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Whitson et al.

[11] **3,780,761**

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[54] **APPARATUS INCLUDING AN EQUALIZATION CHAMBER FOR DISCONTINUOUS VENTING OF A VESSEL**

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[51] **Int. Cl.** **G05d 7/06,** G05d 16/18

[58] **Field of Search** 137/112, 113, 118, 137/119, 121, 122, 565, 205, 572; 141/65; 417/148

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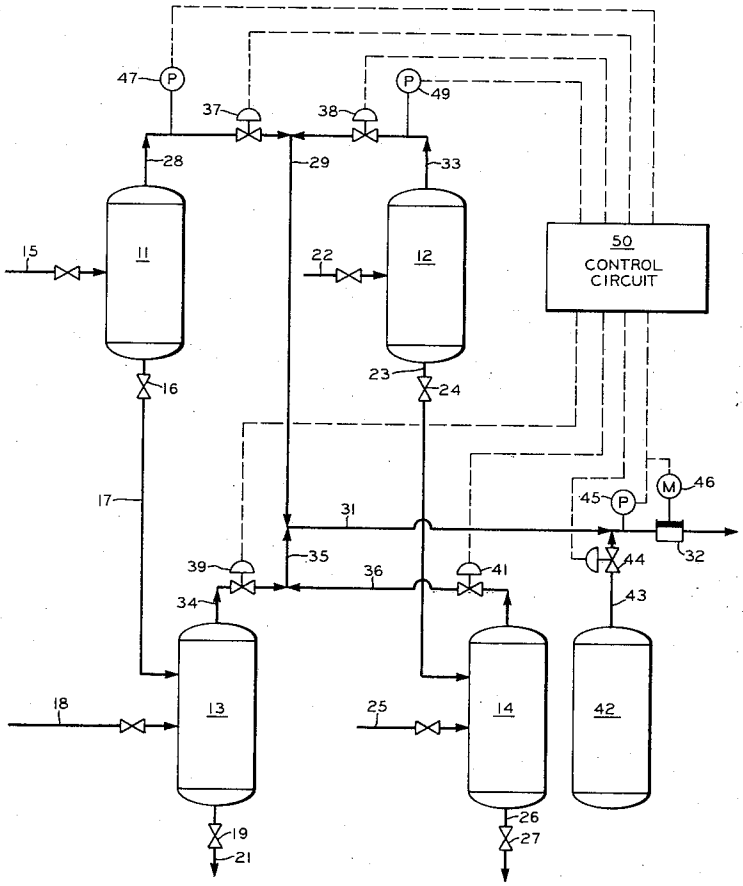
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Attorney—Quigg & Oberlin

[57] **ABSTRACT**

A vessel to be vented on a discontinuous basis is connected by first conduit means, containing a first valve means, to the inlet of a compressor. An equalization chamber is connected by second conduit means, containing a second valve means, to the first condut means at a point between the first valve means and the inlet of the compressor. The valves are selectively actuated to initially connect the vessel and the equalization chamber to permit the gas pressures therein to equalize, then to close off the chamber while the compressor withdraws additional gas from the vessel until the desired pressure is reached, and finally to withdraw gas from the chamber. The equalization chamber and compressor can be employed to sequentially vent a plurality of vessels. A control means can be utilized to perform the selective actuation of the valves.

