Feb. 15, 1955 B. R. MACKINNON 2,702,280

METHOD OF MIXING GAS-AND FOAM-PRODUCING LIQUIDS

Filed June 26, 1947 2 Sheets-Sheet 1

FIG.1.

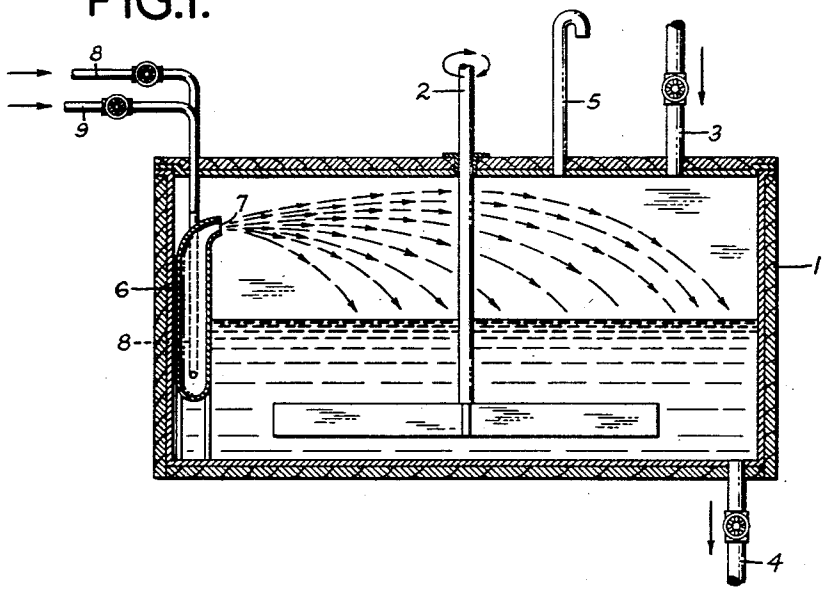
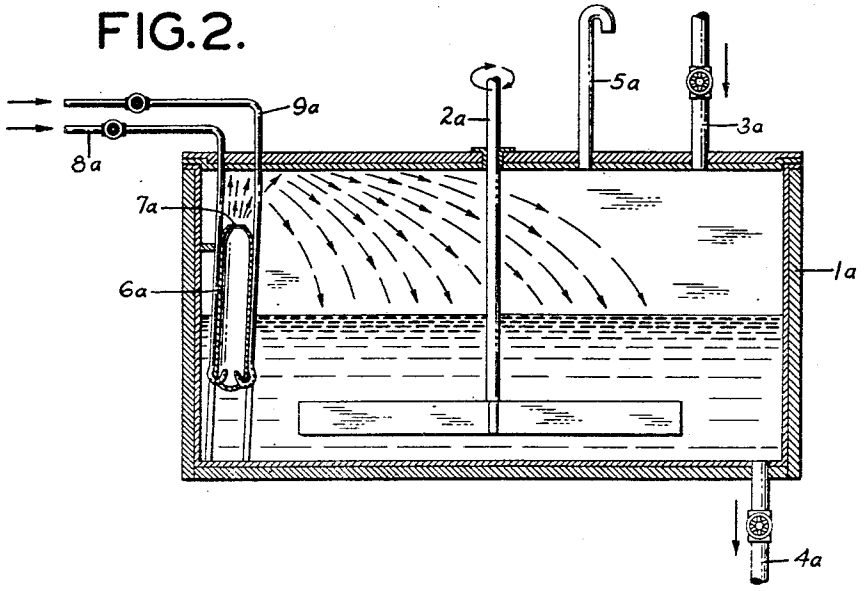


FIG.2.



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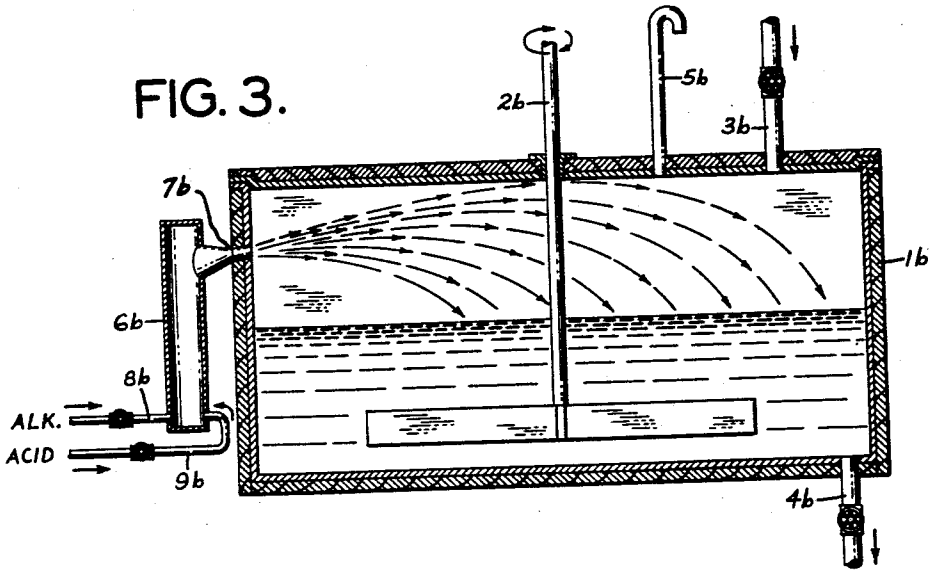
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METHOD OF MIXING GAS-AND FOAM-PRODUCING LIQUIDS

