United States Patent

Eron

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[54] **FOAM-SOLIDS BLENDER**

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[52] **U.S. Cl.** .....**259/10,** 259/178 R

[51] **Int. Cl.** **B01f 7/08**

[58] **Field of Search**.....259/4, 9, 10, 18, 25, 26, 45, 259/46, 36, 151, 147, 178

[56] **References Cited**

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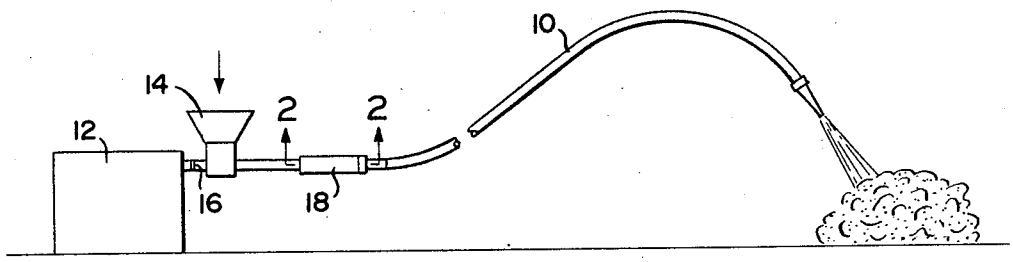
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Attorney—Stefan M. Stein

[57] **ABSTRACT**

A blender system for intermixing particulate materials with foams comprising an elongated conduit in which the materials to be blended enter in a mixed or unmixed condition. A sleeve formed in the conduit has a blending means removably mounted therein which serves to direct the flow path of the materials so as to accomplish a thorough blending. The blending device may comprise a perforated membrane arranged in a convoluted configuration or a plurality of discrete substantially spherical particles. The sleeve may have a different size diameter to facilitate efficient flow and blending of the materials and is detachably connected to the conduit to permit access to the blending means.

