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(54) **INNER DEVICE FOR NEUTRALIZATION OF ELECTROSTATIC CHARGES FROM MATERIAL IN CONTACT**

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(57) **ABSTRACT**

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The present invention is about a mechanism in the a container such as a FIBC, which enables the immediate neutralization of the electrostatic charges generated during filling, emptying or transporting of the containers. FIBCs are used to carry bulk solid powders, such as sugar, flour, starch and chemical substances.

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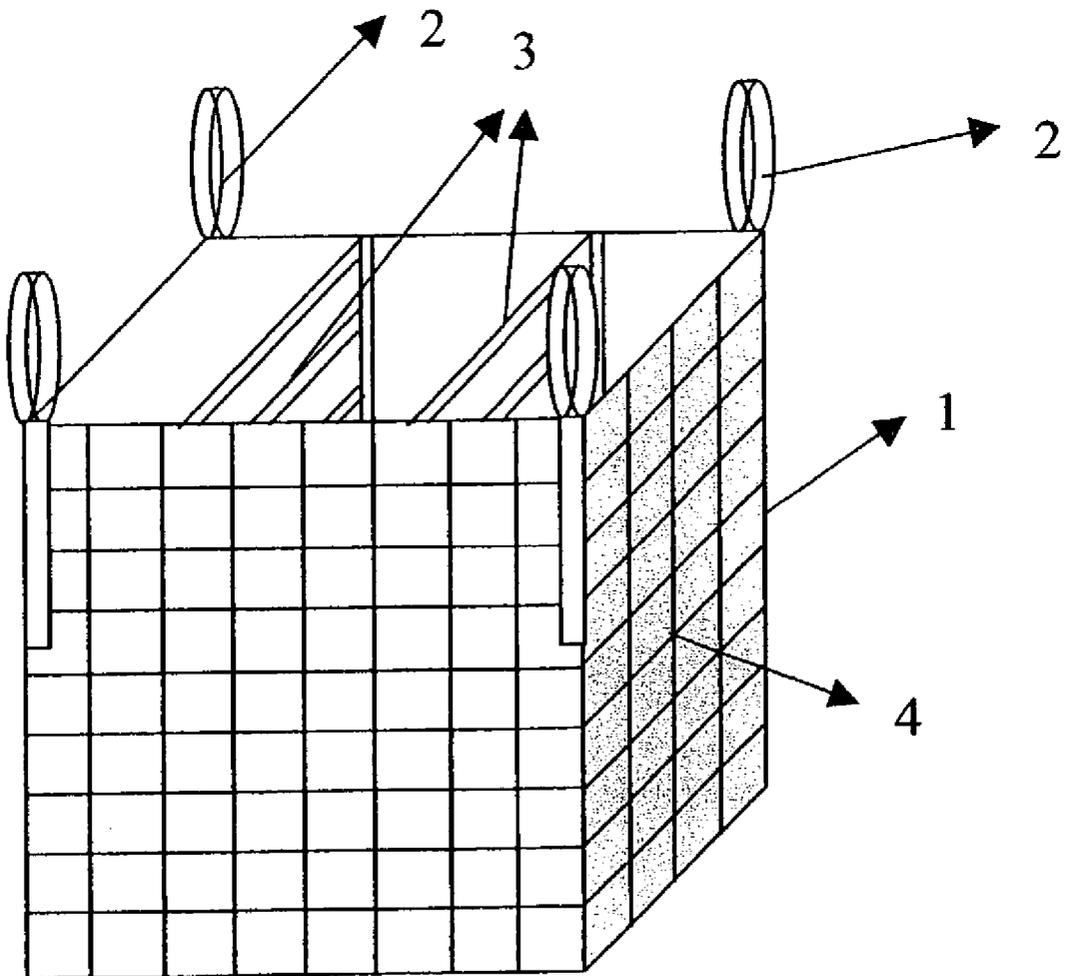
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The FIBC, which enables neutralization of the electrostatic charge generated within the material in the bag, developed with this invention, is characterized by inner devices knitted preferably with multi-filaments or mono-filaments and tapes, made of polymers in the form of a web or net with a special antistatic additive, established to an appropriate place in the FIBC so as to have maximum contact with the bulk solid powders in the FIBC in order to neutralize the electrostatic charge at distant points of the FIBC's wall.