6 Claims, 2 Drawing Figures



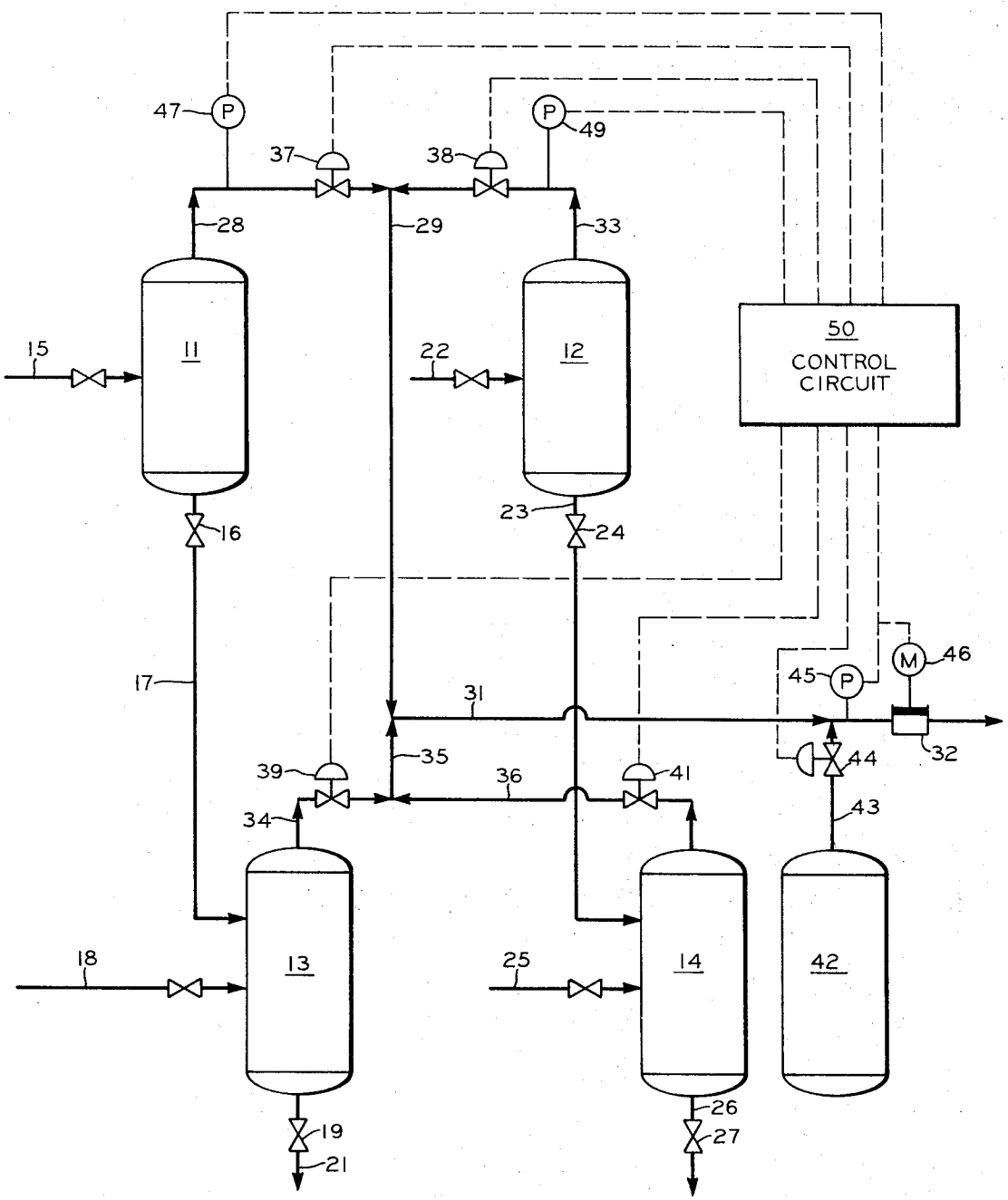

47
P
37
38
P
49
28
29
33
15
11
22
12
50
CONTROL
CIRCUIT
16
23
24
17
31
45
P
M
46
32
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35
36
41
44
34
43
18
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42
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26
27

