

April 11, 1961

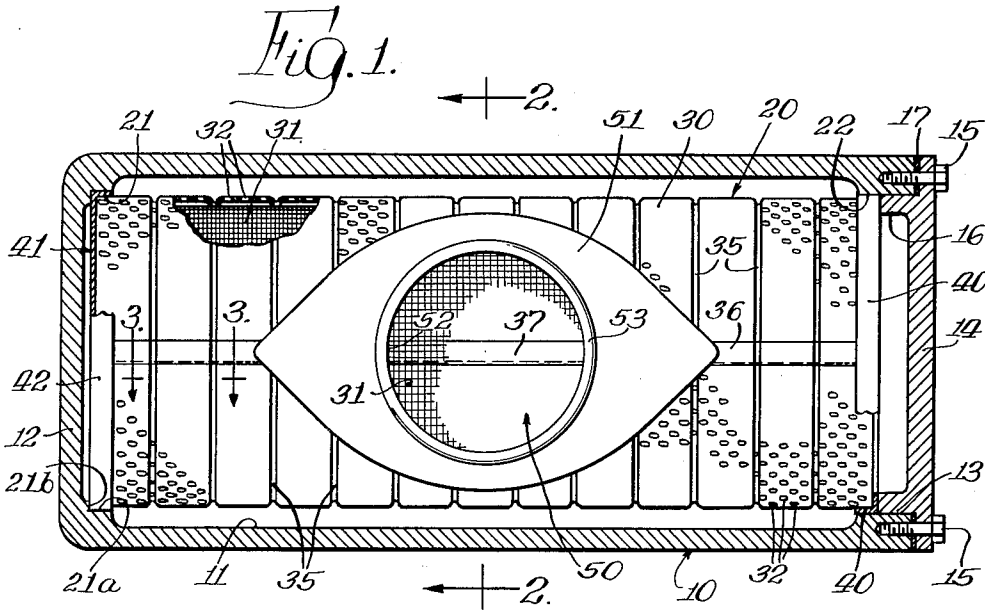
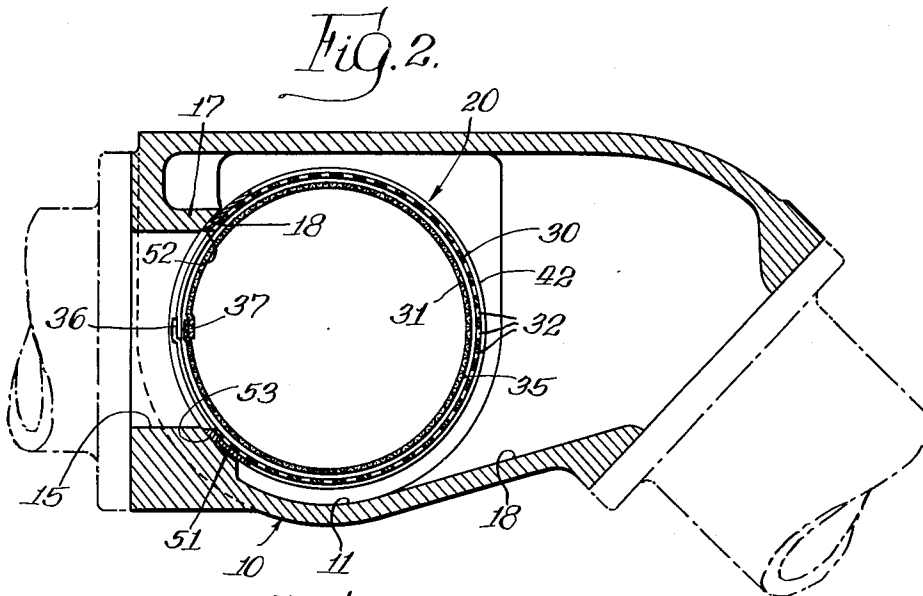
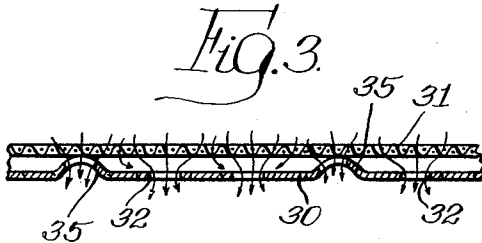
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2,979,209

