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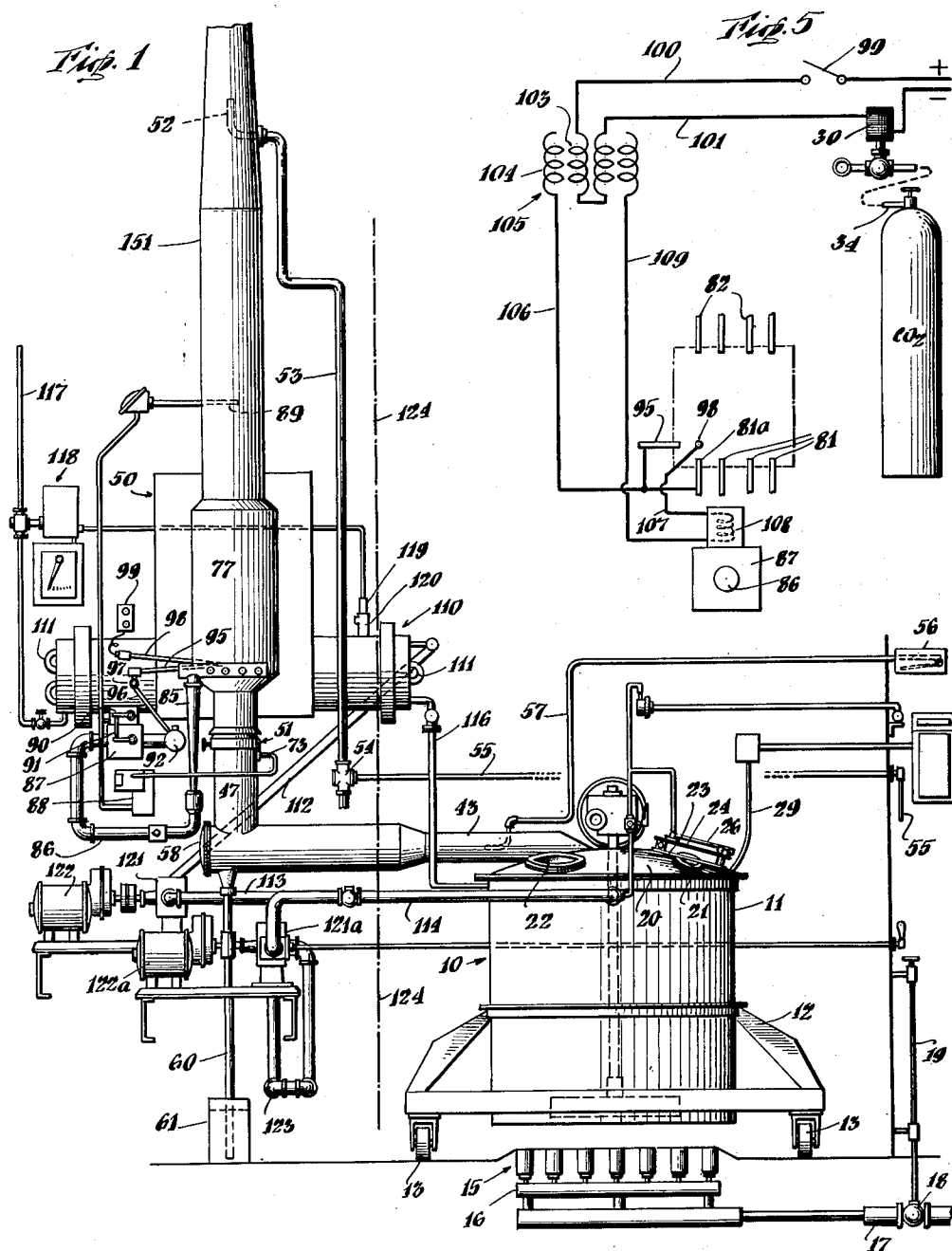
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2,656,008