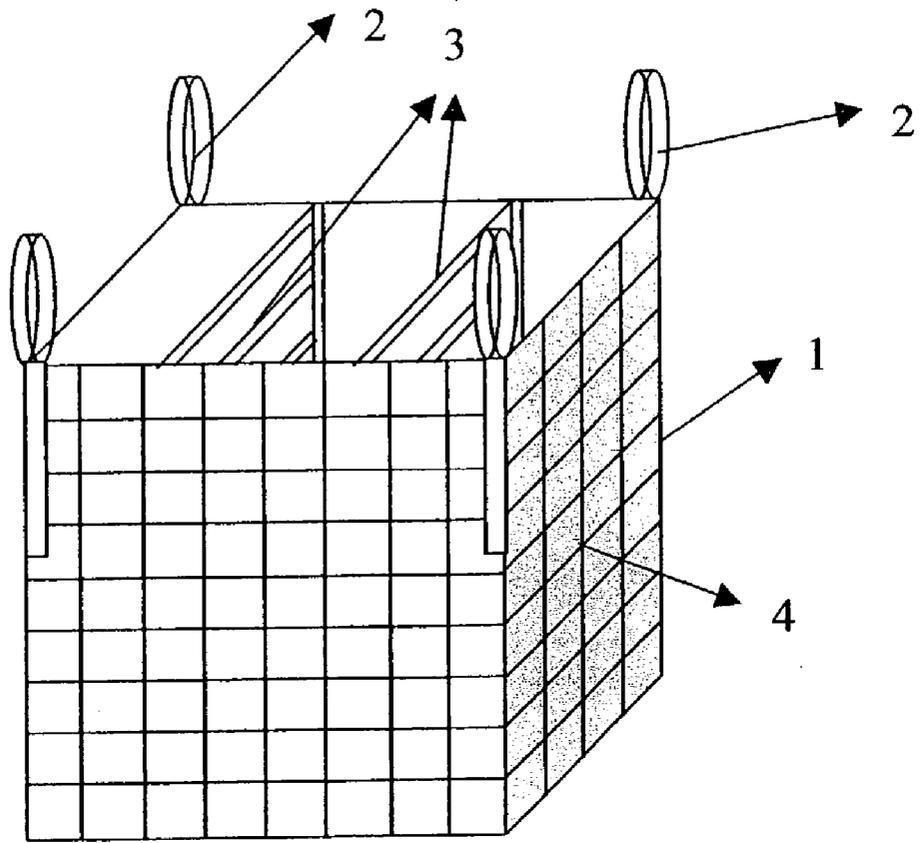


Figure -1

