United States Patent

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[54] **STRAINER OR FILTER FOR CLEANING FLUIDS**
9 Claims, 4 Drawing Figs.

[52] **U.S. Cl.** **210/439**
[51] **Int. Cl.** **B01d 27/00**
[50] **Field of Search** 210/350, 439–443

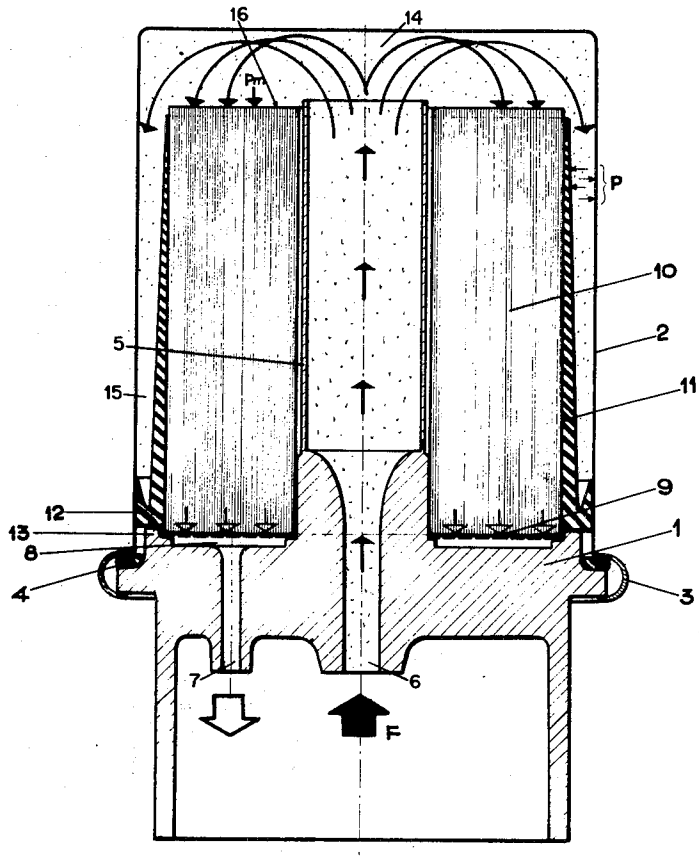
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Assistant Examiner—R. W. Burks
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ABSTRACT: A strainer of filter assemblage for cleaning fluids in which a body is provided with a fluid inlet, a fluid outlet, an inlet header and an outlet header. A paper roll is supported by the body between the inlet header and the outlet header and through which the fluid to be cleaned must flow axially from the inlet header towards the outlet header. An elastic deformable sheath adapted to surround and constrict the paper roll is provided within the inlet header and located a distance from the wall thereof is adapted to be forced by the pressure of the fluid within the inlet header against the outer surface of the paper roll.



