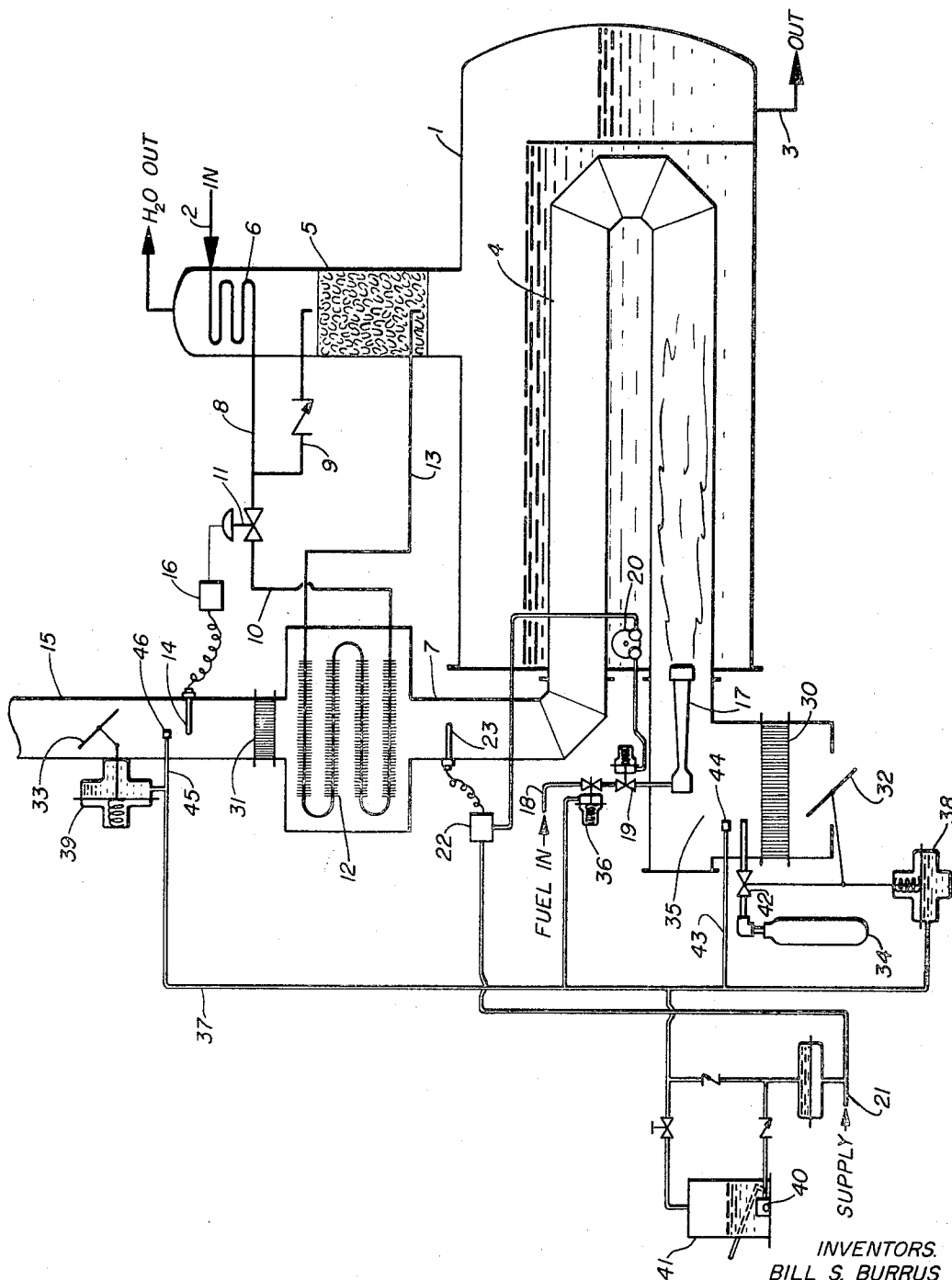


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METHOD OF AND MEANS FOR OPERATING FIRED PROCESSING EQUIPMENT

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ABSTRACT OF THE DISCLOSURE

The drawings show a vessel in which liquid desiccant is heated to boil water from the desiccant so it can be re-used to dry natural gas. The heat comes from a firetube down which a burner directs products of combustion. Foraminous structures are placed across the firetube, the burner between them. Also dampers are mounted to block the firetube on each side of the burner. Linkage is actuated by excessive temperature inside the firetube to close the dampers, release fire-extinguishing fluid into the tube and shut off the fuel to the burner.