FUME DISPOSAL SYSTEM

Filed March 22, 1950

2 Sheets-Sheet 1



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2 Sheets-Sheet 2

Fig. 2

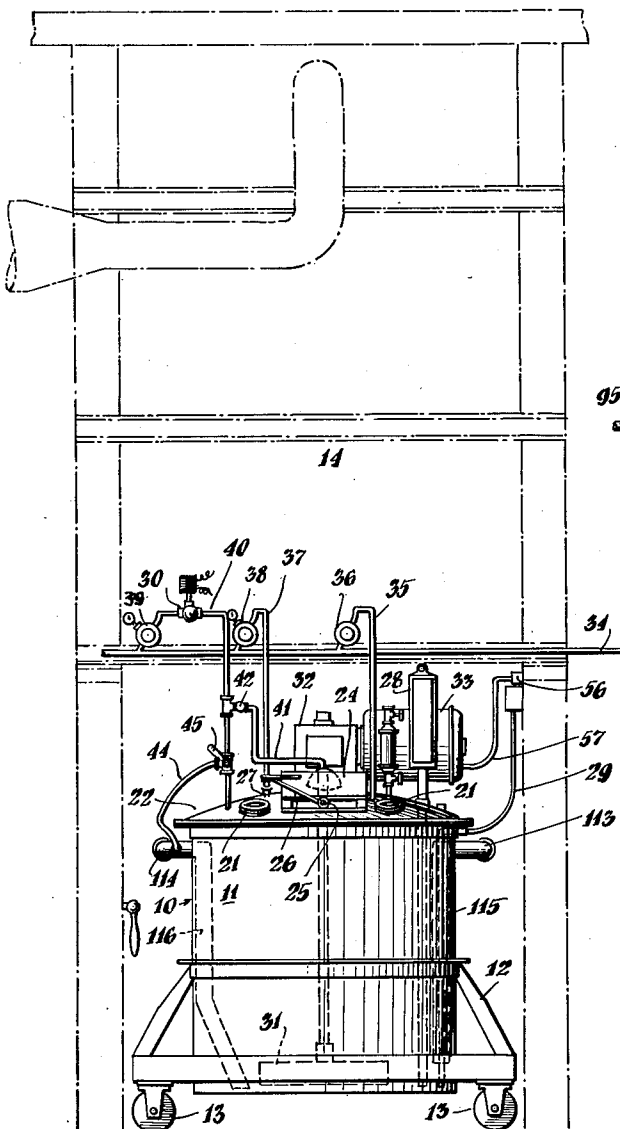


Fig. 3

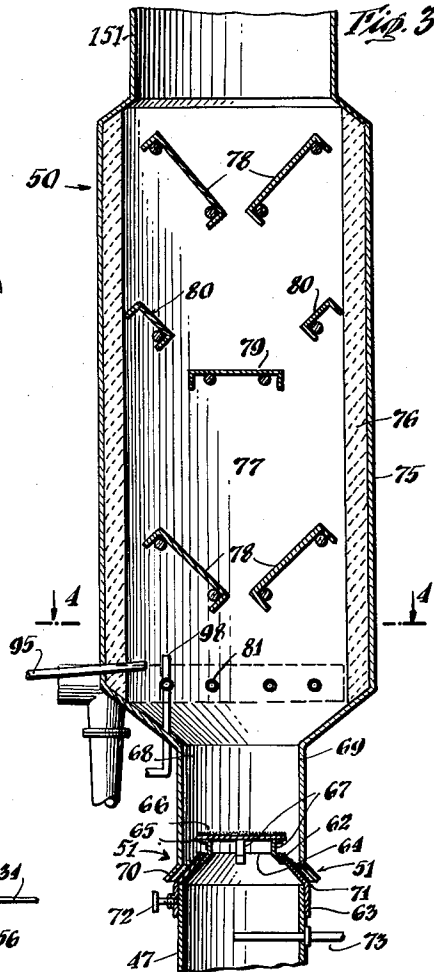
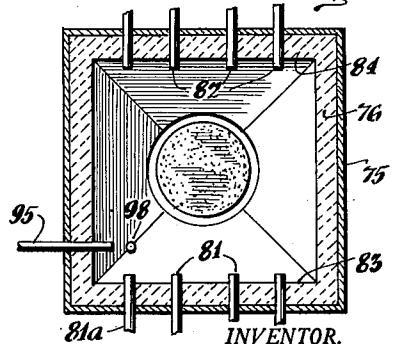


Fig. 4



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FUME DISPOSAL SYSTEM

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8 Claims. (Cl. 183-6)

1 This invention relates to fume disposal by incineration.

In many industrial plants it is necessary or desirable to dispose of fumes and this is particularly so in plants where products such as varnish and paint vehicles are produced. The fumes generated in the manufacture of varnish and resins and in the heat treatment of oils for paint vehicles are combustible and are a constant fire and explosion hazard. They are acrid and obnoxious.

There are three general methods used to control or to eliminate these fumes. One method employs a simple chimney at the bottom of which open kettles of oils or varnishes are processed. The fumes from the kettle pass up through the chimney and are permitted to dissipate into the atmosphere. Of course, this method can hardly be called a fume elimination system.