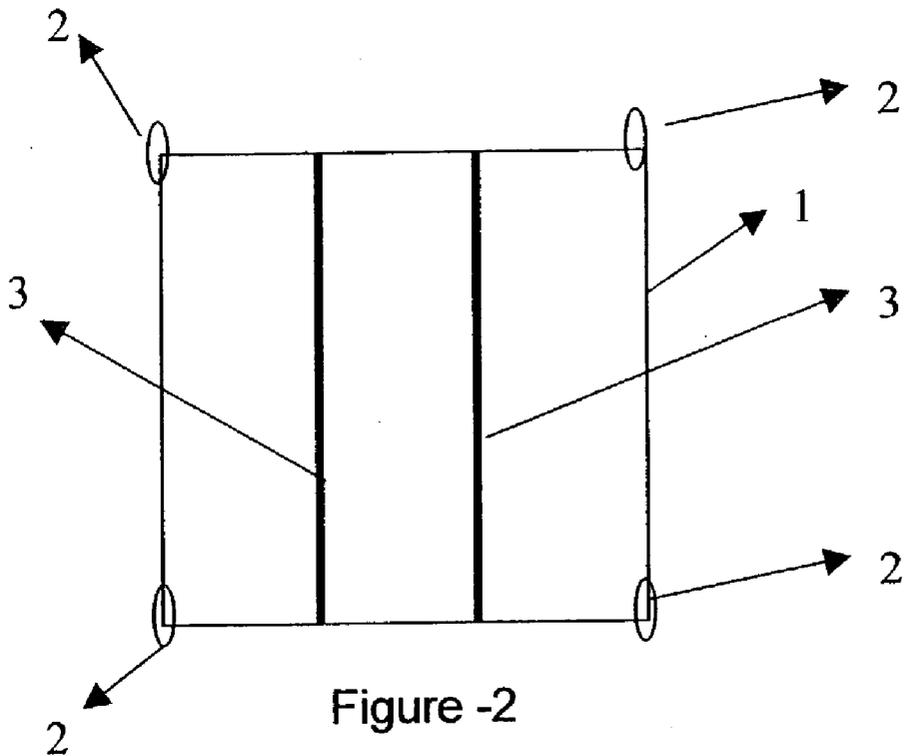


Figure -2

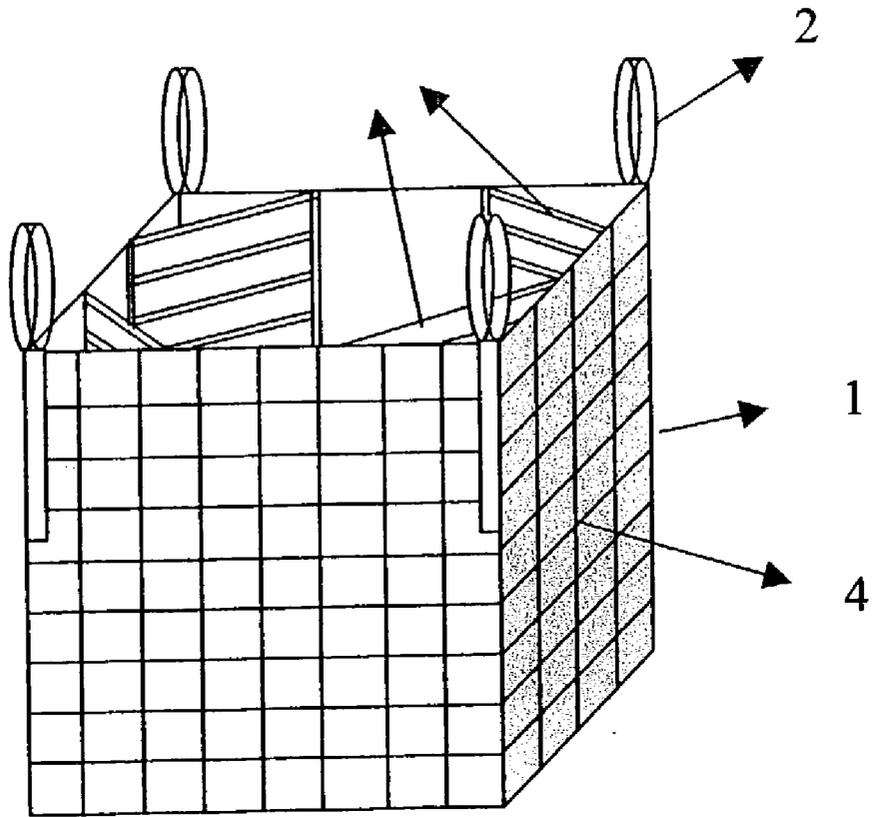


