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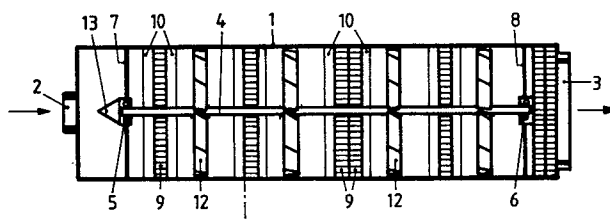
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Process and apparatus for producing a foam, having micro foamvesicles for dust control.

(57)

Process and apparatus for providing a foam solution having microvesicles which strongly adhere to dust producing materials such as coal or sand, for dust control in open air storage or transport of said materials.

The apparatus has fibre filters and means for imparting swirling movement to the solution when passed through the filters (9, 17) and means (12, 18, 13).



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Title: Process and apparatus for producing a foam having micro
foamvesicles for dust control.

5 The invention relates to a process for strongly reducing the vesicle
size of an aqueous aerosol solution containing one or more surfactant
chemical agents. The foam as obtained therewith may be used for the
control of environmental dust contamination, since this foam adheres
to the exterior of materials tending to produce dust, such as coal,
coalpowder, sand, rock, drilling waste etc. For example when storing
10 such materials in heaps near electric power plants or blast furnaces,
or when conveying the material of the storage heaps to the place of
use by means of uncovered conveyor belts.

Up till now often water was used for said dust control, the
water being sprayed onto the material. This requires much water and
15 spraying continuously or with short intervals, since the water vaporizes.
The water may also freeze, whereby the material contains more water
than is desirable when using the material.

The invention aims at obtaining such fine pulverisation of
the chemical agent or agents in the aerosol solution, that said anti-dust
20 agents are very uniformly divided over the material to be treated and
strongly adhere thereto.

Thereby only unfrequently imparting the foam is required,
which results in a saving of material and apparatus.

25 The fine or micro pulverisation is obtained with the process
according to the invention in that the aerosol solution is carried through
a plurality of successively positioned fibres filters and is given a
swirling motion between each two filters.

The invention also comprises an apparatus for carrying out
the process, said apparatus being characterized in that it comprises a
30 tubular housing having an inlet opening and an outlet opening, which
are coaxially placed, each fibres filter being constituted by a disc
shaped grid, which is secured at its circumference to the tube wall,
the grid apertures of which being filled with fibre material.

In order to permit the permanent retention of the fibres
35 evenly divided along the filter surface, preferably the grid has

honeycomb shaped cells.

In view of dividing the supplied aerosol solution as evenly along the filter surface as possible, in an embodiment according to the invention a rotary drivable shaft is provided in the tube axis
5 which is rotatable relative to the tube wall, a blade wheel or turbine being secured to the shaft between each two filters.

In an other embodiment according to the invention for that purpose between each two filters one or more fixed helical blades are provided, each having a circumferential extension of at least 90°
10 and the diameter of which increases from practically zero to the tube diameter when going from the first to the second filter or vice versa.

In both cases a swirling movement is imparted to the liquid by a filter, said movement substantially being in the circumferential direction of the housing and thereafter the liquid is directed substantially parallel to the tube axis, by means of the passage through
15 the next filter. The foam is divided into micro vesicles or droplets due to the changes in direction occurring therewith and in combination with the passage through the filter. The foam then forms a very even uninterrupted thin film on the material when it is sprayed thereon.

If the tube diameter is several times the diameter of the inlet
20 opening for the aerosol solution in the tube, which usually is the case in the embodiment having blade wheels, it is preferable to divide the liquid along the full crosssection directly after it enters the tube. This could also be obtained by placing a blade wheel also
25 before the first filter. However, preferably in that case a deflector cone is provided before the first filter, said cone widening in the tube outlet direction.

The invention will hereunder be further explained with reference to the drawing showing schematically two embodiments of
30 the apparatus according to the invention.

Fig. 1 shows schematically an apparatus having blade wheels.

Fig. 2 shows, likewise schematically, the embodiment having fixed helical blades.

Fig. 3 shows schematically a mixing tube for mixing the
35 aerosol solution.