In another method a power driven exhaust fan pulls the fumes from the kettle hood and forces the fumes through variously designed fume scrubbers, water curtains, electrical precipitators, or chemical absorbers. This method is not entirely satisfactory. Frequently these means are inefficient or fail to completely dispose of the fumes. The scrubbers often fail of their purpose because they can not absorb all the fume ends even at the period of maximum efficiency of their cycle. The operating cycle of such a system, in any case, is short because of duct work and absorbing chambers become plugged with condensed or precipitated fumes and their questionable initial efficiency drops considerably after a very short period of operation.

The third general method of fume disposal is to destroy them by incineration. Heretofore, systems for destruction of the fumes by incineration have had serious drawbacks. First, prior systems did not prevent burn-back into the ducts which lead the fumes to a necessarily hot incinerator and, second, they had not provided for carburetion of the proper amount of air for combustion of the fumes. My invention relates to this system and its object is to eliminate these drawbacks.

In accordance with my invention, a system is provided for producing varnish or heat reacted oils or resins in which the fumes may be disposed of by incineration, wherein the fumes may be controlled at auto-ignition temperature to preclude explosive mixtures; burn-back or flashback from the incinerator to the duct work from the reactor may be prevented, and the proper

2 amount of air may be carburetted at the proper location to insure safe operation and economy.

Although the novel features which are believed to be characteristic of the invention will be pointed out in the annexed claims, the invention itself as to its objects and advantages and the manner in which it may be carried out may be better understood by reference to the following description taken in connection with the accompanying drawings forming a part hereof, in which:

Fig. 1 is a side view in elevation and partly diagrammatic of a plant embodying my invention;

Fig. 2 is a front view in elevation showing the reactor;

Fig. 3 is a view in cross-section of the incinerator and its adjacent carburetor arrangement;

Fig. 4 is a view on line 4-4 of Fig. 3; and

Fig. 5 is a diagram to illustrate the operation of the electric ignition to light the pilot burners in the incinerator.

In order more fully to understand my invention I mention here that there are two types of reactors generally used in manufacturing plants where varnish or heat treated or reacted oils and resins are produced. One type is an open kettle, usually equipped with a loosely fitting cover. The other type is a closed chamber, called a reactor, which completely excludes the atmosphere. It is, of course, known that fumes driven from an open kettle and collected by a hood or loose cover under draft will be mixed with air drawn from the surrounding area by this same draft. This air fume mixture is combustible. It may or may not be an explosive mixture. Usually an excess amount of air is mixed with the fumes to keep them below the explosive limit. However, heated reactors have in the past been ruptured by explosions which have frequently been brought about when a small amount of air was permitted to enter and change the vapor in the reactor to a vapor-air mixture in the auto-ignition range. Despite this, it is often desirable or necessary to open a closed reactor during a process, or to operate it as an open kettle for a portion of the process and then close it. In some cases the closed type of reactor must be operated open or vented for an entire process. Consequently, these variations of operation produce fumes and gases varying in concentration and characteristics, and it is desirable to control the quality or characteristics of the fume-air mixture to insure against auto-ignition conditions when changing from below the lower explosive limit to above the explosive limit or vice versa. It will be understood also that the temperature in a reactor is usually

high enough to ignite fume-air mixtures with certain ranges of concentration; this kind of ignition being known as auto-ignition and is to be distinguished from ignition caused by flashback from the fire in the incinerator.

According to my invention, I make provision to control the fume-air mixture so that it can not be ignited by auto-ignition and at the same time provision is made to burn the fume in the mixture in an incinerator regardless of its concentration; this being made possible by a carburetor arrangement adjacent the inlet to the incinerator which introduces air and properly carburets it to insure efficient and complete combustion of the fumes in the incinerator. This carburetor is so constructed that radiant heat from the hot incineration chamber is shielded from the fume conduit leading to the incinerator and flashback or burning of the fumes in the duct is prevented.

Referring now to the drawings, which illustrate a plant embodying my invention and in which like reference characters represent like parts in the several views, the reactor 10 is of the closed type. It comprises a cylindrical kettle 11 supported on a frame 12, which in turn is supported on universal rollers 13. Thus, when desired, the kettle may be moved in and out of the bay 14 provided by the building construction which houses the plant. As shown, the reactor 10 is positioned over the gas burners 15 connected to a manifold 16 which is fed by a gas supply line 17 having a valve 18 adjustable with a key 19.

