

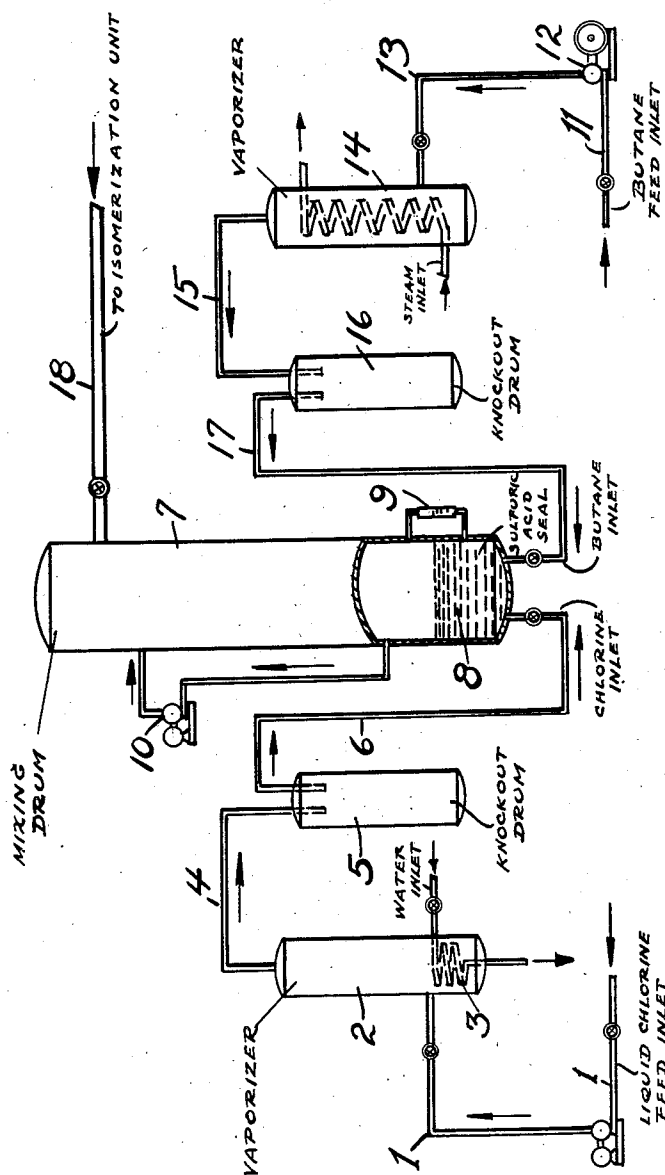
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METHOD OF CONTROLLING FLUID FLOW

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METHOD OF CONTROLLING FLUID FLOW

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5 Claims. (Cl. 137-78)

This invention relates to a process for the introduction of fluids into mixing chambers or other receiving vessels and to a method of preventing the backward flow of fluids into the feed lines, and it has particular reference to a method by which the formation of explosive mixtures of certain substances may be avoided when the substances are being mixed in certain proportions.

In many types of chemical apparatus, particularly where two or more fluids are being introduced into a common receiving drum or mixing chamber, it is desirable to prevent the backward flow of the materials within the drum into the feed line when the supply of one of the fluids is cut off through accident or otherwise. This control is particularly desirable in cases where two fluids are being introduced in carefully controlled ratios, and when there is danger that explosive mixtures will be formed if the ratio of materials is considerably changed. By way of example, the control is desirable as applied to such fluids as chlorine and butane or chlorine and ethylene.

In the accompanying drawing a typical arrangement of apparatus for applying the present invention to the formation of butane-chlorine mixtures is shown in schematic form.

In the drawing, the feed of liquid chlorine is introduced through line 1 into vaporizer 2, where it is vaporized by contact with water coil 3. The vaporized chlorine then passes through line 4 to knockout drum 5 and thus through the inlet tube 6 to the bottom of mixing drum 7, where it then passes through a body of sulfuric acid 8 into the main body of the drum. Gauge 9 shows the level of the sulfuric acid in the drum. Pump 10 provides for circulation and mixing of the components entering drum 7. At the same time liquid butane is fed through line 11 to pump 12 and then through line 13 to vaporizer 14, where it is vaporized by contact with a steam coil. The gaseous butane then passes through line 15 to knockout drum 16 and thus through inlet tube 17 to the bottom of mixing chamber 7, and then through the sulfuric acid seal 8 to the main body of the drum, where it mixes with the incoming chlorine. The mixed gases pass out of the drum to the isomerization unit through line 18.

The above described apparatus may equally well be used when the butane is introduced into the mixing chamber as a liquid. In this case no vaporizer for the butane will be employed.

It can be seen that if the supply of chlorine were inadvertently cut off, the mixture contain-

ing a large proportion of butane might flow back through line 6 into knockout drum 5, and there would be great danger that an explosive mixture would be formed in the knockout drum or even in inlet tube 6. If this tube is sufficiently narrow and the sulfuric acid seal is employed, the sulfuric acid will flow backward only very slowly, and if there are regular inspections of the level of the sulfuric acid in the receiving drum, such backward flow would be detected, and if the inspection were of sufficient frequency there would be no danger that any of the butane mixture would reach line 6 before the interruption in supply of chlorine could be detected and the inlet tube shut off. There would also be danger if the butane flow were interrupted, since in that case the percentage of chlorine would build up in drum 7 to dangerous proportions. If the sulfuric acid flowed backward through line 17, the fact could be detected on inspection, as in the previous case. If extreme caution is desired, the cross sections of both line 6 and line 17 may be made sufficiently small so that if the supply of both of the components is interrupted at about the same time, and the acid flows backward through both of the tubes, the rate of flow would be sufficiently slow to permit detection within the normal period of inspection.