STRAINERS

Filed Oct. 2, 1957

3 Sheets-Sheet 1



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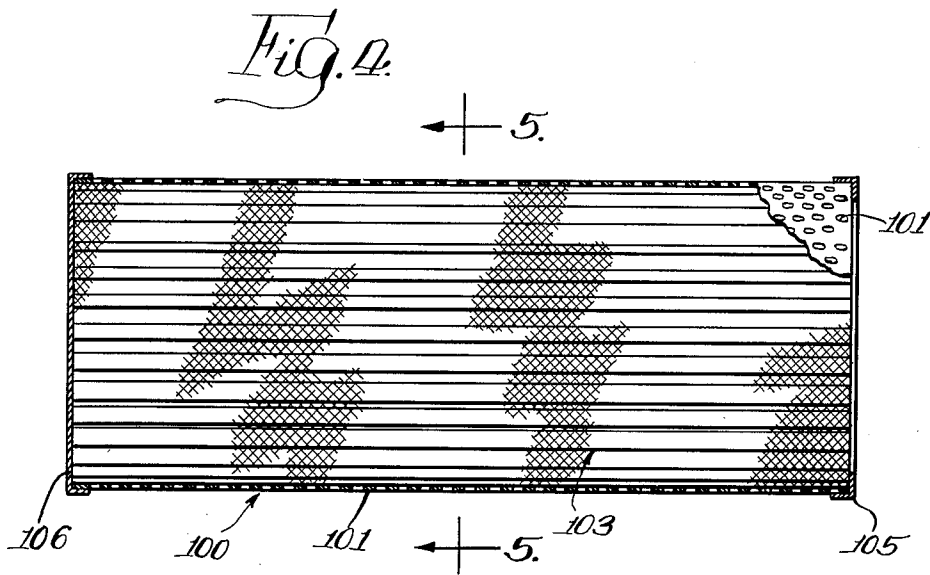
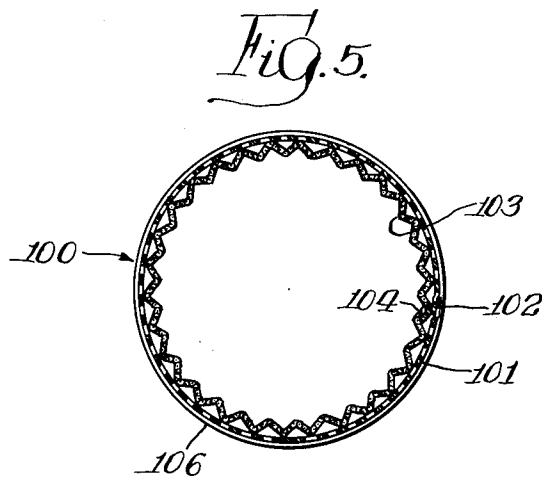
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STRAINERS

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3 Sheets-Sheet 2



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3 Sheets-Sheet 3

Fig. 6.

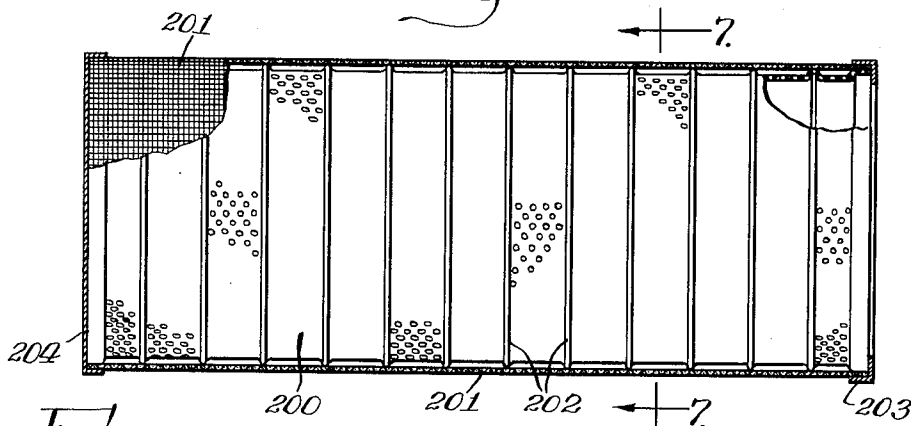


Fig. 7.

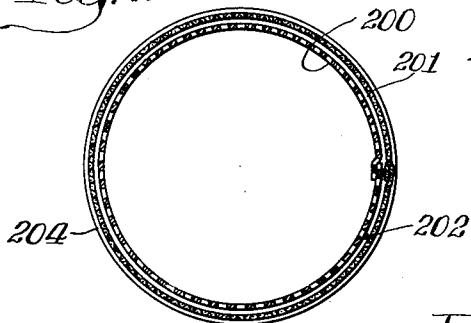


Fig. 9.