The top wall or cover 20 of the reactor is equipped with sealed sight glasses 21, sealed explosion head 22 and charging hatch 23, covered with a hinged cover 24. This cover has a wing nut latch 25 for locking it closed. A lever 26, cooperating with the latch, is connected to a valve 27 in the CO₂ (carbon dioxide) system. As will be described in further detail hereinafter, the lever 26 extends across the top of the hinged cover 24 when the cover is closed and locked and the arrangement is such that if the latch is unlocked to lift up the cover, this lever must be moved out of the way of the cover and in so doing the lever automatically opens the CO₂ valve 27 and CO₂ gas passes into the interior of the reactor to form a protective blanket when the cover 24 is lifted.

The reactor is provided with a standard mercury type varnish maker's thermometer 28 and an indicating and regulating and chart recording potentiometer 29 having a range of 200°-600° F. It is adjusted so that the regulator opens a valve 30 in the CO₂ system at any predetermined temperature. The reactor is also provided with a stirrer 31 connected above the top wall of the reactor through a speed reducer 32 to an electric driving motor 33.

The plant is equipped with a CO₂ system having outlets at various points to supply CO₂ to the reactor and to various conduits and ducts, the CO₂ serving as a protective inert gas which intermixes with the fumes which are generated, thereby permitting a control which is used to prevent the formation or accumulation of mixtures of air and fumes which might be explosive in character or subject to auto-ignition. A supply of CO₂ under pressure in standard CO₂ cylinders is connected to a main supply pipe 34 from which a branch pipe 35, having a control valve 36, leads into the interior of the reactor. Another branch pipe 37, having a control valve

38 and lever operated valve 27, leads into the interior of the reactor at the charging hatch. Another branch pipe 40, having a control valve 39, is connected to pipe 41, having a valve 42, which leads into the reactor and to pipe 44, having a valve 45. Pipe 44 leads into pump out conduit 114. Pipe 40 also has a pressure switch valve 30, mentioned before.

Referring again to the valve 27, it is important to note that it is operated by the lever 26. When the outer end of the lever is connected with the latch 25 which fastens down the hatch cover 24, the valve 27 may be closed, but when it is desired to open the hatch, the hatch cover must be lifted up. This can not be done unless the lever is moved out of its way. When the lever is moved to permit the cover to be lifted to open the hatch, the valve 27 is opened in response to the movement of the lever. The pipe 37 which carries CO₂ under pressure then delivers CO₂ into the reactor at the hatch to provide a protective blanket of CO₂. Consequently, despite any high temperature in the reactor which may contain very hot 25 so diluted with inert CO₂ that an explosive air-vapor mixture is prevented because the hatch can not be opened until CO₂ gas is passing into the reactor through the valve 27. Thus the arrangement provides a "foolproof" safety device for preventing an unwanted explosive or auto-igniting fume mixture in the reactor.

The fumes generated in the reactor as a result of reactions due to heating the charge (oils, resins, paint vehicles, or the like), together with any CO₂ introduced or air let in, are drawn through a flue duct pipe 43 which is relatively short in length, thence through an upstanding duct pipe 47 connected to an incinerator 50, where the fumes are burned, thence upwardly through a chimney or stack 151 from which the burned gases are discharged and dissipated into the atmosphere. A steam ejector 52 in the stack 151 provides means for establishing and maintaining a controlled draft in the stack. It is supplied with steam pressure through a pipe 53 having a control valve 54 which may be regulated by a key 55. A draft gage 56 connected through a tube 57 in the duct 43 provides an indicator for the operator to maintain a proper draft by adjusting the steam valve 54 which controls the steam ejector 52.

The incinerator 50 is provided with a carburetor arrangement 51 which admits air into the stream of fumes passing through the horizontal duct 43 and upstanding duct 47. It may be noted here that the flue duct is closed with a removable end plate 58 and a drip pipe 60 is connected at its upper end to the duct 43 and extends at its lower end into a water seal 61. Any condensate which accumulates in the duct will settle into the drip pipe. However, the flue duct 43 is made as short as possible to inhibit condensation of fumes in the flue duct. And it is particularly significant to note that the incinerator 50 includes a depending portion 69 which is coaxial with the axis of the incinerator. This provides a throat to the incinerator chamber 77; this throat serving as a fume-air mixing chamber 68 of the carburetor arrangement now to be described.