Filed June 26, 1947 2 Sheets-Sheet 2

FIG. 3.



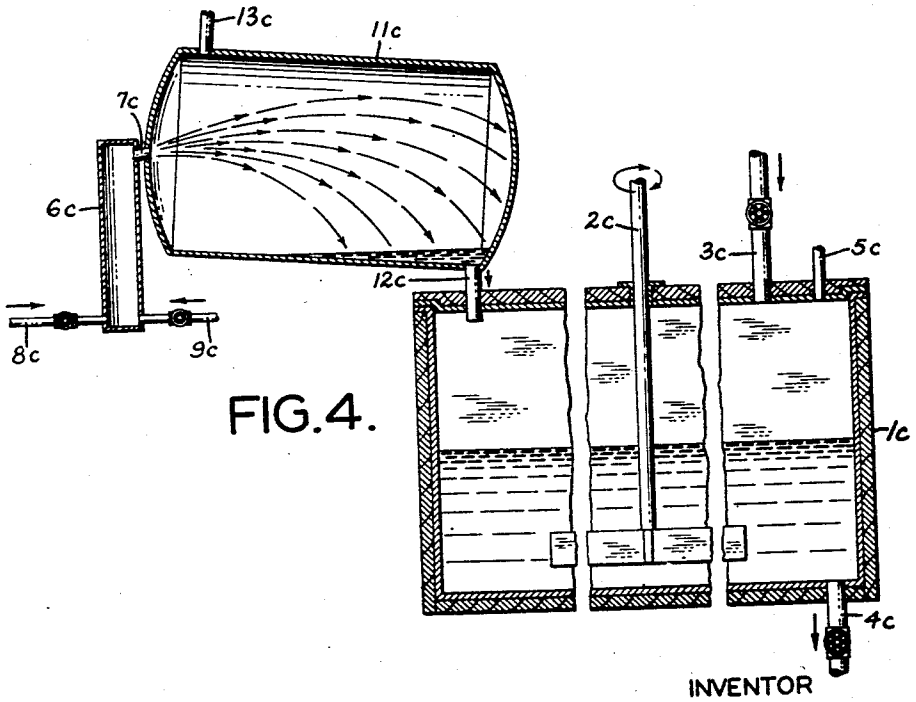


FIG. 4.

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METHOD OF MIXING GAS- AND FOAM-PRODUCING LIQUIDS

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19 Claims. (Cl. 252—161)

This invention relates to a method of mixing liquids which upon admixture react rapidly with much evolution of gas and with a strong tendency to foam. In the manufacture of organic sulfuric acid derivatives suitable for use as detergents, for example, it is sometimes desirable to neutralize an organic sulfonic or sulfuric acid with an alkaline reagent such as sodium carbonate to produce the detergent in the form of a salt. Since lathering properties in many instances are considered beneficial to the cleansing action of detergents, many of these detergent salts possess such properties in high degree. Neutralization by means of sodium carbonate or other carbonates is a rapid reaction which liberates large volumes of carbon dioxide as a gas and this gas liberation within the detergent solution tends to produce a bulk of foam or froth which quickly fills the neutralizing vessel, and unless the neutralization is effected very carefully and at a low rate, causes the foam to overflow the vessel with consequent spillage and loss.

It is an object of the present invention to provide a method for mixing reagents which react rapidly and tend to froth upon mixing, which will permit much more rapid neutralization than conventional neutralization apparatus.

A further object of the invention is the provision of a method especially adapted for mixing such reagents which upon combination release a gas and form a product of strong foaming tendencies, in which method the mixing may be effected with relatively little difficulty arising from the production of foam during the process.

A further object of the invention is the provision of an apparatus embodying a foam gun or jet within which mixing and reaction of foam-producing liquids take place suddenly with development of such pressure that the foam is ejected from the gun or jet at high velocity and with a sharp reduction in pressure which explodes foam bubbles and essentially dissipates the foam.

