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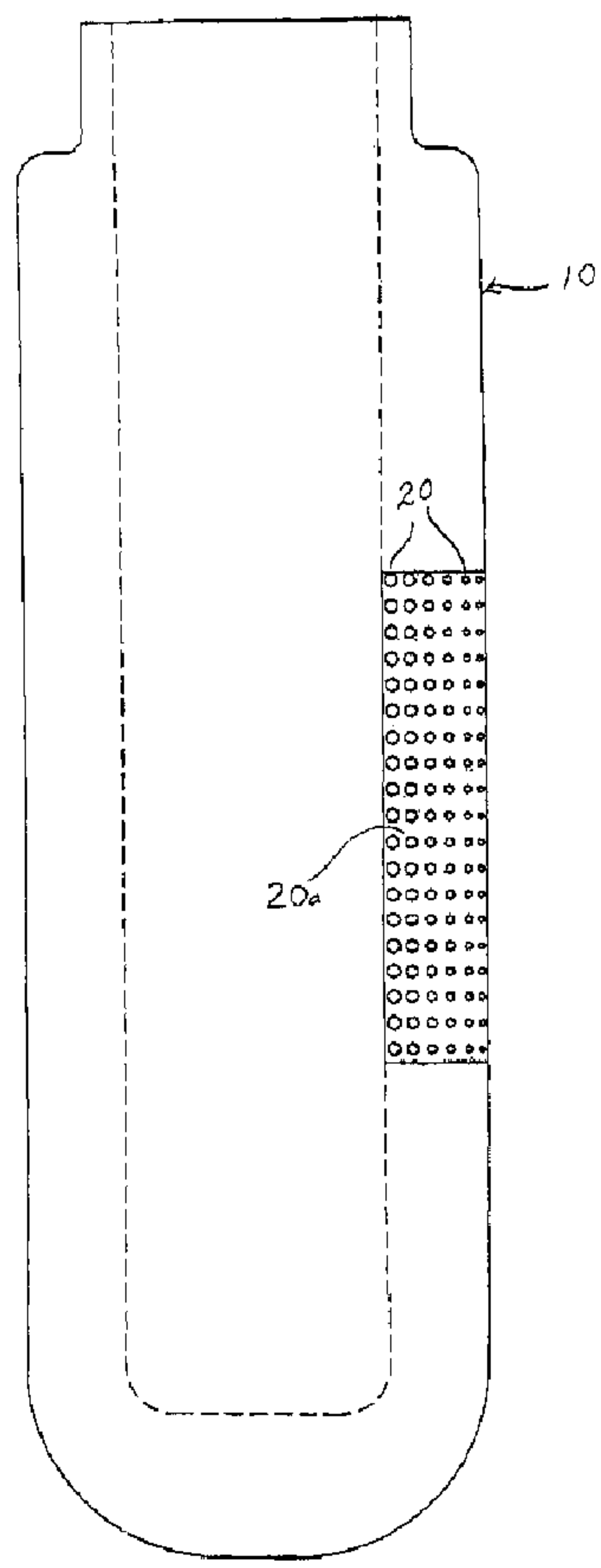
(54) **Titre :** ELEMENT FILTRANT AVEC PAROI A DENSITE VARIABLE

(54) **Title:** FILTRATION ELEMENT HAVING A VARIABLE DENSITY SIDEWALL



(57) **Abrégé/Abstract:**

A filtration element formed of overlapping fibrous strands or components. Those fibrous strands at the side of the filtration element which first receives the gas flow being of one thickness and those fibrous strands at the side of the filtration element where the gas flow exits being of a thickness substantially less than the one thickness of the strands at the opposite sidewall of the element.

ABSTRACT

A filtration element formed of overlapping fibrous strands or components. Those fibrous strands at the side of the filtration element which first receives the gas flow being of one thickness and those fibrous strands at the side of the filtration element where the gas flow exits being of a thickness substantially less than the one thickness of the strands at the opposite sidewall of the element.

FILTRATION ELEMENT HAVING A VARIABLE DENSITY SIDEWALL

SUMMARY OF THE INVENTION

[0002] This invention relates to a filtration element for gases and will have application to bag type filters.