16 Claims, 9 Drawing Figures



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FIG. 1

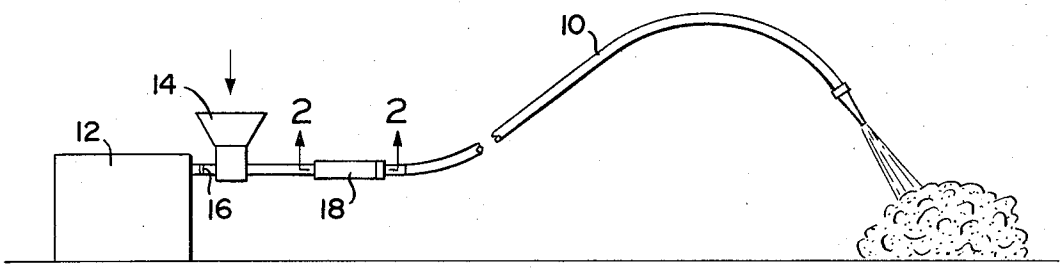


FIG. 2

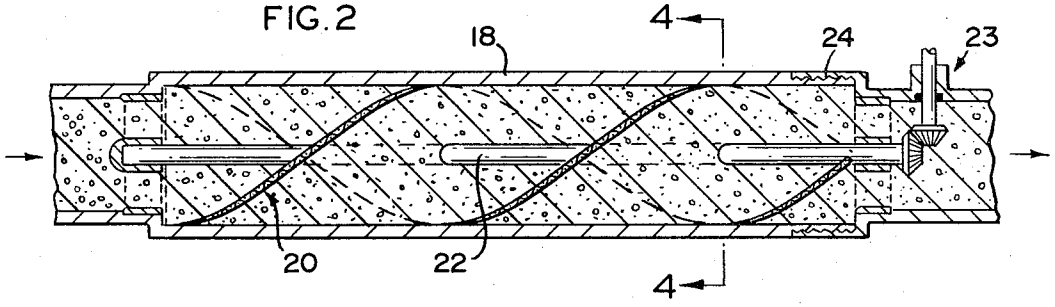


FIG. 3

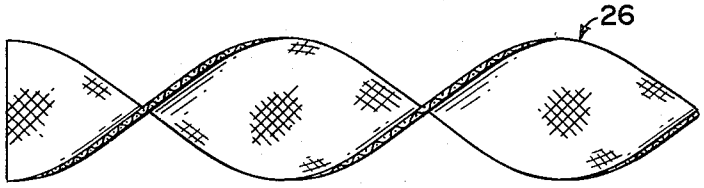
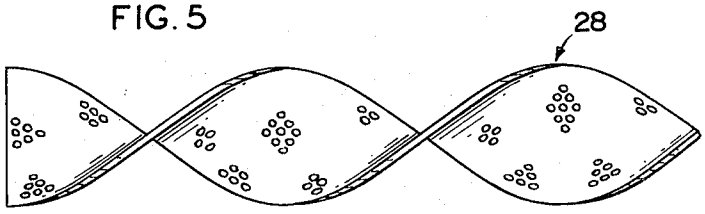


FIG. 5



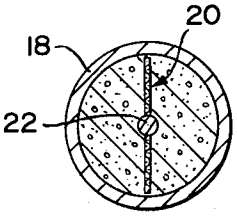


FIG. 4

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FIG. 6

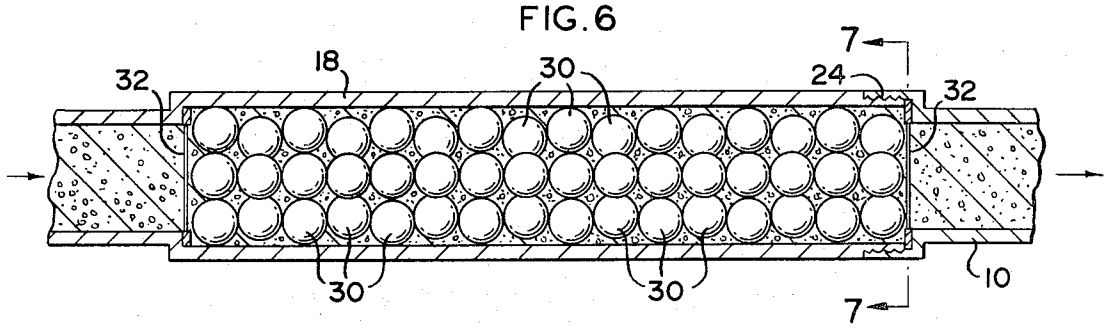
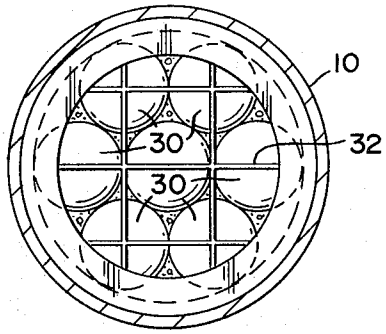