The carburetor arrangement comprises the upstanding duct 47 which may be considered as the fume or fuel inlet. Mounted over the upper open end of duct 47 is a baffle 62 in the shape of

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a truncated cone. It is secured at its lower peripheral edge to a depending ring 63 slidably fitting on the duct 47. The truncated cone baffle 62 is insulated on its upper surface and has a jet opening 64, over which is mounted a circular horizontally disposed baffle 65, having insulation 66 on its upper surface. This baffle is held in place a short distance above the peripheral edge of opening 64 by brackets 67. This arrangement of the baffles forms a fume or fuel jet through which the fumes pass into the mixing chamber 68 which is formed by a short section of conduit 69 which provides the coaxial throat depending from the incinerator 50 as mentioned above. The throat provided by depending portion 69 of the incinerator has a flared bottom end, providing a truncated cone ring 70 lying above and substantially parallel with the baffle 62. Thus the flared throat and the truncated cone baffle 62 provides an annular air duct 71 communicating with the atmosphere. Inasmuch as the ring 63 is adjustable vertically the effective area of the air duct 71 may be increased or decreased as desired to regulate the amount of air drawn into the mixing chamber 68 to be carburetted by the fumes passing into this chamber through the jet opening 64. The jet is kept in desired position by a set screw 72.

This carburetor construction, it will be noted, is adjacent the incinerator, the mixing chamber 68 itself serving, in effect, as a part of the incinerator inasmuch as it will contain a combustible mixture. Furthermore the insulated baffle 65 and the inclined baffle 62 provide shielding means which inhibit radiant heat in the hot incinerator from entering the duct 47, thus preventing flash-backs into the duct and possible ignition of any condensate in the flue duct, as would otherwise be the case. The baffles are also kept cool by the air drawn in from the atmosphere through the air duct 71.

The incinerator 50 comprises a steel casing 75 lined with refractory 76 which provides a combustion chamber 77. Inclined refractory baffles 78, 79 and 80 are mounted within the combustion chamber to provide a tortuous path for the flame and to insure complete combustion of the fumes in the incinerator. The burned gases pass upwardly into the chimney 151 and are discharged into the atmosphere.

The incinerator is provided with two sets of gas burners 81 and 82 oppositely disposed in the lower end of the incinerator chamber 77 passing through opposite walls 83 and 84. Each set of burners is connected through a manifold 85 to a gas supply pipe 86. A control valve 87 to regulate the amount of gas passing to the burners is set in the supply pipe 86 and this valve is operated in response to the temperature at the outlet of the incinerator. An electrical pyrometer (up to 2000° F.) 88, having its thermocouple 89 placed in the stack 151 adjacent the outlet of the incinerator chamber 77, is connected with a control motor 90. The control motor 90 is connected by an operating lever 91 to the control valve 87 in the gas supply pipe 86. As shown, the pyrometer and control valve arrangement is a "Wheelco" 2000° F. pyrometer connected to an American Temperature Control Unidirectional motor, these devices being available on the market. The gas supply pipe 86 is connected to a header 92 which is connected to a public utility gas supply which provides a source of manufactured gas. The pyrometer 88 also is connected

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with a thermocouple 73 so that the temperature in duct 47 can be had, if desired.

The incinerator is provided with an electrical ignition and gas pilot, and it is so arranged that the gas or fumes in the incinerator can not be lighted unless the protective CO₂ system is in operative condition. The gas pilot burner 95 is connected through a pipe 96, having a valve 97, to the gas supply pipe 92. The gas at the pilot burner is ignited by a spark generated by an electric igniter 98 through a switch 99. This electric circuit is connected with the pressure switch valve 30. This switch is arranged to cut off the supply of electric current in the circuit if the CO₂ pressure in the CO₂ protective system is absent. If the CO₂ pressure is on, then the switch 30 closes the circuit. Assuming the circuit is closed, the igniter can be operated by button switch 99. A Wheelco Flametrol is provided in the incinerator and it is arranged so that the main supply of gas to the incinerator is shut off in case of gas failure. This arrangement is shown diagrammatically in Fig. 5.

The circuit 100, 101 is connected to a source of current; the manually operated switch 99 being in this line (see Figs. 1 and 5). The line 101 is connected through pressure valve switch 30 (see also Fig. 2), which is connected into the CO₂ protective system. Circuit 100, 101 is connected to primary coil 103 which energizes the secondary coil 104 of transformer 105. Line 106 is connected to the pilot gas burner 95 and also to burner 81a of the bank of burners 81. A flame control electrode 98 is positioned in the path of the flame from the gas pilot 95 and burner 81a and is connected to line 107 through solenoid 108 and line 109 which returns to the secondary 104. The solenoid closes the valve 87 in the gas supply line 86 when there is no flame from either the gas pilot burner 95 or the burners 81. This device is a Flametrol available on the market and it operates on the principle that the gas flame serves as an electrical conductor. Accordingly, the arrangement is such that manually operated switch 99 in circuit 101, 102 can be operated to ignite the pilot only when the CO₂ system is in operative condition since the pressure operated switch 30 is closed only when the CO₂ pressure is on. Once the pilot is lighted current passes through circuit 106, 107, the gas flame serving as a conductor. However, if the flame is extinguished because of gas failure, then the solenoid 108 allows main valve 87 (see Figs. 1 and 5) to close and shut off all gas supply to the burners 81 and 82. To ignite the gas in the pilot burner switch 99 is operated to cause a flow of current through circuit 100, 101. This causes an ignition spark between burner 95 and electrode 98 to light the gas.