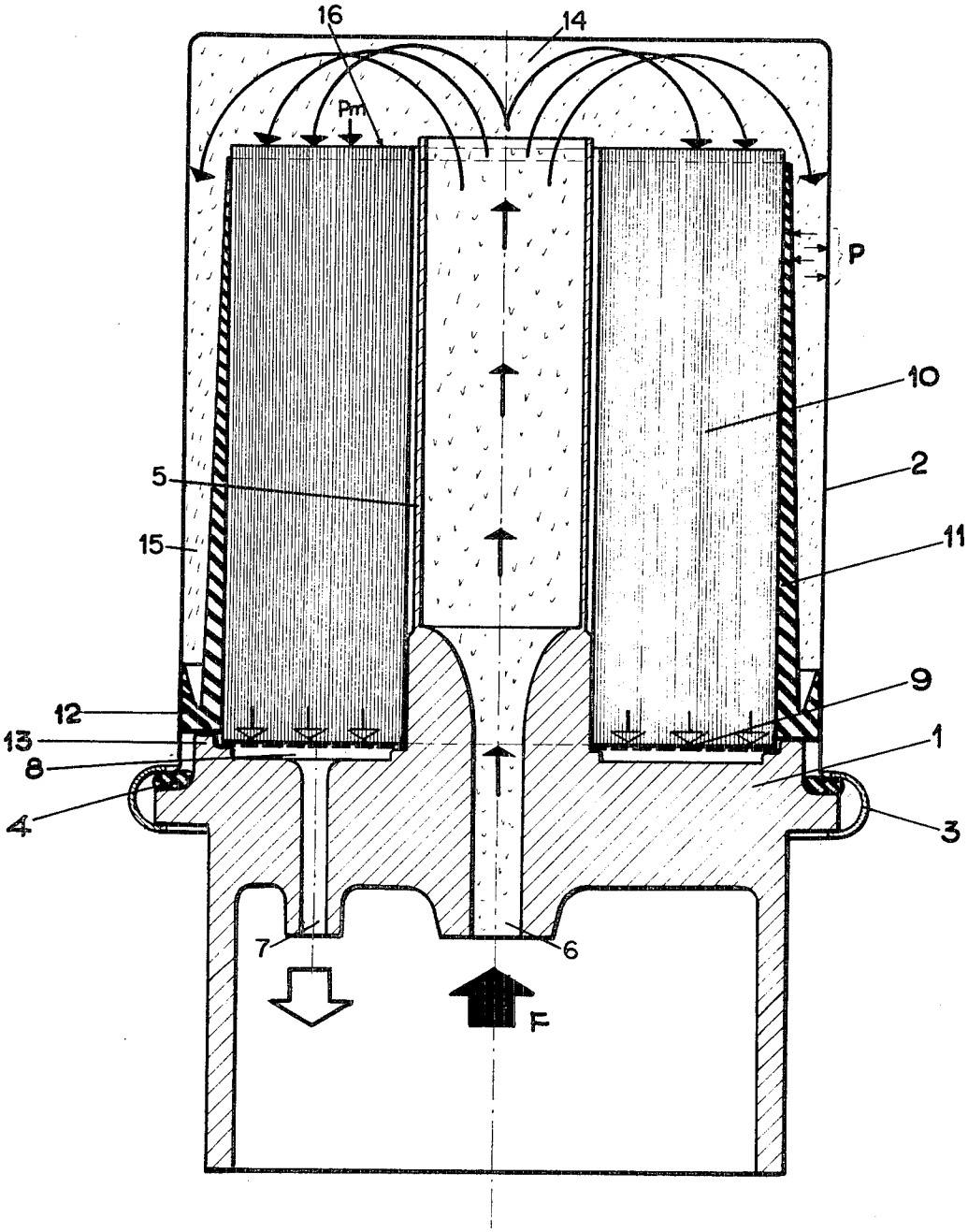


Fig. 1

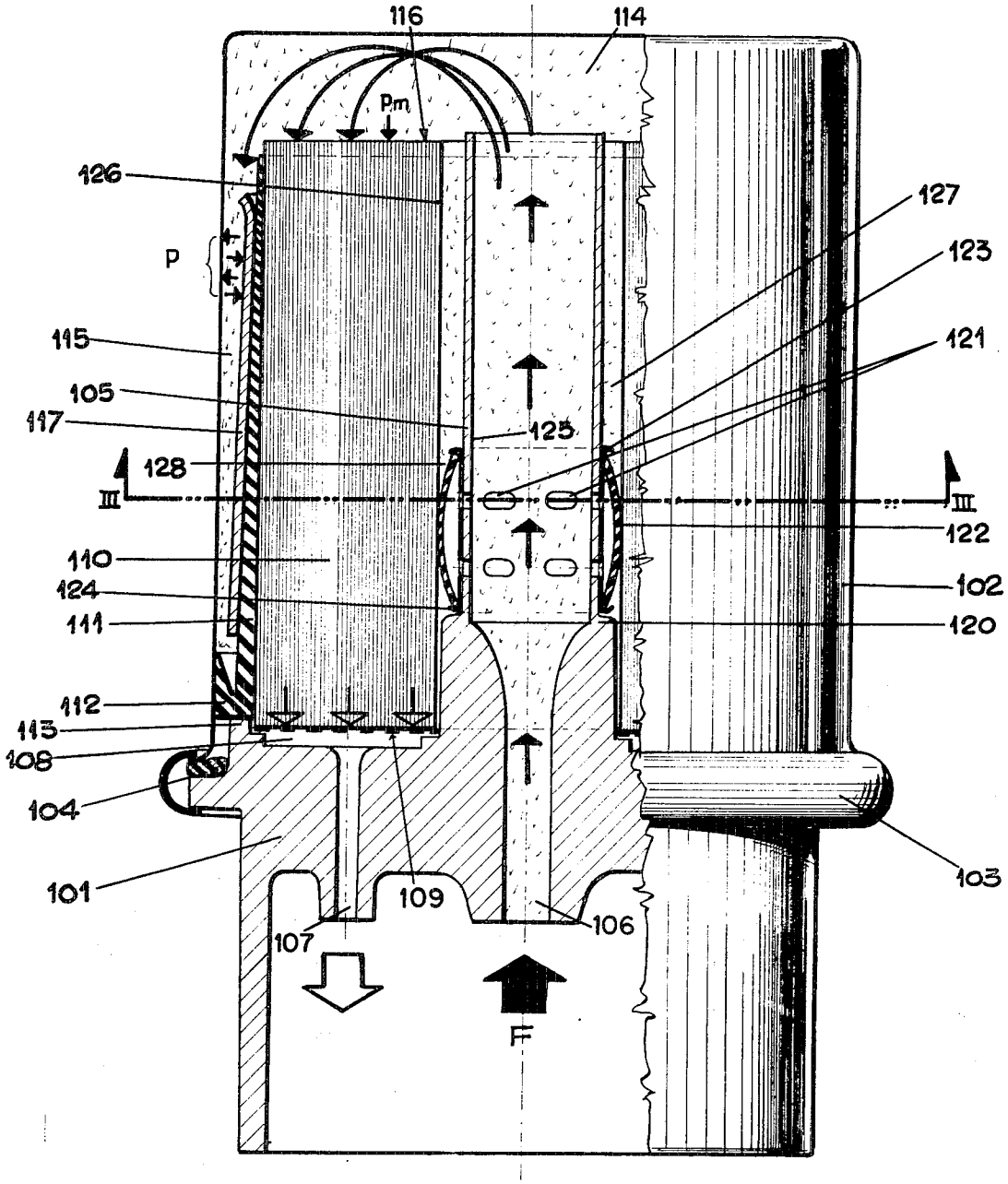

116
114
Pm
126
127
123
P
121
115
105
125
117
128
III
III
122
110