[0003] In this invention, the filtration element was formed of overlapping fibrous strands or components with the strands varying in diameter or thickness, the largest of which is at the side of the filter which first receives the gas flow for filtration and the smallest of which is at the opposite side of the filter where the gas exists after passing through the filtration element. Further, the side of the filter which first receives the gas flow will generally be more rigid than the opposite side of the filter so as to provide a substantially incompressible surface.

[0004] Accordingly, it is an object of this invention to provide a filtration element which is of economical construction and which is of efficient operation.

[0005] Still another object of this invention is to provide a filtration element which is for gases and which provides for more even distribution of filtered particulate matter throughout the thickness of the element.

[0006] Other objects of the invention become apparent upon the reading of the following description.

BRIEF DESCRIPTION OF THE DRAWINGS

[0007] Figure 1 is a fragmentary perspective view showing an example of the apparatus which can be used to make the filtration element of this invention.

[0008] Figure 2 is a side view of a filter element in the form of a bag having a portion of the bag sidewall broken away to illustrate in cross-section the filtration strands forming the sidewall of the filter bag.

[0009] Figure 3 is a side view of the filter bag showing in illustrative form the varying thicknesses of the filtration strands.

DETAILED DESCRIPTION OF INVENTION

[0010] The preferred embodiment herein described is not intended to be exhaustive or to limit the invention to precise form disclosed. It is chosen and described to explain the principles of the invention and its application and practical use to enable others skilled in the art to best utilize the invention.

[0011] This invention may be best understood by the following descriptions and the workings of the equipment which is used to produce the filter element, seen in the drawing as a filter bag 10. As illustrated in Figure 1, a quantity of material, preferably polypropylene or other thermoplastic materials capable of producing filaments when molten and air dried, is introduced into an extruder 12 at hopper 14 and is fed through a nozzle 16. A plurality of ring heaters 18 circumscribe nozzle 16 and serve to produce heat sufficient to liquefy the thermoplastic material as it flows through the nozzle. Nozzle 16 terminates in a plurality of laterally spaced discharge outlets 22 through which the thermoplastic material in its molten state is propelled in melted and fibrous strands 20 by heated air from manifolds 23 toward a mandrel 28. Mandrel 28 may be formed from metal, wood or similar material and resembles in its outer configuration the intended shape of the filter bag 10 to be produced. Mandrel 28 is rotated about an axis 35 within the flow path of the fibrous strands 20 from nozzle discharge outlets 22. Normally, Mandrel 28 is placed between 1 to 3 feet from outlets 22 and rotated at a constant speed such as between 30 to 80 rpm. The fibrous material or strands 20 are sufficiently cooled as they reach the mandrel 28 so as to be formed about the mandrel in layers.

[0012] In this invention, the diameters of the strands 20 are varied as the thickness of the sidewall 32 of bag 10 increases. This is best illustrated in viewing figures 2 and 3 where a section of the sidewall of the filter bag has been broken away for illustrative purposes. In figure

2 the strands 20 are shown in cross-section, the largest diameter strands being at the inside of the bag and the smallest diameter of the strands being at the outside of the bag with the gas flow through the bag being from the inside towards the outside of the bag. In figure 3, there is shown in illustrative form the varying thickness of the strands 20 with the strands becoming progressively thinner from the inside to the outside of the bag in the direction of gas flow through the bag. In this manner, the outer margin of the sidewall of the bag will have its strands more compactly layered so as to increase the degree of filtration as the outer edges of the bag are reached. Thus, the larger particulate matter being filtered from the gas will first become entrained within the filter bag closer to the inside of the bag with the smaller particulate matter becoming entrained closer to the outside of the bag. This will produce more even distribution of the filtered particulate matter throughout the bag.

[0013] The thickness of the strands 20 of bag 10 may range from 50 to 200 microns towards the inside of the bag and progressively become smaller in transverse dimension to .5 microns at the outside surface of the bag with the bag being approximately ¾ to 1 inch thick. The precise thickness or transverse dimension of the strands of the fibrous material and thickness of the bag can vary depending upon the type of material intended to be filtered and the size of the filter bag.

