Dec. 25, 1934. E. W. BEARDSLEY ET AL 1,985,234

VALVE

Original Filed April 23, 1931 3 Sheets-Sheet 1

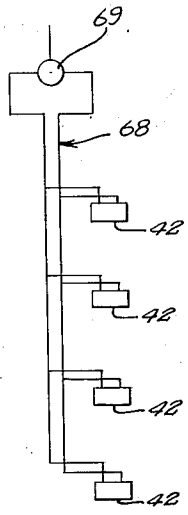



Fig. 6.




Fig. 1.

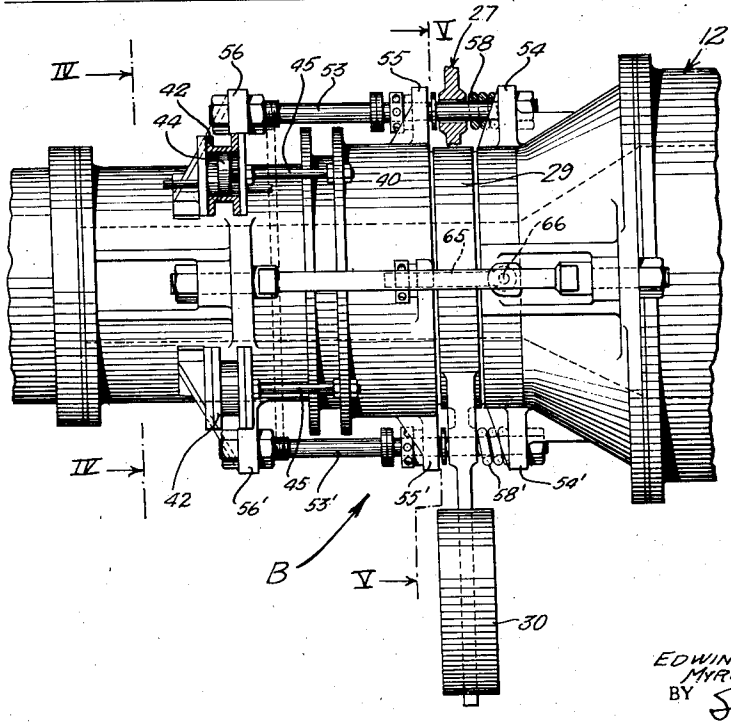



Fig. 2.

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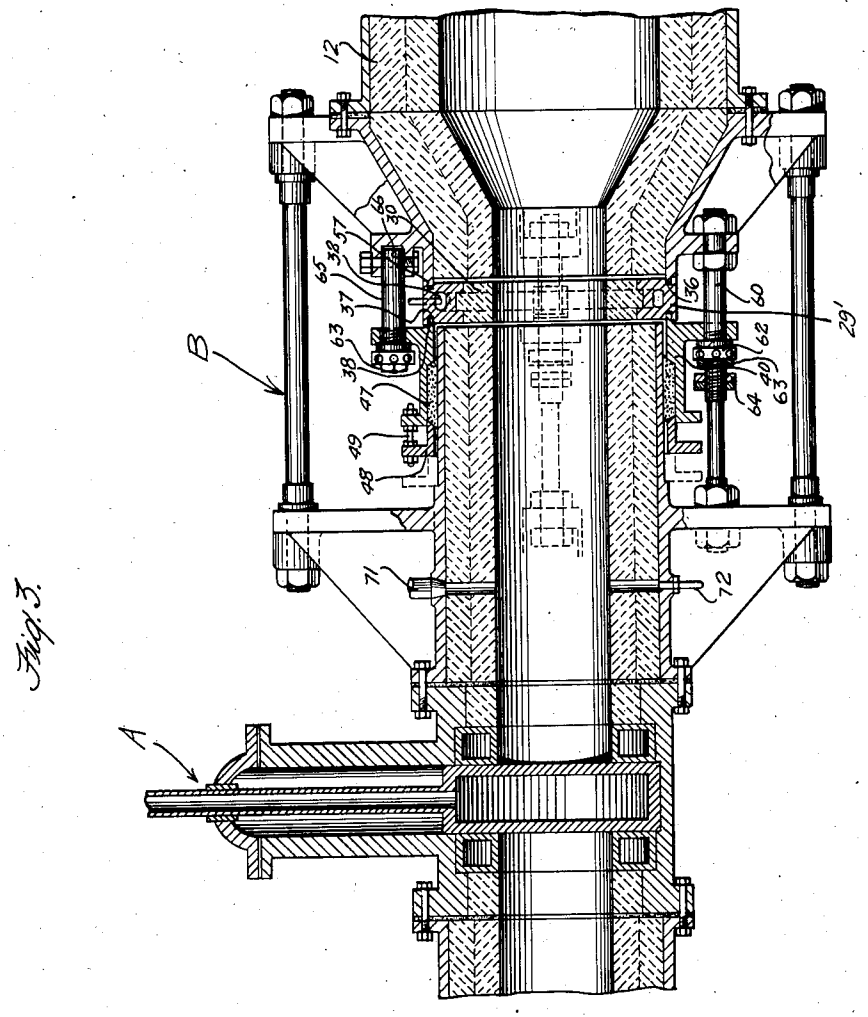



