

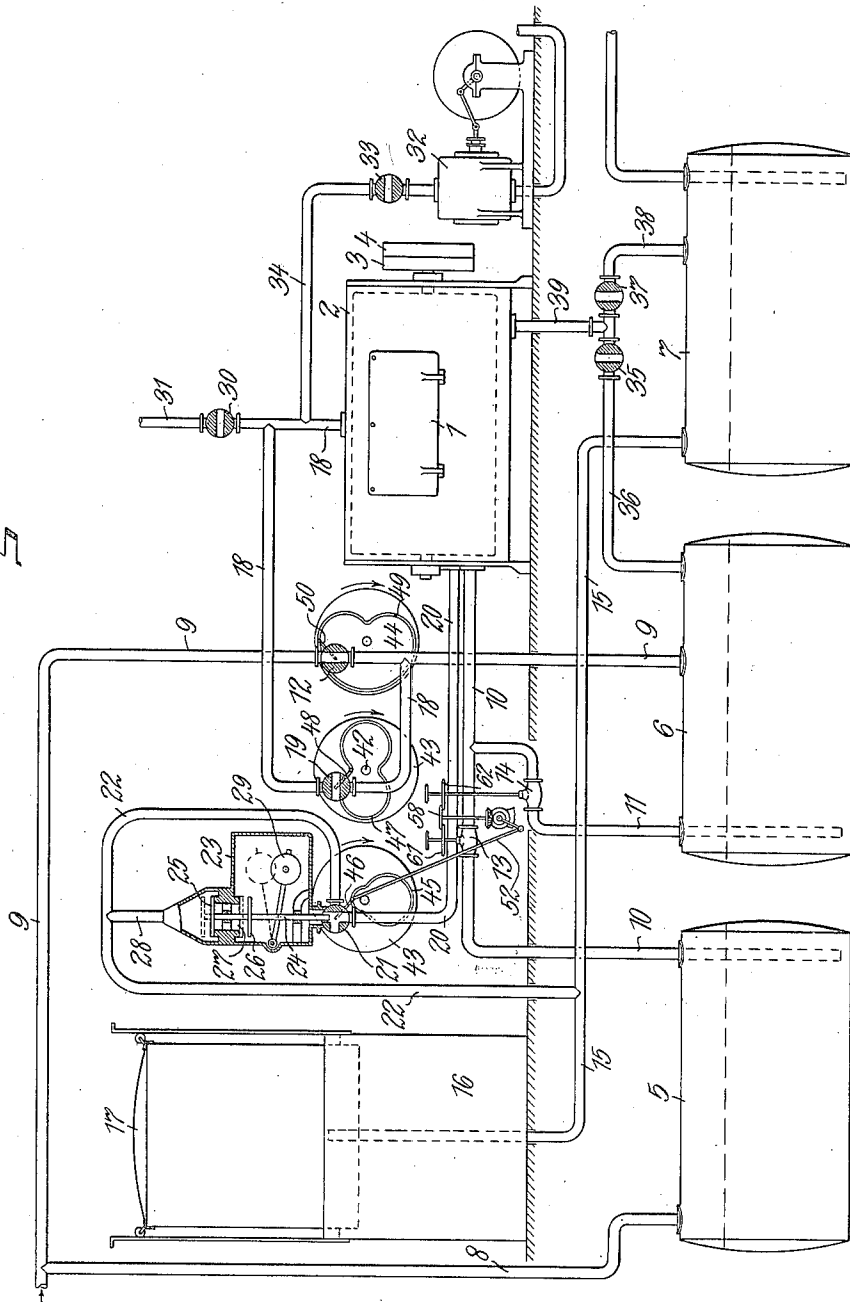
P. GÜNGERICH.
 MEANS FOR SAFEGUARDING CLOSED VESSELS AGAINST FIRE AND EXPLOSION.
 APPLICATION FILED MAR. 26, 1913.

1,172,884.

Patented Feb. 22, 1916.

3 SHEETS—SHEET 1.

Fig. 1.



Witnesses:

Charles Mathé
Georg W. Case, junr

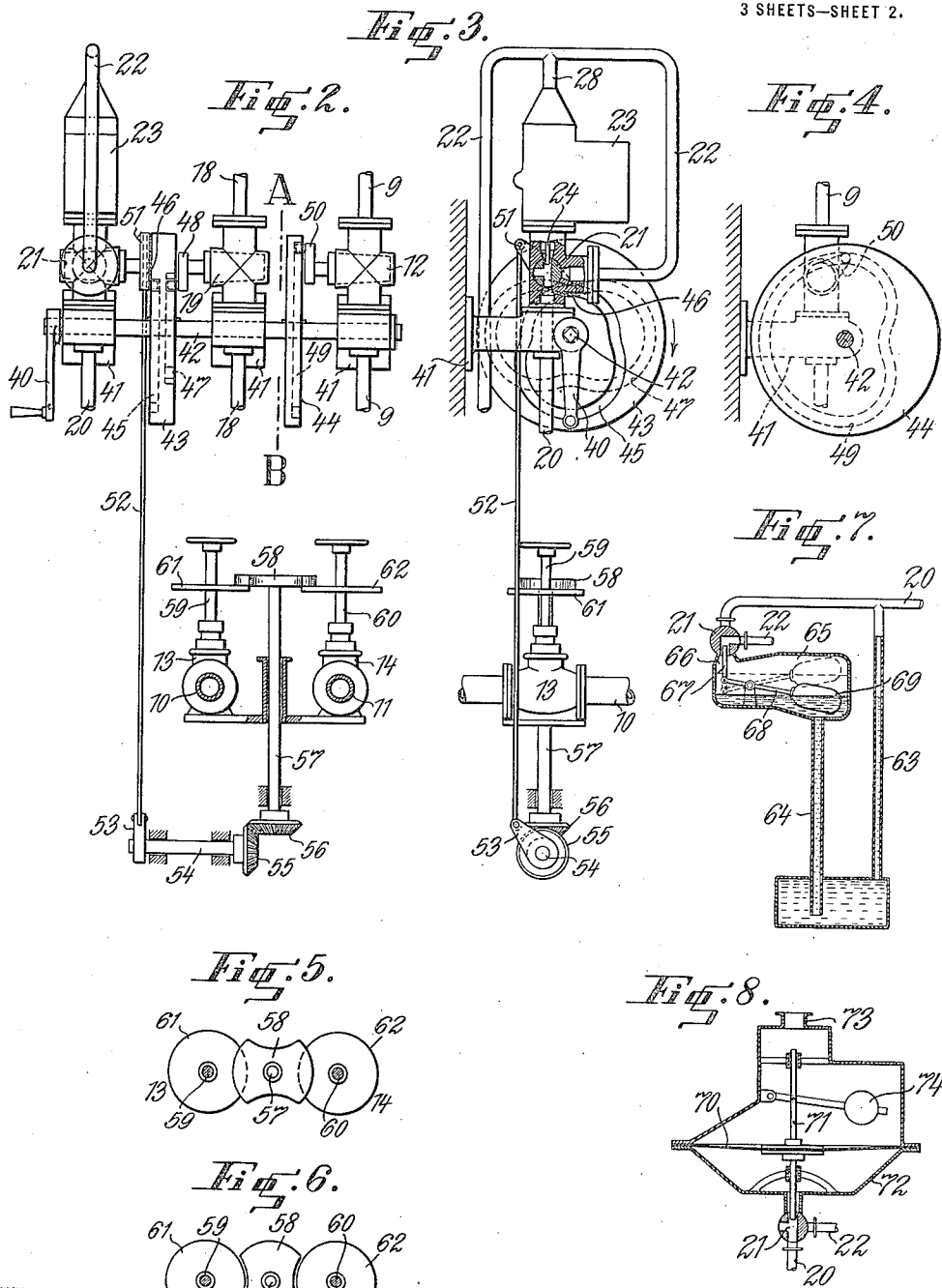
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 Georg Tasejunt.

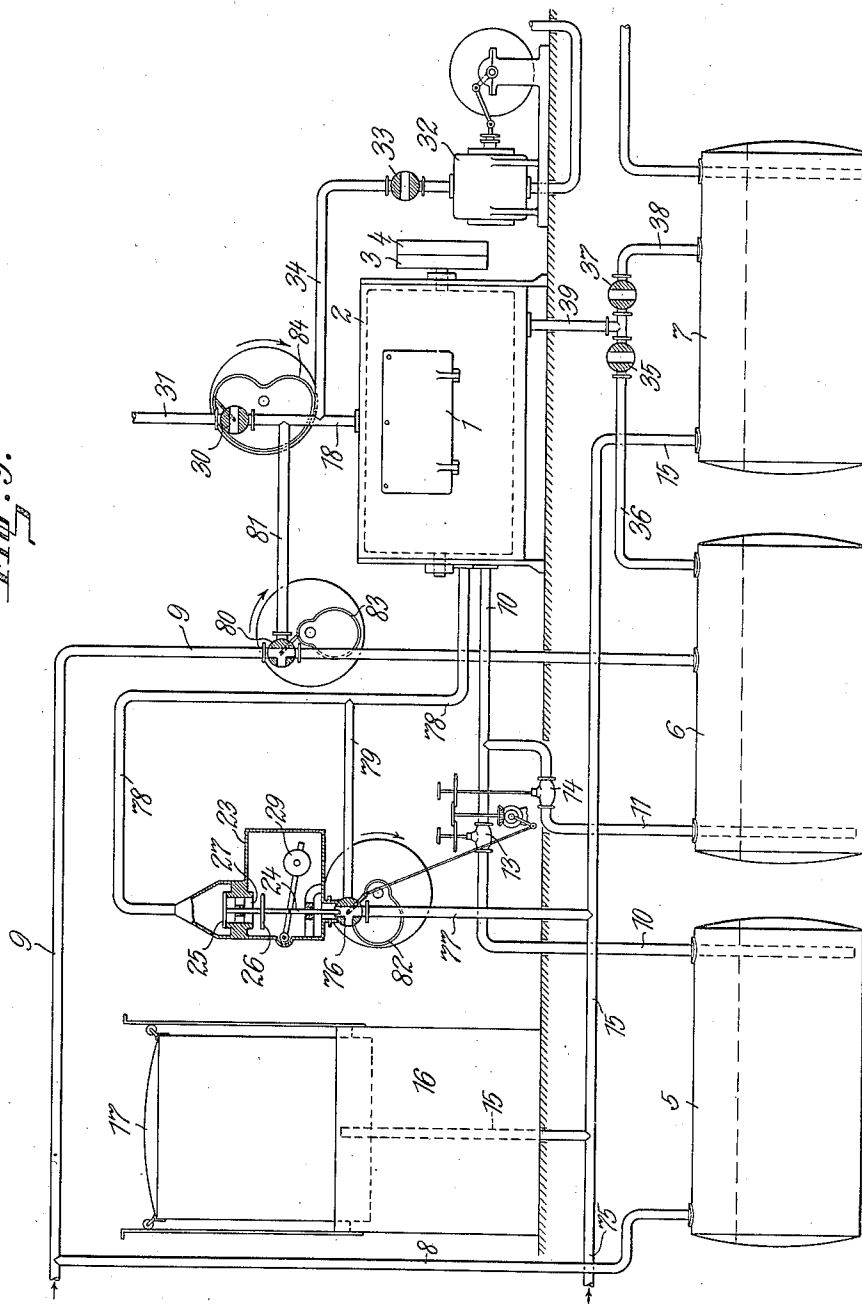
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3 SHEETS—SHEET 3.

