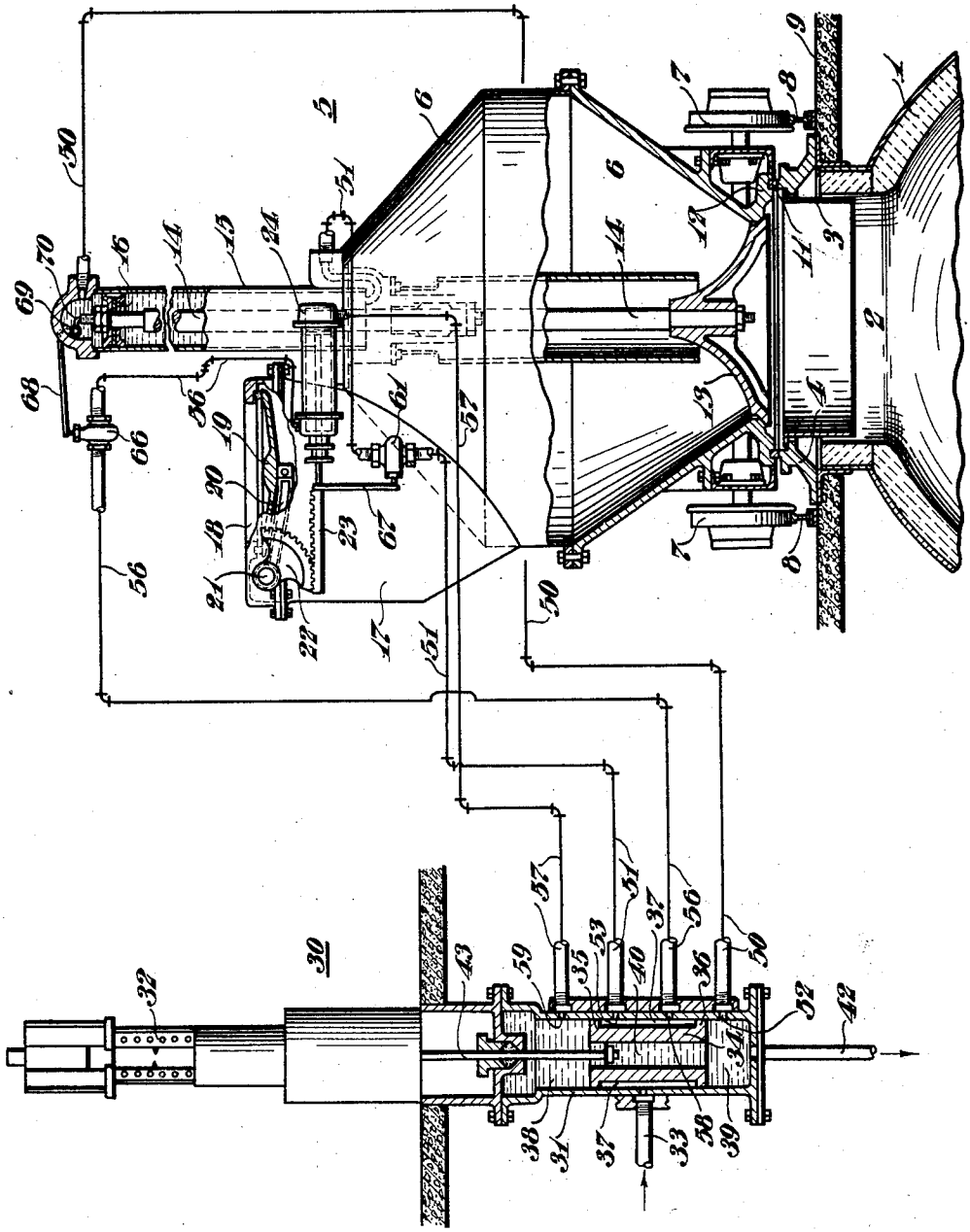
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CHARGING APPARATUS FOR GAS GENERATORS

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CHARGING APPARATUS FOR GAS GENERATORS

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This invention relates to gas generators and it has particular relation to charging devices which admit a predetermined quantity of fuel to a generator.