Fig. 3.

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Fig. 4.

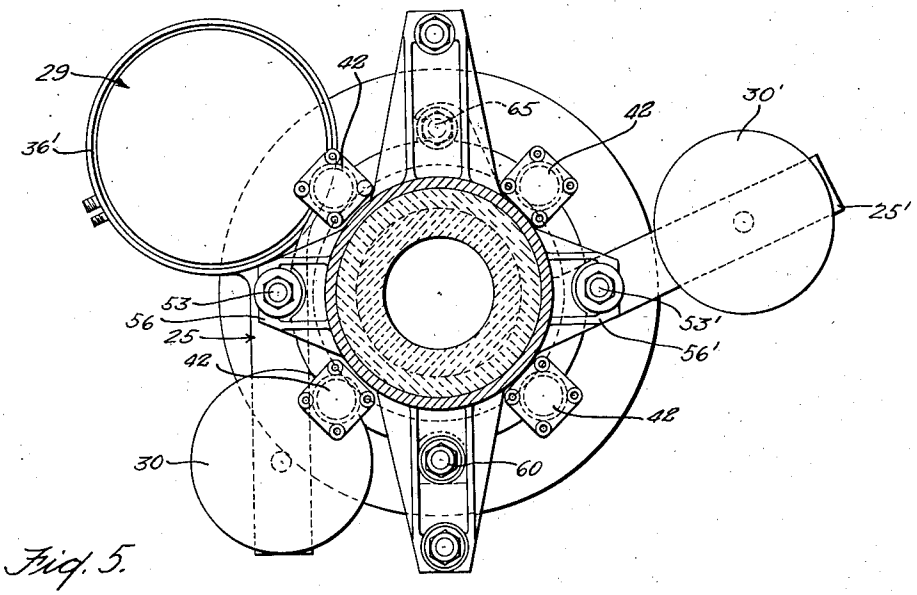
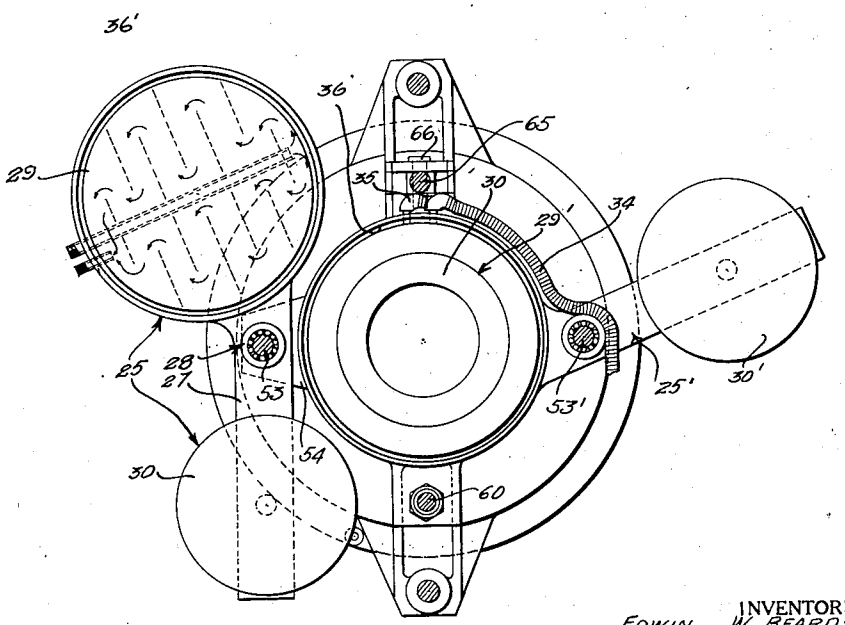



Fig. 5.