Fig. 9.



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UNITED STATES PATENT OFFICE.

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MEANS FOR SAFEGUARDING CLOSED VESSELS AGAINST FIRE AND EXPLOSION.

1,172,884.

Specification of Letters Patent.

Patented Feb. 22, 1916.

Application filed March 26, 1913. Serial No. 757,037.

To all whom it may concern:

Be it known that I, PAUL GÜNGERICH, a citizen of the German Empire, and resident of Berlin-Steglitz, Germany, have invented certain new and useful Improvements in Means for Safeguarding Closed Vessels Against Fire and Explosion, of which the following is a specification.

This invention relates to means for safeguarding against fire and explosion, closed vessels in which materials or articles are treated with inflammable liquids in the presence of a protective gas. Instances of such treatment will be found in the chemical cleaning of clothing etc. by means of washing machines using benzin (gasolene), and in the removal of fats from bones, leather and the like in extraction apparatus using volatile solvents.

To prevent explosions in industrial processes carried out with inflammable liquids, in closed vessels, it has been proposed to introduce a non-oxidizable or inert protective gas (such as carbonic acid gas or nitrogen) into the vessel, thus preventing the vapors of the inflammable liquid from forming an explosive mixture with the air contained in the vessel in which the operation is conducted. The safety against explosion within the vessel depends on the presence of a well-determined amount of protective gas, sufficient to keep the proportions of the resulting mixture of gases below the danger point or "explosion point" of the particular mixture, the explosion points of various gases or gas mixtures being well known. Therefore, all danger of an explosion within the vessel may be avoided by not introducing the inflammable liquid into the vessel (after the latter has been closed) until there has been introduced into the vessel an amount of protective gas sufficient to form with the air contained in the vessel, a mixture which will insure the non-explosiveness of the final gaseous mixture resulting from the subsequent admixture of vapors of the inflammable liquid.

The present invention is based on the consideration that whenever two gases (in the present case, air and protective gas) one of which is under a pressure different from the other, are mixed in different propor-

tions, there will correspond to each particular mixture-proportion, a predetermined pressure prevailing in the vessel and susceptible of being utilized for the purpose of governing a locking device adapted to close a shut-off device provided in the conduit through which the inflammable liquid is supplied to the vessel. This device will remain closed, thus preventing the admission of said liquid to the vessel, until the air or the mixture of the air with the protective gas added thereto, has a predetermined pressure which will insure the non-explosiveness of the mixture formed subsequently when vapors are evolved from the inflammable liquid. The pressure which governs the locking device and the release of the shut-off device located in the conduit through which the inflammable liquid is supplied, may be obtained either by introducing the protective gas under a pressure greater than atmospheric pressure into the vessel filled with air under atmospheric pressure, or by first producing a partial vacuum in the vessel by means of a suitable exhausting device, and then utilizing this vacuum for the introduction of an amount of protective gas sufficient to prevent the formation of explosive mixture. In this latter case the protective gas need not be under a pressure higher than atmospheric pressure.

It may be desirable to provide additional means for insuring the proper supply and withdrawal of the protective gas and of the inflammable liquid, particularly if, (as in chemical washing or cleaning) separate vessels are used for pure benzin, semi-pure benzin, and soiled benzin respectively. For this purpose the shut-off devices for the protective gas and for the inflammable liquid respectively may be connected positively or operatively in such a manner that the opening and closing of these devices can be effected only in the proper order. In a hand-actuated apparatus, this is preferably accomplished by positively connecting the shut-off device or devices for the supply and withdrawal of protective gas, and the shut-off device or devices for the admission of the inflammable liquid, with a crank controlled by the locking device governed by the pressure prevailing within the vessel.

Several examples of apparatus suitable for carrying out the process described above, are shown in the accompanying drawings, in which—

5 Figure 1 is a diagrammatic elevation (partly in section) of a plant for chemical washing or cleaning, with a locking device governed by a pressure above atmospheric pressure, prevailing in the washing machine; Fig. 2 is a side elevation, upon an enlarged scale, showing one mode of constructing the operative connection between the several shut-off devices; Fig. 3 is a front elevation of the construction shown in Fig. 2, with parts in section; Fig. 4 is a section taken on line A—B of Fig. 2; Figs. 5 and 6 are top views showing the valves for shutting off the supply of the inflammable liquid, and also showing their latching device in two different positions; Figs. 7 and 8 are vertical sections representing two additional forms of construction of the locking device governed by a pressure above atmospheric pressure, prevailing in the washing machine; and Fig. 9 is a diagrammatic elevation (partly in section), of a plant for chemical washing or cleaning, with a locking device governed by a partial vacuum in the washing machine.