Fig. 4 is a diagram showing the operation of the apparatus. The embodiment according to fig. 1 comprises an elongated tube 1 having a circular crosssection and provided with an inlet opening 2 and an outlet opening 3. Both said openings may be provided with a short tubular portion provided with interior screw thread whereby the apparatus may be connected to conduits. A shaft 4 is mounted in the tube axis by means of ball bearings 5, 6 mounted in stationary partitions 7, 8 provided in the tube. Said shaft extends with a close fit through fibres filters 9 which are provided regularly spaced in the tube. Said fibres filters are stationarily mounted in the embodiment shown, relative to the tube wall by means of rings 10, which at both sides of each filter are secured through tack welding to the tube shell.

Each fibres filter 9 comprises according to fig. 1a a grid having cells, the cells 11 being shown herein in the shape of honeycomb cells. Said cells are filled with a fibre material, e.g. nylon fibres or any other suitable fibres material. It is retained in place by the cell walls and is evenly divided along the tube crosssection. It appears from figure 1 that in certain locations, e.g. in the middle and at the end of the tube, a double filter may be provided.

Between each two filters a blade wheel 12 is coaxially secured to the shaft. Each blade wheel may e.g. have ten blades having a predetermined pitch angle, e.g. of 22° . At the front end of the shaft 4 adjacent to the inlet opening 2 furthermore a deflector cone 13 is secured to the shaft. However, this cone could also be provided stationary in the housing and not connected to the shaft. However, if the cone is secured to the shaft, the aerosol solution, as supplied is not only constrained towards the tube circumference, but simultaneously already given a certain swirling movement. The shaft bearings 5, 6 are provided with suitable seals so that the aerosol solution cannot enter the bearings.

The apparatus operates as follows that with supply of an aerosol solution to the inlet opening 2 under some pressure said solution is constrained by the cone 13 towards the tube circumference, wherein it will be clear that the walls 7, 8 only are comprised of spokes. The solution moves through the first filter 9 to the first

blade wheel 12 and is given thereby a swirling motion. Thereafter the droplets after a change of direction again move parallel to the tube axis due to the influence of the next filter 9 and arrive at the blade wheel 12 provided thereafter. Thereby at the outlet opening 3 of the tube, a foam comprising micro vesicles becomes available.

For instance the tube may be a steel tube, plastic coated in order to prevent corrosion, and the shaft, the deflector cone 13 and the bearing holders and partitions 7, 8 may be manufactured from stainless steel. The fibre grids 9 may be manufactured from aluminum as well as the blade wheels. The tube 1 may have a length of 50 cm and a diameter of 11 cm.

The stationary embodiment of the apparatus according to the invention, as shown in fig. 2, also comprises an elongated tube 14 having an inlet opening 15 and an outlet opening 16. Also said openings may be provided with interior screw thread for connection with supply tubes or hoses. Longitudinally regularly spaced within the tube are fibre filters 7, stationarily mounted within the tube. Said filters comprise cells, like in the embodiment according to fig. 1, preferably also honeycomb cells. Between two successive filters 17, swirling means 18 are provided each comprising e.g. two helical blades which are stationarily mounted in the tube and extend through about 90° of the tube circumference and extend from the tube axis towards the circumference or vice versa. Thereby the supplied aerosol solution is given a swirling movement, which in the embodiment according to fig. 1 was obtained by the blade wheels.

For instance it may be said that the tube has successively a plurality of sections each comprising a filter 17 with successive swirling means 18, e.g. 12 sections when the tube has a length of 80 cm and a diameter of 5 cm. The tube, the filter and the swirling means may be manufactured from the same materials as mentioned with reference to fig. 1. The grids may be secured in the tube through an interference fit. Said grids also retain the swirling means provided between two grids.

Preferably the swirling means 18 are provided alternately such that first the flow occurs in correspondance with clock hands and

between the next filters occurs against the movement of clock hands. Also therewith a foam having micro vesicles is obtained at the tube end. The number of sections determines the final vesicle dimension, so that the apparatus may be adapted to this film to be obtained by means of the length of the tube, namely for varying the vesicle dimensions thereof.

Figure 3 shows a mixing tube 19 for forming an aerosol solution from water and a surfactant chemical agent with the intermediary of air.