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# UNITED STATES PATENT OFFICE

1,985,234

## VALVE

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Application April 23, 1931, Serial No. 532,258
Renewed November 21, 1933

5 Claims. (Cl. 196—2)

Our present invention relates to improvements in regenerative heating systems of the type employed for heating combustible gas and also for an improved valve and seat combination for use therein. The present invention, while of general application, is of particular utility in a process for cracking oil in which relatively large quantities of a combustible gas are required which are heated to temperatures in the neighborhood of 1400° F. and under pressure of fifty pounds and over. In such a system for gas heating it is common to employ a plurality, usually three or more, of regenerative units of the hot blast stove type in order that the supply of heated gas may be continuous. These various units are connected by a common main or conduit for supplying the cold gas to the units and by a second main, termed a hot blast main, for leading away the hot gas.

Valves are provided in the connections from the stove to both mains, the arrangement permitting any stove of the battery to be heated or fired while any other is on the heat yielding or blast phase. It will be understood that when a stove is being fired, its connection to the hot blast main will be closed, but since the main is filled with hot gas under pressure from the stove then on blast, any leakage past this valve will cause the hot combustible gas to find its way into the stove on fire which is under atmospheric pressure. The invention is accordingly concerned with an improved arrangement of valves to obviate this leakage in the hot blast connections.

The problem of devising a satisfactory gas tight valve for this use offers considerable difficulties because of the high temperature and pressure of the heated gas. When a system of blast stoves is used for heating air, the problem is simplified by reason of the fact that usually a lower pressure differential exists, and particularly by the fact that leakage of air from the hot blast main into the stoves in which combustion is taking place is not a serious matter. On the other hand, to permit leakage of combustible gas into the stoves undergoing firing or about to be fired is of serious consequence since an explosive mixture may be formed which would constitute a menace to life and property.

In accordance with our present invention we employ in each connection from the stoves to the hot blast main a pair of valves, one of which may be a valve, preferably watercooled, of the usual type, e. g. a globe (mushroom), or watercooled gate, or of the piston type inserted in an elbow, and the other a valve of the sliding type extending across a cross section of the main. The preferred type of this latter valve is a so-called goggle valve which in closed position will effectively prevent leakage into the stoves and which will be placed between the first mentioned valve and the stove. To prevent pressure of gas from building up between the valves at times when the sliding valve is to be operated, a lead-off connection is preferably provided in the region or spool between the valves. A further feature of our invention is to provide an improved form of seat, preferably exterior of the conduit, for the sliding valve, which seat is movable toward and away from the valve whereby a thoroughly tight fit may be had. A further feature of the invention, as will be apparent, is to enable existing standard types of valves to be utilized, which types if used alone would be unsuitable by reason of the unavoidable leakage which would occur past them.

The invention will be best understood by reference to the following detailed description taken with the accompanying drawings, in which

Figure 1 is a diagrammatic view showing one of a battery of regenerative heaters of the hot blast stove type which has in connection therewith a preferred embodiment of our invention;

Figure 2 is a plan view of the improved valve of the sliding type used, parts being shown in section;

Figure 3 is a view in vertical section of the valve combination seen in Figure 1;

Figure 4 is a view taken in section along line IV—IV of Figure 2;

Figure 5 is a similar view taken along line V—V of the same figure; and

Figure 6 is a diagrammatic view showing the operation of the hydraulic pistons operating the valve seats.

Referring to Figure 1, 10 denotes the regenerative heater which is provided with a connection 12 to the hot blast main at the left of Figure 1, not shown, a cold blast main 14, a cold blast main connection 15 having therein a valve 16 and a connection 18 leading to stack 20 and having a valve 21 therein, it being noted that connection 15 communicates with the stove through connection 18.