Figure -3

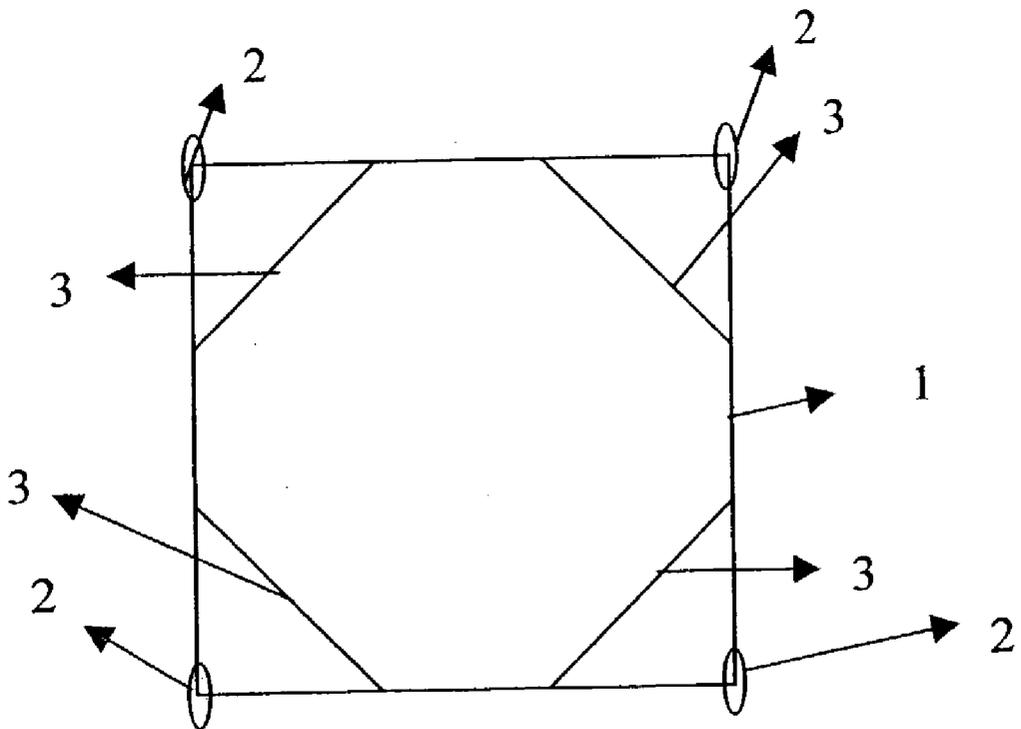