The reactor is connected with an intercooler or heat exchanger 110. It has tubes 111 in a shell connected through headers at each end. The inlet to the intercooler is connected by a pipe 112 from pump 121 through a pump out pipe 113 connected to a pipe 115 extending to the bottom of the reactor. The outlet of the cooler tubes is connected to a pipe 116 to return the charge circulated through pipes 113 and 115 and intercooler tubes 111 back to the reactor. The intercooler 110 is cooled by water which flows through the shell outside the tubes 111. Cooling water from a suitable source is passed through water pipe 117 into the shell and the amount of cooling water is controlled by a

pyrometer regulator 118 which has its thermocouple 119 in the water outlet pipe 120 from the shell. Hence, the charge in the reactor may be circulated through the intercooler by the pump 121 operated by a motor 122.

The system is provided with a second pump 121a operated by a reversible motor 122a so that the raw material may be charged to the reactor. Also, finished material may be pumped by pump 121a to and from the reactor through pipes 116—114 and 123 to field tanks, or raw material may be charged to the reactor by this pump. A fire wall, indicated in Fig. 1 by dot-dash line 124, which is a part of the building within which the plant is installed, separates the reactor 10 and burners 15 from the pumps, incinerator and other parts of the fume disposal system. This is primarily a fire protection measure.

In describing the operation of the fume disposal system, it may be assumed that the reactor has been charged with raw oil material which is to be reacted. After the reactor is charged the hatch cover 24 is closed. The lever 25, if CO₂ valve 27 is to be closed, is placed across the cover. This is necessary to close valve 27. If it is desired to close valve 27 when the cover is open, the lever is placed across the hatch. In bringing the charge up to reaction temperature by gas fired burners 15, there is a certain amount of fumes generated by the charge in the reactor which vary as the process proceeds and finally reaches its end; the chemical reaction once started is usually exothermic. Draft is supplied in the stack 151 by steam ejector 52 and ordinarily regulated at about one-half inch of water on draft gage 56. In the meantime there is CO₂ pressure in the CO₂ protective system. The valve 30 is set to operate at about 30 p. s. i. to close the switch to make circuit 100—101 ready. Then manually operated switch 99 is closed which ignites the pilot gas burner 95. When the pilot flame is on, the solenoid 108 opens valve 87 and it is under the control of the pyrometer 88 which is set to maintain a temperature in the incinerator outlet at about 1150°–1200° F. The incinerator is kept heated to incandescence. Then as the fumes are drawn from the reactor through the flue duct 43 they pass through the jet opening 64 of the carburetor 51. The area of air duct 71 is adjusted so that a proper amount of atmospheric air is drawn through to be carburetted by the fumes to efficiently burn all the fumes in the incinerator. Also, it may be noted that the draft may be regulated to control the amount of air drawn through the carburetor. Manifestly, there will be a variation in the amount of heat generated by the burning of the fumes since the supply of fumes is not constant. However, any variation in the amount is taken care of by the pyrometer controlled valve 87 which operates in response to the temperature at the outlet of the incinerator. When little heat is derived from the fumes the gas valve 87 is automatically opened to supply more gas and automatically closed in proportion when the fumes are sufficient to maintain the desired predetermined temperature in the incinerator.

At the end of the reaction cycle, the charge is hot and frequently too hot to pump directly to the storage tanks. The charge may be cooled rapidly by circulating it through the intercooler 110 and when cool enough it may be pumped through the line 123 to a field tank. Pump 121a is used for pumping finished material through pipes 116 and 114 and 123 to the field tank.

If it is desired to open the hatch 23 at any time when the charge is hot or if there be danger of drawing air into the reactor which might form an explosive mixture, the lever 25 must be moved aside. This automatically opens valve 27 and CO₂ passes through the valve into the reactor to form a protective blanket of CO₂ and the CO₂ serves as an inert diluent to prevent an explosive or auto-ignition mixture. Also, the CO₂ system, it will have been observed from the foregoing description, has other outlets into the reactor and conduits to let in CO₂, as desired, for a like purpose. The foregoing description is primarily for illustrative purposes and it will be understood that the plant with its various controls and protective and regulating devices lends itself to many variations in operation.

