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MEANS FOR TRANSFERRING CORROSIVE LIQUIDS

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This invention relates to pipe connection constructions for transferring corrosive liquids from sources of supply to autoclaves for injection therein under pressure. More particularly, it relates to pipe and coupling arrangements for the injection of concenetrated sulfuric acid into autoclaves containing aqueous treating or leaching liquids operating at high temperatures and pressures.

In the leaching of nickeliferous iron ores with dilute sulfuric acid utilizing high temperatures (up to 475° F.) and pressures (up to 520 p.s.i.g.), it is recognized that corrosion properties are lessened by storing and transferring the sulfuric acid in concentrated form to the high pressure leaching vessel containing the finely divided ore in aqueous slurry form, the dilution of the acid to the desired strength occurring in the vessel. Although acid resistant metal pipes for transferring and injecting the acid will successfully withstand corrosion by the concentrated acid, unavoidable contact between the injection pipe and acid in a range of dilutions occurs. If the injection pipe terminates in the vapor space of the autoclave, the dilution will occure at the discharge tip of the pipe as a result of the combination of condensing steam with the acid. Also when the introduction of the acid is discontinued, the acid will flow out of the pipe, and steam will flow back up into the pipe, condense and dilute the acid, there corroding the inside of the pipe, back to the check point, i.e. a valve, a check valve or a liquid seal. If the acid injection pipe terminates below the surface of the aqueous slurry, corrosion at the pipe terminus and within the pipe likewise unavoidably occurs.

To overcome this corrosion problem, a number of steps have been tried without adequate success. Glass lined piping was tried and it resisted the corrosion, but breaking was unavoidable due to vibration of the autoclave and connections thereto. Tetrafluoroethylene (Teflon) tubes placed within metal tubes also resisted corrosion but they were only partially successful because the plastic expands excessively on heating and is subject to deformation under the heat and physical pressure encountered, thus permitting leaks to develop at the point of junction with the metal pipe leading from the concentrated acid source.

An object of the present invention is to provide an injection pipe and connection which overcomes all of the hereinbefore mentioned limitations and which provides for continual operation of the autoclave processing over long periods of time without interruption due to corrosion, breakage or other faults.

Broadly considered, the invention may be defined as involving an injection line and connecting construction for intermittently feeding or transferring concentrated, or relatively concentrated sulfuric acid or other corrosive liquid from a storage tank or other source to an autoclave which comprises a plastic tube resistant to corrosion by such corrosive liquid at all concentrations or dilutions, having one end terminating within or a a wall of the autoclave and the other in one side of a coupling the other side of which coupling is connected to a source

of supply for said liquid, a metal pipe concentrically surrounding and contacting said plastic pipe attached at one end into said autoclave and at the other end to said coupling, said tube and pipe or a section thereof extending in an upwardly direction from the coupling to the autoclave, whereby the corrosive liquid will remain in at least part of the tube by force of gravity when the feeding of corrosive liquid has been stopped. This upwardly extending arrangement of the tube serves to prevent any diluted liquid from flowing back to the coupling where it would cause corrosion.

The plastice pipe is preferably constructed of tetrafluoroethylene, for it will withstand all concentrations of sulfuric acid at all temperatures which will be encountered, i.e. from room temperature up to 475° F. Its high coefficient of expansion and deformation characteristics under these changing temperature conditions are eliminated as a consideration by the manner of connecting the tube into the autoclave and the cooling effect obtainable in the pipe leading to the coupling. Other corrosion-resistant plastic tubes contemplated are fabricated from other halogen carbon resin compounds related to tetrafluoroethylene, from silicone resins or from various tough phenolic resins.

When the plastic tube is in its preferred form, an inverted U loop, a column of concentrated acid or other liquid is always retained in the leg of the tube starting at and leading from the coupling where the plastic tube is joined to the metal pipe leading to the liquid source. Thus the steam and excessive heat of the autoclave is prevented from reaching the coupling. The coupling between the plastic tube and liquor source is accomplished through the use of a liquid-tight friction joint.

The inability of the plastic tube to withstand the vapor pressure under which the autoclave is operated is overcome not only by the provision of the surrounding metal pipe or armour pipe but also by the arrangement of the end of the tube and the pipe in the autoclave. The annulus or area between the tube and pipe is left open to the pressure within the autoclave and hence the pressure on the outside of the plastic tube is the same as that on its inside surface, excepting of course, the slightly greater pressure created inside the tube during the introduction of the acid. The armour pipe should have heat radiating surfaces adequate to prevent heat from the autoclave from damaging the plastic tube connection at the coupling. Such radiation may be provided by the length of the armour pipe exposed to the atmosphere or by a cooling means applied to the pipe.

The looped tube and pipe, or at least the top portions thereof, are preferably arranged above the level of the autoclave and connect into the top thereof or into the vapor space above the liquid reaction mass. The plastic tube may terminate in the upper part or vapor space or in the lower part or below the liquid level. The armor pipe likewise may terminate at any level or at the autoclave wall, but it should have one or more openings into the vapor space to prevent the acidic reaction liquid from backing up into the annulus between the plastic pipe and the armour pipe where corrosion would occur. When the armour pipe projects into the acidic reaction mass, it can be fabricated of titanium metal. In all of these arrangements, the plastic tube advantageously is longer than the armour metal pipe, thus providing a free end of the plastic tube.

The invention may be more completely understood from the accompanying drawings which illustrate merely preferred embodiments. Figure 1 is a vertical section of an autoclave and an elevation of the connecting line and coupling connecting said line to a pipe leading from an acid storage tank (not shown). Figure 2 is an enlarged vertical section of a suitable coupling for anchoring the