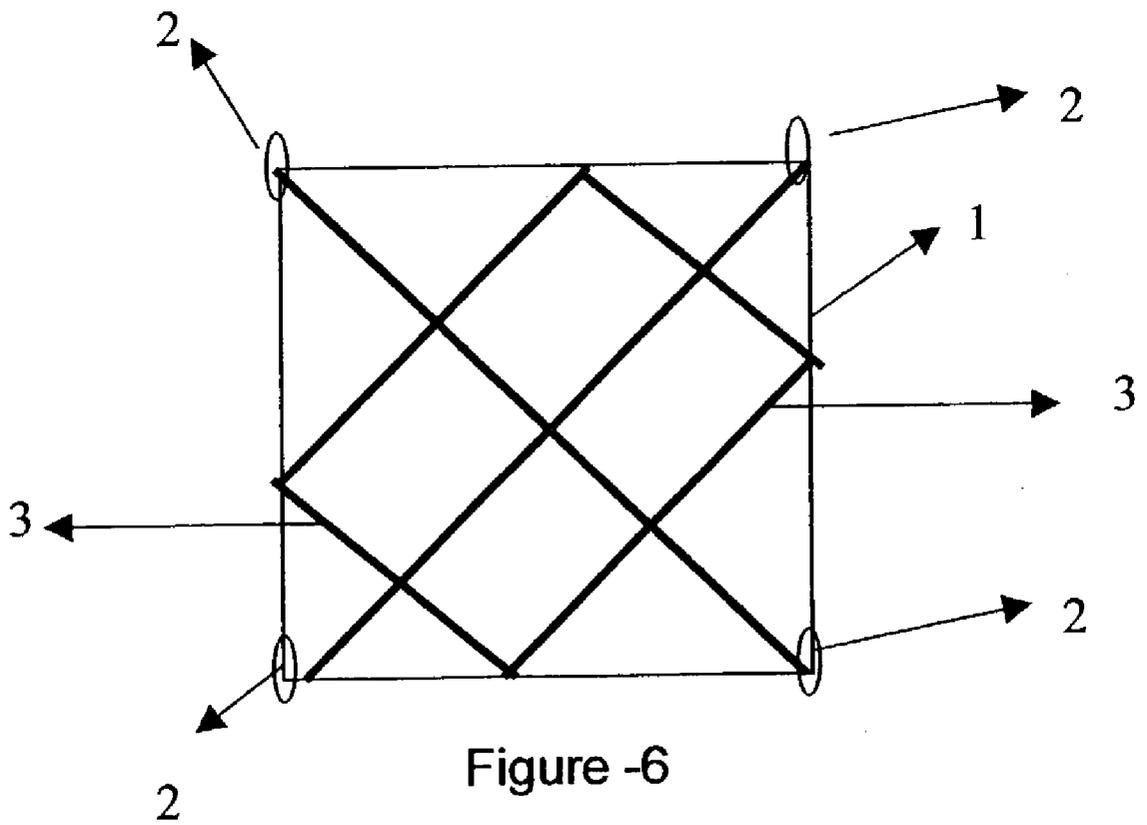
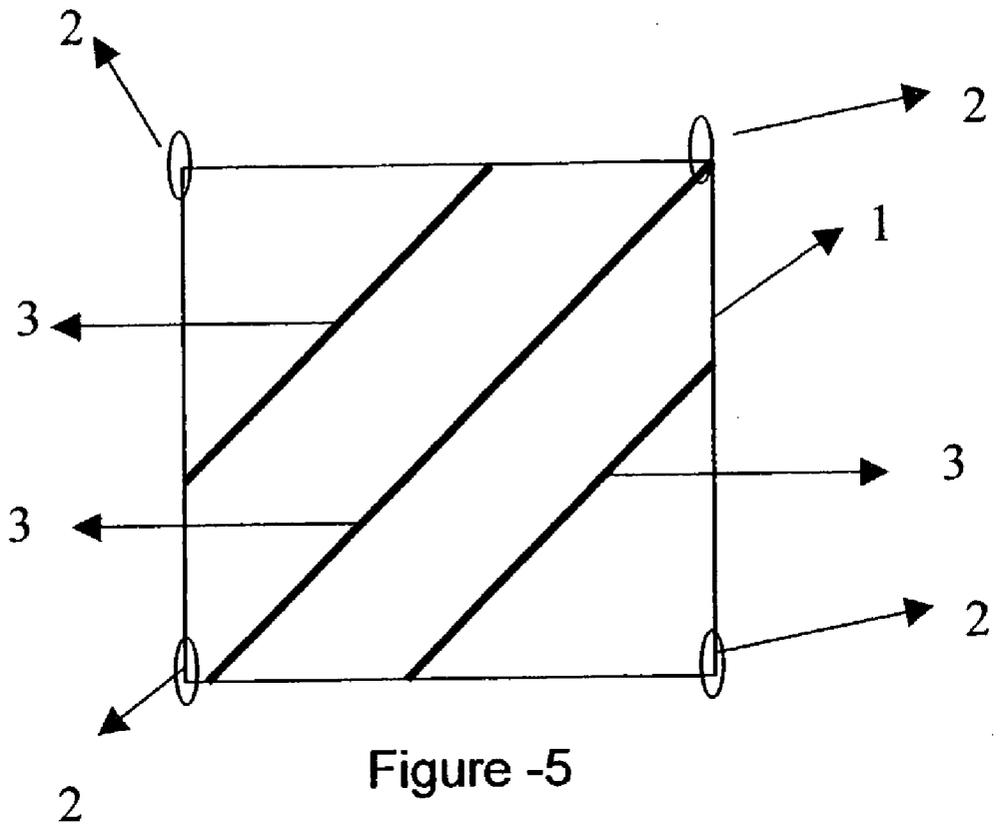


