through said passageway into the upper chamber and escape through said port, a valving member in one of said chambers normally spaced vertically from said passageway but movable toward said passageway to throttle said flow of fluid into the upper chamber, a vertical conduit extending through said valving member and passageway and secured to said valving member to move therewith, the upper end of said conduit opening into said upper chamber and the lower end of the conduit being immersed in the liquid in the lower chamber.

4. Apparatus of the character described, comprising an enclosed vessel containing a liquid and, above the surface of the liquid, a fluid under pressure, an enclosed chamber, at least a portion of said chamber being positioned above said vessel, a passageway extending vertically downward from said portion of the chamber to the fluid space in the upper portion of said vessel whereby said fluid is admitted to said chamber, said chamber having an outlet port for said fluid, which port is restricted in size relative to said passageway, a valve associated with said passageway and vertically movable to throttle the flow of said fluid from the vessel into said chamber, a vertical duct extending through said valve and open only at its upper and lower ends, the open upper end of the duct being above the valve and within said chamber, and the open lower end of the duct being immersed in the liquid in the bottom of said vessel.

5. Apparatus of the character described, comprising an enclosed vessel containing a liquid and, above the surface of the liquid, a fluid under pressure, an enclosed chamber, at least a portion of said chamber being positioned above said vessel, a passageway extending vertically downward from said portion of the chamber to the fluid space in the upper portion of the vessel whereby said fluid is admitted to said chamber, said chamber having an outlet port for said fluid, which port is restricted in size relative to said passageway, a valve associated with said passageway and vertically movable to throttle the flow of said fluid from the vessel into the said chamber, a vertical tube having its upper end secured to said valve to move therewith, the open lower end of said tube being immersed in the liquid in the lower part of said vessel, and a passageway extending from the upper end of said tube through the valve into the interior of said chamber whereby said throttling of the fluid flow causes said liquid to flow upwardly through the tube and be discharged into the chamber.

6. Apparatus of the character described, comprising an enclosed vessel containing a liquid and, above the surface of the liquid, a fluid under pressure, an enclosed chamber, at least a portion of said chamber being positioned above said vessel, a passageway extending vertically downward from said portion of the chamber to the fluid space in the upper portion of said vessel whereby said fluid is admitted to the chamber, said chamber having an outlet port for said fluid and a valve associated with the port for opening and closing same, a discharge passageway through which said fluid flows from said chamber when the valve is open, said last passageway being restricted in size relative to said first passageway, a valve associated with said first passageway and vertically movable to throttle the flow of said fluid from the vessel into said chamber, a vertical duct extending through said second valve and open only at its upper and lower ends, the open upper end of the duct being above the second valve and within said chamber, and the open lower end of the duct being immersed in the liquid in the bottom of the vessel.

7. Apparatus of the character described, comprising an enclosed vessel containing a liquid and, above the surface of the liquid, a fluid under pressure, an enclosed chamber, at least a portion of said chamber being positioned above said vessel, a passageway extending vertically downward from said portion of the chamber to the fluid space in the upper portion of said vessel whereby said fluid is admitted to the chamber, said chamber having an outlet port for said fluid and a valve associated with the port for opening and closing same, a discharge passageway through which said fluid flows from said chamber when the valve is open, said last passageway being restricted in size relative to said first passageway, a valve associated with said first passageway and vertically movable to throttle the flow of said fluid from the vessel into said chamber, a vertical tube having its upper end secured to said second valve to move therewith, the open lower end of said tube being immersed in the liquid in the lower part of said vessel, and a passageway extending from the upper end of the tube through said second valve into the interior of said chamber whereby said throttling of the fluid flow causes said liquid to flow upwardly through the tube and be discharged into the chamber.