Such a charging device is described and claimed in U. S. Patent No. 1,597,314, granted August 24, 1926, to A. C. Howard and Thomas W. Stone. The present invention will be described with respect to the Howard & Stone charger but is applicable to other devices of the same character.

In such charging devices there is commonly provided a hopper adapted to be positioned over the charging opening of a gas generator. Within this hopper is positioned a valve which may serve both as a door for the generator and as a distributor for the fuel released from the hopper into the generator. Admission of fuel into the hopper is provided for by means of a second valve or inlet door suitably positioned in said hopper or in a chute communicating therewith.

An object of the present invention is to provide means for preventing the opening of both of said valves at the same time.

A further object of my invention is to prevent communication between the interior of the generator and the atmosphere.

My invention has for further objects such other operative advantages and results as may hereinafter be found to obtain.

It will be apparent that communication between the interior of the generator and the atmosphere at any time when the generator is filled with combustible gas may result in ignition and explosion which would ordinarily take place in the hopper of the charging apparatus and which might be attended with serious consequences.

While the devices employed for operating the charging device are ordinarily so constructed as to provide for opening only one of the charging device valves at one time, either one of said valves may occasionally be prevented from closing properly by some accidental cause. For example, lumps of coal and coke have been known to become wedged in the charging device in such position as to prevent the seating of the charging valve. This condition is not visible to the operator under ordinary circumstances, although access is ordinarily provided to the charging hopper, so that obstructions may be removed when necessary.

Accordingly, I provide means for interlocking the doors or valves of the charging apparatus; that is, I provide means for positively preventing movement of either of said valve mechanisms whenever the other of said valve mechanisms is in an open position.

In order that my invention may be clearly set forth and understood, I now describe, with reference to the accompanying drawing, the preferred manner in which it is accomplished and embodied.

In the drawing, the single figure is a vertical view, partly in elevation and partly in section, certain parts being more or less diagrammatically represented and parts being broken away, of charging apparatus for a gas generator, including a portion of said gas generator and means for operating said charging apparatus.

Referring to the drawing, a gas generator 1 is provided at its upper extremity with a charging opening 2 that is in turn provided with a protecting sleeve 3 supported by a sealing ring 4.

The charging apparatus 5 comprises in part a hopper 6 adapted to be positioned over the charging opening 2. The hopper 6 is so designed as to be movable laterally to and fro with respect to the generator 1. For this purpose, it is supported upon wheels 7 mounted in a vertically adjustable truck (not shown) and supported, when desired, upon tracks 8 and an operating floor 9. When in position over the charging opening 2 of the generator 1, the wheels 7 are raised and the hopper 6 is lowered until a gasket 11, carried by a flange 12, which forms a part of the lower portion of the hopper 6, engages the sealing ring 4 and prevents communication with the atmosphere at this point.

The charging apparatus 5 is provided with a charging valve 13, which serves as a closure means for the hopper 6 and a door for the generator 1. The charging valve 13 also serves as means for distributing the fuel released from the hopper 6 into the generator 1.

The charging valve 13 is operatively connected by means of a rod or shaft 14 to a hydraulic cylinder 15, the upper end of the shaft 14 terminating in a piston 16 slidably positioned within the hydraulic cylinder 15. By means of hydraulic pressure within the cylinder 15, which may be controlled as will hereinafter be shown, the shaft 14 and charging valve 13 may be held in the uppermost position, as shown in the drawing, or may be lowered into the interior of the generator 1 for the purpose of releasing fuel from the hopper 6 into the generator 1.

The hopper 6 is further provided with a chute 17 communicating therewith and the chute is, in turn, provided at its other extremity with an inlet 18 and a corresponding inlet door 19. The inlet door 19 is operatively connected by means of an arm 20, a shaft 21, a gear segment 22 and a rack 23 to a hydraulic cylinder 24. By means of hydraulic pressure admitted to the cylinder 24, the inlet door 19 may be opened for the purpose of admitting fuel to the hopper 6 or brought into the closed position, as shown in the figure.

The usual procedure with respect to charging the generator 1 with fuel is to maintain the charging valve 13 closed while fuel is admitted to the hopper 6 through the inlet 18, the inlet door 19 being in its open position. Subsequently the inlet door 19 is closed and then the charging valve 13 may be lowered, releasing the contents of the hopper 6 into the generator 1, after which the valve 13 is raised into the closed position and the process may then be repeated.