The tube 19 has an inlet opening 20, provided or not with interior screw thread for connection to a conduit. An inner tube 21 is connected to the inlet opening and said tube leads to a tube 22 within which helical blades 23 are provided, in the embodiment shown two helical blades, each having a pitch angle of e.g. 127° and a phase shift of 180° in the circumferential direction. The tube 22 ends at an outlet opening 24, likewise provided or not provided with interior screw thread.

Two thinner tubes 25, 26 extend parallel to the tube 21 and having a circumferential spacing of 180° , said thinner tubes likewise opening at the beginning of the tube 22, the inlet ends 25', 26' of said thinner tubes being deviated through 45° . The tube 20 serves for the supply of compressed air, whereas the tubes 25, 26 serve for the supply of water or a chemical agent respectively, to the helical blade portion of the mixing tube.

Figure 4 is a diagram of the use of the apparatus according to the invention. Therein a rotary or stationary apparatus according to fig. 1 or fig. 2 respectively has been indicated with the numerals 1, 14, a mixing tube 19 according to fig. 3 being connected with said apparatus. An air conduit 27, a water conduit and a conduit 29 for the supply of the chemical agent are connected with said mixing tube. A compressor 30 and a pressure regulator 31 are provided in the conduit 27. A pump 32 is provided in the conduit 28, the entrance portion of said conduit being immersed in an auxiliary tank 33, which is filled with water. A pump 34 is provided in the conduit 29, whereas the entrance portion of said conduit is immersed in an auxiliary tank 35, containing the

surfactant chemical agent. The tank 35 is connected by a conduit 36 with a main tank 37 for the chemical agent. It will be clear that said surfactant chemical agents are known per se and are chosen in adaptation to the dust to be controlled. Level regulators are
5 connected in known manner to the different tanks, said level regulators switching the pumps, also a pump 38 connected in the conduit 36, when a minimum or a maximum level respectively in the relative tank is reached. Said controls are indicated only very schematically.

C L A I M S

1. A process for strongly reducing the vesicle dimensions of a aqueous aerosol solution containing one or more surfactant chemical agents, characterized in that the aerosol solution is carried through a plurality of fibre filters (9, 17) which are successively positioned and the solution is imparted a swirling movement between each two filters.

2. Apparatus according to claim 1, characterized in that the apparatus comprises a tubular housing (1, 14) having an inlet opening (2, 15) and an outlet opening (3, 16), which openings are coaxial, each fibre filter (9, 17) being is disc shaped grid, which is secured at its circumference to the tube wall and the grid apertures (11) of which are filled with fibres material.

3. Apparatus according to claim 2, characterized in that the grid (9, 17) comprises honeycomb shaped cells (11).

4. Apparatus according to one or more of the previous claims, characterized in that a rotary drivable shaft (4) is provided in the tube axis, said shaft being rotatable relative to the tube wall (1), a blade wheel (12) being secured to the shaft between each two filters (9).

5. Apparatus according to one of the claims 1 - 3, characterized in that one or more fixed helical blades (18) are provided between each to filters (17), each helical blade having a circumferential extension of at least 90° , the diameter of the blade increasing from practically zero to the tube diameter, when going from the first to the second filter (17), or vice versa.

6. Apparatus according to claim 4, characterized in that a deflector cone (13) widening in the direction towards the tube outlet, is provided before the first filter (9).