8. Apparatus of the character described, comprising a vessel containing a liquid and, above the surface of the liquid, a fluid under pressure,

an enclosed chamber above the vessel having an inlet port in the bottom thereof, a passageway extending vertically downward from said port to the fluid space in the upper portion of the vessel whereby said fluid can pass from the vessel into said chamber, said chamber having an outlet port spaced above the passageway in vertical alignment therewith, a valve in said chamber normally closing said port but movable downwardly to open same, a discharge passageway through which said fluid flow from said chamber when the valve is open, said last passageway being restricted in size relative to said first passageway, a second valve in said chamber normally spaced above said inlet port but linked to said first valve to move downwardly therewith, said second valve constructed and arranged upon such downward movement to throttle the flow of fluid through said first passageway after a predetermined downward movement of said second valve, a vertical duct extending through said second valve and open only at its upper and lower ends, the open upper end of the duct being above the second valve and within said chamber, and the open lower end of the duct being immersed in the liquid in the bottom of said vessel.

9. Apparatus of the character described, comprising a vessel containing a liquid and, above the surface of the liquid, a fluid under pressure, an enclosed chamber above the vessel having an inlet port in the bottom thereof, a passageway extending vertically downward from said port to the fluid space in the upper portion of the vessel whereby said fluid can pass from the vessel into said chamber, said chamber having an outlet port spaced above the passageway in vertical alignment therewith, a valve in said chamber normally closing said port but movable downwardly to open same, a discharge passageway through which said fluid flows from said chamber when the valve is open, said last passageway being restricted in size relative to said first passageway, a second valve in said chamber normally spaced above said inlet port but linked to said first valve to move downwardly therewith, a vertical tube having its upper end secured to said second valve to move therewith, the open lower end of said tube being immersed in the liquid in the lower part of said vessel, and a passageway extending from the upper end of the tube through said second valve into the interior of said chamber whereby said throttling of the fluid flow causes said liquid to flow upwardly through the tube and be discharged into said chamber.

10. Apparatus of the character described, comprising a vessel containing a liquid and, above the surface of the liquid, a fluid under pressure, a body mounted on the top of said vessel and containing a bore extending vertically upward from the fluid space in the upper part of said vessel, said bore being enlarged in a limited region intermediate its upper and lower ends to form a mixing chamber, an upwardly seating valve member in said chamber for normally sealing said chamber off from the portion of the bore above the chamber, the bottom of said valve member being normally spaced above the bottom of the chamber and the sides of the valve member being spaced inwardly from the sides of the chamber, a vertical conduit secured at its upper end to the bottom of the valve member and having its lower end immersed in the liquid in said vessel, at least one passageway extending from the upper end of said conduit laterally through said valve member and opening into the space between the side wall of the valve member and the side wall of the chamber, means for moving said valve member and conduit downwardly as a unit thereby to unseat the valve and optionally continuing such movement to cause the lower portion of the valve member to enter the portion of the bore below said chamber, said lower portion of the valve member being only slightly smaller in size than said lower portion of the bore whereby it is adapted to throttle the flow of fluid from the upper portion of said vessel into the chamber.

11. Apparatus of the character described, comprising a vessel containing a liquid and, above the surface of the liquid, a fluid under pressure, a body mounted on the top of said vessel and containing a bore extending vertically upward from the fluid space in the upper part of said vessel, said bore being enlarged in a limited region intermediate its upper and lower ends to form a mixing chamber, an upwardly seating valve member within said chamber for normally sealing said chamber off from the portion of the bore above the chamber, said valve comprising a plug whose lower end is normally spaced above the bottom of the chamber and whose sides are spaced inwardly from the sides of the chamber, said plug having intermediate its top and bottom an annular groove, a vertical conduit secured at its upper end to the bottom of said plug and having its lower end immersed in the liquid in said vessel, a passageway through said plug extending from the upper end of said conduit into the bottom of said groove, means for moving said plug and conduit downwardly as a unit to unseat the valve and optionally continuing said movement to advance the portion of the plug below said groove into the portion of said bore below said chamber, said last portion of the plug being only slightly smaller in size than said last portion of the bore whereby it is adapted to throttle the flow of fluid from the upper part of said vessel into said chamber.

12. Apparatus as in claim 11 wherein said plug has an upwardly tapered portion which projects into the portion of said bore extending upwardly from said chamber.