Various devices may be employed for operating the hydraulic cylinders of the charging valve 13 and inlet door 19 but I prefer to use a control device, indicated generally by 30, which consists, in the main, of a control cylinder 31 and a timing device 32. The control cylinder 31 is provided, about midway of its height, with a hydraulic pressure inlet 33. Within the control cylinder 31 is situated a more or less spool-shaped control valve 34 that is provided at its upper and lower ends with flanges 35 and 36, respectively, that slidably engage the walls of a cylinder 31. There is thus provided an annular space 37 which is bounded by the sides of the cylinder 31, the flanges 35 and 36 and the central portion of the control valve 34. This space 37 is always in communication with the hydraulic pressure inlet 33 and consequently always constitutes a high-pressure zone.

The remaining portions 38 and 39 of the interior of the cylinder 31 not occupied by the control valve 34 or the high-pressure zone 37 are in communication with each other through a conduit 40 within the control valve 34 and also with a drain or discharge pipe 42. The spaces 38 and 39 accordingly constitute low-pressure zones.

In the operation of the control device 30, the control valve 34, which is operatively connected by means of a rod 43 to the timing device 32, is moved through a series of successive up-and-down strokes within the cylinder 31. The various valves of the gas generating mechanism—for example, a carburetted water-gas set—are provided with operative hydraulic cylinders. Pairs of hydraulic pressure and relief lines provide communication between the ends of said cylinders and corresponding ports in the sides of the control cylinder 31. Each of the ports is so positioned as to be separated from the corresponding port by a space equal to the distance between the flanges 35 and 36 of the valve member 34. As the control valve 34 travels past a pair of ports, one of the ports is placed in communication with the high-pressure zone 37 and the corresponding port is simultaneously placed in communication with one of the low-pressure zones 38 or 39, thus causing water under pressure to flow against one side of the piston of the hydraulic cylinder of the particular valve and causing the opposite side to be relieved by a flow of the confined liquid into the cylinder 31 and the exit pipe 42, thus effecting a stroke of the piston and a corresponding opening, closing or reversing of the operating valve. When the control valve 34 reaches the end of its stroke, it reverses and, at some time during the succeeding and opposite stroke, it passes these ports again. At this time, the pressure conditions are reversed in the hydraulic cylinder and the particular operating valve connected therewith is reversed or closed or opened, as the case may be.

It will be noted that the automatic control 30 is substantially that described and shown in United States Patent No. 1,670,911, granted May 22, 1928, to Thomas W. Stone and Walter A. Barr. In that patent is stated in detail the manner of operating this device, including a description to the effect that the total cycle of operation is only a mere seven or eight minutes (see matter commencing at line 36 on page 7 and continuing to line 2 on page 8 of said patent), and also that the individual periods of the cycle are adjustable to from five to fifteen seconds (see lines 95 to 99 on page 1 of said patent).

In view of this, it is obvious that, to be effective for the purposes indicated, control of the interlocking means must be adjusted so as to time with these extremely short intervals, so that automatic operation is practically essential. In view of this fact, and in view of the fact that some of the valves controlled are applied to a movable charging device such as that described in the Howard and Stone patent above recited, it is substantially necessary that the movement of these valves be controlled positively by equally quick acting means both as to opening and closing of the same.

In the present instance, the various operating valves of the water-gas set, with the exception of the valves incident to the operation of the automatic charging device, are not illustrated, but the foregoing description will be made clear by examination of the following detailed description of the operation of the valves of the charging apparatus and their corresponding hydraulic cylinders.

The upper and lower ends of the cylinder 15 are connected by a pair of conduits 50 and 51, respectively, to a corresponding pair of ports 52 and 53 in the sides of the cylinder 31 of the control device 30. For clearness of illustration, portions of the several conduits are represented by a single line.

Assuming, for purposes of explanation, that flow through the lines 50 and 51 is unobstructed at any time, it will be seen that in the drawing the control valve 34 is in such position that the port 53 is in communication with the high-pressure zone 37, whereas the port 52 is in communication with the low-pressure zone 39.