As a variation or addition to the method of the present invention, an automatic liquid level indicator of any conventional type may be employed, and an automatic control could be supplied whereby an additional quantity of sulfuric acid could be introduced into the mixing drum when the level of the acid reached a certain minimum point. This provision would delay the entrance of the mixed fluids into the inlet tubes until all of the available supply of sulfuric acid is used, but it is not intended that this will be a substitute for periodic inspections, since there might be failure of the automatic control.

In the operation of the above described apparatus other precautionary measures should be taken to prevent the local formation of explosive mixtures. It is well to provide a large mixing drum in order that there will not be a rapid increase of chlorine percentage in case the butane supply fails but without backward flow through line 17. Continuous thorough mixing of the ingredients within the drum should be maintained by means of pump 10.

The actual dimensions of the inlet tube or pipe and connecting lines which must be provided in a particular case in order to cause the desired delay in backward flow of the sealing

liquid under a maximum pressure differential may be calculated by well known engineering formulas. As an illustration, it has been found that where there is a pressure differential of 50 lbs./sq. in. between the receiving drum and the apparatus supplying a component, such as chlorine, and there are 2,000 gals. of sulfuric acid of about 98% concentration in the bottom of the drum as sealing liquid, about one hour is required for the acid to flow out of the drum through an inlet tube 1 in. in diameter and 50 ft. long. A similar length of time for outflow of this amount of acid will be required if the pressure differential is of the order of 1,250 lbs./sq. in. and the tube diameter is reduced to $\frac{1}{2}$ in. If, on the other hand, the pressure difference is only 6 or 7 lbs./sq. in., a tube as wide as $1\frac{1}{2}$ in. may be used to obtain a one hour outflow time. In general, it may be said that when not more than 2,000 gals. of concentrated sulfuric acid are used as a seal, and the pressure in the receiving drum becomes greater than that in the feed lines, the feed lines should have a diameter at least as small as $1\frac{1}{2}$ in. and a length of at least 50 ft., if a one hour delay or longer is required for the outflow. Smaller lines or greater length of lines, or both, will be required as the pressure differential is increased, as shown by the examples cited.

The scope of the present invention is not to be limited by any of the described examples of its operation and application, but it is to be limited solely by the terms of the appended claims.

I claim:

1. In a process comprising the introduction of a fluid into a container through an inlet tube, the step which comprises passing the fluid in its normal forward flow from said inlet tube through a body of chemically inert sealing liquid so situated that in the event of cessation of the normal forward flow of said fluid the sealing liquid will tend to flow backward through said inlet tube, and so choosing the cross section and length of the said inlet tube and viscosity, density and amount of the sealing liquid that no portion of the contents of the said container other than the sealing liquid will pass out through the said inlet tube during the time elapsing between regular prearranged inspection periods under the pressure differential than prevailing between the inside of the said container and the farther end of the inlet tube.

2. A process step according to claim 1 in which the said sealing liquid is located in the bottom of the said container, and in which the inlet tube is so situated that the incoming fluid passes through the said sealing liquid.

3. In a process which comprises simultaneously and continuously introducing a plurality of feed fluids into a common container by means of separate narrow inlet tubes, the step which comprises passing each of the said fluids in its normal forward flow from the inlet tube through a body of chemically inert sealing liquid so situated that in the event of cessation of the normal forward flow of one of the fluids the contents of the

said common container will be delayed in passing out through the inlet tube of such fluid by the relatively slow movement of the sealing liquid through the inlet tube, the viscosity, density and amount of the sealing liquid and the dimensions of each inlet tube being so chosen that under the conditions of the process and in the event of cessation of normal forward flow of any of the incoming fluids, no portion of the contents of the common container other than the said sealing liquid will make contact with a feed fluid elsewhere than in the common container during the time elapsing between regular prearranged inspection periods.

4. In a process for preparing mixtures of two fluid substances by simultaneously and continuously flowing the components of the mixture in the form of fluids into a common container through separate narrow inlet tubes at substantially constant relative rates which will provide a mixture of the desired portions in the said container, the method of delaying the backward flow of said mixture into contact with an individual component in the event of cessation of the inflow of such component, which comprises providing a body of sealing liquid through which each component fluid must flow from the inlet tube to reach the said common container, said sealing liquid being chemically inert to and substantially immiscible with either of the components of the fluid mixture, the viscosity of the sealing liquid and dimensions of the inlet tube for each component of the fluid mixture being so chosen with relation to the maximum possible pressure differential that in the event of cessation of the inflow of one component at least one hour is required for all of the sealing fluid to pass out of the common container through the inlet tube of such component.

5. In a process for preparing mixtures of a light hydrocarbon and a halogen of non-explosive proportions by simultaneously and continuously flowing the components of the mixture in gaseous form into a common container through separate narrow inlet tubes entering at the bottom portion thereof at substantially constant relative rates, the method of delaying the backward flow of said mixture into contact with an individual component outside of said common container, in the event of cessation of the inflow of such component, which comprises providing a body of concentrated sulfuric acid as a sealing liquid in the bottom portion of the said common container, through which each component gas must pass from the inlet tube to reach the mixture of gases in the said common container, the amount of sulfuric acid and dimensions of the inlet tube for each component of the fluid mixture being so related to the maximum pressure differential in the event of cessation of the inflow of such component that at least one hour is required for all of the sulfuric acid to pass out of the common container through the said inlet tube.

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