102
124
120
111
112
113
108
104
103
101
109
106
107
F

Fig. 2

Fig. 3

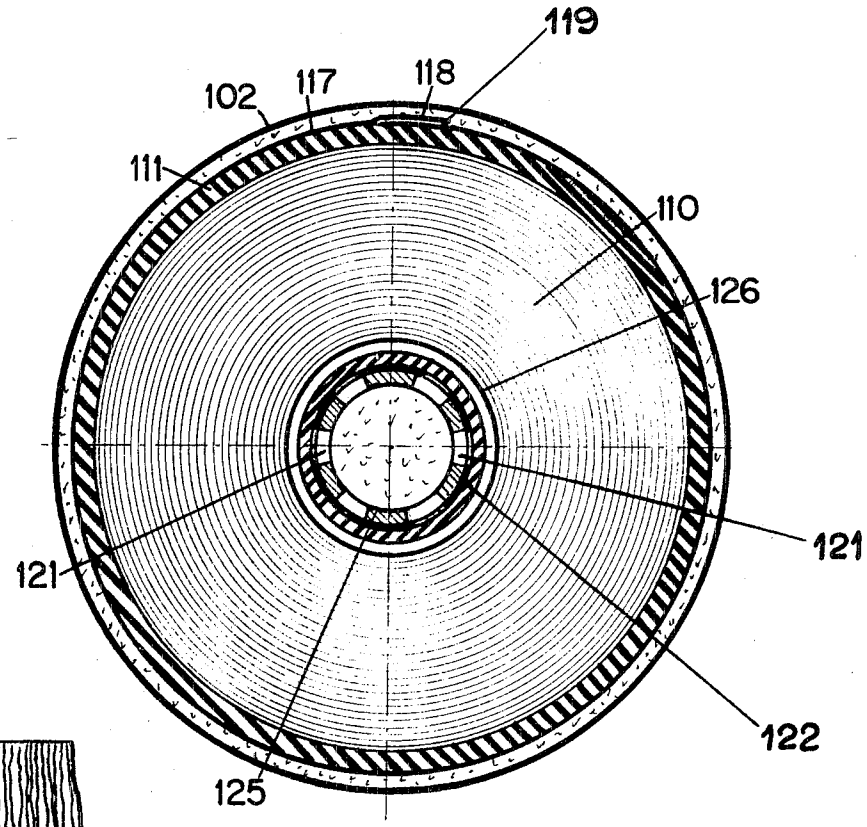
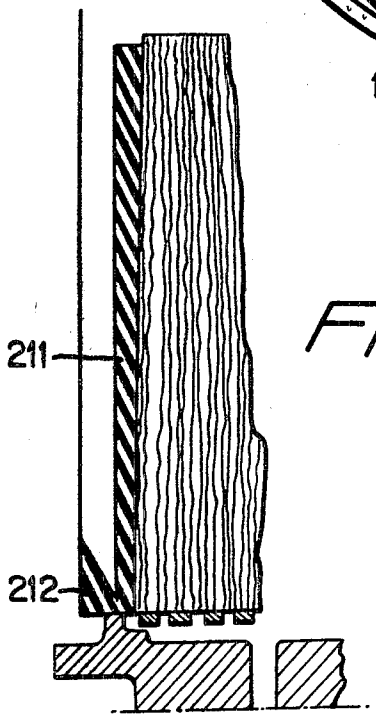