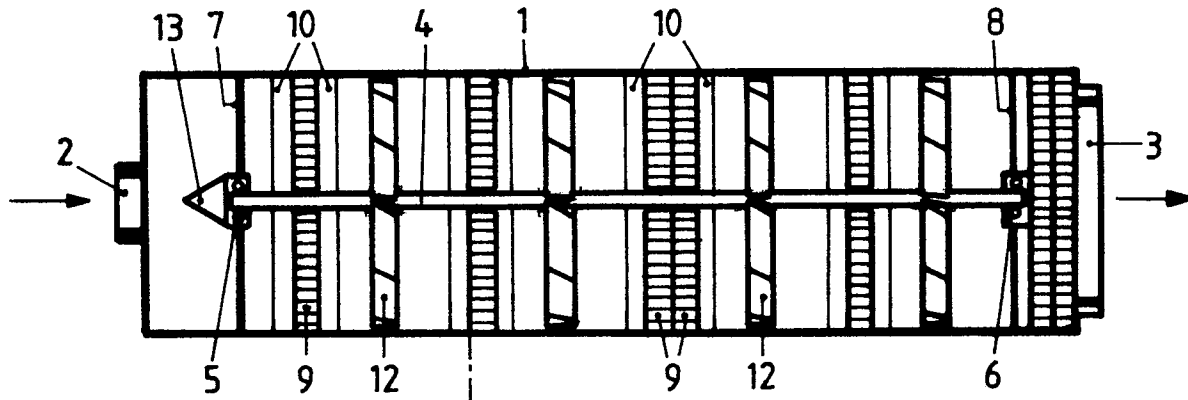


FIG. 1

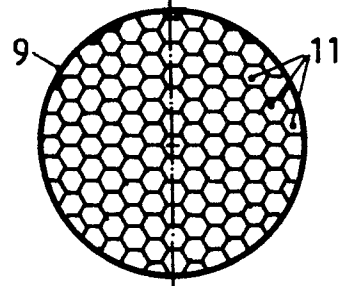


FIG. 1a

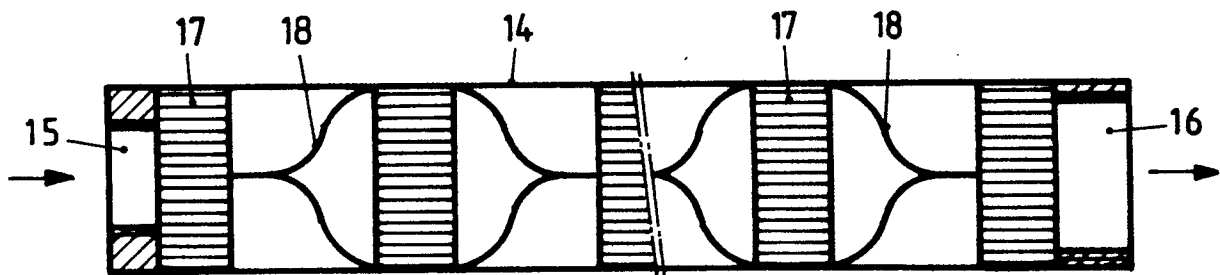


FIG. 2

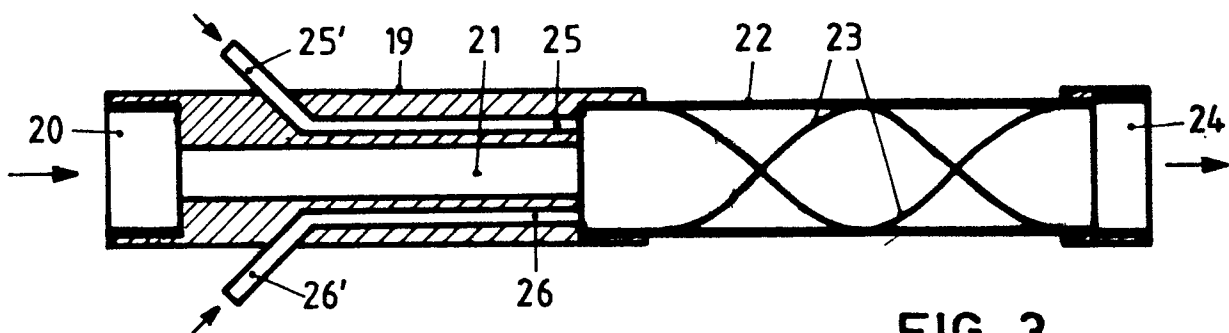


FIG. 3

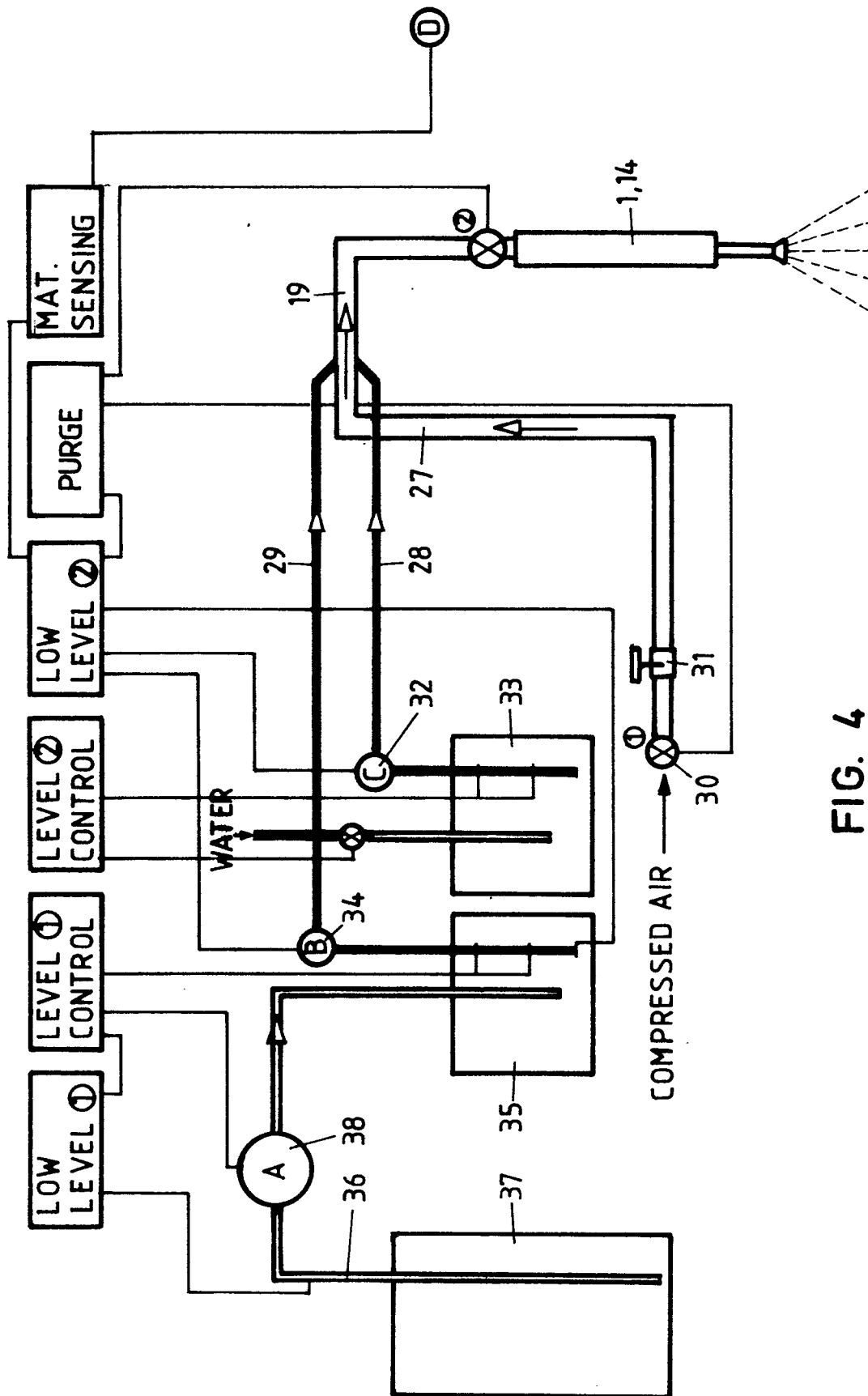


FIG. 4



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EUROPEAN SEARCH REPORT

0155024

Application number

EP 85 20 0167

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int. Cl.4)
X	US-A-2 335 339 (KEEN) * Figures 1-5; page 1, left-hand column, line 53 - right-hand column, line 25 *	1,2,4	B 01 F 5/06 B 01 F 3/04
A	---	3,5	
A	DE-C- 813 195 (DEFENSOR AG) * Page 4, lines 44-59 *	1	
A	--- NL-A- 279 114 (SHELL INTERNATIONALE RESEARCH) * Claims 11,12 *	1	
A	--- US-A-4 207 202 (COLE Jr.) * Column 2, lines 13-23; column 3, lines 26-56; column 4, lines 57-61 *	1,3	
A	--- DE-A-2 356 595 (ERDMANN) * Figure 1 *	6	
A	--- US-A-4 068 830 (GRAY) * Figure 1 *	5	
A	--- NL-C- 2 007 (SILKEBORG MASKINFABRIK)		
A	--- DE-A-2 331 825 (KOTTHOFF) -----		
The present search report has been drawn up for all claims			
Place of search THE HAGUE		Date of completion of the search 14-05-1985	Examiner ASH R.A.
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document			