FIG. 1

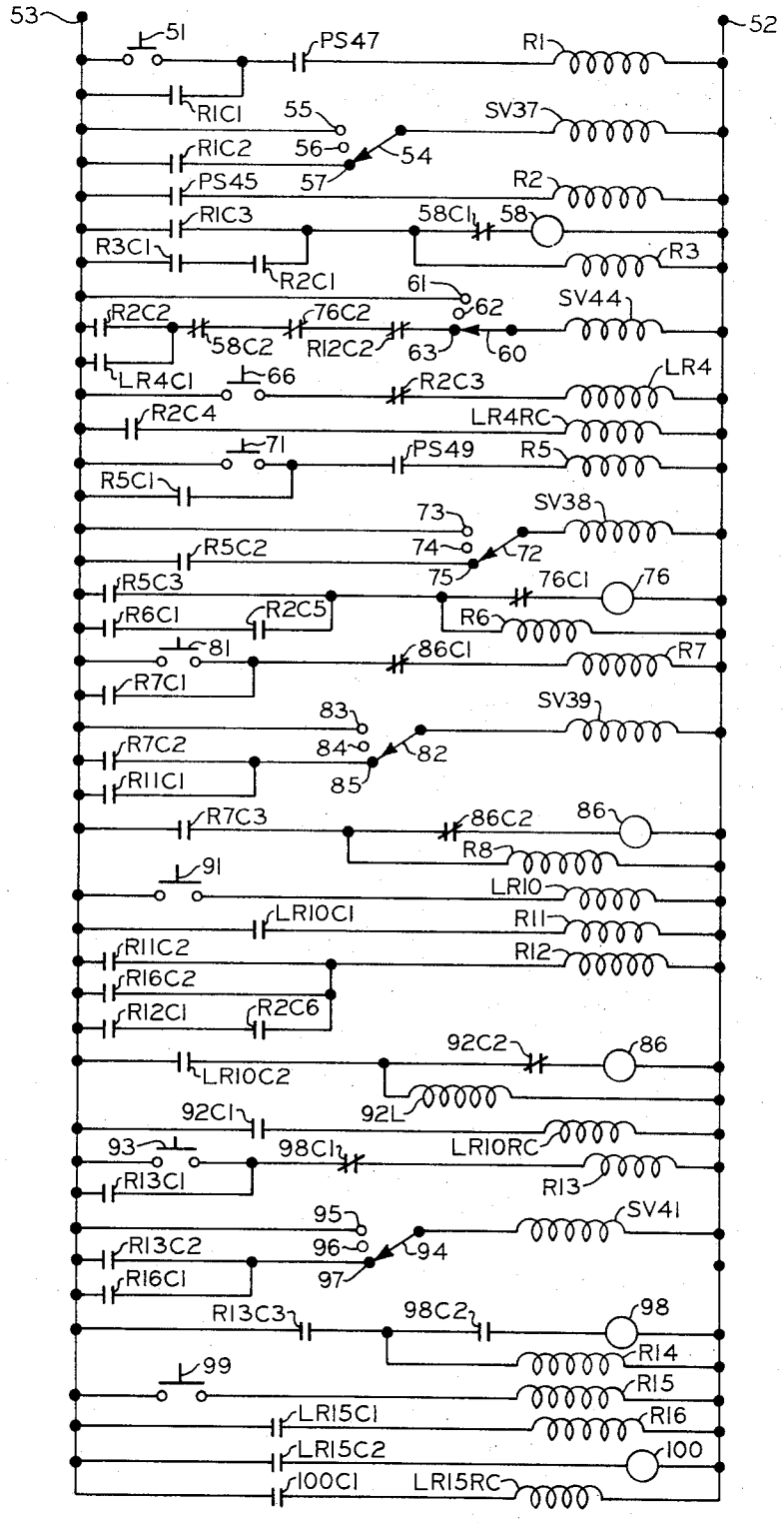

53
52
51
PS47
R1
R1C1
55
SV37
R1C2
56
54
57
PS45
R2
R1C3
58C1
58
R3C1
R3
R2C1
61
62
SV44
R2C2
76C2
58C2
R12C2
63
60
LR4C1
66
R2C3
LR4
R2C4
LR4RC
71
PS49
R5
R5C1
73
SV38
R5C2
74
72
75
R5C3
76C1
76
R6C1
R2C5
R6
81
86C1
R7
R7C1
83
SV39
R7C2
84
82
85
R11C1
R7C3
86C2
86
R8
91
LR10
LR10C1
R11
R11C2
R12
R16C2
R12C1
R2C6
92C2
86
LR10C2
92L
92C1
93
98C1
LR10RC
R13C1
R13
95
SV41
R13C2
96
94
97
R16C1
R13C3
98C2
98
R14
99
R15
LR15C1
R16
LR15C2
100
100C1
LR15RC

FIG. 2

APPARATUS INCLUDING AN EQUALIZATION CHAMBER FOR DISCONTINUOUS VENTING OF A VESSEL

The invention relates to method and apparatus for discontinuous venting of at least one vessel. In a specific aspect the invention relates to the utilization of an equilization chamber as an aid in venting a vessel.

In many batch processes it is necessary to periodically vent one or more vessels. The venting operation can consume a significant portion of the cycle time, thereby reducing production, as well as require the attention of the operator, thereby increasing the operating cost. Although larger compressors can be employed to conduct the venting operation in a shorter period of time, the larger compressors carry higher capital costs and would be utilized for a smaller percent of the time, thereby decreasing efficiency.

In accordance with the present invention it has been discovered that the use of an equalization vessel permits the time for venting a vessel to be reduced for a given size compressor and/or the size of the compressor to be reduced. The utilization of an automatic control system for operating the vent valves and the compressor substantially reduces the time of the operator needed for the venting operation.

Accordingly, it is an object of the invention to provide new and improved method and apparatus for venting a vessel on a discontinuous basis. Another object of the invention is to reduce the down time of a process necessary to permit the venting of a vessel. Yet another object of the invention is to provide an improved automatic control system for a venting operation. A further object of the invention is to reduce the time of a process operator needed to conduct the venting of a vessel. Other objects, aspects and advantages of the invention will be apparent from a study of the specification, the drawings and the appended claims to the invention.

In the drawings,

FIG. 1 is a diagrammatic representation of a process embodying the present invention, and

FIG. 2 is a schematic representation of an electrical circuit which can be utilized as the control circuit of FIG. 1.

Referring now to the drawings and FIG. 1 in particular, there is illustrated a batch reaction system comprising batch reactors **11** and **12** and their associated receiving vessels **13** and **14**, respectively. The reactants for the batch reaction are introduced into reactor **11** through one or more input lines **15**. When the reaction has reached the desired state, valve **16** in conduit **17** is opened to pass the liquid reaction product from a lower portion of reactor **11** into receiver vessel **13**. Additional reactants such as shortstop agents or chain terminating agents can be introduced into receiver vessel **13** through one or more input conduits **18**. After the desired residence time in vessel **13**, valve **19** can be opened to withdraw the liquid reaction product from vessel **13** by way of conduit **21**. Similarly, the reactants can be introduced into batch reactor **12** through one or more input conduits **22** and at the end of the desired reaction time, the liquid reaction effluent can be passed through conduit **23** and valve **24** into receiver vessel **14**. The additional reactants can be introduced into vessel **14** through one or more conduits **25** and after the desired contact time in vessel **14**, the liquid reaction product can be withdrawn therefrom by way of conduit **26** and valve **27**.