A further object of the invention is the provision of a simple and effective method for reacting rapid-reacting solutions tending to form an ebullient foamy mixture, for example, for deacidifying organic sulfonic or sulfuric detergent acid solutions by means of alkali-metal carbonates, without the foaming problems encountered by previously proposed methods.

A further object is the preparation of organic sulfate and sulfonate detergents, and especially the latter, of exceptionally good quality and color.

Still further objects will be apparent from the following description of the invention and illustrative examples of its application.

The apparatus of the invention comprises a liquid container or receiver of appropriate size and at least one substantially smaller vessel or gun adapted to operate at a substantially elevated pressure with respect to the receiver and provided with a pair of liquid inlets directing liquids to be mixed into the lower region of the vessel and provided further with a constricted outlet in the upper region thereof exhausting into the receiver at a location elevated substantially from the bottom thereof so that liquid accumulating in the receiver will not interfere with or be agitated by flow from the outlet.

The receiver may be a conventional tank or vat, which may be but need not be provided with a stirring device. For treatment of corrosive liquids the receiver may be constructed of materials especially resistant to corrosion.

The mixing vessel or gun, sometimes referred to as a "rocket," is provided with an outlet the cross-sectional

area of which is preferably at least the sum of the cross-sectional areas of the two liquid inlets but is not more than one-quarter the cross-sectional area of the vessel. These dimensional limitations facilitate the maintenance of sufficient pressure in the vessel to cause the virtual explosion of foam bubbles upon emission from the vessel into the receiver. The vessel also is desirably elongated with the outlet end substantially higher than the other end and with the inlets disposed near the lower end of the vessel and at a distance from the outlet at least about five times the square root of the cross-sectional area of the vessel. This mathematical relationship of the cross-sectional area of the vessel to the distance between inlets and outlet affords a convenient means for securing a sufficient retention of liquid in the vessel to assure intimate mixture and quite complete reaction so that gas generation and bubble formation take place preponderantly within this vessel. If reaction is incomplete and bubble formation is delayed until after the liquid passes the outlet from the vessel, the advantage of sharp reduction in pressure during passage through the outlet is lost and the proportion of foam formed in the receiver is correspondingly increased.

In the manufacture of detergents in accordance with the invention the detergent acid and the carbonate solution are introduced continuously into the mixing vessel which provides a confined space for reaction, and the rates of introduction of the acid and carbonate are controlled to provide a substantial elevation of pressure in the confined space with resulting forcible ejection of the mixture in the form of a geyser of bubbles which leaves the confined space at substantially the rate at which the acid and carbonate enter it, i. e. without substantial hold-up, and passes into a zone of lower pressure in the receiver, whereby the bubbles are caused to expand and rupture.

In the manufacture of sulfonic acid salt detergents from alkyl benzene-sulfonic acids, such as sulfonated mixture derived from hydrocarbon-substituted benzenes which are obtained by condensing benzene with higher alcohols or olefins or chlorinated petroleum distillates (for example as described in U. S. P. 2,247,365, U. S. P. 2,340,654, U. S. P. 2,387,572, U. S. P. 2,388,962) to provide for the most part mono-substituted benzenes in which the substituents are hydrocarbon groups containing from about 7 to about 35 carbon atoms in the substituting hydrocarbon groups, it is preferred to carry out the neutralization in two steps, the first step being effected with a carbonate of the alkali-metal group, for example sodium, potassium, lithium or ammonium carbonate, by the previously outlined procedure employing sufficient of the carbonate to supply between 70% and 85% of the carbonate requirements for complete neutralization to a pH of 7, and thereupon to complete the neutralization with alkali-metal hydroxide. Mixed detergents may be prepared by employing more than one carbonate or hydroxide or by employing a carbonate of one alkali-metal and a hydroxide of a different alkali-metal. However, commonly the sulfonate detergents are marketed in the form of the sodium salts and consequently sodium carbonate and sodium hydroxide will customarily be employed. The quantity of the hydroxide employed is between 15% and 30% of that normally required in the absence of the use of the carbonate. Advantageously the rate of addition of carbonate may be regulated, for example, by means of a pH meter control, to provide a product having a pH of 5.5; the final neutralization with hydroxide is desirably regulated to provide a final pH not greater than 7.

The nature of the invention will be more fully appreciated from a description of the invention in connection with particular illustrative embodiments thereof shown in the accompanying drawings wherein Figures 1 to 4 show, partly in section, alternative arrangements embodying the invention and adapted to accomplish its purposes.