30 In the construction illustrated by Fig. 1, the receptacle in which the clothing or other articles to be cleaned are treated with a volatile solvent, for instance benzin, consists of a vessel 2 having a lateral door 1 adapted to close gas-tight, said vessel containing the usual perforated drum (not shown) which is rotated by means of a belt (not shown) susceptible of being applied either to the fast pulley 3 or to the loose pulley 4 on the projecting end of the drum shaft. In this example of the invention, the benzin is used over and over again for cleaning purposes, such procedure being well known. For this purpose, three receptacles are provided, to wit a pure benzin receptacle 5, the benzin of which is used only for rinsing the cleaned articles, a semipure benzin, receptacle 6, the benzin of which is used for washing the goods with the aid of the perforated drum in the vessel 2, and a soiled benzin receptacle 7, the benzin of which is purified by distillation so as to be available for further use. The benzin is stored in these receptacles 5, 6 and 7 under conditions safeguarding against explosions, the upper portions of the receptacles being filled with a non-oxidizable protective gas, such as carbonic acid gas or nitrogen. The receptacles 5 and 6 are connected by pipes 8 and 9 respectively with a tank (not shown) in which the protective gas is contained under a pressure sufficient to drive the pure benzin into the vessel 2 through a pipe 10 and the semipure benzin into said vessel through a pipe 11. In the pipe 9 for the supply of the protective gas is

arranged a shut-off device or cock 12, while the pipes 10 and 11 are provided with shut-off devices or valves 13 and 14 respectively, controlling the connection of the receptacles 5 and 6 respectively with the washing vessel 70 or machine 2. The soiled benzin receptacle 7 is supplied with protective gas through a pipe 15 connected with a gasometer 16 having a bell 17 adapted to move up and down. This gasometer is filled with a protective gas which is also adapted to be used for safeguarding the washing machine or vessel 2 against explosion. Protective gas under pressure above atmospheric pressure is supplied to the washing machine or vessel 2 80 through a pipe 18 branched off from the pipe 9 and provided with a shut-off device or cock 19, said pipe 18 leading to the top or cover of the vessel 2. This vessel is further in communication with a pipe 20, 85 which according to the position of a three-way shut-off device or cock 21 can be connected either with a pipe 22 branched off from the pipe 15 or with the interior of a casing 23. The casing 23 is provided with a yielding pressure member which in the construction illustrated by Fig. 1 consists of two valve disks 25 and 26 secured to a valve rod 24, one or the other of said disks being adapted to close the valve opening or passage 27. On the side nearest the disk 25 the passage 27 is connected with a pipe 28 branched off from the pipe 22. The pressure member 25, 26 is weighted by means of a weight 29 connected with the rod 24, the lower end of said rod being adapted to enter a bore of the plug of the cock 21, so as to lock said cock. The washing machine or vessel 2 is further connected with the surrounding air by means of a pipe 31 provided with a shut-off cock 30, and still another connection 34, provided with a shut-off cock 33, leads from the vessel 2 to an exhausting device or air pump 32. After having been used in the vessel 2, the pure benzin may be conveyed to the semi-pure benzin receptacle 6 through a pipe 36 provided with a stop cock 35. Similarly the semipure benzin, after use in the vessel 2, may be conveyed into the soiled benzin receptacle 7 through a pipe 38 provided with a shut-off device 37. The pipes 36 and 38 are branched off from a common pipe 39 connected with the bottom of the vessel 2. The cock 21, which is adapted to be locked by the pressure member 25, 26 is positively connected with the cocks 19 and 12, and also with the valves 13 and 14, in such a manner that the movements of the parts 19, 12, 13 and 14 will be dependent on the movement of the cock 21 and can be effected only in a predetermined order.

In the construction shown in Figs 2 to 6, where the shut-off devices are controlled manually by means of a crank 40 (Fig. 2), two controlling disks 43, 44 are secured to 130

the crank shaft 42 supported in bearings 41. One face of the disk 43 is provided with a cam groove 45 into which extends a crank pin 46 secured to the plug of the cock 21. The other face of the disk 43 has a cam groove 47 into which extends a crank pin 48 secured to the plug of the cock 19. The disk 44 is provided with a cam groove 49 (Fig. 4) into which extends the crank pin 50 secured to the cock 12. To the plug of the cock 21 is further secured a crank 51, connected by a link rod 52 with a crank 53 of a horizontal shaft 54 journaled adjacent to the valves 13 and 14. The rotation of the shaft 54 is transmitted, by means of meshing bevel gears 55, 56, with an upright shaft 57, held against longitudinal movement and provided with a locking member 58 which in the closed position of the valves (Figs. 2 and 5) lies against stop disks 61 and 62 provided on the valve spindles 59 and 60 respectively; the valves are thus prevented from opening. The shape of the cam grooves 45, 47, 49 and the connections for transmitting motion from the cock 21 to the member 58 which locks the valves 13 and 14, are so selected that the opening and closing of the cocks 21, 19, 12, or the unlocking of the valves 13 and 14 by turning the crank 40 will take place in the manner required for a safe operation, when the cock 21 establishes communication between the pipe 20 (and therefore the interior of the washing machine or vessel 2) and the casing 23. By means of a suitable pawl or equivalent device (not shown) the crank 40 is held against turning in one direction.

The weighting of the pressure member 25, 26 is so selected that the existence of a predetermined degree of pressure (above atmospheric pressure) in the vessel 2 will cause the said member to be raised to the position indicated by dotted lines in Fig. 1, so that the lower disk or plate 26 will close the opening or passage 27, and so that the cock 21 will be unlocked or released by the lifting of the rod 24.