Fig. 4



STRAINER OR FILTER FOR CLEANING FLUIDS

BACKGROUND OF THE INVENTION

Generally, this invention relates to strainers or filters of the type commonly used for cleaning fluids either gases, liquids or viscous substances of solid or dense impurities carried in suspension by the fluids. More specifically, the invention relates to strainers or filters to be employed for cleaning fuels and lubricants for internal combustion engines although the invention is of broader application and can be employed with efficacy for the cleaning of beverages, drugs and other medicinal products and the purification of gases.

The invention is directed to strainers of the type which as a filtering element employ a paper roll, such as toilet paper, and through which the fluid to be cleaned is caused to flow in a direction parallel to its axis along the sinuous passages existing between the superposed layers of paper wherein the impurities in the fluid are trapped. However, such paper rolls cannot be easily obtained with a satisfactory degree of precision as regards the outer dimensions, or their inner texture so that leakages developed between the paper roll and the containing vessel of the strainer body which allows some of the impurities in the fluid to bypass the straining element and as a consequence reach the outlet which is undesirable. Moreover, it is not possible to employ partially damaged paper rolls or rolls of less than normal diameter, unwound rolls or rather loosely wound rolls for effecting a good cleaning of the fluid passing therethrough.

A further objection to strainers of this type when employed for cleaning lubricants in machines and more particularly internal combustion engines for motor vehicles in which speeds of revolution may vary greatly and the resulting acceleration may be very high, such high accelerations result in rapid increases of pressure within the strainer body so that a great pressure gradient arises along the paper roll and particularly in the area of its inlet end whereby the paper layers become strained and crushed thus damaging the filter element and impairing or destroying its usefulness.

An object of the present invention is to provide a strainer or filter for gases, liquids or viscous fluids in which the straining or filtering element is defined by a paper roll for effecting a proper cleaning of the fluid even with paper rolls of poor quality in proper dimensions, etc., since the strainer is capable of withstanding sudden increases of flow and pressure at the inlet end of the straining element without any ill effects or impairment of the straining action of the assemblage.

SUMMARY OF THE INVENTION

Broadly, the above and other important objects are realized by providing an elastic and preferably supple sheath adapted to surround the paper roll suchwise as to adapt itself to the outer diameter thereof, compress the roll to a degree proportional to the pressure gradient therealong and to respond quickly to any rapid elevation of pressure in the fluid to be cleaned and effect an excellent seal between the inlet and outlet headers independently of the size of the paper roll, its condition and the a pressure difference between the headers.

Moreover, an inflatable membrane may be provided for effecting a seal between the fluid inlet and the internal surface of the paper roll for completely preventing any contaminated fluid from reaching the fluid outlet without such fluid having passed through the paper roll.

The elastic sheath as well as the membrane are immersed in the high-pressure fluid either of the inlet header, or the inlet duct so that the outer faces thereof are at all times subjected to the pressure of the incoming fluid which is true even in situations of rapid pressure changes by virtue of the wide passages provided for the incoming fluid to the most remote areas of the sheath and membrane, with the inner faces of such components being in contact with various points of the paper roll and as a consequence subjected to the actual pressures existing at such points.