FIG. 7



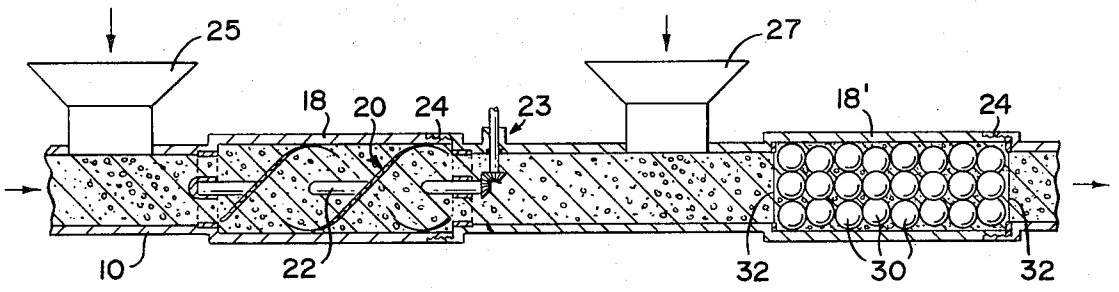


FIG. 8

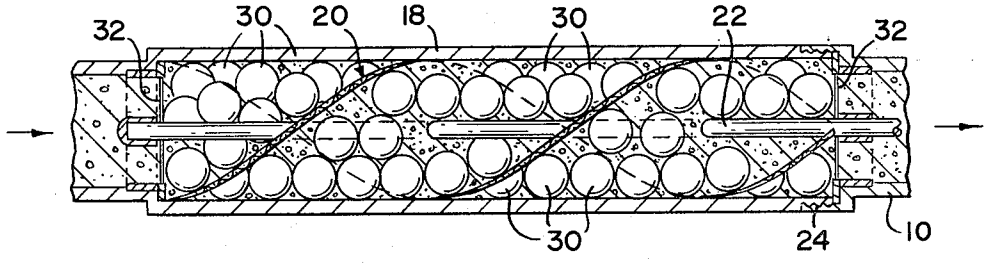


FIG. 9

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FOAM-SOLIDS BLENDER

BACKGROUND OF THE INVENTION

1. Field of the Invention

A blender designed to intermix at least two materials by means of a blending device arranged in a conduit which is additionally designed for the conveying and dispensing of the mixture at a desired location.

2. Description of the Prior Art

A number of conventional mixing or blending devices are directed to the intermixing of two or more materials which are in liquid, gaseous or solid states. A number of these devices comprise a container designed to hold solid material which is located in the main flow path of the material through the device. A liquid or gaseous material is then directed through the solid storage container wherein the materials are intended to be mixed. This type blender construction is inherently incapable of regulating the consistency or concentration of the final mixed product. This is due to the reliance on the breakdown of the solid material due to the force exerted by the traveling liquid or gas. Accordingly, the ratio of solid to liquid material in any given dispersed quantity is very irregular due to the irregular rate of breakdown of solid material. With this conventional type blender the different materials being intermixed cannot be efficiently changed, especially during operation of the device. Down time necessarily occurs since the container must be removed, emptied and refilled with a different material. This, of course, results in time wasted while the blender is out of operation.

A number of prior art devices have included the use of certain blending means which normally comprise structurally complex moving parts. These blending means are designed to consistently break down the solid material and adequately disperse it in the flowing liquid or gaseous material. Relatively complex blending devices of this type are initially more expensive to operate. Other disadvantages include additional maintenance and repair expense due to down time which is much more prevalent with these type blending devices. Still another disadvantage with known blenders is the problem of maintaining the desired consistency of mixed product as it is conveyed from the blending device to the point of discharge. Maintaining this consistency of product is of course highly desirable and important for even distribution necessary for a number of applications.

An additional disadvantage of conventional blenders, especially those handling food, is the problem of cleaning in order to maintain certain sanitation standards. Normally cleaning requires the disassembly of a major portion of the blender. This results in a large amount of time lost and a general inefficient cleaning procedure.

SUMMARY OF THE INVENTION

The present invention is directed toward a blender system primarily designed to intermix foam with particulate and other materials. The foam and solid materials are individually fed in mixed or unmixed condition to an elongated conduit. The conduit directs the flow of both materials to a blending means which may be in the form of a perforated membrane having a convoluted configuration. Alternatively, the blending means may comprise a plurality of marble-like spheres closely packed in designated area of the conduit. Flow of the materials through the spheres causes thorough intermixing of the different materials. Other embodiments of this invention comprise blending means including the plurality of spheres and convoluted membrane arranged, in the conduit, successively in spaced relation or collectively in the same designated space. After blending, the mixed material is further directed through the conduit to a discharge nozzle or the like, capable of dispersing the mixed product at any desired location.

More specifically, the present invention comprises a means to thoroughly blend two or more products while these products are being conveyed to a discharge point. The products for which the present invention is primarily designed include foam and solid particulate material of various sizes. However, the blender is capable of blending and discharging any material which may be intermixed with foam. Furthermore, the present invention is capable of intermixing foam with any material which because of its size or consistency cannot be applied directly to a foam generator. Such materials to be mixed and dispersed may be in the form of slurries, smokes or even gases. Therefore, the invention is directed to an efficient means of intermixing foam with various solid materials without causing a breakdown of the foam structure or clogging due to the direct mixing of a material in the foam generator.

The blending means provides a number of advantages over prior art devices. This is due to the fact that the blending means comprises a single strip of perforated membrane arranged in a convoluted fashion. The membrane is detachably secured within a sleeve area of a channeling conduit collinear with the flow path through the conduit. The membrane may be of a mesh screen perforated plastic or any suitable equivalent dependent upon the compatibility of the material with the product being blended. The apertures in the convoluted membrane are designed to be of a predetermined size so as to allow both the foam and particulate materials to flow therethrough. In operation however, the particulate material will be channeled over the surface which is arranged in a convoluted configuration. The blending of certain material may be further enhanced by using a convoluted membrane which may be continuously rotated during flow of the materials through the sleeve. Alternatively, both the spheres and the membrane may be container within the same sleeve for efficient blending of certain materials.