[0014] In producing filter bag 10, the thicker strands are first wound upon the mandrel and then as the bag's thickness progressively increases, the temperature produced by heaters 18 can be increased so as to make the thermoplastic material more molten with the air pressure produced at manifolds 23 increased, thus increasing the length of the strands and reducing their transverse dimension. In this manner, by selectively increasing the temperature of the molten thermoplastic material and/or increasing the air pressure by which the molten thermoplastic material is driven through and propelled from the nozzles, the thickness of the strands can be selectively varied as they are wound upon the mandrel to produce the sidewall of the filter bag or cartridge depending upon the type of filtration element being produced.

[0015] Also, in addition to varying the thickness of the strands, by varying the temperature of the molten thermoplastic material and/or varying the volume of air by which the material is driven through and propelled from the nozzles, the stiffness of the strands can be increased so that the inner wall section 20a of the filter bag becomes stiff or rigid. Bag side walls may substantially collapse during use due to the gas pressure within the bag. This reduces the bag's permeability and filtering capacity. By rigidifying a wall section of the bag at the side where the gas first contacts, the bag strands remain open to provide intervals or voids between the strands to catch or entrain filtered particles. The depth of wall section 20a can vary, even extending the entire thickness of the filter bag, depending upon the filtration characteristics desired.

CLAIMS:

1. A fluid filter comprising an upstream side where fluid enters and a downstream side where fluid exits, said filter being formed of filaments and being in bag form, said filaments near said upstream side having a greatest thickness within said filter, said filaments continuously and gradually decreasing in thickness from said upstream side toward said downstream side such that pores between said filaments are largest near said upstream side, gradually decreasing in thickness toward said downstream side, thereby allowing particles of different sizes to be separated and evenly distributed throughout the filter, at least some of said filaments being cohesively bonded, said filaments having greatest rigidity within said filter near said upstream side, said filaments continuously and gradually decreasing in rigidity from said upstream side toward said downstream side to form a sidewall of said filter having sufficient stiffness so as not to require additional structural support to maintain its shape, said filaments varying progressively in transverse dimension.