More specifically, the strainer or filter comprises a body having inlet and outlet ducts and headers for the contaminated and cleaned fluid respectively, with such body being adapted to be equipped with a paper roll through the layers of which the fluid to be cleaned must flow in a direction parallel to the axis of the paper roll from the inlet header towards the outlet header and an elastic deformable sheath is adapted to surround and constrict the paper roll located within the inlet header and at a certain distance from the walls thereof for permitting a free flow of the incoming fluid under pressure, with the sheath being adapted to be urged by pressure of the fluid against the outer surface of the paper roll.

The sheath may be provided with an end having an upturned portion for bearing against the wall of the inlet header and for providing a seal between the inlet and outlet headers. The sheath may be a tube of an elastomeric substance such as an artificial rubber or an elastic plastic or it may be a contractable hollow rounded body of an elastic stiff material which is overlapped approximately along at least one generating line of the hollow body with the overlapped ends being movable against and with respect to one another. The sheath may be a composite component including a deformable elastomeric tube doubled up with a contractable hollow body of an elastic yet stiff material either metallic or nonmetallic such as plastic.

Moreover, an elastic, supple, deformable membrane may be provided about a section of at least part of the fluid inlet lying within the axial bore of the paper roll and provided with openings with such membrane being adapted to be deflected outwardly by the pressure fluid within the fluid inlet against the inner surface of the axial bore of the paper roll.

The sheath may be of lesser width or of greater thickness at its end opposite the end provided with the upturned portion for such end may be defined by a stronger, more rigid material such as one having a greater modulus of elasticity.

In other words, the sheath may be of lesser or greater diameter at such end.

BRIEF DESCRIPTION OF THE DRAWINGS

Further objects and advantages of the invention will become more readily apparent to persons skilled in the art from the following detailed specification and annexed drawings and in which drawings:

FIG. 1 is a view in longitudinal cross section of a strainer or filter embodying the present invention and finding particular use in connection with internal combustion engines for motor vehicles.

FIG. 2 is a view partly in side elevation and partly in longitudinal cross section of a further embodiment of the invention for use with internal combustion engines for motor vehicles.

FIG. 3 is a view taken along the line III—III of FIG. 2, the view looking in the direction of the arrows.

FIG. 4 is a fragmentary view in section of a modified form of sheath.

DETAILED DESCRIPTION OF THE INVENTION

Referring to FIG. 1, it will be noted that the strainer or filter includes a body 1 and a hood or cover 2 hermetically connected or joined to the body by fixing means 3 and an annular gasket 4. The body 1 is further provided with a centrally located axially extending tube 5 which serves as an inlet conduit for fluid F to be cleaned as well as a support for a straining element to be later described. A central inlet duct 6 communicates with the interior of the tube a5 and a laterally located outlet for the clean fluid 7 communicates at its upper end with an annular outlet header 8 provided in the body 1. A perforated support or grid 9 located above the upper surface of the body serves as a support for the lower end of a straining or filtering element 10 and provides the upper limit of the outlet header 8. The filtering or straining element 10 is a paper roll and preferably a roll of toilet paper.

It will be noted that a substantially cylindrical or conical sheath **11** of an elastic and supple material which resists the attack of fuels and lubricants such as synthetic rubber or some other elastomer is adapted to embrace or surround the paper roll **10** and after being thus embraced, the roll and sheath can be positioned about the tube **5** with the lower end of the roll resting on the support **9**. The lower end of the sheath **11** is formed with an annular upturned portion or a lap **12** and whose base rests against a peripheral ledge **13** on the body **1** surrounding the outlet header **8**. This particular arrangement serves as a seal for the upturned portion **12** and such portion bears against the lower part of the inner surface of the hood or cover **2** for effecting a tight seal between the sheath **11** and the hood or cover **2**.

It will be further noted that between upper end or face **16** of the paper roll **10** and the inner face of the closed end of the hood or closure **2** there is provided a space **14** which constitutes an inlet header into which the fluid is introduced via the tube **5**. The space **14** communicates with a further space **15** of substantial width located between the outer surface of the sheath **11** and the sidewall of the hood or closure **2** and such space **15** enables any sudden elevation of pressure developing within the space **14** to immediately travel to the lowermost portion of the space **15** for thus supplying instantaneously the new uniform pressure to the entire outer surface of the sheath **11** and via the sheath **11** to the paper roll **10**. As a consequence, a sudden increase of pressure in the supply fluid to the strainer has no ill effects on the condition of the paper roll **10** since the increased pressure applied to the upper face **16** of the roll is immediately applied to the lateral surface of the roll thereby avoiding any "fanning-out," crushing and destruction of the paper layers of the roll **10**.