BACKGROUND OF THE INVENTION

Field of the invention

This invention relates to control of the temperatures of equipment which is internally heated. More specifically, the invention relates to isolating the combustion process, and fluids heated by the combustion process, from collections of hazardous fluids which are external the equipment.

Description of the prior art

Surface equipment for producing oil and gas wells use industrial burners to supply heat for various purposes. This equipment is representative of a wide range of industrial units fired to process material. Although the heat of combustion, when controlled and directed from a burner, can be very useful, uncontrolled combustion in and around the burner, and resulting from the burner operation, can become quite hazardous. As an example of potential hazards, if inflammable hydrocarbon fluids reach zones external the equipment which have temperatures at or above the ignition temperature of the hydrocarbons, there will be created a danger of widespread fire and explosion.

Part of this problem is solved by the inventions of U.S. Patents 3,213,921 and 3,079,242. These inventions are directed to isolate the burner and uncontrolled combustion near the burner, from hazardous external conditions by establishing barriers in the inlet to the burner, and uncontrolled combustion, to the entrance of air. However, as the danger becomes more acute, the stakes rising on off-shore platform operations, a more plenary control of the temperature conditions within the fired equipment is required.

SUMMARY OF THE INVENTION

A principal object of the invention is to mechanically isolate the normal combustion process, and uncontrolled combustion, within internally heated processing equipment when the temperature at a location of uncontrolled combustion within the equipment reaches a predetermined level.

Another object is to supplement isolation of all combustion within heated processing equipment with a combustion-extinguishing fluid.

The invention contemplates providing a positive mechanical barrier about the area of normal combustion and

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an area of undesirable combustion within the heating apparatus of internally heated processing equipment when necessary to prevent the ignition temperature of hazardous fluid collections being reached externally of the equipment.

It is contemplated that foraminous structures normally be established across both the entrance and exit of combustion equipment to prevent flash-backs to external combustible material. Additionally, it is contemplated that structure equivalent to positive shut-off dampers be placed in series with the foraminous structures and be actuated by means responsive to the undesirable, uncontrolled combustion to preclude combustion air reaching any combustion process or products of combustion being discharged externally.

Also, it is contemplated that containers of fire-extinguishing fluid be mounted to discharge at all areas of combustion and the means responsive to the combustion be further arranged to discharge this fluid into all combustion areas when complete extinguishment is necessary to prevent the ignition temperature of hazardous fluids external the equipment from being reached. Other objects, advantages and features of this invention will become apparent to one skilled in art upon consideration of the written specification, appended claims, and attached drawing.

BRIEF DESCRIPTION OF THE DRAWINGS

The drawing is a somewhat diagrammatic elevation of a liquid desiccant reboiler in which the present invention is embodied.

DESCRIPTION OF THE PREFERRED EMBODIMENT

General operation of the process

In the drawing, vessel 1 represents internally heated equipment for thermally processing material. More specifically, the vessel is a so-called reboiler for liquid desiccant. Glycol, as a desiccant, is introduced to the system with conduit 2 and removed with conduit 3.

The glycol is heated in vessel 1 by firetube 4. All glycol and water vapors ascend in still column 5. A cooling (reflux) coil 6 is mounted in the upper portion of column 5 to condense glycol vapors so the condensate will flow back into the reboiler vessel 1, leaving the water vapors to discharge from the top of the column.

The reboiler is, of course, part of a larger system processing the glycol for re-use in a contact device. The glycol is employed to directly contact gas to be dehydrated. Rich with water absorbed from the gas it contacts, the glycol is then inserted into vessel 1 to have the absorbed water extracted in the thermal process within the vessel. Obviously there is much of the associated equipment of the system not shown in the drawing in order to serve the purposes of simplicity.