Figure -4



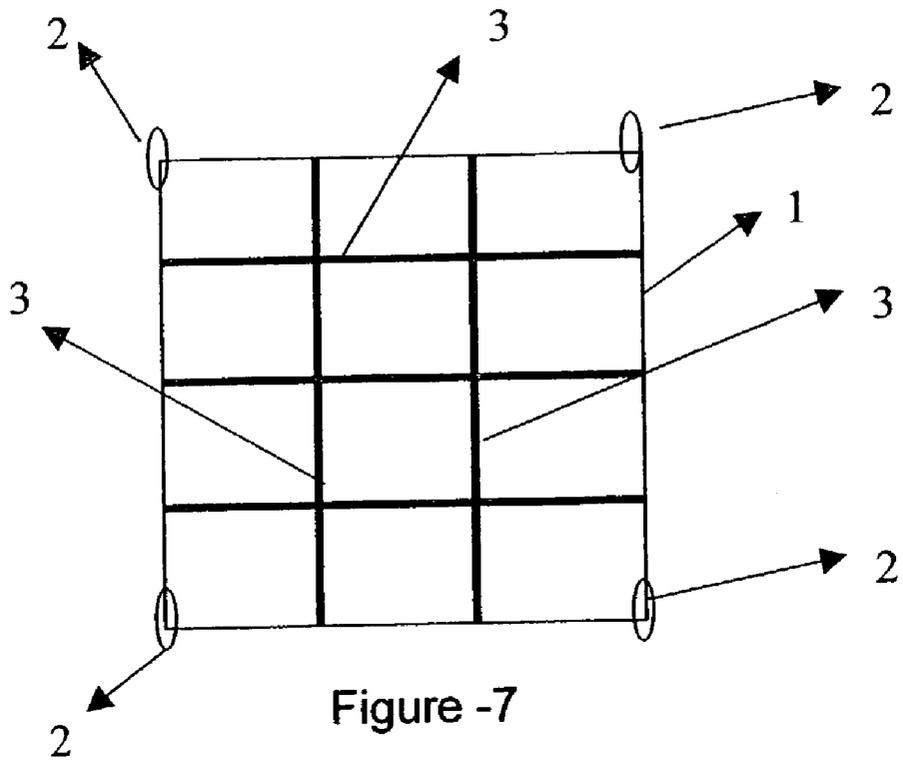


Figure -7

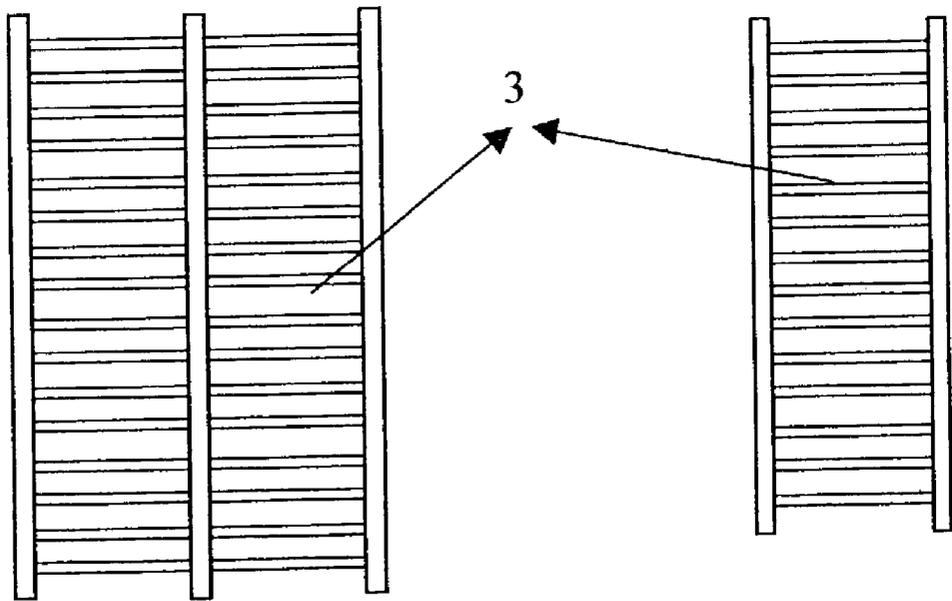


Figure -8

Figure -9

## INNER DEVICE FOR NEUTRALIZATION OF ELECTROSTATIC CHARGES FROM MATERIAL IN CONTACT

### BACKGROUND

[0001] The present invention addresses a mechanism for use in a Flexible Intermediate Bulk Container (FIBC), which enables the immediate neutralization of the electrostatic charges generated during filling, emptying or transporting of the FIBC. FIBC's are used to carry bulk solids powders, such as sugar, flour, starch and chemical substances.