As stated, two valves are provided in the hot blast stove connection 12, a valve A of ordinary type, preferably water cooled, and a valve B of the sliding type provided with valve seats of special construction to be described. Valve B, which is a so-called goggle valve, is preferably of the double type, having a goggle 25 and a goggle 25' each consisting of the valve proper and a counter weight. Goggle 25 comprises a lever 27 mounted

in a ball bearing 28, a blind valve member 29, preferably water cooled as shown, and, at the other end of lever 27, a counterweight 30. Goggle 25' is similarly constructed except that it contains the apertured valve member 29'. The latter is provided with a refractory lining 30 which is seen in Figures 3 and 5. Apertured goggle valve member 29' is also water cooled, for which purpose a duct 32 is provided as seen in Figure 3 to which are connected flexible hose connections 34 and 35. For the purpose of effecting a gas-tight fit of the valve, preferably a groove 36 is provided at the periphery thereof and on one side of the valve while a similar groove 37 is provided on the opposite side. Similar grooves of which 36' is seen in Figure 5 are provided for the blind valve member 29. Adapted to engage in the appropriate groove is a movable valve seat member 38 which may be formed integrally with a ring 40 mounted exteriorly of the conduit.

The construction is such that the ring 40 is movable back and forth along the conduit so as both to make a tight connection with the goggle valve member 29 or 30, or to be moved fully out of such groove to permit the goggle valve to be moved. To accomplish this movement longitudinally of the conduit, a plurality of hydraulic cylinders 42, 42, 42, 42 may be provided which are also mounted on the conduit 12. In each case, a piston 44, Figure 2, is connected to ring 40 by means of a rod 45 whereby the ring may be moved back and forth by the operation of the hydraulic cylinders 42. In order to preserve a gas-tight fit between the ring 40 and the exterior of the conduit, ring 40 is provided with packing 47 and a packing gland 48, the compression on which is adjusted by means of the bolt and nut construction 49.

On the opposite side of the goggle valve from the ring 40, a valve seat member 51 is provided which extends into the groove in the goggle valve member opposite thereto. In lieu of making this member movable, I preferably mount the goggle valve members for a slight movement longitudinally of the conduit. This mounting can take the form of bearing shaft 53 which may be mounted in ears 54, 55, 56, Figure 2. Between ear 54 and the goggle valve member is a spring 58 tending to move the valve away from valve seat member 51. Similar parts designated by the same reference characters additioned by a prime (') are provided for the goggle valve member 25'. For the purpose of locking the goggle members in place against the valve seats independently of the hydraulic cylinders 42, tension rods, four in number, are provided of which rod 60 is seen in Figure 3. This rod passes through the ring 40 and is provided with an adjusting nut 62 and a lock nut 63 which are both in threaded engagement with the rod 60. It is necessary, however, that the upper holding rod 65 be swingably mounted as at 66 in order not to interfere with the swing of the goggle valve members.

For operating the cylinders 42, appropriate piping 68 for fluid under pressure may be provided as shown in Figure 6, such piping being preferably controlled by a single three-way valve 69 by means of which all pistons are movable in unison. A pipe 71 is also provided for bleeding off the gas which leaks past the valve A during the time that the goggle valves are being changed. In operating either goggle valve, it is merely necessary to loosen the holding nuts 62 of the ring 40 against the goggle valve in place and then retract the ring by use of the hydraulic cylinders 42. When this occurs, the action of the spring 58 or 58' will be to move the goggle valve out of contact with the seat 51 and thus permit the valve to be swung on its axis. In the form shown in the drawings, each goggle member since it is counterweighted with some degree of accuracy is adapted for manual operation, it being noted that either member is inoperative when the counterweight is nearest the ground, as for example the position shown for counterweight 30 in Figures 4 and 5. If necessary or desirable, the valve members may be actuated by power means, not shown.