Conduits **28**, **29** and **31** are connected in series to provide fluid communication between an overhead portion of reactor **11** and the inlet of compressor **32** for the removal of excess gaseous material from reactor **11**. Similarly, conduits **33**, **29** and **31** provide fluid communication from an overhead portion of reactor **12** to the inlet of compressor **32**. The overhead portion of vessel **13** is connected to the inlet of compressor **32** by means of serially connected conduits **34**, **35** and **31** while vessel **14** is connected to the inlet of compressor **32** by the serial connection of conduits **36**, **35** and **31**. Conduits **28**, **33**, **34** and **36** contain on-off valves **37**, **38**, **39** and **41**, respectively, to permit the selective venting of the individual reactors **11** and **12** and vessels **13** and **14**.

In accordance with the present invention a vent equalization vessel **42** is connected to conduit **31** by means of conduit **43** and valve **44**. Although some of the benefits of the present invention can be achieved with vessel **42** being smaller than any of vessels **11**, **12**, **13** and **14**, it is presently preferable that vessel **42** be at least as large as and more preferably significantly larger than vessels **11**, **12**, **13** and **14**.

When it is desired to vent reactor **11**, valve **37** and valve **44** are opened to provide communication between reactor **11** and vent equalization vessel **42** and the inlet of compressor **32**. A pressure sensor **45** can be mounted on conduit **31** to determine the pressure of the gas contained therein and to establish a control signal responsive to the thus determined pressure. This control signal can be utilized to actuate motor **46** of compressor **32** when the pressure in conduit **31** reaches a predetermined level. Conduits **28**, **29** and **31** and **43** are of sufficient size to permit the gas pressure in vessels **11** and **42** to reach equilibrium quickly. After the gas pressures in vessels **11** and indicates have reached at least substantially equal values, valve **44** can be closed so that compressor **32** draws suction only on reactor vessel **11**. A pressure sensor **47** can be mounted on conduit **28**, upstream of valve **37**, to determine the pressure of the gas flowing therethrough and establish a control signal representative thereof. This control signal can be utilized to close valve **37** after the gas pressure in vessel **11** has been reduced to the desired minimum value. Valve **44** can then be opened in response to the closing of valve **37** or in response to a timer which indictates the passage of a period of time sufficient for the gas pressure in reactor **11** to have been reduced to the desired value. Thereafter compressor **32** draws suction on vent equalization vessel **42**. The venting of reactor vessel **12** can be accomplished in the same manner as for reactor vessel **11** with pressure sensor **49** being mounted in communication with vessel **12** in correspondence to the function of pressure sensor **47**.

When it is desired to vent receiver vessel **13**, valve **39** can be opened and compressor motor **46** will again be actuated by pressure sensor **45**. Valve **44** can be opened to permit the gas pressures in vessels **13** and **42** to at least substantially reach equilibrium. If desired valve **44** can then be closed and suction drawn on vessel **13** by compressor **32** until the desired minimum pressure in vessel **13** is achieved. However in some systems this may not be necessary, and valve **39** can be closed after equilibrium between vessels **13** and **42** is achieved so that compressor **32** is utilized to evacuate vessel **42**. If desired, a further reduction in the gas pres-

sure in vessel 13 can be effected by compressor 32 subsequent to the pressure in vessel 42 being reduced to the desired value, e.g., during the time that vessel 13 is being filled with the liquid reaction effluent from reactor 11. The venting of receiver vessel 14 can be accomplished in the same manner as for vessel 13.

When fully automatic control or operator initiated automatic control of the venting processes is desired, the output signals from pressure sensors 45, 47 and 49 can be transmitted to the inputs of a control circuit 50, with valves 37, 38, 39, 41, and 44 being connected to outputs of control circuit 50.

Referring now to FIG. 2, there is illustrated a specific embodiment of an operator initiated electrical control circuit which can be utilized to carry out the control functions of the control circuit 50 of FIG. 1. When the operator desires to vent reactor 11, he momentarily pushes switch 51 closed. Switch 51 is connected in series with pressure switch PS47 and relay coil R1 between the terminals 52 and 53 of a suitable source of electrical power, for example 117 volts A.C. Pressure switch PS47 is actuated to a closed position when the pressure in conduit 28, as measured by pressure sensor 47, exceeds the desired minimum value, and is in the open position when the pressure in conduit 28 is less than or equal to this desired minimum value. The simultaneous occurrence of the closed conditions of switches 51 and PS 47 actuates relay R1, thereby effecting the closure of latch switch R1C1 which is connected in parallel with switch 51 to maintain the activated state for relay R1 after the operator releases the push button of switch 51.

