May 23, 1961 F. G. SPRANG, JR 2,985,387

LIQUID MATERIAL DISTRIBUTOR

Filed Oct. 13, 1959

Fig. 1.

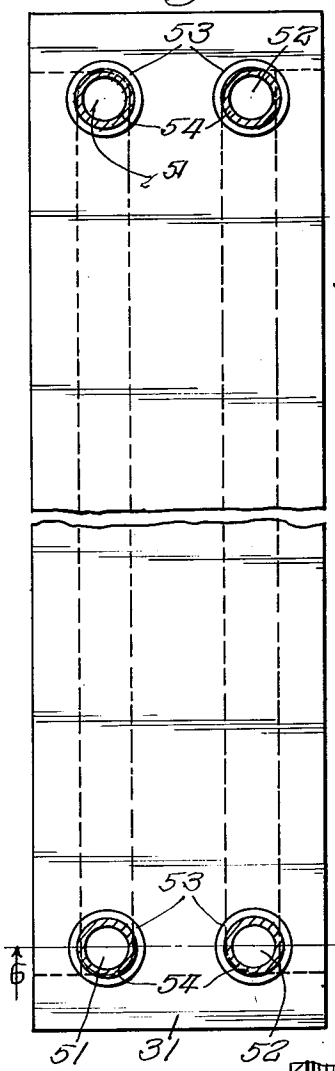


Fig. 2.

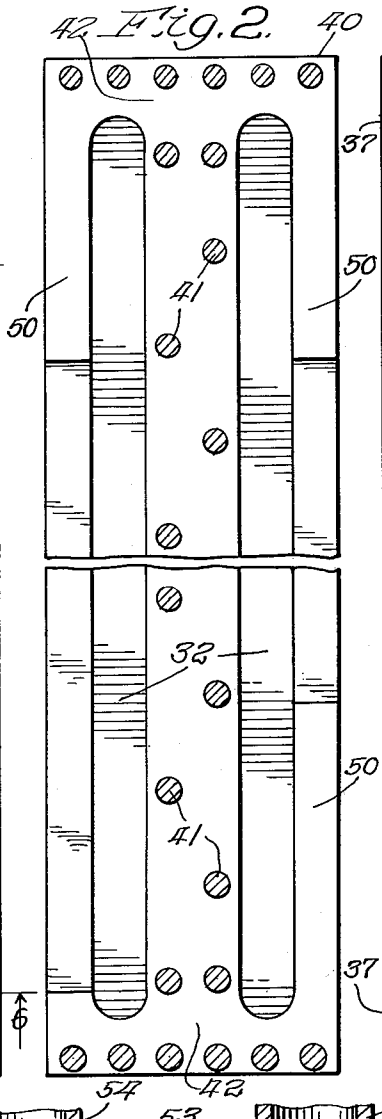


Fig. 3.

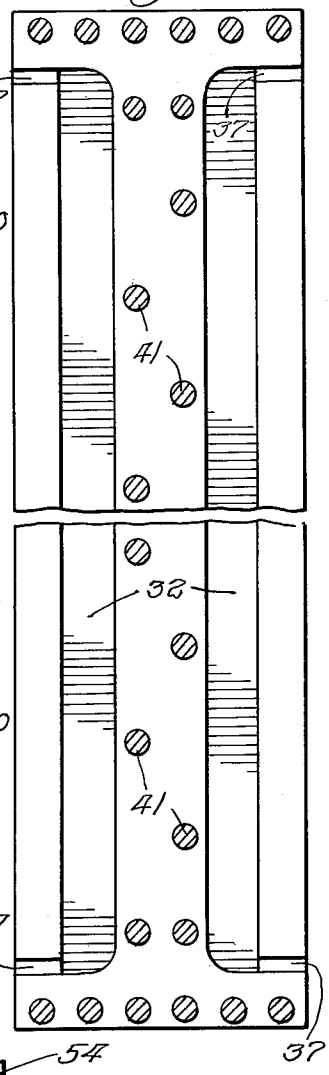
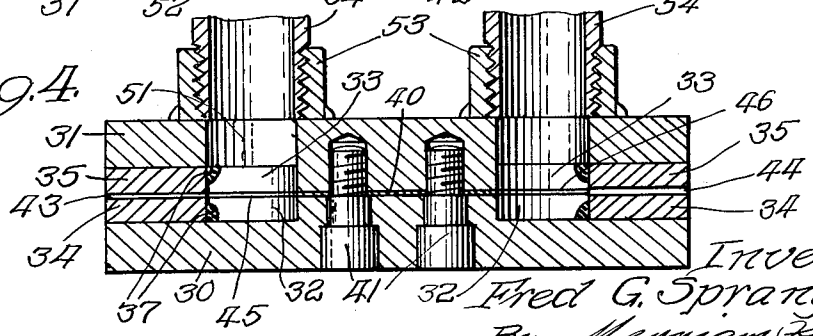


Fig. 4.