Instead of the membrane, the blending means may comprise a plurality of spheres or similarly shaped particles positioned directly in the flow path of the foam as it passes through the conduit. The spheres are arranged within the conduit in an unattached relationship to one another so as to allow sufficient space for flow therebetween of the materials being mixed.

Alternatively, the blending means may comprise both the plurality of spheres and the membrane arranged at different positions in spaced successive relation along the conduit. This allows for the addition of various sizes of particulate material at different points along the conduit. Each of the blending means are secured within a separate containing sleeve formed in the conduit. These sleeves are arranged relative to the

conduit such that flow of the material passes directly through the sleeve. The sleeve may be formed with a diameter having a different size than the remainder of the conduit. This prevents a backup in the conduit due to the added resistance to flow created by the blending means within the sleeve. This particular embodiment of the present invention could be used for the blending of foodstuffs such as sandwich spreads or dressings. Intermixing these products would include the blending of different sized particulate material. As stated, this is most efficiently accomplished by adding the different sized particulates at different points. Thorough intermixing is assured since the different particulates are added immediately upstream of a separate blending means.

In order to facilitate cleaning of the blender, removal of the blending means is simplified by making the conduit separable in the vicinity of the sleeve. Accordingly, each of the blending means are maintained within the sleeve by means of a detachable mounting means. In the case of the blending means comprising a plurality of spheres the mounting means are in the form of porous screens or cross wires arranged at each extremity of the sleeve. This allows adequate containment of the spheres and no added resistance to flow of the material. The mounting means for the convoluted membrane includes a central support core or shaft detachably mounted within the sleeve. Maintenance of sanitation requirements is efficiently accomplished, especially in the case of the blending of food products.

In operation each of the materials to be mixed enter the conduit at separate points in an essentially unmixed condition upstream from the blending means. One of the materials being intermixed is produced by a foam generator which causes the materials in the conduit to travel to the blending means by the force created in pumping the foam from the generator. The materials enter the sleeve wherein the blending means is located. The materials are thoroughly blended and mixed due to their interaction with the blending means. At the discharge end of the sleeve the intermixed materials continue to travel along the conduit wherein they are directed to a dispersal means.

Through the use of the blending means, as described above, the present invention is capable of producing an intermixed product having a predetermined desired consistency dependent upon the rate of feed of the materials to the conduit. Furthermore, the individual materials being mixed and dispersed can be rapidly and efficiently changed without shut down be merely adding the material to the conduit upstream of the blending means.

Accordingly, it is an object of the present invention to provide a blender for efficiently intermixing two or more materials to form a product having an intimate mixture through the use of a structurally simplified and substantially maintenance-free blending means, wherein the product may be easily dispersed at a desired location.

The invention therefore comprises the features of construction, combination of elements and arrangement of parts which will be exemplified in the construction hereinafter set forth, and the scope of the invention will be indicated in the claims.

BRIEF DESCRIPTION OF THE DRAWINGS

For a fuller understanding of the nature and objects of the invention, reference should be had to the following detailed description taken in connection with the accompanying drawings in which:

FIG. **1** is a front plan view of the invention wherein the intermixed materials are being dispersed.

FIG. **2** is a sectional view of the blending means and sleeve structure taken along lines **2—2** of FIG. **1**.

FIG. **3** is a front plan view of the blending means being in the form of an apertured membrane having a convoluted configuration.

FIG. **4** is a sectional view of the sleeve blending means taken along line **4—4** of FIG. **2**.

FIG. **5** is a front plan view of another embodiment of the apertured membrane

FIG. **6** is a sectional view of still another embodiment of the blending means as contained in the sleeve of the present invention.

FIG. **7** is a cross sectional view of the blending means and sleeve as taken across line **7—7** of FIG. **6**.

FIG. **8** is a sectional view of blending means including separate sleeve structures arranged in spaced relation to one another.