2. A method for forming the fluid filter of claim 1 comprising:

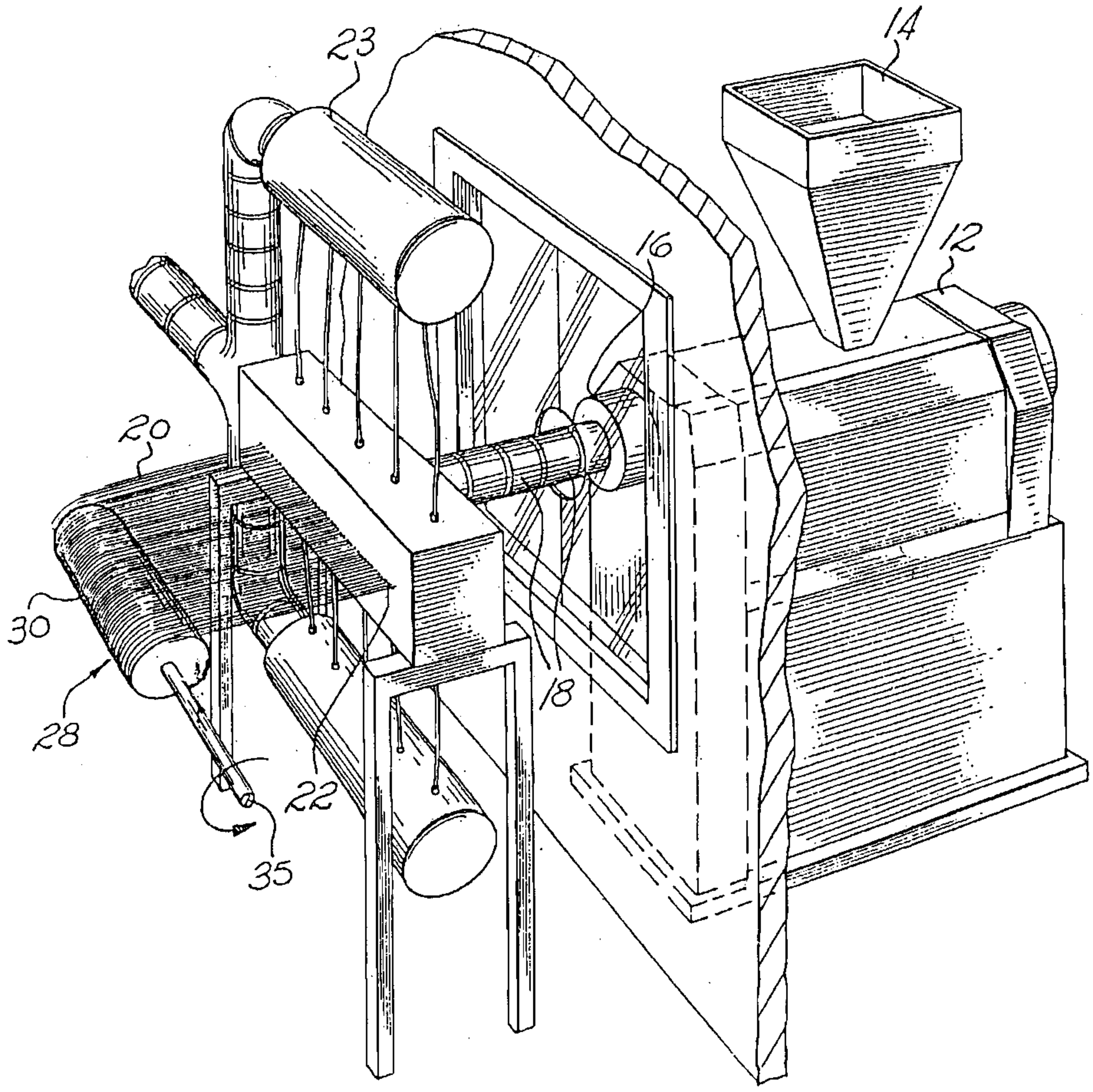
- extruding a molten thermoplastic material while continually and gradually reducing a transverse dimension of the strands to form the filaments, and
- winding the filaments upon a mandrel to form the fluid filter.

3. The method according to claim 2, wherein the transverse dimension of the strands is continually and gradually reduced by continually and gradually increasing a temperature of

the molten thermoplastic material during the step of extruding.

4. The method according to claim 3 or 4, wherein the transverse dimension of the strands is continually and gradually reduced by continually and gradually increasing an air pressure driving the step of extruding.