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LIQUID MATERIAL DISTRIBUTOR

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6 Claims. (Cl. 239—597)

This invention relates to liquid dispensing nozzles or spargers. More particularly, it is concerned with a novel sparger particularly useful for ammoniating superphosphate.

It is conventional practice to treat superphosphate with ammonia or ammoniating solutions to form a nitrogen containing fertilizer. Liquid or gaseous anhydrous ammonia, aqua ammonia, or ammoniating solutions containing free ammonia and a solid nitrogen carrier such as ammonium nitrate or urea are employed as ammoniating agents. In addition, it is sometimes desirable to add simultaneously a concentrated solution of an acid, and particularly sulfuric acid to neutralize excess ammonia present.

The ammonia or ammoniating solutions are usually introduced into the superphosphate as it rotates in a mixing drum by means of a sparger or nozzle located below the surface of the tumbling superphosphate.

The sparger in conventional use heretofore comprised a horizontal pipe with holes drilled therein in a row for about the length of the pipe. The holes in the pipe were protected by a V-shaped shield or lips that extend from one end of the sparger to the other. The lips also helped to spread out the flow of liquids rather than to have it hit the solid material in individual streams. Such a sparger is shown in U.S. Patent No. 2,741,545. In actual practice, this type of sparger left much to be desired. It was costly to fabricate out of stainless steel but, and most importantly, the lips were readily eroded or corroded away with the result that distribution control and efficiency were lost.

There is provided by the subject invention a novel sparger which is readily fabricated and which has been found by actual experimental use to function properly with little or no maintenance for extended periods of time during almost continuous operation.

The sparger in a broad embodiment is comprised of an elongated block having an elongated channel therein which runs for a major length of the block, a slit in the block that extends from a face of the block to the channel whereby fluid can be expelled from the channel out the slit as a thin film, and an opening in the block through which liquid can be fed to the channel.

The block is advisably made of two separate plates of about the same length and width placed in face-to-face relationship to each other. The channel is readily formed by providing a longitudinal groove in the inner surface of one, or both of, the plates. The plates, being advisably flat, thus mutually form the channel. When grooves are provided in each plate they are located and of such a size as to cooperate or complement each other to form the channel. A gasket is positioned along one side of, and between, the plates and sealing means, such as screws, are provided to make a leak-proof joint. The inner surfaces of the plates, being advisably flat and smooth are thus displaced apart about the thickness of the gasket and form lips of the resulting slit through which liquid is expelled via the channel. At least one supply opening

is provided through which liquid can be fed to the channel. The gasket advisably is also extended the width of both ends between the plates so that the stream of liquid is expelled from the slit in one direction as a thin film.

The invention will now be described in conjunction with Figs. 1 to 4 of the attached drawings in which:

Fig. 1 is a plan view of a specific embodiment of a sparger according to this invention,

Fig. 2 is a plan view of the sparger of Fig. 1 with the top plate removed,

Fig. 3 is a plan view of the bottom plate with the inner side up, and

Fig. 4 is a sectional view of Fig. 1 taken on the line 6—6.

As shown in Figs. 1 to 4, the sparger has bottom plate 30 and upper plate 31, both of substantially identical size and shape and which, in lateral section are E-shaped. The two plates when placed together form a structure which has a block-8 section. Each of plates 30 and 31 is provided with two longitudinal grooves 32 and 33 respectively, which extend a major distance of the length of the plates.

The inner surfaces 34 and 35 adjacent the side of each plate can be integral with and of the same composition as the remainder of the plates but advisably these surfaces, which form the lips of the slit through which liquid is expelled, are of a different more corrosion resistant metal inlaid therein. Hastelloy C (C—0.04 to 0.15%; Cr—13.0 to 16.0%; Ni—54.5 to 59.5%; Mo—15.0 to 19.0%; W—3.5 to 5.5% and Fe—4.0 to 7.0%) is a particularly useful material for the lips and it can be welded 37 in place in the form of an elongated bar in place of integrally formed lips. The plates themselves can be of low carbon steel.