In the operation of our improved system, it may be supposed a given stove on blast is to be cut out of the system and a freshly heated stove is to be cut in. The fresh stove in which the combustion process has just been stopped is at atmospheric pressure. Both the gate valve A and the spectacle valve B of this stove have been closed during the firing period but because of the leakage past the valve A, pressure of the combustible gas from the hot blast main has been built up between these valves. The valve 70 in vent pipe 71 is then opened which will relieve this pressure whereupon the valve seat 37 will be loosened by loosening the bolts 62 and proper operation of the control valve 69. The open goggle 37 is now swung upwardly into open position and the valve seats tightened. Since atmospheric pressure exists at both sides of the goggle valve at the time of opening, there will be no appreciable escape of gas through the opening occupied by the goggle valve while it is being moved. The stove to be cut in is then purged of combustion gases and brought up to the pressure existing in the hot blast main during which process the gate valve A remains closed. This valve is then opened and hot gas under pressure is permitted to flow from the stove into the hot blast main and this phase of reversal of the stove is thus completed. The cooled off stove which was previously on the blast now remains to be cut out of the system. This is accomplished by closing the outer valve A, the goggle valve B remaining open. Pressure is then released from the stove to the gas holder and the stove purged of residual gas by steam or a neutral gas. The stove is now at atmospheric pressure, except for slight leakage of gas through the closed outer hot gas valve A. This, however, may be vented from the spool between the valves by use of the vent 71. When this has been done the goggle valve seat 38 is released and the blind goggle valve member 29 swung into operative position. Here again pressure on either side of the goggle valve is atmospheric and leakage through the opening in the conduit occupied by the valve does not occur during the valve changing operation. The valve seat 38 is then brought home against the closed valve. It will be noted that even should the goggle valve leak, such leakage will be to the atmosphere and will not be into the stove undergoing firing.

It will be evident that in lieu of a goggle valve we may use any valve of the sliding type and that various other means than that shown may be used to operate the valve seats.

We claim:

1. In combination with a source of hot gas under pressure, a conduit, the interior of which is subjected to said pressure, a valve in said conduit, a second valve of the goggle type in said conduit beyond the valve first mentioned in the direction of lower pressure, and means for bleeding off the gas pressure building up between said

valves by leakage past said valve first mentioned when said goggle valve is being moved.

2. In a system for heating combustible gas under superatmospheric pressure comprising a battery of regenerative heating units, means for supplying each individual unit with combustible gas to be heated and means for burning fuel in each of said units to heat the same up prior to admitting the combustible gas thereto, a hot blast main connecting said units, a connection from said main to each of said units, a valve in at least one of said connections of the type making a substantially absolute seal against the admission of gas from the main into the regenerative heating unit associated therewith, and means including a second valve for holding back to pressure in the blast main while the first mentioned valve is being operated at a pressure then prevailing in the unit associated therewith, which pressure is lower than the hot blast main pressure.

3. In a system for heating combustible gas under superatmospheric pressure comprising a battery of regenerative heating units, means for supplyng each individual unit with combustible gas to be heated and means for burning fuel in each of said units to heat the same up prior to admitting the combustible gas thereto, a hot blast main connecting said units, a connection from said main to each of said units, a valve in at least one of said connections of the type making a substantially absolute seal against the admission of the gas from the main into the regenerative heating unit associated therewith, means including a second valve of the type operable under a substantial difference in pressure on either side thereof but permitting slight leakage past such valve, and means for bleeding off the accumulated gas between the valves.

4. In a system for heating combustible gas under superatmospheric pressure comprising a battery of regenerative heating units, means for supplying each individual unit with combustible gas to be heated and means for burning fuel in each of said units to heat the same up prior to admitting the combustible gas thereto, a hot blast main connecting said units, a connection from said main to each of said units, a valve in at least one of said connections of the type making a substantially absolute seal against the admission of gas from the main into the regenerative heating unit associated therewith, which valve is adapted for operation at atmospheric pressure only, and means including a second valve for holding back the pressure in the hot blast main while the first mentioned valve is being operated at atmospheric pressure.

5. In a system for heating combustible gas under superatmospheric pressure comprising a battery of regenerative heating units, means for supplying each individual unit with combustible gas to be heated and means for burning fuel in each of said units to heat the same up prior to admitting the combustible gas thereto, a hot blast main connecting said units, a connection from said main to each of said units, a valve of the goggle type in at least one of said connections, said valve being movable across a cross section of the conduit and having means associated therewith for binding said valve against such section of the conduit so as to make a substantially absolute seal against the admission of gas from the main into the regenerative heating unit associated therewith, and means including a second valve for holding back the pressure in the last main while the first mentioned valve is being operated at a pressure then prevailing in the unit associated therewith, which pressure is lower than the hot blast main pressure.

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