Fig. 1



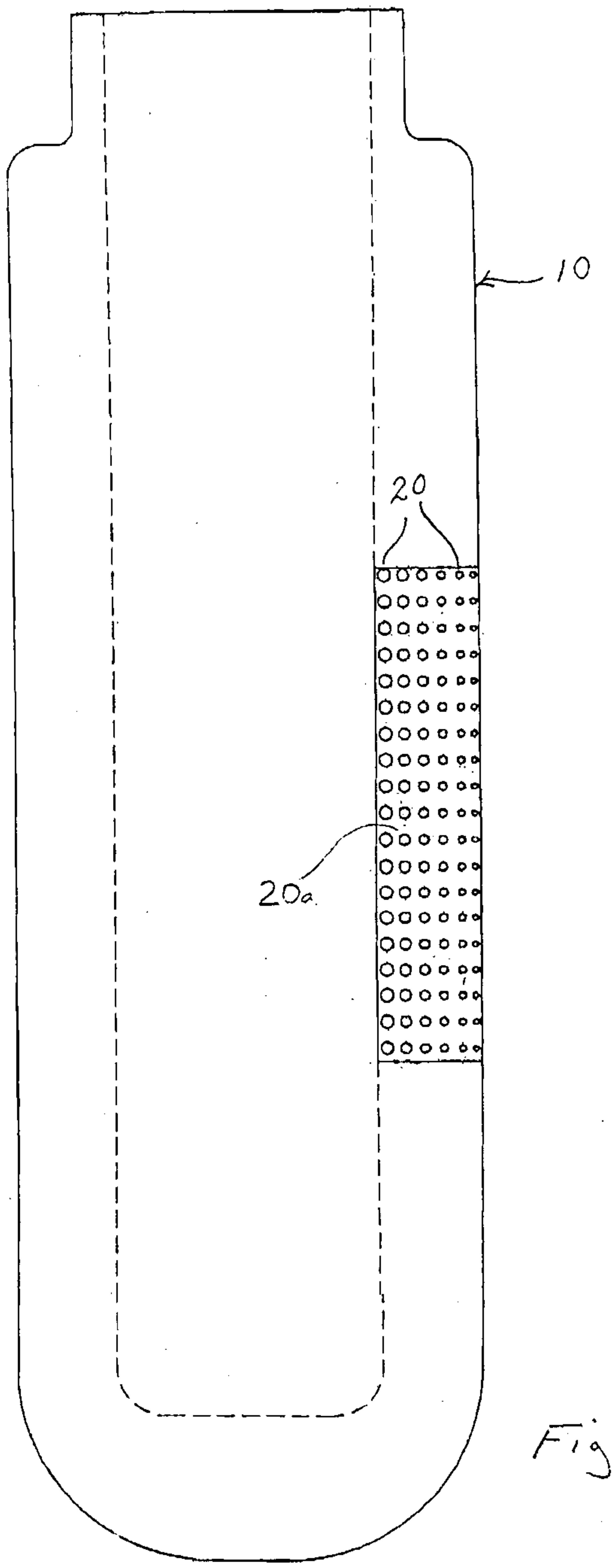


Fig. 2

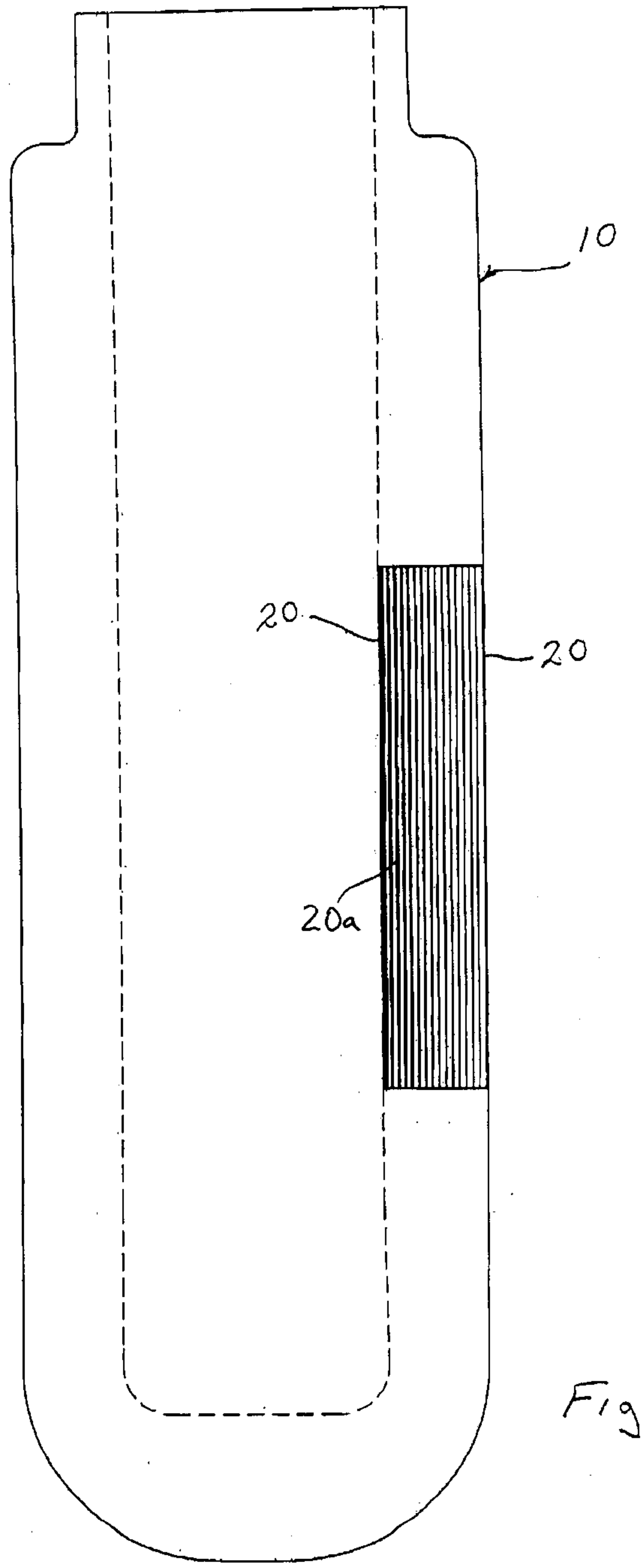
