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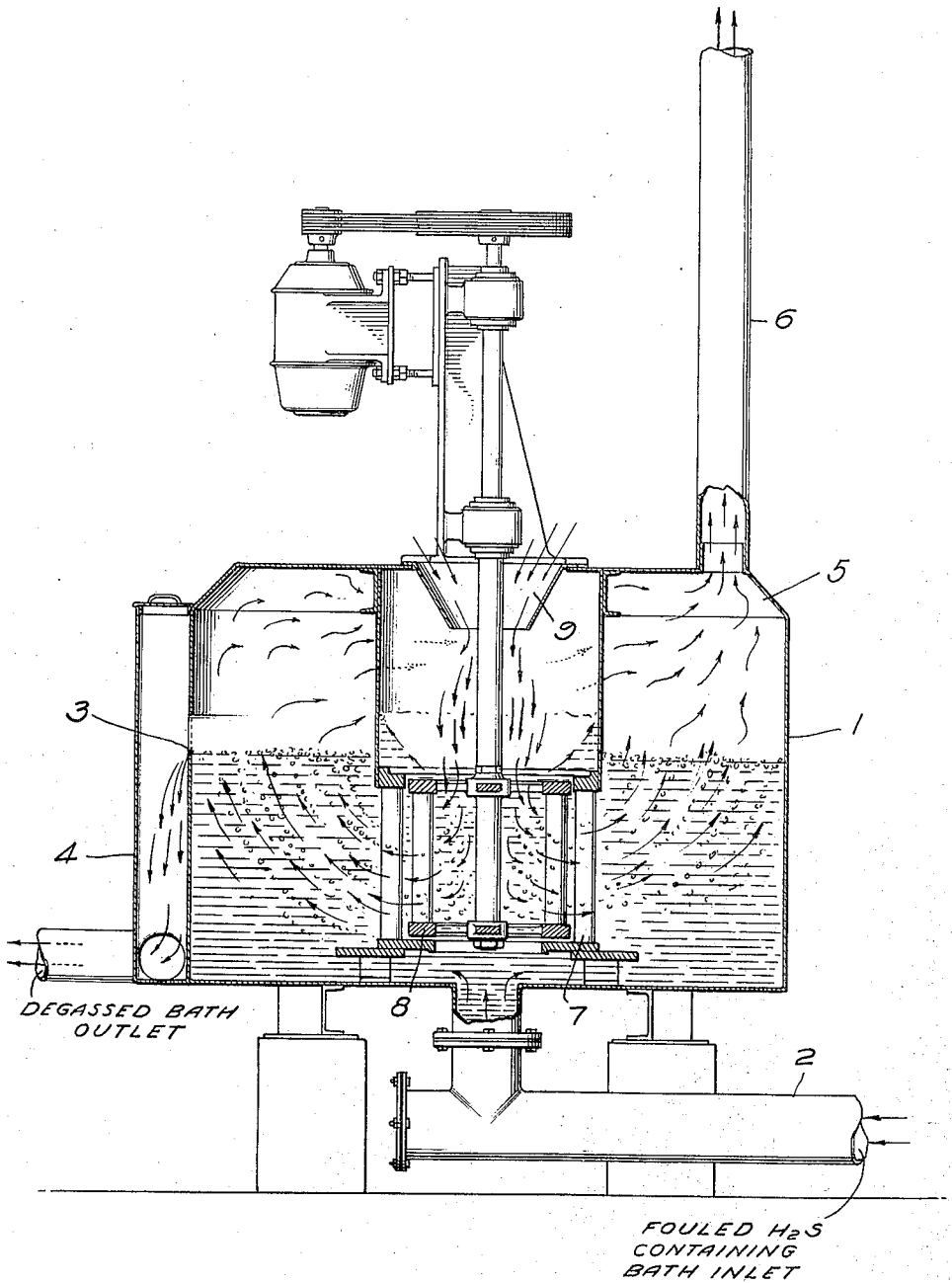
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DEGASIFICATION OF LIQUID DISPERSIONS

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## DEGASIFICATION OF LIQUID DISPERSIONS

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This invention relates to a method for the removal of gases and/or volatile substances from liquids or liquid suspensions of solid materials without the removal of the suspended solids.

It is an object of the present invention to provide an efficient and economical method of degassing and removing or recovering volatile substances from liquid solutions thereof or from liquid suspensions of solid materials.

The present invention is based on a peculiar use of a machine ordinarily employed for mechanical froth flotation. A mechanical flotation machine is primarily designed to produce a froth by introduction of air or gas bubbles into a suspension of solid and causes certain select portions of the solids to adhere to the bubbles of froth, followed by separating the froth from the liquid. I have found according to the present invention that if a froth flotation machine is used under conditions in which no substantial froth flotation takes place, that is to say no froth is obtained and removed, it does, however, serve to remove volatile obnoxious constituents from solid suspensions in liquid, such as for example, dissolved gases, volatile liquids either as a mixture or dissolved, emulsions or the like without any substantial loss of solid constituents. At the same time, although the flotation machine is operated so that it will not perform its normal function, its efficiency as a degasifying machine is not impaired. In this respect the present invention is unique since normally when a machine is operated so that its normal function is not performed, it is a relatively inefficient machine for other functions.