Consequently, the lower portion of the interior of the hydraulic cylinder 15 is also in communication with the high-pressure zone 37 through the line 51 and port 53, whereas the portion of the interior of the cylinder 15 above the piston 16 is in communication through the line 50 and port 52 with the low-pressure zone 39. The charging valve 13 is thus maintained in its uppermost position, as shown in the drawing.

Were the control valve 34 to descend to its lowermost position, these pressure conditions would be reversed when the flanges 35 and 36 passed ports 53 and 52, respectively. In such lowermost position of the control valve 34, the upper portion of the interior of the hydraulic cylinder 15 would be in communication through line 50 and port 52 with the high-pressure zone 37 and the liquid within the lower portion of the cylinder 15 would flow through line 51, port 53, the low-pressure zone 38, the conduit 40, the low-pressure zone 39 and the exit pipe 42. As this liquid escapes, the piston 16 descends and in this manner the charging valve 13 would be lowered into the interior of the generator 1. Upon the next upstroke of the control valve 34, the pressure conditions would again be reversed when the ports 53 and 52 were passed again and the charging valve 13 would once more be raised into a closed position.

The ends of the cylinder 24 which serves to operate the inlet door 19 are similarly connected through conduits 56 and 57 with a corresponding pair of ports 58 and 59 in the walls of the cylinder 31, spaced as are the ports 52 and 53. In the position of the control valve 34, shown in the drawing, the left-hand end of the cylinder 24 is in communication with the high-pressure zone 37 and, as a consequence, the inlet door 19 is closed. Pressure conditions would be reversed at some point near the uppermost limit of travel of the valve 34, i. e., when flanges 35 and 36 pass ports 59 and 58, respectively. The inlet door 19 would then open, to be closed again on the ensuing downstroke of the valve 34.

In order to interlock the valves 13 and 19 in such manner as to prevent the opening of both of said valves at the same time, I provide a pair of safety blocks or valves 61 and 66 in lines 51 and 56, respectively. The valve 61 is so positioned as to be opened by a rod 67, rigidly connected in this instance to that end of the rack 23 nearest the hydraulic cylinder 24, at a point corresponding to the uppermost travel of the inlet door 19. In other words, the valve 61 is closed except when the inlet door 19 is closed, at which time the valve 61 is opened.

The valve 66 is operated by means of a lever 68 turning about a shaft 69 and rigidly connected to another lever 70. The valve 66 and the levers 68 and 70 are so positioned that the latter will be engaged at the uppermost point of travel of the rod 14 in such manner as to open the valve 66. In other words, the valve 66 is closed except when the charging valve 13 is closed, at which time the valve 66 is opened.

When the inlet door 19 is opened, the valve 61 is closed and consequently no liquid can flow through the line 51. As a further consequence of this fact, the liquid confined in the lower portion of the hydraulic cylinder 15 below the piston 16 is not allowed to escape and consequently the charging valve 13 is maintained in its uppermost position. On the other hand, so long as the charging valve 13 is open, since the valve 66 will therefore be closed, no liquid will be able to flow through the line 56 from the cylinder 24 and, consequently, the inlet door 19 will be maintained in its uppermost or closed position. In short, neither of valves 13 or 19 can be opened when the other is open and communication between the generator 1 and the atmosphere is thus effectually and positively prevented.

Whenever, however, either of valves 13 or 19 reaches its closed position, the corresponding valve 66 or 61 in the hydraulic lines leading to the other of said valves will be opened and, consequently, the other valve 13 or 19, as the case may be, may also be opened.

In the present instance, ports 58 and 59 are located at the top of the stroke of the cylinder 34 by reason of the fact that the blow period of the water-gas cycle is usually in effect at this point and, consequently, while it is not advisable to charge the generator at this time, it is a suitable time to fill the hopper 6 with the fuel later to be supplied to the generator. On the other hand, ports 52 and

53 are located at the points near the lowermost point of travel of the valve 34 for the reason that the down-run of the water-gas cycle is generally in force at this point and consequently only steam but no combustible gas is present in the upper portion of the generator, making this an opportune time to charge. In any event, the positions of the ports 51, 52, 58 and 59 are similarly located with respect to the ports operating the main valves of the water-gas generator apparatus.