FIG. **9** is a sectional view of combined blending means arranged in a common sleeve.

Similar reference characters refer to similar parts throughout the several views of the drawings.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

This invention involves a blender for intermixing a foam with solid particulate material through the use of a blending means. The blending means is positioned in a conduit which defines the flow path of the material being mixed and serves to channel the material from the point of entrance to the point of discharge of the intermixed materials.

More specifically, the foam material enters conduit **10** from a supply source such as a foam generator **12**. The second material, which may be a particulate material enters conduit **10** at a second independent point through hopper **14**. A resistance screen **16** is located adjacent to the discharge orifice of generator **12** in order to provide adequate back pressure necessary for the production of foam with a desired consistency.

Blender sleeve **18** may be formed integrally with conduit **10** and arranged downstream from the entrance points of the different materials to be mixed. Sleeve **18** may also be formed to include a larger diameter than the adjacent portions of conduit **10**. This reduces any added resistance which the material meets as it passes through sleeve **18** while the materials are being intermixed.

As shown in FIGS. **2–4**, the materials are combined into an intimate mixture by a blending means generally indicated at **20** and arranged within sleeve **18** in direct line with the flow path of conduit **10**. As specifically shown in FIG. **2**, blending means **20** may be in the form of an apertured membrane arranged in a convoluted configuration within sleeve **18**. A support core **22** extends down the longitudinal axis of the blending means **20** and may serve as a means of removing the mem-

brane from sleeve **18**. This removal is facilitated by threaded engagement **24** provided to separate conduit **10** from sleeve **18**. In addition, a drive means **23** is connected to core **22** and serves to rotate blending means **20** thereby more efficiently forming an intimate mixture of materials being blended.

FIGS. **3** and **5** show different embodiment of the apertured membrane which may be in the form of mesh screen **26** (FIG. **3**) or a strip of perforated plastic **28** (FIG. **5**). In each of these embodiments the apertures formed within the membrane are of sufficient size to permit passage therethrough of both the foam and particulate material.

Alternatively, as shown in FIG. **6**, the blending means **20** may comprise a plurality of spheres **30** mad from glass or any suitable material. The spheres **30** are independently arranged within sleeve **18** to provide sufficient space to allow passage of the materials about the spheres. Cover screens **32** are mounted at each extremity of sleeve **18** adjacent to the junction between conduit **10** and sleeve **18** and serve to contain the spheres in place. The cover screens include a grid-like cross configuration as shown in FIG. **7**. This allows the unimpeded flow of the materials to be mixed to pass into one end of sleeve **18** and out of the opposite end in an intermixed operation.

In operation, foam is pumped from generator **12** through resistance screen **16** and into conduit **10**. Simultaneously, particulate material is fed through hopper **14** and enters conduit **10** on the opposite side of resistance screen **16** from generator **12**. From their respective points of entry, up stream of the blending means **20**, the materials pass in an essentially unmixed state to sleeve **18**. Blending means **20** in the form of an apertured membrane arranged within sleeve **18**, in a convoluted configuration, is positioned directly in the flow path of the unmixed material. As the materials enter sleeve **18** the foam will have a tendency to pass through the apertures within the membrane. The particulate material on the other hand will have the tendency to follow the curving surface of the membrane until it is picked up by the foam material and passed through the membrane in an intermixed state. The materials exit the opposite end of sleeve **18** and pass into the remaining portion of conduit **10**. A discharge nozzle or the like may be arranged at the far extremity of conduit **10** for the dispersal of the mixed product at any desired location.

In the embodiment shown in FIG. **6** wherein the blending means comprises a plurality of spheres **30** the foam and particulate material pass through containment screen **32** to enter sleeve **18**. Interaction of the foam, particulate material and spheres produces an intimate mixture of the foam and particulate material.

FIG. **8** is directed to another embodiment of the present invention wherein the blending means comprises a convoluted screen **20** and a plurality of spherical particles **30** arranged in separate spaced sleeves **18** and **18'**. Inlets **25** and **27** are attached to conduit **10** immediately upstream of sleeves **18** and **18'**. These different inlets are arranged so that particulate material may be added to the foam and additional material being intermixed immediately prior to each of the blending means **20** and **30** in their respective sleeves. The adding of the particulate material at these inlets **25** and **27** thereby allows different size particulate material to be added to the flow of material within conduit **10** at the most efficient point for thorough intimate mixing. More specifically, blending means **20** and **30** arranged in their separate sleeve may be particularly adapted to handle particulate material of a predetermined size or consistency in order to form an intimate mixture having more than one particulate material combined therein.