While it is an advantage of the present invention that any suitable type of mechanical froth flotation machine may be employed in order to remove volatile obnoxious constituents from a suspension under the ordinary speeds of operation, I have found that with certain machines, notably the highly efficient Fagergren type of flotation machine, an enhanced degasification may be obtained by operating the machine at a speed above that which is normally considered as an optimum for froth flotation. In a more specific aspect therefore, the present invention includes operating froth flotation machines at speeds higher than normal.

The drawing, which is a vertical sectional view, illustrates a suitable Fagergren flotation apparatus for carrying out the present invention. The apparatus comprises a tank 1 having an inlet 2 in the bottom suitable for introducing liquids and an adjustable overflow weir 3 leading

to the launder 4. The tank 1 is covered by a hood 5 which has an opening into a vent pipe 6. An agitating and aerating mechanism which is comprised of a stator 7 having located therein a rotor mechanism 8, said stator and rotor mechanism being so arranged that when the rotor mechanism is rotated, air is drawn into the liquid through the passageway 9.

In utilizing the apparatus illustrated in carrying out the present invention, the fouled cellulose regenerating bath containing hydrogen sulfide and solid colloidal materials is introduced into the flotation apparatus through the opening 2 whereupon the liquid is subjected to agitation and aeration by the rotating action of the rotor mechanism being driven from a suitable source of power indicated here as an electric motor. The air displaces the hydrogen sulfide from the liquid which collects in the hood portion of the tank and is withdrawn through the vent 6. The liquid free from hydrogen sulfide, but still containing the colloidal solid materials passes over the weir 3 into the launder 4 and is ready for reuse in the regeneration of hydrated cellulose.

The present invention is, of course, not limited to the use of the particular type of apparatus disclosed, and the process may be carried out by other types of apparatus which have suitable agitating and aerating mechanisms combined with means for collecting the hydrogen sulfide and other contaminating gases when displaced from the liquid by the air, and suitable means for continuously removing the degassed liquid containing the solid materials in suspension from the tank. The Fagergren type of apparatus illustrated is the preferred apparatus, however, because it permits operation in such a manner that efficient aeration can be obtained and at the same time prevents the collection of large quantities of solids in the froth at the surface of the liquid which would interfere with the escape of the hydrogen sulfide. In the Fagergren type of apparatus we have found that when the rotor speed is increased over that normally used in flotation operations, the amount of air drawn into the solution is increased while at the same time the amount of solids collected in the froth is decreased, and this is a particular advantage of this apparatus in carrying out the present invention.

The operation of the present invention is in considerable part due to the intimate admixture of fine bubbles of a relatively fixed gas with the suspension to be treated so that volatile constituents tend to vaporize into the gas of the

bubbles through the interface. In spite of the fact that the operation of the present invention is carried out under conditions which will result in no froth flotation, as set out above, efficiency is not sacrificed which is a result at variance with the normal experience in flotation machines, because the formation and stability of froth produced is normally considered a vital factor in the efficient operation of the machine. According to the present invention, I have found that the degassing effect is not adversely affected by the absence of a froth of consistency such as to produce effective froth flotation of a portion of the solids. All of the factors entering into the operation of the present invention have not been fully determined and the invention is therefore not intended to be limited to any particular theory of action. I believe, however, that as a result of numerous tests with various materials, at least one factor contributing to the unexpected result may be the fact that the absence of an adherent froth prevents the formation of an oily interface between the gas of the individual bubble and the main body of the liquid and since there is no film or interface of limited gas permeability, the evaporation of the volatile liquid into the gas of the individual bubble may be accelerated. It is possible and even probable that in many cases other factors are also present and in certain cases they may be of greater importance than the one referred to above which is advanced only as a reasonable explanation of the otherwise anomalous results that a procedure that results in a very low grade froth, if any, produces degasifying results which are better than those obtained when a machine is operated under conditions for optimum flotation efficiency.

The conditions of the suspension which is to be treated by the present invention will vary with the different suspensions and the different characteristics of volatile obnoxious components contained therein. In some cases flotation is prevented by depressing of otherwise floatable constituents through the addition of depressing chemicals. In other cases the process proceeds by the elimination or substantial neutralization of constituents having frothing, froth stabilizing, or collecting properties. In other cases the addition of materials having high surface tension lowering properties such as for example wetting agents may be employed, and in this latter case it is probable that the lowering of the surface tension at the bubble interface may be an important factor permitting more rapid volatilization of the obnoxious component through the interface of the bubble.