With particular reference to Figure 1, the apparatus comprises, as receiver, a lead-lined wooden tank 1 of generally cylindrical contour having a mechanical stirrer 2, inlet pipe 3, outlet pipe 4, and vent 5, all of conven-

tional design. Supported against one side wall of tank 1 is the foam gun or rocket 6 of cylindrical cross-section and composed of lead or other corrosion-resistant material. The vessel 6 has a mouth or outlet 7 which has been drawn down to an aperture approximately one-quarter the cross-sectional area of the vessel. Two inlet pipes 8 and 9 lead into vessel 6 near the bottom and have their ends within this vessel spaced apart, open, and opposing one another so that liquids passing into the vessel through these inlets will forcibly strike one another and thus be thoroughly mixed. Inlet pipes 3, 8 and 9 and outlet pipe 4 are provided with suitable control valves shown conventionally.

The apparatus shown in Figure 2 is similar to that shown in Figure 1 and corresponding parts are similarly numbered with the letter "*a*" following the numeral. In this apparatus inlet pipes 8*a* and 9*a* are shown in the plane of the drawing so that the relationship of the open ends within vessel 6*a* can be seen more clearly. The apparatus of this figure differs from that shown in Figure 1 merely in the design of the outlet 7*a*, which is directed upward so that spray or foam ejected from vessel 6*a* strikes the top of receiver 1*a* and is thereby deflected downward into this receiver. The vessel 6*a* is shown mounted at a slight angle from the vertical so as to cause the deflection of foam away from the side wall of the container.

The apparatus shown in Figure 3 has corresponding parts indicated by similar numerals followed by the letter "*b*." This apparatus involves a receiver 1*b* having a stirrer 2*b*, inlet pipe 3*b*, outlet pipe 4*b*, and vent 5*b*. In this apparatus the mixing vessel 6*b* is mounted outside of receiver 1*b* and is connected by a short outlet tube 7*b* mounted below the top but in the upper region of vessel 6*b* at an angle deviating slightly from the horizontal to direct foam ejected from vessel 6*b* slightly upwardly. As in the apparatus illustrated in Figures 1 and 2, the inlets 8*b* and 9*b* to vessel 6*b* are arranged to introduce entering liquids near the lower end of the vessel and in opposing directions.

The apparatus illustrated in Figure 4 of the drawing differs from that shown in Figure 3 primarily in that a separate receiver 11*c* is provided between the outlet 7*c* from vessel 6*c* and container 1*c*. The receiver 11*c* serves to provide a space for disintegration of the foam emitted from outlet 7*c* and the resulting liquid may flow directly into container 1*c* by way of connecting pipe 12*c*. Receiver 11*c* is provided with a vent 13*c* for exhausting gas produced in the mixing process.

In the apparatuses illustrated, for the sake of simplicity, inlets 8 and 9 have been shown in each case directly opposing one another. This particular arrangement is not essential, however, as any other arrangement providing rapid and thorough mixing may be used. Thus the entering streams may be directed at right angles to one another or may be introduced concurrently and concentrically of one another.

Since the operation of the several modifications of the apparatus illustrated in Figures 1 to 4 is essentially the same, a description of the manner of using the apparatus shown in Figure 1 will serve to illustrate the operation of all.

Example

In this specific example, receiver 1 was a cylindrical lead-lined wooden vat about 13 ft. in diameter and 6½ ft. high, provided with a stirrer operated at about 24 revolutions per minute. The vessel 6 was composed of lead and was cylindrical in form about 8 inches in diameter and about 46 inches long. The lower ends of pipes 8 and 9, which were 1-inch lead pipes, were located about 2 inches from the bottom of vessel 6 and directly opposed each other with a space of approximately 2 inches between. Receiver 1 was first charged with 3000 lbs. of cold water. Sulfuric-acid-washed keryl-benzene was prepared from benzene and chlorinated kerosene substantially as described in U. S. P. 2,387,572, Example 1, parts 1, 2 and 3. A keryl-benzene-sulfonic acid mixture containing free sulfuric acid was made by sulfonating the sulfuric-acid-washed keryl-benzene with 1.4 times its weight of 100% sulfuric acid at a temperature between 30° C. and 35° C.; the mixture was allowed to warm to about 55° C. and was agitated at that temperature for about one hour. Then 11,000 lbs. of the mixture of keryl-benzene-sulfonic acid and sulfuric acid thus prepared was introduced continuously into vessel 6 through inlet pipe 8 in a period of 1½ hours. At the same time a 20% aqueous solution of sodium carbonate was introduced through inlet pipe 9 at a rate controlled to maintain a pH of 5.5 in the mixture passing into receiver 1. About 5,000 lbs. of sodium carbonate (Na_2CO_3) was thus introduced in the 1½ hour period. Both the sulfonic acid and the sodium carbonate solution were at a temperature of about 50° C. The two liquids upon entering vessel 6 reacted and foamed violently with generation of considerable pressure in vessel 6 and resultant emission of foam from outlet 7 as a roaring geyser with sufficient velocity to carry the bubbly spray more than half way across the open space of receiver 1. At the point of emission the product resembles whipped cream and optimum operating conditions are characterized by this and the steady hum or roar of the gun. Upon entering this space, where a relatively low pressure (substantially atmospheric) prevailed, the foam bubbles broke quickly and the liquid spray settled into the water in the bottom of this receiver. Carbon dioxide evolved in the reaction passed out through vent 5. During the reaction of sulfonic acid and carbonate the solution in receiver 1 rose gradually from near the bottom of the receiver to a level near but below outlet 7. At no time did the solution rise sufficiently high to cover this outlet.