The above-described device operates as follows: With the cock 21 in the locked position as shown in Fig. 1, the cock 12 controlling the supply of protective gas to the semipure benzin receptacle 6 is open, while the cock 19 controlling the supply of protective gas to the washing machine or vessel 2 and all the other cocks are closed and the valves 13, 14 are locked in their closed position. By then turning the crank 40 in the direction of the arrow, through an angle of 90°, the crank pin 48 is turned to the same extent and opens the cock 19, while the crank pins 46 and 50 remain stationary owing to the concentric curvature of the corresponding portions of the cam grooves 45 and 49 respectively, so that the locking member 58 of the valves 13 and 14 also remains sta-

tionary in its locking position. Protective gas under pressure will then flow into the washing vessel 2 and will get mixed with the air confined in said vessel or machine. As soon as the pressure of the gas mixture reaches a value corresponding to the weight bearing on the pressure member 25, 26, the latter and its rod 24 are raised, releasing the cock 21. The parts are so proportioned that the member 25, 26, will be raised only by such a pressure as will insure a non-explosive character of the mixture formed upon the subsequent evolution of gasolene or benzin vapors. Therefore, after the cock 21 has been released as described, benzin may be introduced into the washing machine or vessel 2 without any danger of an explosion. This introduction of benzin is effected by giving another quarter-turn to the crank 40, that is to say, to a position 180° from its original position, whereby the cock 21 is turned to a position in which it places the pipe 20 in direct communication with the pipe 22. As the crank 40 is thus turned, the crank 48 is turned also, to close the cock 19, while at the same time the turning of the crank pins 51 and 53 will bring the locking member 58 of the valves 13 and 14 into the releasing position shown in Fig. 6. The opening of the cock 21 causes a certain quantity of protective gas to escape from the vessel 2 through the pipes 20, 22 and 15 into the gasometer 16, and into the outer air when the bell 17 is in its upper position. This escape of gas reduces the pressure within the vessel 2, and in the particular construction shown, the protective gas under this reduced pressure, is utilized for preventing explosions in the soiled benzin receptacle 7, the cover of which is connected with a branch or end of the pipe 15.

The valves 13 and 14 having been released, the valve 14 may be opened. The amount of semipure benzin required for the cleaning operation is forced into the washing machine or vessel 2 by the pressure of the protective gas supplied to the receptacle 6 through the pipe 9; the valve 14 is then closed manually, its stop disk 62 again coming to lie under the locking member 58. When the washing operation has been completed, the cock 37 is opened to allow the soiled benzin to pass from the washing machine 2 to the soiled benzin receptacle 7. The cock 37 is then closed again, and the valve 13 opened, so that the protective gas passing from the pipe 8 into the receptacle 5 will drive a certain quantity of pure benzin from this receptacle into the washing machine 2, through the pipe 10. If the valve 13 is then closed, its stop disk 61 will also be brought back to lie under the locking member 58.

After the rinsing operation, the pure benzin used for rinsing must be conveyed into

the semipure benzin receptacle 6. Since the protective gas in this receptacle is under a higher pressure than in the washing machine 2, it would apparently be necessary to place the receptacle 6 at a level sufficiently below that of the washing machine to enable this pressure difference to be overcome by the head. In order to avoid the considerable height of the plant which such an arrangement would require, means are provided for equalizing the pressure in the semipure benzin receptacle 6 and the washing machine 2. This is accomplished by giving the crank 40 a further quarter-turn (that is to say, to a position 270° from the original position); the crank pin 50 is thus turned downward to close the cock 12, while the crank 48 is turned up to open the cock 19. Pressure in 6 and 2 will then become equalized through the connections afforded by the pipes 9 and 18, so that upon opening the cock 35 benzin may flow from the washing machine 2 to the receptacle 6 through the pipes 39 and 36. Thereupon the cock 35 is closed again.

By turning the crank 40 through an angle of 270° , the cock 21 is brought back to its original position, in which a bore of the plug aligns with the rod 24 of the pressure member 25, 26. At this time the locking member 58 assumes again the position shown in Fig. 5, in which it secures the two valves 13 and 14 in their closed position. By again turning the crank 40 another 90° (that is, to the 360° position), the crank pin 48 is swung downward to again close the cock 19 and the crank pin 50 is swung upward to again open the cock 12.

The cleaned articles contained in the washing machine 2 may then be dried in suitable apparatus (not shown) provided for this purpose; the benzin which adheres to these articles evaporates during this drying operation and may be recovered in a condenser. In order to avoid exposing the workmen to the unpleasant vapors which may escape from the apparatus upon opening the door 1, it may be advisable (before the door is opened to remove the cleaned articles from the machine 2) to withdraw the larger portion of the mixture or vapors from the washing machine 2; this may be effected by first opening the cock 33 and then operating the air pump 32 to withdraw the gaseous mixture from the washing machine through the pipe 34 and forcing said mixture out into the surrounding air, the cock 30 being opened thereupon to admit air to the washing machine.

The yielding locking device controlled by the pressure prevailing in the washing machine 2 may be constructed in other ways than shown in Fig. 1. Thus Fig. 7 illustrates a construction in which this device comprises a float and a liquid seal. The sealing liquid, for instance mercury, is contained

in communicating tubes 63, 64, one of which 63, is connected with the pipe 20 leading to the washing machine 2, while the other tube, 64, is enlarged at its upper end to form a float chamber 65, the lever of the liquid being in said chamber. At the top of the chamber is an opening or nipple 66 which according to the position of the cock 67 is connected either with the pipe 20 or with the pipe 22 leading to the gasometer 16. Before the washing machine 2 is operated, the chamber 65 communicates with the pipe 22, as shown in Fig. 7, that is to say, one bore of the plug of the cock is open to the chamber 65. Into this bore is adapted to project a locking rod 67 pivotally connected with one arm of a lever 68 fulcrumed within the casing or chamber 65, the other arm of said lever carrying a float 69. If the pressure in the washing machine 2 is the same as that of the surrounding air, the level of the liquid in the chamber 65 will be so low as to cause the rod 67 to enter the bore of the plug and thus lock the cock 21. When upon opening the cock 19, pressure rises in the pipe 20, owing to the inflow of protective gas under pressure into the washing machine 2, the level of the liquid will sink in the tube 63 and rise in the chamber 65, thus causing the float 69 to move upward, so as to withdraw the locking rod 67 from the plug of the cock 21. The surface areas of the liquid in the tube 63 and chamber 65 respectively are so proportioned that the float 69 will not reach the position in which it releases the cock 21, until the gas and air mixture in the washing machine has reached the proper pressure assuring safety. After being released, the cock 21 can be turned so as to enable the cleaning operation to be carried out in the manner described above.

