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PROCESS AND APPARATUS FOR TREATING LIQUIDS WITH SULPHUR COMBUSTION GASES

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This invention relates to a process and apparatus for treating a continuous flow of liquid with sulphur combustion gases.

Sulphur dioxide is extensively used as a reducing agent or as an acidic agent in a wide variety of commercial processes, such as in the treatment of potable water, waste products and other materials. One familiar example of the use of this gas is for removing the chlorine taste from chlorinated drinking water samples. Another example is the reduction of the alkalinity of boiler water with the formation of sodium sulphate whereby caustic embrittlement of boiler steel is prevented.

A third example involves the use of sulphur dioxide to lower the pH value of the water to a point where precipitation of certain scale-forming solids in boiler feed pumps and economizers will be prevented.

Yet another example is the use of sulphur dioxide to decrease the pH value of water to be softened by those base exchange materials which are attacked and disintegrated by water of high pH value. Sulphur dioxide may also be used as an auxiliary reagent with coagulants used in water purification for the removal of turbidity, organic coloring matter or other impurities.

Additional examples of the use of sulphur dioxide are found in the paper, bleaching and in many other arts wherein aqueous solutions are treated with sulphur dioxide to increase the acidity of the solution or to assist in their purification.

In accordance with prior practice, sulphur dioxide has been provided for use in such treatments in the form of a gas, a liquid under pressure as well as in the form of aqueous solutions. When sulphur dioxide is to be used in the liquid state, it is necessary that it be stored under pressure in heavy containers, thereby rendering the cost of transportation and handling unduly high. Moreover, an appreciable amount of sulphur dioxide is unavoidably left in the containers, thereby adding to the cost of the treatment to the consumer. This method of handling sulphur dioxide has other disadvantages apart from its costliness and inefficiency, including the wide variations in the quantity and the pressure of sulphur dioxide delivered when the pressure on the container is released for use of the gas. This latter failing makes uniform treatment of a liquid with sulphur dioxide gas derived from liquid sulphur dioxide quite difficult.

Many attempts have been made to overcome the foregoing deficiencies as by heating the container, drawing the gas off into a low pressure storage container and then with the aid of a suction device, leading the gas into the water to be treated. Under this method, the control of the quantity of reagent added to the water being treated depends upon an accurate control of the volume of gas drawn into each storage container. Such procedures require the use of additional equipment, complicate treatment processes, and create numerous inconveniences in the use of sulphur dioxide.

In accordance with prior practice, there were certain advantages in using sulphur dioxide in aqueous solutions rather than in the liquid or gaseous phase. Yet the preparation of appropriate aqueous solutions requires considerable apparatus and controls. Moreover, the solutions are usually dilute thereby involving bulky and costly packaging and handling.

The solutions of sulphur dioxide are usually made by passing sulphur dioxide gas through an absorption tower which has the absorbing liquid disposed over a large surface of packing material within the tower and collecting the solution as it flows out at the bottom of the tower in the form of a dilute solution of sulphurous acid or alkaline sulphites. This solution is then used as a source of sulphur dioxide for the treatment of various liquids. However, a control of the quantity of sulphur dioxide used in the treatment of such liquids requires a control of the concentration and volume of this auxiliary solution. Numerous solution-feeding devices have been invented which may be used for controlling the volume and concentration of the solution added either in proportion to the flow of a second liquid or at a constantly adjusted rate. These devices are well known in the art of water-treatment but they are costly and complicated. Likewise, attempts to treat a stream of liquid with solutions of sulphur dioxide as it is produced have proven impractical. A constant concentration of sulphur dioxide in a flow of liquid being treated directly with the solution of sulphurous acid or alkaline sulphites requires a regulation both of the rate of sulphur burning and the volume of absorbing liquid. Regulatory devices of a practical nature are not available for exercising such controls. Hence, prior known devices are not adapted for use in processes designed to treat streams of liquids with sulphur dioxide as it is produced unless complicated and expensive auxiliary control devices are introduced.

It is a principal purpose of the instant invention to provide an improved process for treating