After all of the sulfonate had been introduced into receiver 1, stirring of the liquid in this container was continued and to this liquid at a temperature between 50° and 60° C. sufficient aqueous 50% NaOH solution (about 2,000 lbs.) was added to bring the final pH of the solution to 6.8. Neutralization was complete in between ½ and one hour. The product was then withdrawn through outlet 4 and passed to a spray drier where it was dried in the customary manner. Upon withdrawal of the neutralized solution through outlet 4 the apparatus was ready to receive a new charge.

The receiver employed in this example was the same type of container as previously commonly employed in the neutralization of keryl benzene sulfonic acid sulfuric acid mixtures by means of aqueous sodium hydroxide solution. Attempts to neutralize the mixtures in such a container merely by adding the solutions directly, without the provision of mixing vessel 6, resulted in excessive foaming and the container became filled with foam so that in order to avoid substantial losses by overflow the rate of addition had to be reduced rapidly until it was approximately ⅛ of that employed in the example, so that 12 to 15 hours was required for neutralization of an 11,000 lb. sulfonic sulfuric acid charge.

Not only did modification of the apparatus in accordance with the invention permit reduction of the neutralization time in this manner but it was found that the final product was distinctly whiter and its solutions in water were distinctly clearer than when the neutralization was effected by the usual procedure employing aqueous sodium hydroxide. The reason for the improved result is not entirely clear, but a possible explanation is that the high velocity of flow and thorough mixing of reactants resulting from use of the foam gun or rocket 6 resulted in more uniform reaction of the neutralizing agent and more uniform temperature conditions and thus eliminated deteriorating effects of relatively high local temperatures caused by less uniform heat evolution in the customary neutralization process, using sodium hydroxide solution alone.

The application of the invention in the manner described has resulted in accomplishing neutralization of sulfonic acid detergent mixtures by means of 20% to 30% sodium carbonate solutions at neutralization rates entirely equal to those involving the use of sodium hydroxide solution alone and has completely eliminated operating difficulties caused by excessive foaming. Although there is usually a small amount of residual foam on the surface of the liquid collected in the receiver, the amount of this foam has been insufficient to interfere materially with the neutralization procedure or with the subsequent handling of the solution.

While apparatus of the dimensions specified in the preceding example has given highly satisfactory results, substantial latitude is permissible in design and proportion without seriously interfering with the successful operation of the apparatus. Thus reactors like vessel 6 having a diameter of 10 inches and lengths from 46 to 60 inches and outlet diameters from 3 to 5 inches have been used entirely satisfactorily with one inch inlet pipes and inlet line pressures of around 20 to 30 lbs. per sq. in. gauge

(measured in the carbonate solution feed line). On a similar reaction vessel or gun an outlet 7 compressed into a "fish-tail" 4 inches by 1 inch and having a cross-sectional area of 4 square inches also has been found to be entirely satisfactory. The size of the receiver is governed only by the size of the charge which it is desired to handle. In general, it should be very much larger than the vessel 6 in order to provide ample space for the spray emitted from vessel 6 and to provide a reasonable storage space for incoming liquids.

In the neutralization of keryl benzene sulfonic acids it has been found advantageous to terminate the neutralization by means of carbonate solution when a pH of about 5.5 is attained. The particular reaction mixtures involved in the manufacture of these detergents have been found to possess such a resistance to foam breakage at pH's above 5.5 as to render the use of sodium hydroxide solutions more practical for completing the neutralization. However, the quantity of alkali required for de-acidifying to a pH of 5.5 is substantially greater than that required for completing the neutralization so that a very material reduction in the sodium hydroxide requirements is achieved by use of the invention. This is illustrated by the fact that for accomplishing the neutralization illustrated in the example about 9560 parts of 50% NaOH solution would be required if no sodium carbonate were used, whereas in this example only about 2000 parts of 50% NaOH solution or about ⅕ of the normal requirements were used. In general it is feasible to supplant between 70% and 85% of the NaOH requirements for complete neutralization to a pH of 7 by Na_2CO_3.