A thin gasket 40 is positioned between the sandwiched plates at least in the area between the channels and screws 41 or other fastening means used to tighten the plates together into a liquid tight seal so that the liquids in each channel are maintained apart. The gasket is advisably, but not necessarily, provided with end portion 42 so that liquid is expelled only from the sides of the sparger.

Slits 43 and 44 are provided for delivering liquid from the channels 45 and 46 respectively in the form of a thin film. The slits are readily varied in thickness by varying the gasket thickness. Since the plates are advisably flat, the slits are of the same thickness as the gasket unless the lips are built up or milled down. In the drawings slit 43 can be 0.030 inch (the thickness of the gasket) on the acid solution side and slit 44 can be 0.060 inch on the ammoniating solution side. The slit 44 is readily made thicker by milling one or both of the lip surfaces forming the slit.

The gasket 40 of Fig. 2 can have inwardly extending fingers 50 on one or both ends thereof, and on one or both sides, to adjust the width of either, or both, of the slit openings. In this way the liquid films expelled from the sparger can be varied in width.

Supply openings 51 are provided in the top plate 31 at the ends of, and leading to, channel 45 for introduction of liquid thereto. Similarly, supply openings 52 are provided in the top plate 31 at the ends of, and leading to, channel 46 for the same purpose. Although each channel is shown having two supply openings, one such opening to each channel is adequate for short spargers. Couplings 53 are provided for receiving supply pipes 54.

The described sparger forms thin films of the ammoniating solution and acid solution and thus gives even distribution which is important to good granulation control and accurate analyses.

The great width or depth of the lips forming the slits minimizes the effect of any corrosion which takes place

since, to have any effect, corrosion must be for the entire depth of the lips and not just part way.

Furthermore, variance of as little as 0.01 inch in thickness of the slit can cause serious corrosion where the opening is widest. Since the sparger of this invention is made of steel plates, it can be made by machining to close tolerances so that the slits are of uniform thickness. Good distribution thus results.

Any resulting poor distribution of the ammoniating solution or acid solution changes the analysis of the product to the point that it is off-grade and affects granulation by creating oversize and undersize granules. Oversize develops when excess distribution takes place and undersized granulated material is formed from the superphosphate where a low flow of solution is distributed.

With the block sparger of this invention it is quite simple to change the distribution capacity by using a different gasket. With the prior art sparger the operator had to depend upon change in pump pressure to control flow since the slit opening was not variable. This is much more difficult to control than is maintaining the same pump pressure and changing the slit size.

Obviously, gaskets of two different thicknesses can be used to produce slits of different thickness by splitting one of the plates longitudinally and making gaskets for each of the respective halves.

Various changes and modifications of the invention can be made and, to the extent that such variations incorporate the spirit of this invention, they are intended to be included within the scope of the appended claims.

What is claimed is:

1. A sparger comprised of two substantially similar elongated rectangular plates in face-to-face arrangement, each of said plates having two spaced apart elongated parallel grooves in the inner face of each of said plates and projecting only partially through the plate thickness but extending for about the length of the plate, said grooves in each plate being complementary to the grooves in the other plate to form two spaced apart parallel elongated four-sided channels, a gasket between the plates in the area between the grooves and projecting around the ends of the channel, means sealing the plates together so that the gasket joint is leakproof, and an elongated single slit extending from each of the channels to outside the plates and extending about the length of the plates so that fluid can be expelled from each channel out each slit as a single thin wide film, and supply openings in at least one of said plates leading from outside the plate to each of the channels.

2. The sparger of claim 1 in which each slit has two straight lips of equal depth formed by inner planar surfaces of the sandwiched plates.

3. The sparger of claim 1 in which each slit has two straight lips of equal depth formed by inner planar surfaces of the sandwiched plates, said lips being of a corrosion resistant material inset in the plates.

4. The sparger of claim 1 in which the slits are of equal thickness.

5. The sparger of claim 1 in which the slits are of unequal thickness.

6. A sparger comprised of two substantially similar elongated rectangular flat plates in face-to-face arrangement, at least one of said plates having two spaced apart elongated parallel grooves in the inner face of said plate and projecting only partially through the plate thickness but extending for about the length of the plate, said grooves in combination with the surfaces of the other plate forming two spaced apart parallel elongated channels, a gasket between the plates in the area between the grooves and projecting lateral to the ends of the channel, means sealing the plates together so that the gasket joint is leakproof, and an elongated slit extending from each of the channels to outside the plates and extending about the length of the plates so that fluid can be expelled from each channel out each slit as a single thin wide film, and separate supply openings in at least one of said plates leading from outside the plate to each of the channels.

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