The solenoid coil SV 37 is connected between power supply terminal 52 and the contactor of a switch 54. Switch 54 can be manually actuated to a first position (manual open) in contact with terminal 55, which is connected to the opposite power supply terminal 53 to thereby energize solenoid coil SV37 to actuate valve 37 to an open condition. Switch 54 can be manually moved to a second position (manual closed) in contact with blank terminal 56, resulting in the de-energization of solenoid coil SV37 and the closing of valve 37. Switch 54 can be manually positioned in a third position (automatic) in contact with terminal 57, which is connected through switch R1C2 to the power supply terminal 53. Terminals 55 and 56 represent the manual mode of operation while terminal 57 represents the automatic mode of operation for valve 37. Switch R1C2 is actuated to a closed position upon the energization of relay coil R1, and when the contactor of switch 54 is on terminal 57, this results in the energization of solenoid coil SV37 and the opening of valve 37.

The actuation of relay R1 also effects the closing of switch R1C3 which is in series with timer 58 and its cam actuated normally closed switch 58C1 between the power supply terminals 52 and 53, thereby starting timer 58. Timer clutch coil R3 is also connected in series with switch R1C3 between terminals 52 and 53 and is energized upon the closing of switch R1C3. Pressure switch PS45 and relay coil R2 are connected in series between the power supply terminals, and normally open switch PS45 is actuated to a closed condition when the signal from pressure sensor 45 indicates that the pressure in conduit 31 exceeds the desired minimum operating value for the inlet of compressor 32. The signal from pressure sensor 45 also turns on compressor motor 46 when the pressure in conduit 31 exceeds this desired minimum operating value. Normally open switches R3C1 and R2C1 are connected in series across the terminals of switch R1C3. Switch R2C1 is closed upon the actuation of relay R2 while switch R3C1 is closed upon the actuation of timer clutch coil R3. Simultaneous occurrence of the closed condition of switches R3C1 and R2C1 will maintain timer clutch coil R3 actuated even though relay R1 is subsequently deactuated, thereby opening the switch R1C3.

Solenoid coil SV44 is connected between terminal 52 of the power supply and the contactor of switch 60. Switch terminal 61 is connected to the terminal 53 of the power supply and represents the manual mode of opening valve 44. Blank terminal 62 represents the manual mode position for de-energizing solenoid coil SV44 and thereby closing valve 44. Terminal 63 is connected to the terminal 53 of the power supply through a serial arrangement of normally closed switches R12C2, 76C2, and 58C2 and normally open switch R2C2. When the contactor of switch 60 is on terminal 63 (automatic mode), the activation of relay R2 effects the closing of normally open switch R2C2, thereby activating solenoid coil SV44 to open valve 44 to the vent surge vessel 42.

At the expiration of a preset time period determined by the setting of timer 58, the timer operated cam opens switch 58C2 to deactivate solenoid coil SV44, thereby closing valve 44. The period of time determined by timer 58 is sufficient for the gas pressure in vessels 11 and 42 to become equalized. The timer 58 then maintains switch 58C2 in the opened condition until timer clutch coil R3 is de-energized. Compressor 32 continues the evacuation of reactor vessel 11 until the pressure therein reaches the predetermined desired value, at which time the signal from pressure sensor 47 opens switch PS47, thereby deactuating relay R1 and opening switches R1C1, R1C2 and R1C3. The opening of switch R1C2 deactuates solenoid coil SV37, thereby causing valve 37 to close. Compressor 32 continues a reduction in the pressure of the gas in conduit 31 until the pressure measured by pressure sensor 45 reaches the preset value at which pressure switch PS45 is opened and compressor motor 46 is deactuated, thereby de-energizing relay R2 to open switches R2C1 and R2C2. The opening of switch R2C1 deactivates timer clutch coil R3 which resets timer 58, as switch R1C3 is already open.

This leaves vent equalization vessel 42 containing the equilibrium quantity of gaseous material from reactor 11. When the operator is ready to vent vessel 42, he momentarily actuates push button control switch 66, which is connected in series with normally closed switch R2C3 and latching relay coil LR4 between the terminals of the power supply. Switch R2C3 is in the closed position when relay R2 is de-energized as a result of pressure switch PS45 being open because the pressure in conduit 31 is less than the minimum desired operating value for compressor 32. Similarly, switch R2C3 is in the open condition whenever switch PS45 is closed. The actuation of latching relay coil LR4 closes switch LR4C1, which is in parallel with switch R2C2, thereby energizing solenoid coil SV44, resulting in valve 44 being opened. The gaseous material in vessel 42 enters conduit 31 and the resulting increase in pressure is detected by pressure sensor 45 and compressor motor 46 is energized. Pressure sensor 45 also closes pressure switch PS45, thereby energizing relay

R2. The actuation of relay R2 results in the closing of switch R2C2 to provide an alternate path for the actuation of solenoid SV44. The actuation of relay R2 also opens switch R2C3 to prevent accidental actuation of latch relay LR4, and closes switch R2C4, thereby actuating latch relay release coil LR4RC to return latch relay R4 to its normal unactivated condition. Compressor 32 continues the evacuation of vent equalization vessel 42 until the gas pressure measured by pressure sensor 45 drops sufficiently low for the pressure signal to cause switch PS45 to open, thereby deactuating relay R2. The deactuation of relay R2 effects the opening of switch R2C2, resulting in the de-energization of solenoid coil SV44 and the accompanying closing of valve 44. At this time the venting operation for reactor 11 has been completed and the venting system is available for venting of the next vessel.