While the invention has been described with particular reference to the manufacture of keryl benzene sulfonate detergents, it is not limited thereto. It may be applied with advantage to the neutralization of other organic acids whose aqueous alkali metal salt solutions tend to form foams which are more or less stable, such as diisopropyl naphthalene sulfonic acids, keryl phenol sulfonic acids, long chain alkyl sulfuric acids, sulfonic acids obtained by the sulfonation of petroleum distillates, such as sulfonated naphthenic acids, sulfonated oils, such as sulfo-ricinoleic acid, sulfonated oleic acid, sulfo-fatty aromatic acids, e. g. naphthalene stearo-sulfonic acid, and mixtures thereof.

I claim:

1. A method of mixing rapid-reacting gas- and foam-producing liquids which comprises continuously introducing said liquids at an elevated temperature at which rapid reaction and evolution of gas take place into a confined space having a constricted outlet near the top thereof and mixing them therein at such a rate as to cause a substantial elevation of pressure in said space and violent and continuous ejection of the mixture through said outlet as a geyser of bubbles into a zone of lower pressure whereby the bubbles of said geyser are caused to expand and rupture, and collecting the resulting liquid in the zone of lower pressure.

2. Method of claim 1 wherein the gas- and foam-producing liquids are an organic sulfonic acid and an alkali-metal carbonate.

3. Method of claim 1 wherein the gas- and foam-producing liquids are an alkyl benzene sulfonic acid and an alkali-metal carbonate and the carbonate is employed in a proportion corresponding to between 70% and 85% of the alkali-metal carbonate requirement for complete neutralization to a pH of 7.

4. In the manufacture of an alkyl benzene sulfonate salt detergent, the improvement which comprises continuously introducing a mixture of alkyl benzene sulfonic acid and sulfuric acid and an alkali-metal carbonate solution in proportions corresponding to between 70% and 85% of the alkali-metal carbonate requirement for complete neutralization to a pH of 7, into a confined space having a constricted outlet near the top thereof and mixing the acid mixture and carbonate solution therein at such a rate as to cause a substantial elevation of pressure in said space and violent and continuous ejection of the mixture through said outlet as a geyser of bubbles into a zone of lower pressure, whereby the bubbles of said geyser are caused to expand and rupture, collecting the resulting liquid in a zone of lower pressure and completing the formation of detergent salt by mixing the collected liquid with alkali-metal hydroxide in a proportion corresponding to between 15% and 30% of the total requirement for complete neutralization of the aforesaid mixture of sulfonic and sulfuric acids to a pH of 7.

5. A process as defined in claim 4, wherein the alkali-metal carbonate is sodium carbonate and the alkali-metal hydroxide is sodium hydroxide.

6. A process as defined in claim 5, wherein the proportion of sodium carbonate is controlled to provide a pH of about 5.5 and the proportion of sodium hydroxide is controlled to provide a pH not greater than 7.

7. A continuous process for the manufacture of a particulate, substantially dust-free surface-active product of neutralization of an organic sulfonic acid, which comprises neutralizing a liquid feed stream containing an organic sulfonic acid by mixing said feed stream with an aqueous dispersion of an inorganic alkaline carbonate in a confined zone while retaining carbon dioxide gas produced by neutralization of said organic sulfonic acid in said confined zone to form a polyphase mixture of said carbon dioxide gas and of an aqueous liquid containing the salt resulting from the neutralization of said organic sulfonic acid; spraying said polyphase mixture into a liquid-collecting chamber by utilizing the force of the autogenous pressure of carbon dioxide gas present in said mixture to effect the release of said carbon dioxide gas; collecting the spray at the bottom of said chamber in the form of an agglomerated, liquid, essentially defoamed slurry; spray-drying said liquid slurry; and recovering solid, relatively uniform dust-free particles of said salt of organic sulfonic acid.

8. A continuous process for the manufacture of particulate surface-active product of neutralization of an alkyl aryl sulfonic acid which comprises neutralizing a liquid feed stream containing said acid, normally tending to form a gas-retaining stable foam, by mixing said feed stream with a feed stream of an aqueous dispersion of an inorganic alkaline carbonate in a confined space while retaining carbon dioxide gas produced by neutralization of said acid in said confined space, to form a polyphase mixture which comprises said gas and aqueous liquid, containing the salt resulting from the neutralization of said alkyl aryl sulfonic acid by said inorganic alkaline carbonate, spraying said polyphase mixture into a liquid-collecting chamber by utilizing the force of the autogenous pressure of carbon dioxide gas present in said mixture to effect the release of said gas, collecting the sprayed particles at the bottom of said chamber in the form of an agglomerated, liquid, essentially defoamed slurry, drying said liquid slurry, and recovering solid, relatively uniform dust-free particles of said salt of said alkyl aryl sulfonic acid.