[0002] During the filling and emptying of FIBC's which are typically made of polymer-based fabric such as polypropylene, HDPE, LLDPE etc., electrical charges can accumulate on the FIBC and inside the FIBC. Electrostatic charges may cause electrostatic discharges and ignition risks in the presence of flammable atmosphere.

[0003] In relation to this issue, there is a patent application TR2001/03444, filed on Nov. 28, 2001 at Turkish Patent Institute, titled "Flexible intermediate bulk container with multiple conductive fibers having permanent antistatic effect". It is explained that the electrostatic charge accumulated on the FIBC is discharged to the surrounding atmosphere by permanent anti-static-treated multi-filaments fibers in the FIBC. With the defined practice in this application the electrostatic charge generated during filling and emptying on the FIBC is neutralized. The static charge generated at a distance from the walls of the FIBC, however, cannot be neutralized immediately.

### BRIEF SUMMARY OF THE INVENTION

[0004] An object of the present invention is to neutralize any electrostatic charges generated within the material in the FIBC bag during filling, emptying and transporting the FIBC, to avoid ignition risks in the presence of a flammable atmosphere.

[0005] The electrostatic changes generated in the material within the FIBC are neutralized in this invention by contact with inner devices which conduct the charge to the atmosphere. These inner devices consist of anti-static fibers configured within the material in the FIBC.

[0006] Although the present invention is described and depicted primarily in reference to its use inside FIBC's the principles of the inner devices can be readily adapted by one skilled in the art to other applications such as containers of all sizes including rail cars, trucks, silo's and any other enclosure used for storage/transport of bulk solid powders.

### BRIEF DESCRIPTION FIGURES

[0007] The figures attached for further explanation of the FIBC and inner devices, which enables neutralization of the electrostatic charges within the material in the FIBC, are as follows:

[0008] **FIG. 1**—Perspective view of an example of a FIBC with inner devices for neutralizing electrostatic charge arranged in parallel with side

[0009] **FIG. 2**—Top view of an example of a FIBC with inner devices for neutralizing electrostatic charge arranged in parallel with one side

[0010] **FIG. 3**—Perspective view of an example of a FIBC with inner devices for neutralizing electrostatic charge arranged across to the corners

[0011] **FIG. 4**—Top view of an example of a FIBC with inner devices for neutralizing electrostatic charge arranged across to the corners

[0012] **FIG. 5**—Top view of an example of a FIBC with inner devices for neutralizing electrostatic charge arranged in parallel diagonally across the FIBC.

[0013] **FIG. 6**—Top view of an example of a FIBC with inner devices for neutralizing electrostatic charge arranged in parallel crisscrossing diagonally across the FIBC.

[0014] **FIG. 7**—Top view of an example of a FIBC with inner devices for neutralizing electrostatic charge arranged in parallel and perpendicular to opposing sides of the FIBC.

[0015] **FIG. 8**—Front view of an example of an inner device for a FIBC, in the shape of a ladder (double column)

[0016] **FIG. 9**—Front of an example of an inner device for a FIBC, in the shape of a ladder or web (single column)