When the operator desires to vent reactor vessel 12, he momentarily pushes manual push button 71, which is connected in series with pressure switch PS49 and relay R5. Pressure switch PS49 and relay R5. Pressure switch PS49 is maintained in a closed condition by the signal from pressure sensor 49 so long as the measured gas pressure in conduit 33 upstream of valve 38 exceeds the predetermined desired minimum value, and is in the open position when the pressure in conduit 33 is less than or equal to this desired minimum value. Upon the simultaneous occurrence of the closed condition of switches 71 and PS49, relay R5 is actuated, resulting in the closing of switch R5C1 which is in parallel with switch 71, thereby maintaining the energization of relay R5 after switch 71 is released.

The solenoid coil SV38 is connected between power supply terminal 52 and the contactor of a switch 72. The manual open mode switch terminal 73 is connected to power supply terminal 53, while the manual closed mode switch terminal 74 is a blank terminal. The automatic mode terminal 75 is connected to power supply terminal 53 through switch R5C2. Switch R5C2 is actuated to a closed position upon the energization of relay coil R5, and when the contactor of switch 72 is in the automatic mode position, this results in the energization of solenoid coil SV38 and the opening of valve 38.

The activation of relay R5 also effects the closing of switch R5C3 which is in series with timer 76 and its cam operated normally closed switch 76C1 between the power supply terminals 52 and 53, thereby starting timer 76. Timer clutch coil R6 is also connected in series with switch R5C3 between terminals 52 and 53, and is energized upon the closing of switch R5C3. Normally open switches R6C1 and R2C5 are connected in series across the terminals of switch R5C3. Switch R2C5 is closed upon the actuation of relay R2, while switch R6C1 is closed upon the actuation of timer clutch coil R6. Simultaneous occurrence of the closed condition of switches R2C5 and R6C1 will maintain timer clutch coil R6 actuated even though relay R5 is subsequently deactuated thereby opening switch R5C3. The actuation of relay R2 closes switch R2C2 to energize solenoid coil SV44 and thereby open valve 44.

At the expiration of a preset time period determined by the setting of timer 76, switch 76C2 is opened by the timer operated cam to deactivate solenoid coil SV44, thereby closing valve 44. This period of time determined by timer 76 is sufficient for the gas pressure in vessels 12 and 42 to become equalized. Compressor 32 continues the evacuation of reactor 12 until the pressure therein reaches the predetermined desired value, at which time the signal from pressure sensor 49 opens switch PS49, thereby deactuating relay R5 and opening switches R5C1, R5C2 and R5C3. The opening of switch R5C2 deactuates solenoid coil SV38, thereby causing valve 38 to close. Compressor 32 continues a reduction in the pressure of the gas in conduit 31 until the pressure measured by pressure sensor 45 reaches the predetermined value at which time the compressor motor 46 is deactuated and pressure switch PS45 is opened, thereby de-energizing relay R2 to open switches R2C2 and R2C5. The opening of switch R2C5 deactivates timer clutch coil R6 as switch R5C3 is already open. This leaves the vent equalization vessel 42 containing the equilibrium quantity of gaseous material from reactor 12, and this can be vented by the operator closing switch 66 as previously described in connection with the venting of reactor 11.

When the operator desires to vent receiver vessel 13, he momentarily closes push button switch 81. Switch 81, relay R7, and normally closed switch 86C1 are connected in series between power supply terminals 52 and 53. The simultaneous occurrence of the closed conditions for switches 81 and 86C1 results in the energization of relay R7, which effects the closing of latch switch R7C1, the latter being connected in parallel with switch 81 to maintain the energization of relay R7.

Solenoid coil SV39 is connected between power supply terminal 52 and the contactor of switch 82. The manual open mode terminal 83 of switch 82 is connected to power supply terminal 53, while the manual closed mode terminal 84 is a blank terminal. The automatic mode terminal 85 is connected to power supply terminal 53 through switch R7C2. The energization of relay R7 effects the closing of switch R7C2 to activate solenoid coil SV39 when switch 82 is in the automatic mode position. When solenoid coil SV39 is in the activated state, it effects the opening of valve 39 to provide fluid communication between receiver vessel 13 and the inlet of compressor 32. The increase in pressure resulting from the flow of gas from vessel 13 into conduit 31 is measured by pressure sensor 45, and the signal from pressure sensor 45 activates compressor motor 46 and PS45 which activates relay R2. Relay R2 closes switch R2C2 to energize solenoid coil SV44, thereby opening valve 44.