As shown in Fig. 8, the yielding pressure member serving to control the locking member may be constructed as a diaphragm 70 provided with a rod 71 adapted to enter the bore of the cock plug. The diaphragm 70 is secured within a casing 72, the compartment above the diaphragm communicating with the surrounding air through a nipple 73, while the compartment below the diaphragm is connected with the pipe 20 by means of the cock 21, before the operation of the washing machine 2 is started. A weight 74 presses the diaphragm 70 downward, causing the rod 71 to remain in the bore of the cock plug until pressure within the washing machine has reached the proper degree assuring safety, when the rod 71 will have been lifted out of the plug so as to release the cock 21.

In the construction represented in Fig. 9, the release of the valves 13 and 14 controlling the supply of benzin, is made dependent on a predetermined vacuum in the washing machine 2. This presents the ad-

vantage that the protective gas to be introduced into the washing machine need not be at a pressure materially above atmospheric pressure; the excess of pressure over atmospheric pressure may, for instance, correspond to the pressure of a column of water 100 millimeters high. For this purpose, the construction shown in Fig. 1 has been modified by connecting, with the pipe 15 leading to the gasometer 16 and to the soiled benzin receptacle 7, a pipe 75 for supplying protective gas under a pressure but slightly above atmospheric pressure; furthermore, the cock 76 controlled by the yielding pressure member 25, 26 will (in the locked position shown) connect the interior of the casing 23 with the pipe 77 communicating with the pipe 15. The protective gas (under a relatively low pressure) will therefore enter the casing 23 and reach the lower face of the valve disk 25 or 26, whichever happens to be seated at the time. The other face of the said seated valve disk is exposed to the pressure prevailing in the washing machine 2, which is connected with the upper end of the casing 23 by a pipe 78. From the latter a pipe 79 leads to the cock 76 and can be connected with or disconnected from the pipe 77 by turning said cock.

A cock 80 is provided in the pipe 9 serving to supply the protective gas under a relatively high pressure to the semipure benzin receptacle 6. By a proper operation of this cock the supply of gas to the receptacle 6 may be interrupted and this receptacle at the same time placed in communication with a pipe 81 branched off from the pipe 18 which leads to the washing machine.

As in the construction shown in Figs. 1 to 6, the cock 76 may be connected by the cranks 51 and 53 with the locking member 58 of the valves 13 and 14, and with the hand crank 40 by a crank pin projecting into a cam groove 82 of a disk secured to the shaft 42 of said hand crank. The shaft 42 also carries a disk provided with a cam groove 83 controlling the position of the cock 80. The mechanism operated by the hand crank 40 further controls the vent cock 30, an eccentric pin on the plug of said cock extending into the cam groove 84 of a disk mounted on the shaft 42.

The operation of this form of the invention is as follows: After filling the washing machine 2 with the articles to be cleaned, and closing the door 1, the cock 33 is opened and a vacuum of a predetermined degree is produced in the washing machine by means of the air pump 32. The proper degree of vacuum is found by calculation in each individual case, the condition being that upon introducing the protective gas into the machine 2, this gas together with the air still contained in the machine will form a mixture which will not be explosive after it has

received, as a further constituent, the benzin vapors arising during the cleaning process.

As soon as this degree of vacuum is attained in the washing machine 2 (the vacuum extending through the pipe 78 as far as the valve disk 25), the pressure member 25, 26 is raised so that the disk 26 will close the communication of the casing 23 with the pipe 78, the rod 24 being at the same time withdrawn from the bore of the cock 76. By turning the crank 40 through 90° in the direction indicated by the arrow the cock 76 is brought to a position in which the pipe 77 connected with the supply of protective gas, communicates with the pipe 79. A certain amount of the protective gas, under a relatively low pressure, will then enter the washing machine 2. During this operation of the crank 40, the cocks 80 and 30 remain in the operative positions shown, being in operative relation at the time with the concentric portions of the cam grooves 83 and 84 respectively. At the same time the turning of the cock 76 will also release the valves 13 and 14, so that by opening the valve 14 semipure benzin may be admitted to the washing machine 2, the valve being then closed to allow the cleaning operation to be carried out in said machine.

After the spent or soiled benzin has been drawn off into the soiled benzin receptacle 7 and after a predetermined amount of pure benzin from the receptacle 5 has been introduced into the washing machine 2 by opening and then closing the valve 13, this pure benzin, used for rinsing, must be transferred to the receptacle 6. Since in this latter the prevailing pressure is the relatively high pressure of the protective gas serving to convey the benzin, while the gas mixture in the washing machine 2 is under a relatively lower pressure of the protective gas, it is necessary, as in the construction shown in Fig. 1, to equalize the pressures in the receptacle 6 and the machine 2. This is accomplished by turning the crank 40 through an angle of 90°, that is to say, to the 180° position, whereby the cock 80 is brought to a position in which the pipe 9 connected with the receptacle 6 communicates with the pipe 81. The cock 30 however remains in its closed position, notwithstanding this operation of the crank 40, while the cock 76 returns to its original position and is locked. At the same time the valves 13 and 14 are also locked in their closed position.