Any heating of the rich glycol prior to contact with firetube 4 will lighten the heat load on the firetube. Also, absorbing heat which would otherwise be thrown away is a salvage which makes the process the more efficient. The rich glycol, in passing through reflux coil 6, picks up a measure of heat. From coil 6, the glycol can pick up more heat from the products of combustion in stack 7. From coil 6, the rich glycol flows through conduit 8.

From conduit 8, the glycol is divided between conduit 9 and conduit 10, dependent upon the setting of valve 11 in conduit 10. Conduit 10 passes a portion of the glycol through heat exchanger 12 which is mounted to contact the products of combustion from stack 7. From exchanger 12, the glycol flows into column 5 from conduit 13, heated by the products of combustion.

The amount of glycol flowed from conduit 8 into

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exchanger 12 is set by the temperature of the products of combustion downstream of exchanger 12. Temperature sensing primary element 14 is mounted in stack section 15 in order to respond to the downstream temperature. A control station 16 responds to element 14 to establish a control signal for positioning valve 11. The result of this control is that rich glycol, heated in exchanger 12 and/or coil 6, is injected into still column 5 for thermal processing in vessel 1 and column 5 to remove water and produce lean glycol in outlet conduit 3.

The heat supplied firetube 4 is determined by the output of burner 17. The combustion at burner 17 is basically regulated by control of fuel from a source to burner 17 through conduit 18. Specifically, control over the fuel is exerted by the setting of valve 19. This valve is modulated from a control 20 which is mounted in vessel 1 to respond to the temperature of the glycol being thermally processed in vessel 1.

Control 20 is supplied its basic power, to establish an output, from a source connected to conduit 21. This supply is routed through a control station 22 which is regulated from temperature sensing primary element 23 which is mounted in stack section 7. From station 22 the supply is routed to control 20. Therefore, the supply of conduit 21 is connected to station 22 and control 20 in series. This arrangement enables the valve 19 to be regulated by the temperature of the products of combustion from firetube 4 and/or the temperature of the glycol in vessel 1 being thermally processed.

Shut-down operation

The general operation of the process is one facet of this disclosure. The normal operation of the process centers around the heat input to firetube 4 and heat absorbed by the incoming rich glycol. However, the complete process must be shut down, and stopped immediately, if temperatures to which hazardous fluids external the vessel 1 are exposed reach predetermined values. The assumption is made that a potentially hazardous mixture of fluids lurks about this fired equipment. Therefore, a system for capsulating the working combustion must be provided. If some uncontrolled condition results in a temperature rise on either side of the combustion process, the invention provides immediate action which results in mechanical barriers being thrown up on either side of the combustion to positively isolate the combustion. Further, a fire-extinguishing fluid is simultaneously injected into the combustion chamber to further eliminate the danger of uncontrolled fire and explosion external the equipment. Further, the burner is cut off from its source of fuel to reinforce the safety provisions against fire and explosion which would damage equipment and endanger personnel.

Mechanical barriers

The first line of defense is embodied in flame arresting elements 30 and 31. The form and operation of these structures may be similar to those of Glasgow 3,079,242 structures. By and large, the danger of hazardous fluids contacting the combustion temperature and flashing back to the external sources is greatly reduced by these elements 30 and 31. Still, any sustained, uncontrolled combustion on the surface of these elements increase the danger of their breaking down and unleashing excessive dangerous temperatures to the hazardous fluids external the equipment. More positive steps must be taken to give absolute safety.

The next mechanical barrier is embodied in dampers 32 and 33. These "trap doors" are also mounted on each side of the combustion chamber within firetube 4. Normally they are held open in the position shown. However, they are both actuated to their alternate, closed position when a predetermined temperature is reached in association with the firetube.

These dampers 32 and 33 may be compared with the snuffer door of Walker et al. 3,213,921. However, here

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the concept is enlarged to include the use of sufficient doors, or dampers to completely isolate, or capsulate, the combustion.