As a matter of fact, the fluid under pressure within the space **14** constituting the inlet header and in the space **15** exerts a pressure "P*m*" upon the surface **16** of the roll and against the closed end of the hood **2** and at the same time exerts a substantially equal pressure "P" against the lateral wall of the roll **10** and the sidewall of the hood or closure **2** with this latter pressure constraining and compacting the roll **10** so that it cannot be destroyed by the pressure "P*m*" as would be the case if the pressure "P*m*" functions in the absence of the pressure "P" as is true in the known devices of this type.

At the same time, this lateral pressure commensurate to the inlet pressure of the fluid to be cleaned ensures that the filtering or straining action of the paper roll remains undiminished by any "opening up" of the paper layers due to a rise in pressure applied to the upper or end surface **16** of the roll. Any impurities which precipitate or collect upon the upturned portion or lap **12** may be readily removed when the strainer or filter is dismantled and cleaned. Hence, this particular arrangement presents no serious drawback to the strainer since such dismantling and cleaning must be performed periodically when changing the paper roll.

Referring to the embodiment illustrated in FIGS. **2** and **3**, this embodiment is generally similar to the components illustrated in FIG. **1**. More specifically, this strainer or filter includes a body **101**, a hood or cover **102**, means **103** and gasket **104** for providing a hermetic seal between the hood **102** and the body **101** and a centrally located axially extending tube **105**. A central fluid inlet **106** communicates with the tube **105** and a lateral fluid outlet **107** with an annular outlet header **108**. A perforated support or grid **109** defines the upper limit of the header **108** and serves for supporting a paper roll **110** constituting a filtering element. A sheath **111** having an upstanding portion or lap **112** at its lower end embraces the roll **110** and rests upon a peripheral ledge **113** surrounding the outlet header **108**. A space **114** located between upper end or surface **116** of the paper roll **110** and the inner surface of the closed end of the support or closure **102** constitutes an inlet header **114** which communicates with an annular space **115** provided between the sheath **111** and the inner surface of the sidewall of the hood **102**.

As was the case of the sheath **11**, the sheath **111** is of synthetic rubber or the like and is in turn surrounded by a rigid yet contractable sheath **117** of steel, elastic PVC or other flexible and elastic material. As shown in FIG. **3** the sheath **117** is open along a generating line and provided with two overlapping strips **118** and **119** which allow variations in diameter of the entire sheath **117** without any gap forming in the perimeter thereof.

It will further be seen that the tube **105** is provided with a reduced section **125** joined thereto via shoulder **120** and the section **125** is formed with a series of ports of openings **121**. An elastic supple membrane **122** surrounds that portion of the section **125** of the tube **105** provided with the ports **121** and the membrane is rigidly affixed to the section **125** by collars or other securing means **123** and **124**.

In the absence of any pressure as well as a very low pressure difference, the membrane **122** adheres to the outer wall of the section **125** but as soon as the interior of the tube **105** is subjected to pressure, the membrane **122** is displaced or bulged outwardly and engages inner wall **126** of the paper roll **110**. More specifically, it engages the inner wall of the paper core for the roll thereby effecting an efficient seal and preventing any fluid from flowing along hiatus **127** located between the tube **105** and the inner wall **126** of the paper roll. At the same time, the sheaths **111** and **117** prevent the fluid from flowing along the outer surface of the paper roll **110** towards the outlet header **108** and the fluid outlet **107**. Hence, the incoming contaminated fluid F is constrained to pass through the interior contours of the paper roll **110** and as a consequence be thoroughly cleansed prior to its exit through the fluid outlet **107**.

The operation of the apparatus is briefly as follows:

The contaminated or polluted fluid flows, under the action of a feed or circulation pump through the tube **105** into the inlet header **114** and therefrom into the paper roll **110** which it crosses in a direction substantially parallel to the axis thereof passing between the sheets between which the impurities are trapped until the fluid collects in the outlet header **108** for flow through the fluid outlet **107** into its fluid circuit.