13. Apparatus for optionally mixing fluids, comprising a mixing chamber having aligned inlet and outlet ports on opposite sides thereof, fluid inlet and outlet passageways associated with the respective ports, said outlet passageway being restricted in size relative to said inlet passageway, a normally seated outlet valve associated with the outlet port, said valve having integral therewith a throttling member disposed in said chamber and normally spaced from said inlet port, means for moving said outlet valve toward said inlet port thereby to unseat same and optionally continuing said movement to advance said member into throttling relation to said inlet port, a source of fluid under pressure connected to said inlet passageway whereby unseating of said valve permits fluid from said source to enter said chamber and escape through said outlet port, said member effective when advanced into throttling relation to said inlet port to reduce the effective size of the flow passageway through said inlet port below the size of said outlet passageway, a tube extending through said inlet passageway and having one end secured to said member to move therewith, a passageway from said one end of said tube

extending through said member and opening into said chamber, and a second source of fluid under pressure connected to the other end of said tube for causing said last fluid to flow through said tube into said chamber when said member is advanced into throttling relation to said inlet port.

14. Apparatus of the character described, comprising a chamber having aligned ports on opposite sides thereof, a plug within said chamber movable along a path aligned with said ports, an annular seat around one of the ports adapted to be engaged by one end of the plug upon movement of same in one direction thereby to close said one port, the other end of the plug being smaller in size than the other port whereby it enters and partially closes said other port upon movement of the plug in the opposite direction, a rigid tube extending into said chamber through one of said ports and having its end secured to the plug whereby the tube moves with the plug, said plug having a lateral bore communicating at one end with said tube and opening at the other end through the side wall of the plug intermediate the opposite ends of the plug, said side wall of the plug being spaced inwardly from the side wall of the chamber.

15. Apparatus of the character described, comprising a chamber having aligned ports on opposite sides thereof, a plug within said chamber movable along a path aligned with said ports, an annular seat around one of the ports adapted to be engaged by one end of the plug upon movement of same in one direction thereby to close said one port, said one port comprising a bore leading away from said chamber, said plug having a tapered projection which extends into said bore and seats against same when said end of the plug engages said annular seat, the other end of the plug being smaller in size than the other port whereby it enters and partially closes said other port upon movement of the plug in the opposite direction, a rigid tube extending into said chamber through one of said ports and having its end secured to the plug whereby the tube moves with the plug, said plug having a lateral bore communicating at one end with said tube and opening at the other end through the side wall of the plug intermediate the opposite ends of the plug, said side wall of the plug being spaced inwardly from the side wall of the chamber.

16. Apparatus of the character described, comprising a generally cylindrical chamber having aligned ports at opposite ends thereof, a generally cylindrical plug in said chamber coaxial with said ports, said plug being smaller in diameter and shorter in length than the chamber, one of said ports being smaller in diameter than the plug and encircled by a seat adapted to be engaged by the end of the plug upon movement of same toward said one port thereby to close said one port, the other port being larger in diameter than the plug whereby the plug is adapted to advance thereinto and partially close said other port upon movement of the plug in the opposite direction, a rigid tube extending into said chamber through one of said ports and having its end secured to the plug whereby the tube and plug move together as a unit, said plug having a lateral bore communicating at one end with said tube and opening at the other end through the side wall of the plug intermediate its opposite ends.

17. Apparatus of the character described, comprising a generally cylindrical chamber having aligned ports at opposite ends thereof, a generally cylindrical plug in said chamber coaxial with said ports, said plug being smaller in diameter and shorter in length than the chamber, said plug having intermediate its ends an annular groove circumscribing the plug, one of said ports being smaller in diameter than the plug and encircled by a seat adapted to be engaged by the end of the plug upon movement of same toward said one port, thereby to close said one port, the other port being larger in diameter than the plug whereby the end portion of the plug on one side of said groove is adapted to advance into and partially close said other port upon movement of the plug in the opposite direction, a rigid tube extending into said chamber through one of said ports and having its end secured to the plug whereby said tube and plug move together as a unit, said plug having a lateral bore communicating at one end with said tube and opening at the other end into said groove.

WILLIAM C. GLOVER, JR.
EDWIN G. STEVENS.

References Cited in the file of this patent

UNITED STATES PATENTS

Number	Name	Date
1,923,422	Conley et al.	Aug. 22, 1933
2,346,821	Cissell	Apr. 18, 1944
2,391,663	Weber et al.	Dec. 25, 1945
2,455,754	Glover	Dec. 7, 1948