Before opening the door 1, the gas mixture contained in the washing machine 2 is withdrawn by means of the air pump 32 and the crank 40 is given another quarter-turn (to the 270° position), thus bringing the cock 80 back to its initial position and opening the cock 30. Only then can air enter the machine 2. Therefore, the positive connection

tion of the cock 30 with the crank 40 absolutely prevents any admission of air to the washing machine by an accidental opening of said cock, as long as a vacuum exists in said machine; such accidental admission of air would of course be liable to alter the proportion of the gaseous mixture contained in the machine, and thus to defeat the purpose of this invention. Upon giving the crank 40 another quarter-turn, that is to say, to its original position, no action takes place except the closing of the cock 30.

It will be evident that the constructions of the yielding pressure member controlled by the pressure prevailing in the washing machine which are illustrated by Figs. 7 and 8, may also be used in connection with the plan shown in Fig. 9. If desired, the shut-off devices for controlling the supply of pure benzin and semipure benzin to the washing machine may be constructed as cocks actuated by cam disks, but valves are more suitable for this purpose because they can be readily locked in the manner described above.

Various modifications may be made without departing from the nature of the invention as set forth in the appended claims.

I claim:

1. The combination, with a vessel having means whereby it may be closed to the surrounding air or thrown open, of a conduit for conveying an inflammable liquid to said vessel, a shut-off device controlling said conduit, a device for locking in its closed position the shut-off device which controls the flow through said conduit, and a pressure member operatively connected with said locking device and having a connection whereby it is exposed to the pressure prevailing within said vessel, so that the shut-off device will be unlocked when the pressure in said vessel attains a predetermined value.

2. The combination, with a vessel having means whereby it may be closed to the surrounding air or thrown open, of a conduit for conveying an inflammable liquid to said vessel, a shut-off device controlling said conduit, a pressure member under the influence of the pressure prevailing in said vessel, and means controlled by said member for holding said shut-off device in its closed position until the pressure in said vessel attains a predetermined value.

3. The combination, with a vessel having means whereby it may be closed to the surrounding air or thrown open, of a device for exhausting gas from said vessel, a connection for supplying protective gas to said vessel, a shut-off device controlling said connection, a device for locking said shut-off device in its closed position, and a pressure member connected with said locking device and having a connection whereby it

is exposed to the pressure prevailing within said vessel, so that the shut-off device will be unlocked when a vacuum of a predetermined degree has been produced in said vessel.

4. The combination, with a vessel having means whereby it may be closed to the surrounding air or thrown open, of a connection for supplying protective gas to said vessel, a shut-off device controlling said connection, a device for locking said shut-off device in its closed position, and a pressure member connected with said locking device and having a connection whereby it is exposed to the pressure of protective gas supplied at a pressure above atmospheric pressure.

5. The combination, with a vessel having means whereby it may be closed to the surrounding air or thrown open, of a connection for supplying protective gas to said vessel, a shut-off device controlling said connection, a device for locking said shut-off device, a pressure member governing the position of said locking device, additional shut-off devices controlling the flow of protective gas, a hand crank rotatable in one direction only, and operative connections between said crank and said shut-off devices to cause the latter to be opened and closed in the proper succession.

6. The combination, with a vessel having means whereby it may be closed to the surrounding air or thrown open, of receptacles adapted to contain pure benzin and semipure benzin respectively, a connection from the gas space of the semipure benzin receptacle to the gas space of said vessel, a shut-off device in said connection, another connection for supplying protective gas to said vessel, another shut-off device controlling said last-named connection, a device for locking the last-named shut-off device, a pressure member controlling the position of said locking device, and an operative connection between said shut-off devices to control the temporary equalization of pressures in the said vessel and in the semipure benzin receptacle.

7. The combination, with a vessel having means whereby it may be closed to the surrounding air or thrown open, of an exhausting device connected with said vessel, a shut-off device for controlling the connection of said vessel with the surrounding air, means for locking said shut-off device, a connection for supplying protective gas to said vessel, a shut-off device controlling said connection, a locking member for said shut-off device, a pressure member connected with said locking member and having a connection whereby it is exposed to the reduced pressure prevailing within said vessel, and an operative connection between said shut-off devices, whereby the connec-

tion of said vessel with the surrounding air cannot be established as long as a vacuum is maintained in said vessel.

8. The combination, with a vessel having means whereby it may be closed to the surrounding air or thrown open, of a connection for supplying a liquid thereto, another connection for supplying protective gas to said vessel, shut-off devices in said connections, a device for locking in its closed position the device controlling the supply of liquid to said vessel, and means governed by the pressure within the vessel, for releasing said shut-off device from its locking device after the admission of a predetermined amount of protective gas to said vessel.

9. In an apparatus for treating articles with inflammable liquids, the combination of a treatment vessel having means whereby it may be closed in an air-tight manner, or thrown open, means for supplying protective gas to said vessel, a conduit for conveying an inflammable liquid into said vessel, a shut-off device controlling said conduit, a device for locking said shut-off device, and a pressure member communicating with the interior of said vessel and having an extension which normally prevents any release of said locking device until, by the initial introduction of a predetermined amount of protective gas into said treatment vessel, a pressure condition is established in said vessel which causes said pressure member extension to be actuated, to enable the locking device to be unlocked, whereafter inflammable liquid may be introduced into said vessel.