In time, the fluid under pressure reaches the annular space **115** from the inlet header **114** wherein it exerts a balance pressure "P" both against the sidewall of the hood or closure **102** and the metallic sheath **117**. The metallic sheath **117** in turn distributes this pressure upon the supple sheath **111** and thereby prevents any substantial deformation of the paper roll **110**. In view of the fact that the pressure "P" exerted against the outer surface of the paper roll **110** is substantially equal at any moment to the pressure "P*m*" exerted by the fluid in the inlet header **114** against the upper face or end **116** of the paper roll **110**, any possible deleterious action of the pressure "P*m*"is countered and prevented and this is even more so towards the lower portion of the strainer where the inner pressure within the paper roll **110** diminishes progressively due to the resistance opposed by the strainer per se to the progress of the processed fluid. To compensate for this difference and to obtain a more uniform pressure differential along the full height of the paper roll **110**, the sheaths **111** and **117** may be of shapes, thicknesses, or materials adapted to exert an elastic force increasing with increasing height on the paper roll. This end may be realized, for example, by providing a sheath in the form of a frustum of a cone, or with a thickness increasing towards the upper zones, or with a material whose stiffness that is to say its modulus of elasticity, increases with the height of the roll of paper. As a consequence, a satisfactory degree of compression may be maintained on the roll in any condition. In FIG. **4**, it will be seen that sheath **211** is of greater diameter at its upper end than at the lower end provided with a lap **212**.

While the incoming fluid under pressure promptly reaches the bottom of the annular space **115** by virtue of the wide dimensions thereof, the fluid only gradually enters the narrow hiatus **127** between the upper part of the tube **105** and the inner wall **126** of the paper roll **110** and its entry into chamber **128** is more or less delayed. In the meanwhile, the greater

pressure which establishes itself, in case of a sudden rise within the tube section **125** forces the fluid through the ports **121** thereby inflating or deflecting the membrane **122** outwardly against the lesser pressure which exists in the chamber **128** and as a result the membrane is forced against the inner wall **126** of the roll **110**. Hence, there is provided an excellent seal against the penetration of contaminated fluid through the hiatus **127** towards the outlet header **108** bypassing the strainer element or paper roll **110**.

While two specific embodiments of the invention have been particularly described and illustrated, it is to be understood that such embodiments are only illustrative and that numerous other embodiments are possible within the scope of the invention and that details for executing the invention may be varied over wide limits and that numerous variations, substitutions, omissions, additions, and changes may be made by those skilled in the art without the departing of the spirit of the invention as recited in the appended claims.

I claim:

1. A strainer assemblage for cleaning fluids including a body having a fluid inlet, a fluid outlet, an inlet header, an outlet header, a paper roll supported by the body between the inlet header and outlet header and through which the fluid to be cleaned must flow axially from the inlet header towards the outlet header, and an elastic deformable sheath surrounding and constricting the paper roll provided within the inlet header and located a distance from the walls thereof adapted to be forced by the pressure of the fluid within the inlet header against the outer surface of the paper roll.

2. The strainer assemblage as claimed in claim **1** in which said sheath is provided with an upturned portion at one end thereof adapted to bear against the wall of the inlet header and effect a seal between the inlet header and the outlet header.

3. The strainer assemblage as claimed in claim **2** in which sheath is of less diameter at its end opposite the end provided with said upturned portion.

4. The strainer assemblage as claimed in claim **2** in which said sheath is of greater diameter at its end opposite the end provided with said upturned portion.

5. The strainer assemblage as claimed in claim **2** in which said sheath at its end opposite said upturned portion is of stronger more rigid material.

6. The strainer assemblage as claimed in claim **1** in which said elastic deformable sheath is defined by a tube of an elastomeric material.

7. The strainer assemblage as claimed in claim **1** in which said elastic deformable sheath is defined by a hollow rounded body of an elastic stiff material overlapped approximately along at least one generating line of said body whereby the overlapped ends thereof are movable against and with respect to one another.

8. The strainer assemblage as claimed in claim **1** in which said sheath is defined by a deformable elastomeric tube doubled up with a contractable hollow body of an elastic stiff material.

9. The strainer assemblage as claimed in claim **1** in which at least a portion of said fluid inlet is provided with ports and an elastic deformable membrane surrounds the fluid inlet in the zone of said ports, with said membrane being adapted to be deflected outwardly by the pressure of the fluid within the fluid inlet against the inner surface of the paper roll.

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