While I have shown and described my invention with relation to a hydraulic control device, it may be otherwise embodied with similar results. For example, means may be provided for interlocking the hydraulic valve mechanisms of the charging apparatus when said mechanisms are actuated and controlled from other types of control devices, for example, a mechanical control device or an electrical control device.

My invention is not limited to the specific instance hereinabove described by way of illustration but may variously be embodied within the scope of the claims hereinafter made.

I claim as my invention:

1. A charging device for a gas generator comprising a fuel chamber adapted to be positioned over the charging opening of the generator, a pair of fuel valve devices located in said chamber, a hydraulic pressure cylinder having a piston operatively connected to one of said fuel valve devices and having conduits terminating in both ends of said cylinder, controlling means for placing one of said conduits in communication with a source of hydraulic pressure greater than that in the other of said conduits, and vice versa, whereby said fuel valve device may be opened and closed by hydraulic pressure, and a valve located in one of said conduits between said controlling means and the cylinder in which said conduit terminates and adapted to open only when the other of said fuel valve devices approaches the end of its stroke.

2. A charging device for a gas generator comprising a fuel chamber adapted to be positioned over the charging opening of the generator, a pair of fuel valve devices located in said chamber, a hydraulic pressure cylinder having a piston operatively connected to one of said fuel valve devices and having conduits terminating in both ends of said cylinder, controlling means for placing one of said conduits in communication with a source of hydraulic pressure greater than that in the other of said conduits, and vice versa, whereby said fuel valve device may be opened and closed by hydraulic pressure, and a valve located in one of said conduits between said controlling means and the cylinder in which said conduit terminates and adapted to close whenever the other of said fuel valve devices is in other than a closed position.

3. A charging device for a gas generator comprising a fuel chamber adapted to be positioned over the charging opening of the generator, a pair of fuel valve devices located in said chamber, a hydraulic pressure cylinder having a piston operatively connected to one of said fuel valve devices and having conduits terminating in both ends of said cylinder, controlling means for placing one of said conduits in communication with a source of hydraulic pressure greater than that in the other of said conduits, and vice versa, whereby said fuel valve device may be opened and closed by hydraulic pressure, and a valve located in the conduit terminating in the end of said hydraulic cylinder opposite to the position of said piston when said fuel valve device is in a closed position and adapted to close whenever said other fuel valve device is in other than a closed position.

4. A charging device for a gas generator comprising a fuel chamber adapted to be positioned over the charging opening of a gas generator, a pair of fuel valve devices in said chamber, a hydraulic cylinder having a piston operatively connected to one of said fuel valve devices, controlling means for reversing the pressure differential between opposite ends of said cylinder to cause said piston to reciprocate to open and close said fuel valve device, and valve means for automatically preventing release of fluid pressure from one end of said hydraulic cylinder until the other of said fuel valve devices approaches the end of its stroke.

5. A charging device for a gas generator comprising a fuel chamber adapted to be positioned over the charging opening of a gas generator, a pair of fuel valve devices in said chamber, a hydraulic cylinder having a piston operatively connected to one of said fuel valve devices, controlling means for reversing the pressure differential between opposite ends of said cylinder to cause said piston to reciprocate to open and close said fuel valve device, and valve means for automatically preventing release of fluid pressure from the end of said hydraulic cylinder opposite said valve whenever the other of said fuel valve devices is in other than a closed position.

6. A charging device for a gas generator comprising a fuel chamber adapted to be positioned over the charging opening of the generator, a pair of fuel valve devices located in said chamber, hydraulic pressure cylinders having pistons operatively connected to said fuel valve devices, respectively, each of said cylinders having conduits terminating in both ends thereof, controlling means for placing one of the pair of said conduits leading to either of said cylinders in communication with a source of hydraulic pres-

sure greater than that in the other conduit of said pair, and vice versa, whereby said fuel valve devices may be opened and closed by hydraulic pressure, and a valve located in the conduit terminating in the end of each of said hydraulic cylinders opposite to the position of the corresponding piston when the corresponding fuel valve device is in a closed position and adapted to close whenever the other fuel valve device is in other than a closed position.

In testimony whereof I have hereunto subscribed my name this 31st day of January, 1928.

WALTER A. BARR.