Fire-extinguishing fluid

At the same time the dampers 32 and 33 are positioned by excessive temperature, a container 34 is emptied into the combustion chamber 35 of the firetube 4. Although the container 34 is disclosed as mounted to empty into the chamber 35, just above flame arrestor element 30, it is to be understood that this is merely representative of many variations of such arrangements. There may be more than one container mounted to discharge into the tube 4. Container 34, or similar container, may be arranged to discharge into other critical areas. The concept is to blanket all combustion with fire-extinguishing fluid when necessary. The specific arrangement is merely representative of any arrangement which will carry out this function.

Fuel cut-off

Valve 36 is placed in conduit 18 and its closure will positively block supply of fuel to burner 17. The predetermined temperature which closes dampers 32 and 33, and discharges container 34, also closes valve 36. The result is a fourth measure taken to eliminate combustion at the desired time.

Actuating system

Dampers 32 and 33, fire-extinguisher 34 and fuel blocking valve 36 are all actuated by a common hydraulic system. Specifically, manifold conduit 37 is connected to damper actuators 38 and 39 and the actuator of valve 36. Pressure is maintained on this system by a pump 40 in reservoir 41. When this manifold is broken, the hydraulic fluid is released, the pressure falls, and the spring-loaded actuators 38 and 39 close dampers 32 and 33. The spring-loaded actuator of valve 36 is also closed. To simultaneously discharge container 34, valve 42 is mechanically linked to actuator 38.

The manifold 37 is broken at any one of a plurality of points. Branch conduit 43 is extended into the combustion chamber 35 and sealed with a fusible plug 44. Branch conduit 45 is extended into stack section 15 and sealed with plug 46. If either plug melts, the hydraulic fluid discharges from the manifold 37 and simultaneously causes dampers 32 and 33 to close, valve 36 to shut and container 34 to discharge. The result is a positive elimination of combustion from burner 17 and an elimination of a fire and explosion hazard.

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

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

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

The invention having been described, what is claimed is:

1. In the operation of internally heated equipment for thermally processing material, supplying fluids to the equipment with which to generate heat normally desired for the thermal process, normally exhausting such of the supplied fluids as contain heat which the equipment failed to utilize in the thermal process, detecting the temperatures of undesired and uncontrolled combustion within the equipment which

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develop on the entrance and exit side of the normally desired heat generation, and utilizing either of the temperatures to positively and mechanically isolate all combustion from thermal communication with any hazardous fluids external the equipment. 5

2. Internally heated equipment for thermally processing material, including:

a supply of fuel to a normal combustion process with which heat is generated for the thermal process, 10
an entrance to the combustion process for air to support the combustion,
an exhaust passage for the products of combustion,
a mechanical closure for the entrance,
a mechanical closure for the exhaust, 15
and a plurality of temperature responsive means connected together and mounted in the equipment to actuate both closures by either means to positively prevent thermal communication between all combustion and external hazardous fluids. 20

3. In combination with a vessel heated by a firetube to thermally process fluids connected with oil well production,

a first foraminous structure across the entrance to the firetube to pass combustion air to the fuel burning process within the tube while resisting back-flashing to external collections of hazardous fluids from the combustion, 25
a second foraminous structure across the exit of the firetube to exhaust products of combustion to external the vessel while resisting back-flashing to external collections of hazardous fluids from the combustion, 30
a mechanical closure for the firetube passage at each foraminous structure which can close to effectively isolate all combustion within the firetube from thermal communication with external collections of hazardous fluids, 35

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a container of fire-extinguishing fluid mounted to discharge within the firetube, and a system for actuation of the closures and container which is responsive to the temperature of undesirable and uncontrolled combustion within the firetube.

4. In combination with a vessel heated by a firetube to thermally process fluids connected with oil well production,

a first foraminous structure across the entrance to the firetube to pass combustion air to the fuel burning process within the tube while resisting back-flashing to external collections of hazardous fluids from the combustion,

a second foraminous structure across the exit of the firetube to exhaust products of combustion to external the vessel while resisting back-flashing to external collections of hazardous fluids from the combustion,

a mechanical closure for the firetube passage at each foraminous structure which can close to effectively isolate all combustion within the firetube from thermal communication with external collections of hazardous fluids,

spring loaded actuators for the closures, and a hydraulic system charged to oppose the spring loading and discharged by the temperature of the undesirable and uncontrolled combustion.

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