The actuation of relay R7 also closes switch R7C3, which is connected in series with timer 86 and cam operated, normally closed switch 86C2 between power supply terminals 52 and 53. Timer clutch coil R8 is also connected in series with switch R7C3 between terminals 52 and 53. Thus, the closing of switch R7C3 results in the activation of timer 86 and timer clutch coil R8. Even with compressor 32 in operation, the gas pressures in receiving vessel 13 and vent surge vessel 42 reach equilibrium in a short period of time. Timer 86 is set so that shortly after this period of time necessary for the gas pressures in vessels 13 and 42 to reach equilibrium, the timer operated cam opens switch 86C1 to deactivate relay R7, which in turn causes switches R7C1 and R7C2 to open, the latter effecting the deactivation of solenoid coil SV39 and thus the closing of valve 39. The deactivation of relay R7 also results in the opening of switch R7C3 to deactuate timer clutch coil R8 and to thereby reset timer 86. Compressor 32 continues operation until the pressure in conduit 31

reaches the minimum desired operating value, at which time the compressor motor **46** is shut off and switch **PS45** is opened, thereby deactuating relay **R2** and opening switch **R2C2**, thus closing valve **44**.

When the operator determines that it is time to transfer the liquid contents of reactor **11** through conduit **17** into receiver vessel **13**, he opens valve **16** and momentarily closes push button switch **91**. Latching relay **LR10** and switch **91** are connected in series between power supply terminals **52** and **53**.

The energization of latching relay **LR10** closes switch **LR10C1**, which is connected in series with relay **R11** between terminals **52** and **53**. The actuation of relay **R11** closes switch **R11C1**, the latter being connected in parallel with switch **R7C2**, thereby activating solenoid coil **SV 39** to open valve **39**. The actuation of relay **R11** also closes switch **R11C2**, which is connected in series with relay **R12** between power supply terminals **52** and **53**. Switches **R12C1** and **R2C6** are connected in series across the terminals of switch **R11C3** to provide an alternate path to maintain the activation of relays **R12**. Switch **R12C1** is closed by relay **R12** during the activated period thereof, while switch **R2C6** is closed by relay **R2** during the period of activation of relay **R2**. Relay **R12** also opens normally closed switch **R12C2**, thereby preventing the actuation of solenoid coil **SV44** when relay **R2** closes switch **R2C2** in response to the pressure in conduit **31** reaching a value sufficient to close switch **PS45**. The gaseous material from receiver vessel **13** enters conduit **31** and pressure sensor **45** transmits a signal to turn on compressor motor **46** and to close switch **PS45**.

The activation of relay **LR10** also closes switch **LR10C2** to energize timer **92**, which is connected in series with switch **LR10C2** between terminals **52** and **53**. At the end of a period of time determined by the setting of timer **92**, a timer cam actuates switch **92C1** to energize latch release coil **LR10RC** to return relay **LR10** to its normal unactivated state. This results in switches **LR10C1** and **LR10C2** being opened, the former causing relay **R11** to be de-energized, thereby opening switches **R11C1**, **R11C2** and **R11C3**. The opening of **R11C1** results in the deactivation of solenoid coil **SV39** and the closing of valve **39** as switch **R7C2** is not closed in this sequence of operations. Relay **R12** remains energized as long as switch **R2C6** is closed. However, compressor **32** quickly reduces the pressure in conduit **31** to the value necessary to effect the opening of switch **PS45** and the deactivation of relay **R2**, thereby opening switch **R2C6** and de-energizing relay **R12**.

When the operator determines that it is time to vent receiver vessel **14**, he momentarily closes push button switch **93**. Switch **93**, relay **R13** and normally closed switch **98C1** are connected in series between power supply terminals **52** and **53**. The simultaneous occurrence of the closed conditions for switches **93** and **98C1** results in the energization of relay **R13**, which effects the closing of latch switch **R13C1**, the latter being connected in parallel with switch **93** to maintain the energization of relay **R13**.

Solenoid coil **SV41** is connected between power supply terminal **52** and the contactor of switch **94**. The manual open mode terminal **95** is connected to power supply terminal **53**, while the manual closed mode terminal **96** is a blank terminal. The automatic mode terminal **97** is connected through normally open switch **R13C2** to power supply terminal **53**. The energization of relay **R13** effects the closing of switch **R13C2** to activate solenoid coil **SV41** when switch **94** is in the automatic mode position. When solenoid coil **SV41** is in the activated state, it opens valve **41** to provide fluid communication between receiver vessel **14** and the inlet of compressor **32**. The resulting increase in pressure in conduit **31** is detected by pressure sensor **45** and compressor motor **46** and relay **R2** are activated. Relay **R2** closes switch **R2C2** to activate solenoid coil **SV44**, thereby opening valve **44**.

The actuation of relay **R13** also closes switch **R13C3**, which is connected in series with timer **98** and its associated cam operated, normally closed switch **98C2**. Timer clutch coil **R14** is also connected in series with switch **R13C3** between power supply terminals **52** and **53**. Thus, the closing of switch **R13C3** results in the energization of timer **98** and timer clutch coil **R14**. Timer **98** is set so that a short time after the gas pressures in vessels **14** and **42** reach equilibrium, the timer operated cam opens switch **98C1** to deactivate relay **R13**, thereby opening switches **R13C1** and **R13C2**, deactivating solenoid coil **SV41** and closing valve **41**. Shortly thereafter pressure sensor **45** shuts off compressor motor **46** and opens switch **PS45** to deactivate relay **R2** and close valve **44**.