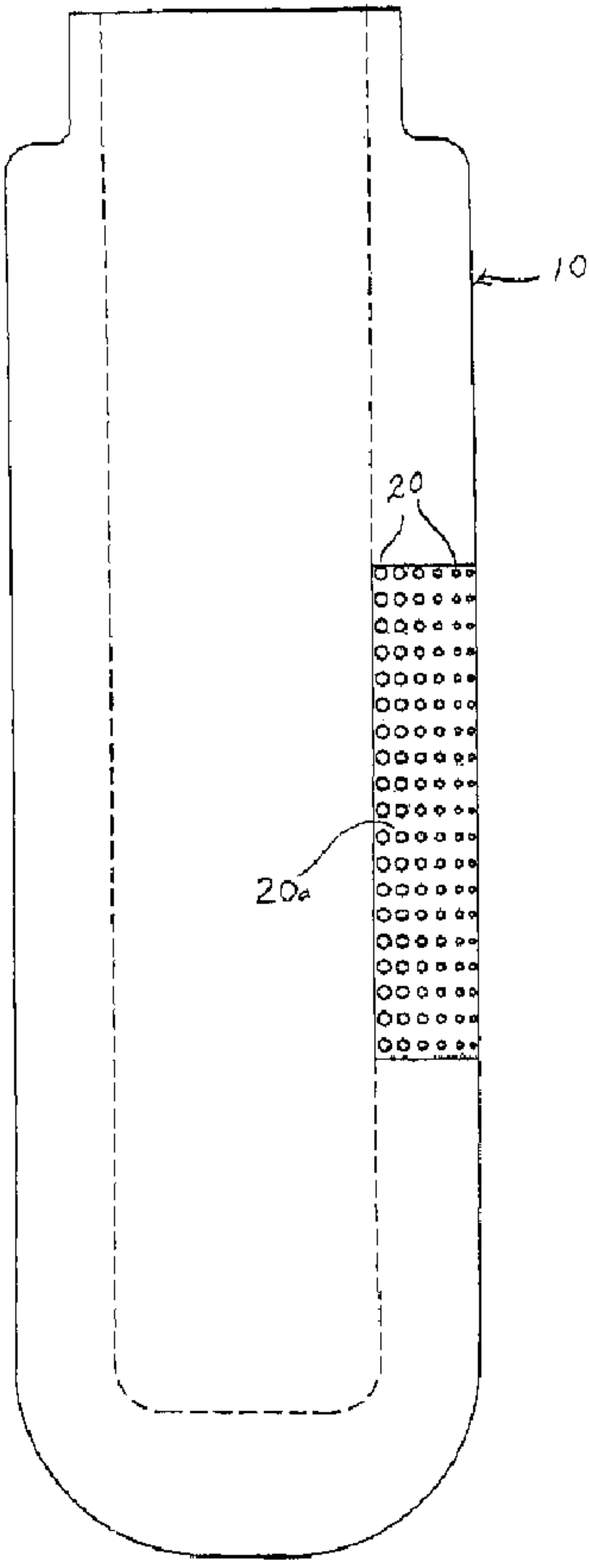


Fig. 3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