9. A continuous process of producing surface-active salts of alkyl aryl sulfonic acids, which comprises neutralizing a liquid feed stream containing an alkyl aryl sulfonic acid, normally tending to form a gas-retaining stable foam, by mixing said feed stream with a stream of an aqueous dispersion of an inorganic alkaline carbonate in a confined spaced, while retaining carbon dioxide gas produced by the neutralization of said acid in said confined space to form a polyphase mixture which contains said gas and aqueous liquid, containing the salt resulting from the neutralization of said alkyl aryl sulfonic acid by said inorganic alkaline carbonate, spraying said polyphase mixture into a liquid-collecting chamber by utilizing the force of the autogenous pressure of carbon dioxide gas present in said mixture to effect the release of said carbon dioxide gas of neutralization, and collecting the sprayed particles at the bottom of said chamber in the form of an agglomerated, liquid, essentially defoamed slurry.

10. A continuous process of producing a sodium salt of alkyl benzene sulfonic acid, which comprises neutralizing a liquid feed stream containing an alkyl benzene sulfonic acid, normally tending to form a gas-retaining stable foam, by mixing said feed stream with a stream of an aqueous solution of sodium carbonate in a confined space, while retaining carbon dioxide gas produced by the neutralization of said acid in said confined space to form a polyphase mixture which contains said gas and aqueous liquid, containing sodium alkyl benzene sulfonate resulting from the neutralization of said alkyl benzene sulfonic acid by sodium carbonate, spraying said polyphase mixture into a liquid-collecting chamber by utilizing the force of the autogenous pressure of carbon dioxide gas present in said mixture to effect the release of said carbon dioxide gas of neutralization, and collecting the sprayed particles at the bottom of said chamber in the form of an agglomerated, liquid, essentially defoamed slurry.

11. A continuous process of producing a mixture of sodium salts of alkyl benzene sulfonic and sulfuric acids, which comprises neutralizing a liquid feed stream containing a mixture of sulfuric and alkyl benzene sulfonic acids, said sulfonic acid normally tending to form a gas-retaining stable foam by mixing said feed stream with a stream of an aqueous solution of sodium carbonate in a confined space, while retaining carbon dioxide gas produced by the neutralization of said mixture of acids in said confined space to form a polyphase mixture which contains said gas and aqueous liquid, containing sodium alkyl benzene sulfonate and sodium sulfate resulting from the neutralization of said mixture of acids, spraying said polyphase mixture into a liquid-collecting chamber by utilizing the force of the autogenous pressure of carbon dioxide gas present in said mixture to effect the release of said carbon dioxide gas of neutralization, and collecting the sprayed particles at the bottom of said chamber in the form of an agglomerated, liquid, essentially defoamed slurry.

12. A continuous process for producing sodium salts of alkyl benzene sulfonic acids, which comprises neutralizing a liquid feed stream containing an alkyl benzene sulfonic acid, normally tending to form a gas-retaining stable foam, by mixing said feed stream with a stream of aqueous solution of sodium carbonate in a confined space, while retaining carbon dioxide gas produced by neutralization of said alkyl benzene sulfonic acids in said confined space, to form a polyphase mixture which contains said gas and aqueous liquid, containing sodium alkyl benzene sulfonate resulting from the neutralization of said alkyl benzene sulfonic acid by sodium carbonate, and spraying said polyphase mixture into a collecting chamber by utilizing the force of the autogeneous pressure of carbon dioxide gas present in said mixture prior to completion of the neutralization reaction.

13. A continuous process of producing surface-active salts of alkyl benzene sulfonic acid containing from 12 to 18 carbon atoms in the alkyl chain, which comprises neutralizing a liquid feed stream containing an alkyl benzene sulfonic acid having from 12 to 18 carbon atoms in the alkyl chain and normally tending to form a gas-retaining stable foam, by mixing said feed stream with a stream of an aqueous dispersion of an inorganic alkaline carbonate in a confined space, while retaining carbon dioxide gas produced by the neutralization of said acid in said confined space to form a polyphase mixture which contains said gas and aqueous liquid, containing the salt resulting from the neutralization of said alkyl benzene sulfonic acid by said inorganic alkaline carbonate, spraying said polyphase mixture into a liquid-collecting chamber by utilizing the force of the autogeneous pressure of carbon dioxide gas present in said mixture to effect the release of said carbon dioxide gas of neutralization, and collecting the sprayed particles at the bottom of said chamber in the form of an agglomerated, liquid, essentially defoamed slurry.