10. In an apparatus for treating articles with inflammable liquids, the combination of a treatment vessel having means whereby it may be closed in an air-tight manner, or thrown open, means for connecting said vessel with a protective gas supply, a conduit for supplying an inflammable liquid to said vessel, a shut-off device controlling said conduit, a device for locking in its closed position, the shut-off device controlling the flow through said conduit, a gas receiver for storing protective gas of decreased pressure discharged from said vessel, a connection between said gas receiver and said vessel, a pressure member disconnectibly inserted into said connection, a device in said connection adapted in proper order to disconnect said pressure member, thereby opening a direct connection with said gas receiver, and to close said connection entirely at a later stage, a positive connection between said disconnecting and closing device and said locking device whereby both can be operated only simultaneously, and a pressure member extension which normally prevents any movement of said disconnecting and closing device until,

by the initial introduction of a predetermined amount of protective gas into said treatment vessel, a pressure condition is established in said vessel which causes said pressure member extension to be moved to enable said locking device to be unlocked, whereafter inflammable liquid may be supplied to said vessel.

11. In an apparatus for treating articles with inflammable liquids, the combination of a treatment vessel having means whereby it may be closed in an air-tight manner, or thrown open, means for supplying a protective gas to said vessel, receptacles for inflammable liquids of various degrees of purity, conduits for conveying to said vessel, inflammable liquids of various degrees of purity, shut-off devices in said conduits, a device for normally locking said shut-off devices simultaneously in their closed position, a receiver for storing protective gas discharged from said vessel, a connection between said gas receiver and said vessel, a pressure member disconnectibly inserted in the last-named connection, a flow-changing and stopping device in said connection, connected positively with said locking device in such a manner that both can be operated only simultaneously, and an extension on said pressure member, adapted to prevent any movement of said flow-changing and stopping device until a predetermined pressure condition is first established in said vessel, which pressure condition insures the presence, during the treatment of the articles, of a non-explosive mixture of gases and vapors, and causes the extension of said pressure member to come out of contact with said flow-changing and stopping device so as to release the same, whereafter said flow-changing and stopping device may be operated to unlock said locking device, thus enabling inflammable liquids to be supplied to said vessel.

12. In an apparatus for treating articles with inflammable liquids, the combination of a treatment vessel having means whereby it may be closed in an air-tight manner, or thrown open, means for initially supplying a certain amount of protective gas to said vessel, a receptacle adapted to contain an inflammable liquid in a pure state, a connection for supplying protective gas to said receptacle, a second receptacle, connected to the outlet of said treatment vessel and adapted to store for further use, inflammable liquids which has been used in said treatment vessel, means for connecting said second receptacle with a source of protective gas, conduits for conveying inflammable liquids from each of said receptacles to said treatment vessel, separate shut-off devices for controlling the flow of the liquids through each of said conduits, a single locking device for normally locking both

of said shut-off devices simultaneously in their closed position, a gas receiver and a connection thereto for storing protective gas discharged from said treatment vessel, a
 5 third receptacle adapted to receive spent liquids discharged from said treatment vessel, a connection between said third receptacle and said gas receiver for supplying protective gas of diminished pressure to said
 10 third receptacle, a pressure member disconnectibly inserted in said connection between said treatment vessel and said gas receiver, a three-way cock within the last-named connection, said cock being connected with said
 15 locking device positively in such a manner that both can be operated only together, and a safety latch on said pressure member, adapted to prevent any movement of said three-way cock until a predetermined pressure
 20 condition is first established in said vessel, which pressure condition insures the presence, during the treatment of the articles, of a non-explosive mixture of gases and vapors, and causes the safety latch of said
 25 pressure member to come out of contact with said three-way cock so as to release the same, whereafter said cock may be operated so as to unlock said locking device and to enable the inflammable liquids to be supplied to said vessel.

13. In an apparatus for treating articles with inflammable liquids, the combination of a treatment vessel having means whereby it may be closed in an air-tight manner, or
 35 thrown open, a connection for supplying a protective gas to said vessel, means for opening and closing said connection, receptacles adapted to contain pure inflammable liquid and partly soiled inflammable liquid
 40 respectively, separate connections for supplying these receptacles with protective gas, an opening and closing device in the connection for supplying protective gas to the receptacle containing partly soiled liquid, a
 45 connection between this latter receptacle and the outlet of said treatment vessel, means for temporarily equalizing the pressures in

the treatment vessel and in said last-named receptacle respectively, conduits for separately supplying inflammable liquids from
 50 each of said receptacles to said treatment vessel, a shut-off device in each of said conduits, a locking device for normally locking both of said shut-off devices simultaneously, in their closed position, a gas receiver, a
 55 connection between said receiver and the treatment vessel, a pressure member disconnectibly inserted in the last-named connection, a three-way cock located in the same connection and adapted to alternately disconnect said pressure member and to close
 60 said connection entirely, said three-way cock being connected positively with the aforesaid locking device in such a manner that both can be operated only simultaneously, an extension on said pressure member for normally locking said three-way cock until a predetermined pressure condition is established in said treatment vessel, which condition causes the pressure member to release
 70 said three-way cock, a hand crank revolvable in one direction only, operative connections between this hand crank and the said three-way cock and the said opening and closing means which controls the supply
 75 of protective gas to said treatment vessel and to said receptacle containing partly soiled inflammable liquid, whereby said cock and said opening and closing means may be actuated in the proper succession from said
 80 hand crank on the release of said three-way cock, a receptacle for receiving spent liquid from said treatment vessel, a connection between said receptacle and said gas receiver, and an exhausting device adapted to be
 85 connected temporarily with said treatment vessel.

In testimony whereof, I have hereunto set my hand in the presence of the subscribing witnesses.

PAUL GÜNGERICH.

Witnesses:

WOLDEMAR HAUPT,
 HENRY HASPER.