It will be seen also from the foregoing description that a system is provided which controls the fumes at auto-ignition temperature to preclude an explosive mixture, burn back or flashback from the incinerator to the flue duct, and there is provision for carburetion of the proper amount of air at the proper location to insure safe and economic operation and the obnoxious and dangerous fumes are totally destroyed by incineration and discharged into the atmosphere and dissipated. The fume disposal system is adapted for use either as a closed reactor or one that is operated as an open reactor, since a CO₂ protective blanket may be charged to the reactor as desired to avoid an explosive mixture. Furthermore the fume disposal system may be adapted for use in disposing of combustible and obnoxious fumes in other industrial plants where such fumes are generated.

The terms and expressions which have been employed herein are used as terms of description and not of limitation, and there is no intention in the use of such terms and expressions of excluding any equivalent of the features shown and described or portions thereof, but it is recognized that various modifications are possible within the scope of invention claimed.

What is claimed is:

1. Apparatus for the disposal of burnable fumes by incineration which comprises a chamber in which said fumes are generated, a duct through which to pass said fumes in a stream from said chamber, an incinerator beyond said duct in which said fumes are burned, a carburetor connected to said duct for introducing air into said stream to be carburetted by said fumes and for passing the carburetted air into said incinerator, means for introducing fuel to said incinerator in addition to said burnable fumes and a discharge outlet from said incinerator to carry away the burned fumes, said carburetor including a truncated cone baffle connected with said duct in the path of travel of said stream of fumes and providing a jet opening, a flat baffle over said jet opening, an air-fume mixing chamber in the path of said stream communicating with said duct and connected to said incinerator and an annular air passageway adjacent said truncated cone baffle providing communication between the atmosphere and said mixing chamber.

2. Apparatus for the disposal of burnable fumes by incineration which comprises a reaction chamber in which said fumes are generated, a substantially horizontal short length duct through which to pass said fumes in a stream from said chamber, a vertical duct connected to said horizontal duct, an incinerator

chamber above said vertical duct in which said fumes are burned, a carburetor connected to the upper end of said vertical duct for introducing air into said stream to be carburetted by said fumes and for passing said carburetted air into said incinerator, means including gas burners for introducing a combustible gas to said incinerator chamber in addition to said burnable fumes, a chimney connected to said incinerator to carry away the burned fumes, and means for establishing a controlled draft in said chimney; said carburetor including a truncated cone baffle connected to said vertical duct in the path of said stream of fumes and providing a jet opening, a horizontal baffle over and above said jet opening, said baffles serving as a radiant heat shield between said incinerator and vertical duct, an air-fume mixing chamber in the path of said stream communicating with said vertical duct and connected to said incinerator, an air passageway between said cone baffle and the wall of said mixing chamber for passage of air from the atmosphere into said mixing chamber, said cone baffle being vertically adjustable to vary the effective area of said passageway.

3. Apparatus for handling and incinerating burnable fumes from a reactor in which vehicles for paint and varnish are processed which comprises a refractory lined incinerator in which said fumes are burned, a plurality of staggered heat resistant baffles in said incinerator providing a tortuous flame-travel path, an air-fume mixing chamber connected to the inlet of said incinerator, a duct to carry the fumes from said reactor in a stream into said mixing chamber, a truncated cone shaped baffle defining a jet in the path of said stream between said duct and mixing chamber, a flared baffle on said mixing chamber adjacent said jet, said cone shaped baffle and said flared baffle defining a passageway from the atmosphere into said mixing chamber through which to pass a stream of air to be carburetted by said stream of fumes, means including burners for introducing combustible fuel into said incinerator in addition to said fumes, means controlled in response to change in temperature in said incinerator to regulate the amount of combustible fuel introduced into said incinerator, an outlet stack connected to said incinerator through which the combustion gases resulting from the combustion of the fumes are discharged and a draft-inducing injector in said stack for drawing a controlled amount of air from the atmosphere through said opening into said mixing chamber.