The present invention is not limited to treatment of any particular suspension of solids. The efficient degasification appears to be general wherever the operation is performed under conditions which prevent substantial froth flotation. The degree of efficiency, capacity, and the like will of course vary with different mechanical flotation machines and to a very considerable extent with the nature of the suspension treated and particularly with the completeness with which the degasification is carried out. It is an advantage of machines of the Fagergren type that extremely fine bubbles are formed and accordingly very rapid degasification to a high degree can be effected in such machines because of the relatively small bubbles. The large degasification which thus results is an important

advantage of the preferred embodiment of the present invention. On the other hand, it is an advantage that the invention is not limited to any particular machine but can be effectively carried out on other types of flotation machines which may be already available, and can be employed with important economical savings due to the utilizing of existing equipment.

It is also an advantage of the present invention that it provides a simple and efficient means for the recovery or disposal of volatile substances from liquid suspensions or solutions in a great many industrial processes. For example, it can be used in the treatment of cellulose regeneration baths to remove obnoxious hydrogen sulfide gas and leave the sulfur or other solids, the presence of which may be desirable in the production of certain types of rayon yarns. It can also be used in the treatment of cellulose regeneration baths and so forth to recover valuable volatile solvents that have been used in processing or conditioning the cellulose baths and the like. Waste liquors such as those from the production of phenol or other volatile substances can be processed according to the present invention to recover the valuable volatile substances or remove them to prevent stream pollution when it becomes necessary to dispose of them as waste products.

In carrying out the present invention it may be desirable when dealing with certain solutions or suspensions to introduce non-obnoxious gases or air during the treatment in the flotation machine to displace the volatile substances, or the operation can be carried out at an elevated temperature. For example the temperature may be raised to or near the point of volatilization of volatile substances.

The term "volatile substances" or "volatile constituents" as used in this specification and in the claims relates to and include gases, liquids and solids that volatilize at relatively low temperatures.

The invention will be illustrated in conjunction with the following specific examples which are used for purposes of illustration only and the invention is not limited thereby.

#### Example 1

A rayon spin bath fouled with impurities produced in a rayon spinning operation was passed continuously into a Fagergren flotation machine at the rate of 4 liters per minute. The agitation chamber of this flotation machine was about 2500 cc. in volume. The effluent from the machine contained 7.3 parts per million hydrogen sulfide as compared with 18.7 parts per million in the bath entering the machine. No solid impurities were removed from the bath during this operation.

#### Example 2

A rayon spin bath, fouled with impurities produced in a rayon spinning operation including sulfur and 18.7 parts per million hydrogen sulfide was agitated in a Fagergren flotation machine. At the start of this operation 0.05% by weight of "Nekal-BX", a secondary butyl naphthalene sulfonate was added to the bath to retard the flotation of the sulfur and other solid impurities. At the end of a two minute treatment in the flotation machine the bath contained 5.4 parts per million hydrogen sulfide.

A second sample of this bath was treated with 0.05% "Avirol-80," a sulfated higher alcohol and

then agitated for three minutes. The bath following this treatment contained 6.3 parts per million hydrogen sulfide.

*Example 3*

A liquor fouled by the presence of finely-divided sulfur and containing 1200 parts per million carbon bisulfide was passed continuously into a Fagergren flotation machine. The agitation chamber of this machine was about 2500 cc. in volume and the bath was introduced at the rate of 2 liters per minute. The effluent from the machine contained 59 parts per million carbon bisulfide.

What I claim is:

1. A method of removing gaseous constituents from fouled cellulose regenerating baths from the regeneration of cellulose xanthate viscose, containing gaseous and solid constituents, which comprises subjecting said bath to a simultaneous aeration and mechanical agitation treatment under conditions normally conducive to the froth flotation of the solids, collecting the gaseous constituents liberated at the surface of the bath and removing the degassed bath with the solid constituents contained therein from the zone of agitation and aeration.

2. A method of degassing fouled cellulose regenerating baths from the regeneration of cellulose xanthate viscose, containing hydrogen sulfide and colloidal sulfur, which comprises subjecting said bath to a simultaneous aeration and mechanical agitation treatment under conditions normally conducive to the froth flotation of sulfur, collecting the hydrogen sulfide liberated at the surface of the bath and removing the degassed bath with the sulfur contained therein from the zone of agitation and aeration.

3. A method of removing hydrogen sulfide from fouled cellulose regenerating baths from the regeneration of cellulose xanthate viscose, containing solids deposited out of solution and hydrogen sulfide in solution, which comprises subjecting said bath to a simultaneous aeration and mechanical agitation treatment under conditions normally conducive to froth flotation of the solids, collecting the hydrogen sulfide liberated at the surface of the bath and removing the degassed bath with the solid constituents contained therein from the zone of agitation and aeration.

4. A process according to claim 3 in which the process is a continuous one.

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