14. A continuous process for the manufacture of a particulate, substantially dust-free surface-active product of neutralization of an organic sulfonic acid, which comprises neutralizing a liquid feed stream containing an organic surface-active sulfonic acid in a mixture with sulfuric acid, by mixing said feed stream with an aqueous dispersion of an inorganic alkaline carbonate in a confined zone while retaining the carbon dioxide gas produced by neutralization of said organic surface-active sulfonic acid and sulfuric acid in said confined zone to form a polyphase mixture of said carbon dioxide gas and of an aqueous liquid containing the salts resulting from the neutralization of said organic sulfonic and sulfuric acids by said inorganic alkaline carbonate; spraying said polyphase mixture into a liquid-collecting chamber by utilizing the force of the autogenous pressure of carbon dioxide gas present in said mixture to effect the release of said carbon dioxide gas; collecting the spray at the bottom of said chamber in the form of an agglomerated, liquid, essentially defoamed slurry; spray-drying said liquid slurry; and recovering solid, relatively uniform, dust-free particles comprising organic sulfonic acid salt and sulfate.

15. A process as defined in claim 7 wherein the aqueous dispersion of an inorganic alkaline carbonate is a dispersion of an alkali metal carbonate.

16. A continuous process for producing surface-active salts of organic sulfonic acids, which comprises neutralizing a liquid feed stream containing an organic surface-active sulfonic acid in a mixture with sulfuric acid by mixing said feed stream with an aqueous dispersion of an inorganic alkaline carbonate in a confined space while retaining the carbon dioxide gas produced by neutralization of said organic surface-active sulfonic acid and sulfuric acid in said confined space to form a polyphase mixture of said carbon dioxide gas and of an aqueous liquid containing the salts resulting from the neutralization of said organic sulfonic and sulfuric acids by said inorganic alkaline carbonate; spraying said polyphase mixture into a liquid-collecting chamber by utilizing the force of the autogenous pressure of carbon dioxide gas present in said mixture to effect the release of said carbon dioxide gas; and collecting the spray at the bottom of said chamber in the form of an agglomerated, liquid, essentially defoamed slurry.

17. A continuous process for producing surface-active salts of organic sulfonic acids, which comprises neutralizing a liquid feed stream containing an organic surface-active sulfonic acid in a mixture with sulfuric acid by mixing said feed stream with an aqueous dispersion of an inorganic alkaline carbonate in a confined space while retaining carbon dioxide gas produced by neutralization of said organic surface-active sulfonic acid sulfuric acid in said confined space to form a polyphase mixture of said carbon dioxide gas and of an aqueous liquid containing the salts resulting from the neutralization of said organic sulfonic and sulfuric acids by said inorganic alkaline carbonate; and spraying said polyphase mixture into a liquid-collecting chamber by utilizing the force of the autogenous pressure of carbon dioxide gas present in said mixture prior to completion of the neutralization reaction.

18. A continuous process for the manufacture of particulate, surface-active product of neutralization of an alkyl benzene sulfonic acid containing from 12 to 18 carbon atoms in the alkyl chain, which comprises neutralizing a liquid feed containing said acid, normally tending to form a gas-retaining stable foam, by mixing said feed with a feed of an aqueous dispersion of an inorganic alkaline carbonate in a confined zone, while retaining carbon dioxide produced by neutralization of said alkyl benzene sulfonic acid in said confined zone, to form a polyphase mixture containing carbon dioxide and aqueous liquid, having a pH equal to at least 5.0 and containing the salt resulting from the neutralization of said alkyl benzene sulfonic acid by said inorganic alkaline carbonate, spraying said polyphase mixture into a liquid-collecting chamber by utilizing the force of the autogenous pressure of carbon dioxide gas present in said mixture to effect the release of the carbon dioxide gas of neutralization, collecting the sprayed particles at the bottom of said chamber in the form of an agglomerated, liquid, essentially defoamed slurry, spray-drying said liquid slurry and recovering solid, relatively uniform, dust-free particles of said salt of said alkyl benzene sulfonic acid.

19. A continuous process for the manufacture of particulate, surface-active product of neutralization of an alkyl benzene sulfonic acid containing from 12 to 18 carbon atoms in the alkyl chain, which comprises neutralizing a liquid feed containing said acid, normally tending to form a gas-retaining stable foam, by mixing said feed with the feed of an aqueous solution of sodium carbonate in a confined zone, while retaining carbon dioxide produced by neutralization of said alkyl benzene sulfonic acid in said confined zone, to form a polyphase mixture containing carbon dioxide and aqueous liquid, containing sodium alkyl benzene carbonate resulting from the neutralization of said alkyl benzene sulfonic acid by sodium carbonate, spraying said polyphase mixture into a liquid-collecting chamber by utilizing the force of the autogenous pressure of carbon dioxide gas present in said mixture to effect the release of carbon dioxide gas of neutralization, collecting the sprayed particles at the bottom of said chamber in the form of an agglomerated, liquid, essentially defoamed slurry, spray-drying said liquid slurry and recovering solid, relatively uniform, dust-free particles of said sodium alkyl benzene sulfonate.

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