4. Apparatus for handling and incinerating burnable fumes from a reactor in which vehicles for paint and varnish are processed which comprises an incinerator chamber in which said fumes are burned, an air-fume mixing chamber below and connected to the inlet of said incinerator chamber, a vertically disposed duct below said mixing chamber, a substantially horizontal duct of short length connected to said vertical duct and reactor to carry fumes from said reactor in a stream into said vertical duct, a truncated cone baffle at the upper end of said vertical duct defining a jet in the path of said stream between said vertical duct and mixing chamber, the wall of said mixing chamber and said truncated cone baffle defining a passageway from the atmosphere into said mixing chamber through which to pass a stream of air to be carburetted by said stream of fumes, means including burners for introducing combustible fuel into said incinerator in addition to said

fumes, an outlet stack connected to said incinerator through which the combustion gases resulting from the combustion of the fumes are discharged, and temperature responsive control means controlling the amount of said combustible fuel introduced into said incinerator in response to changes of temperature in said incinerator.

5. Apparatus for handling and disposing of the burnable fumes from a reactor in which paint vehicles are processed which comprises, a reactor of the closed type having a charging hatch with an openable and closable cover, a pipe system having therein a source of inert gas under pressure and connected to the interior of the reactor, a valve in said system, a lever connected with said valve cooperating with said cover which must be moved before said cover can be opened, said valve being opened in response to such movement of said lever to introduce said inert gas into said reactor before said cover is opened, a flue duct connected to said reactor to carry fumes in a stream from said reactor, an incinerator in which said fumes are burned, a carburetor between said duct and incinerator including an air-fume mixing chamber connected to said incinerator, a stack connected to said incinerator to carry away the burned gases, means including burners to introduce fuel into said incinerator in addition to said burnable fumes, and means responsive to increase and decrease of temperature in said incinerator to selectively increase and decrease the amount of fuel introduced through said burners.

6. Apparatus for handling and disposing of the burnable fumes from a reactor in which paint vehicles are processed which comprises, a reactor of the closed type having a charging hatch with an openable and closable cover, a pipe system having therein a source of CO₂ gas under pressure and connected to the interior of the reactor, a valve in said system, a lever connected with said valve cooperating with said cover which must be moved before said cover can be opened or closed, said valve being opened in response to such movement of said lever to introduce CO₂ into said reactor before said cover is opened or closed, a flue duct connected to said reactor to carry fumes in a stream from said reactor, an incinerator in which said fumes are burned, a carburetor for introducing and carburetting air between said duct and incinerator including an air-fume mixing chamber connected to said incinerator, a stack connected to said incinerator to carry away the burned gases, controllable draft inducing means in said stack, means including burners to introduce fuel into said incinerator in addition to said burnable fumes, and means responsive to increase and decrease of temperature in said incinerator to selectively increase and decrease the amount of fuel introduced through said burners whereby said incinerator may be maintained at substantially constant and incandescent temperature notwithstanding fluctuation in the amount of combustible fumes in the stream passing into said incinerator.

7. Apparatus for handling and incinerating burnable fumes from a reactor in which vehicles for paint and varnish are processed which comprises a duct to carry the fumes from said reactor, a refractory lined incinerator chamber in which said fumes are burned, an air-fume mixing chamber connected to said incinerator and to said duct and between said incinerator chamber and said duct, means defining an opening providing communication between the atmosphere and said mixing chamber for introducing atmos-

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pheric air into said mixing chamber, burners in said incinerator chamber for introducing combustible fuel into said incinerator chamber in addition to said fumes, means operative in response to change in temperature in said incinerator chamber to control the amount of additional fuel introduced into said incinerator chamber through said burners, an outlet chimney connected to said incinerator chamber through which the combustion gases resulting from the combustion of the fumes are discharged, and draft-inducing means in said chimney operative to draw air in controlled amount from the atmosphere through said opening into said mixing chamber.

8. Apparatus for the disposal by incineration of burnable fumes from a reactor in which vehicles for paint and varnish are processed and which are capable of forming an explosive mixture which comprises a chamber in which said fumes are generated; a duct through which to pass said fumes in a confined stream from said chamber, a refractory lined incinerator chamber in which said fumes are burned; said incinerator having an inlet and an outlet; an air-fume chamber connected to said incinerator inlet, a carburetor between said duct and air-fume chamber having a passageway connecting said air-fume chamber with the atmosphere for introducing air into said air-fume chamber to be

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carburetted by said fumes, a truncated cone baffle in said carburetor in the path of travel of said fumes serving as a flash-back preventer to prevent ignition of fumes in said duct by flash-back from fire in said incinerator; fuel burners in said incinerator chamber, means to introduce fuel through said burners into said incinerator chamber in addition to said burnable fumes; a chimney connected to said incinerator outlet to carry away burned fumes for dissipation to the atmosphere, and draft inducing means for providing draft in said chimney.

JOHN P. ENGEL.

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