In FIG. **9** the blending means comprises a convoluted membrane **20** and a plurality of spherical particles **30** both of which are arranged within sleeve **18**. Convoluted membrane **20** may be fixedly or rotatably mounted on a centrally arranged support court **22** as shown in FIG. **2**. The blending means comprising the combined membrane **20** nd spherical particles **30** arranged within the same sleeve **18** is primarily designed for applications wherein an extremely thorough mixing of materials is required. When utilizing the embodiment of FIG. **9** the remaining structural elements of the invention such as the inlet resistance screen and foam generator may be located as shown in FIG. **1**.

It will thus be seen that the objects and advantages set forth above among those made apparent from the preceding description, are efficiently attained and, since certain changes may be made in the above construction without departing from the scope of the invention, it is intended that all matter contained in the above description or shown in the accompanying drawings shall be interpreted as illustrative and not in a limiting sense.

It is also to be understood that the following claims are intended to cover all generic and specific features of the invention herein described and all statements of the scope of the invention which, as a matter of language, might be said to fall therebetween.

Now that the invention has been described, what is claimed is:

1. A blender system designed to intermix at least two materials, said system comprising: conduit means through which said materials are directed, blending means mounted in said conduit for intermixing said materials, sleeve means formed in said conduit means, said blending means arranged within said sleeve means by securing means so as not to impede flow of material through said conduit means; said blending means comprising a membrane arranged in convoluted configuration and a plurality of discrete particles arranged in said sleeve means in cooperative relation to said membrane, whereby said particles cooperate in operative relation to said membrane to intermix said materials.

2. A blender system as in claim **1** wherein said membrane is rotationally mounted within said sleeve means, whereby said materials are intermixed and conveyed through said sleeve by rotation of said membrane.

3. A blender system as in claim **1** wherein said discrete particles comprise marble-like spheres.

4. A blender system as in claim **1** wherein said securing means comprises a containment member mounted adjacent each extremity of said sleeve.

5. A blender system as in claim **4** wherein each containment member is sufficiently porous to allow passage of said materials therethrough.

6. A blender system as in claim **1** wherein said plurality of discrete particles comprise marble-like spheres

loosely contained within said sleeve, said spheres arranged relative to each other so as to have sufficient space therebetween to allow flow therethrough of material being intermixed.

7. A blender system as in claim 1 wherein said convoluted membrane comprises a screen mesh material arranged within said conduit in a convoluted configuration.

8. A blender system as in claim 1 wherein said conduit comprises separable parts; said blending means is detachably secured within said conduit, whereby said blending means is removable from said conduit upon separation of said conduit from said sleeve.

9. A blender system as in claim 1 wherein said sleeve comprises a diameter of different size than adjacent portions of said conduit which defines a flow path for said materials whereby flow of said material through said conduit is unimpeded by said blending means.

10. A blender system as in claim 1 further comprising a restricting member located between respective entrances of a first and a second material, said restricting member being sufficiently porous to allow passage therethrough of said first material.

11. A blender system as in claim 10 wherein said restricting member prohibits passage therethrough of at least said second material.

12. A blender system as in claim 1 wherein said sleeve means comprises at least one sleeve, both said membrane and said particles arranged in said one sleeve, such that said particles are disposed about said membrane.

13. A blender system as in claim 1 wherein said sleeve means comprises a first sleeve having said membrane mounted therein, said sleeve means further comprising a second sleeve arranged in spaced relation to said first sleeve and having said plurality of particles secured therein, both said first and second sleeves arranged in communication with said conduit means.

14. A blender system as in claim 1 wherein said membrane comprises a plurality of apertures formed therein.

15. A blender system as in claim 1 wherein said membrane comprises an apertured plastic material arranged within said conduit in a convoluted configuration.

16. A blender system as in claim 1 further comprising inlet means arranged on said conduit upstream of said sleeve means, whereby different material may be placed in said conduit through said inlet means.

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