### DETAILED DESCRIPTION OF INVENTION

[0017] The FIBC (1), which enables neutralization of the electrostatic charge generated within the material in the bag, developed with this invention, is characterized by inner devices (3) knitted preferably with multi-filaments or mono-filaments and configured in the various forms including ladder, web, or net, with a special antistatic additive. The FIBC inner devices are arranged in an appropriate configuration within the FIBC so as to have maximum contact with the bulk solids powders in the FIBC in order to neutralize the electrostatic charge at a distance from the FIBC's walls. There can be any number of internal devices as warranted to adequately neutralize the material within the bag. Sample configurations of these internal devices are depicted in FIGS. 1-7. These inner devices (3) are configured in various geometrical forms and configurations to enable the neutralization of the electrostatic charge generated during filling, emptying and transporting and are preferably made of the same material as the sides. The inner devices are comprised of mono-filament or multi-filament fibers. These fibers for neutralizing the electrostatic charges preferably include permanent antistatic additives such as IRGASTAT P18 or IRGASTAT P22 manufactured by Ciba Geigy® at a ratio of %6-%20 preferably. The said inner devices (3) are produced from materials which can conduct electricity at each point. These antistatic agents are polyamide/polyether block amides which are incorporated as melt additives.

[0018] The resistance of the inner devices (3) of the FIBC (1), which enables neutralization of the electrostatic charge generated within the material in the (FIBC), is  $10^7$  and  $10^{12}$  ohms/square.

[0019] The fibers added to the inner devices (3) of the FIBC (1), consist of polyamide and fiber conductive material with diameters of approximately 0.2 to 15  $\mu\text{m}$  (micron) and are constructed in the inner devices so as to form a web, net or ladder configuration. Handles (2) are preferably provided to facilitate transport.

[0020] The inner devices (3) are configured in any appropriate arrangement or shape in a manner to maximize

contact with the bulk material with which the FIBC is filled. This includes, but is not limited to, inner devices configured in parallel, diagonally or centrally within the FIBC in reference to the side and bottom walls.

[0021] The inner devices (3) are preferably made of materials which readily conduct electricity to the FIBC outer walls by direct contact with the lateral devices (4).

1. An inner device comprising:

anti-static fibers

the anti-static fibers configured to maximize contact with a material to be neutralized

the antistatic fibers connected at the outer limits of the material to conduct electrostatic charges to atmosphere via contact with an outer container which is configured to contain the inner device.

2. An inner device according to claim 1 in which the anti-static fibers are mono-filament.

3. An inner device according to claim 1 in which the anti-static fibers are multi-filament.

4. An inner device according to claim 1 in which the fibers comprising the inner device are configured in a interconnected manner.

5. An inner device according to claim 1 in which the diameter of the fibers ranges from 0.2 to 15  $\mu\text{m}$  (micron).

6. An inner device according to claim 1 in which the inner device is characterized by a resistance ranging from  $10^7$  to  $10^{12}$  ohms/square.

7. An inner device according to claim 1 in which the inner device is made of materials which conduct electricity.

8. An inner device according to claim 1 in which the container is made of the same material as the inner device.

9. A plurality of inner devices according to claim 1 which are configured within the container in an arrangement that facilitates maximum contact with the material within the container.

10. An inner device according to claim 1 in which the container is a Flexible Intermediate Bulk Container (FIBC).

11. An inner device according to claim 1 in which the anti-static fibers include anti-static additives of polyamide and fiber conductive material.

12. An inner device according to claim 11 in which the additive is a permanent antistatic agent preferably IRG-ASTAT P18 or IRGASTAT P 22.

13. A FIBC according to claim 11 in which the IRG-ASTAT P18 or IRGASTAT P22 additive is in the range of 6-20%.

14. A method of neutralizing the electrostatic charge generated by material consisting of:

configuring an inner device of anti-static fibers.

configuring the anti-static fibers comprising the inner device in a manner to maximize contact with material to be neutralized.

connecting the anti-static fibers to the outer limits of the material to conduct static electricity to atmosphere via contact with an outer container which is configured to contain the inner device and material.

15. A method according to claim 14 in which the anti-static fibers include antistatic additives of polyamide and fiber conductive material, preferably IRGASTATE 18 or IRGASTAT 22.

16. A method according to claim 14 in which a plurality of inner devices are configured within the container.

17. A method according to claim 14 in which the container is made of the same material as the inner device.

18. A method according to claim 14 in which the container is a FIBC.

19. A method according to claim 14 in which the diameter of the fibers ranges from 0.2 to 15  $\mu\text{m}$  (micron).

20. An inner device according to claim 14 in which the inner device is made of materials which conduct electricity.

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