When the operator determines that it is time to transfer the liquid contents of reactor **12** through conduit **23** into receiver vessel **14**, he opens valve **24** and momentarily closes push button switch **99**. Latching relay **LR15** and switch **99** are connected in series between power supply terminals **52** and **53**. The activation of latching relay **LR15** effects the closing of normally open switch **LR15C1**, which is connected in series with relay **R16** between terminals **52** and **53**. The actuation of relay **R16** closes switch **R16C1** which is connected in parallel with switch **R13C2**, thereby activating solenoid coil **41** to open valve **41**. The actuation of relay **R16** also closes switch **R16C2**, which is connected in parallel with switch **R11C2** to energize relay **R12**. Switches **R12C1** and **R2C6** again provide an alternate path to maintain the activation of relay **R12** after relay **R16** is de-energized. Switch **R12C1** is closed by relay **R12** during the activated period thereof, while switch **R2C6** is closed by relay **R2** during the period of activation of relay **R2**. Relay **R12** again opens normally closed switch **R12C2** to prevent the actuation of solenoid coil **SV44**, thereby maintaining valve **44** closed, even though the pressure in conduit **31** reaches a value sufficient to activate relay **R2** and motor **46**.

The activation of relay **LR15** also closes switch **LR15C2** to energize timer **100**. At the end of a period of time determined by the setting of timer **100**, a timer cam closes switch **100C1** to energize latch relay release coil **LR15RC** to return relay **LR15** to its normal unactivated state. This period of time is sufficient for compressor **32** to reduce the gas pressure in receiver vessel **14** to the desired value. The restoration of relay **LR15** to its normal position opens switches **LR15C1** and **LR15C2**, thereby deactivating relay **R16** and timer **100**. The deactivation of relay **R16** opens switch **R16C1** to close valve **41** and opens switch **R16C2** to permit the de-energization of relay **R12** as soon as switch **R2C6** is opened by the deactivation of relay **R2**.

Reasonable variations and modifications are possible within the scope of the foregoing disclosure, the drawings and the appended claims to the invention.

What is claimed is:

1. Apparatus for venting a vessel on a discontinuous basis comprising a first vessel from which gas is to be vented; a compressor having an inlet and an outlet; first conduit means connected to said inlet of said compressor and to said first vessel to provide fluid communication between the interior of said first vessel and the inlet of said compressor; a first valve means operatively positioned in said first conduit means; a second vessel; second conduit means connected to said second vessel and to said first conduit means at a point between said first valve means and said inlet of said compressor to provide fluid communication between the interior of said second vessel and said first conduit means; second valve means operatively positioned in said second conduit means; said first and second conduit means being of sufficient size to permit the gas pressures in said first and second vessels to at least substantially reach an equilibrium condition within a period of time after both of said first and second valve means are actuated to open positions; and control means for initially actuating said first and second valve means to open positions and for actuating said compressor each time said first vessel is to be vented, for actuating said second valve means to a closed position at the expiration of said period of time after said initial actuation of said first and second valve means to open positions, for actuating said first valve means to a closed position after the gas pressure in said first vessel has been reduced a significant amount below the value thereof at said equilibrium condition, for actuating said second valve means to an open position for reducing the pressure in said second vessel after said first valve means has been actuated to a closed position, and for deactuating said compressor after the gas pressure in said second vessel has been reduced to the desired value therefor.

2. Apparatus in accordance with claim 1 wherein said second vessel is at least substantially as large as said first vessel.

3. Apparatus in accordance with claim 1 wherein said control system comprises first pressure sensing means for determining the gas pressure in said first vessel and second pressure sensing means for determining the pressure in said first conduit means at a point between said first valve means and said inlet of said compressor.

4. Apparatus in accordance with claim 3 wherein said control means further comprises electrical relay circuits for selectively actuating said first valve means and said second valve means and containing at least one relay switch actuatable by a signal from said first pressure sensing means and at least one relay switch actuatable by signal from said second pressure sensing means.

5. Apparatus in accordance with claim 1 further comprising another vessel from which gas is to be vented, third conduit means connected to said another vessel and to said first conduit means at a point between said first valve means and said inlet of said compressor to provide fluid communication between the interior of said another vessel and said first conduit means, third valve means operatively positioned in said third conduit means, said control means further comprising means for selectively actuating said third valve means instead of said first valve means when said another vessel is to be vented.

6. Apparatus in accordance with claim 5 wherein said control means comprises means for initially actuating said third valve means and said second valve means to open positions and for actuating said compressor when it is desired to vent said another vessel while maintaining said first valve means in a closed position, for then actuating said third valve means to a closed position after the gas pressures in said another vessel and said third vessel have at least substantially reached equilibrium condition, and then for deactuating said compressor after the gas pressure in said second vessel has been reduced to the desired value therefor.

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