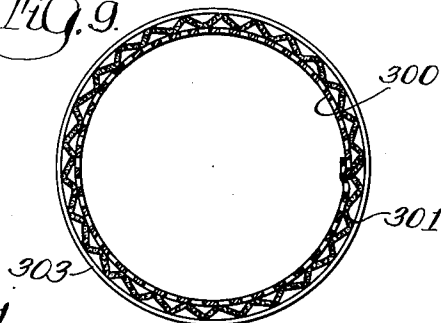
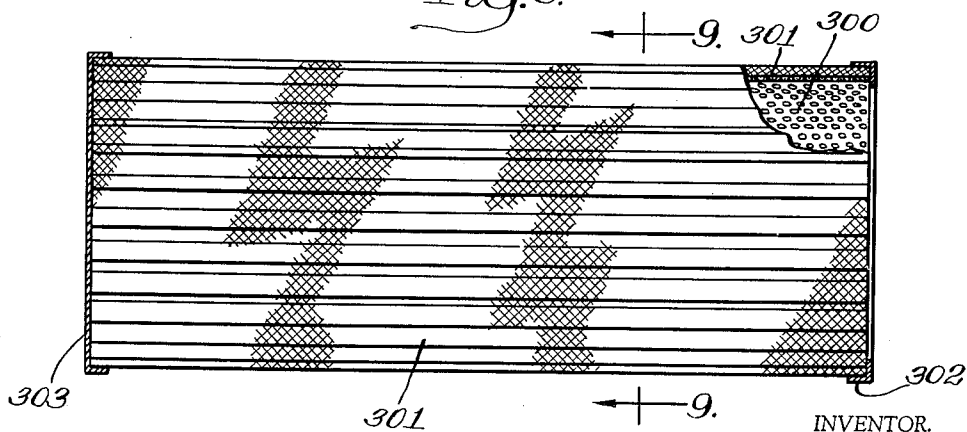


Fig. 8.



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1

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STRAINERS

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5 Claims. (Cl. 210-435)

This invention relates to strainers for removing solids such as dirt, scale and the like from fluids, and has to do more particularly with a novel basket for use in such strainers. The invention also relates to a novel straining or screening element useful in strainers and in other analogous applications.

Strainers of the type to which the present invention relates commonly include a casing through which the fluid passes and a "basket" which is removably disposed in the casing and is adapted to strain out from the fluid passing through the casing solids such as dirt, scale and the like. Such baskets have been previously made in various ways but none of them have proved entirely satisfactory. In one form of basket commonly used heretofore there has been provided an inner or mesh basket formed from woven wire cloth and an outer basket or shroud to reinforce and stiffen the inner mesh basket and to prevent damage thereto during removal and replacement of the strainer basket. The shroud is formed from cast metal and generally has relatively large openings therein; the shroud is in engagement with the mesh basket over a substantial area and occludes the openings in the mesh basket over the entire area of such mutual engagement. This type of basket is subject to the disadvantage that the shroud is relatively heavy and expensive to manufacture, occludes the openings of the mesh basket where the shroud engages the mesh basket. Furthermore the shroud does not always prevent the mesh basket from blowing out through the large openings in the shroud under high fluid pressures.

An object of the invention is to provide an improved strainer wherein the above and other disadvantages of prior strainers are not present.

Another object is to provide a strainer basket of the type employing a woven wire screen as the primary straining element and a rigid protective shroud associated with the screen, wherein the shroud protects and reinforces the screen to a maximum extent and at the same time occludes the openings in the screen to a minimum extent.

Another object is to provide a strainer basket of highly efficient construction which can be formed easily and inexpensively.

Still another object is to provide a strainer basket which is highly efficient in its straining action, is strong and rugged and is relatively light in weight.

A further object is to provide a strainer basket which may be made of relatively small and compact size and which at the same time has a relatively large area of screen effective for screening solids from a fluid passing through the basket.

A further object is to provide a straining element capable of removing relatively small sized particles from a fluid flowing through the element, which element is so constructed that it is strong and rugged and highly resistant to damage in ordinary usage and which offers a relatively low resistance to the flow of fluid there-through.

2

Still another object is to provide a straining element including a relatively fine screen element and a relatively rigid shroud element, the screen and shroud being disposed mutually in overlying relation and firmly connected to prevent relative displacement wherein the arrangement is such that the screen and shroud are spaced from each other except at minor areas of abutment distributed over the mutually overlying areas whereby there is a minimum of occlusion of the openings in the screen.

Other objects and advantages of the invention will appear from the following description taken in connection with the appended drawings wherein:

Figure 1 is a longitudinal sectional view through a strainer including a strainer basket constructed in accordance with my invention;

Fig. 2 is a transverse sectional view taken along line 2-2 of Fig. 1;

Fig. 3 is an enlarged, fragmentary, cross-sectional view taken along line 3-3 of Fig. 1;

Fig. 4 is a longitudinal sectional view through a strainer basket constructed in accordance with a second embodiment of my invention;

Fig. 5 is a transverse sectional view taken along line 5-5 of Fig. 4;

Fig. 6 is a longitudinal sectional view through a strainer basket constructed in accordance with a third embodiment of my invention;

Fig. 7 is a transverse sectional view taken along line 7-7 of Fig. 6;

Fig. 8 is a longitudinal sectional view taken through a fourth form of strainer basket constructed in accordance with my invention; and

Fig. 9 is a transverse sectional view taken along line 9-9 of Fig. 8.

The strainer basket of my invention is capable of use in strainers of various forms and the straining element is suitable in various applications, and for the purpose of illustrating the invention it is shown in connection with one particular form of strainer, but it is to be understood that the invention is not limited to a strainer basket of the exact form shown, or a basket for use in a strainer of the particular form illustrated and the straining element is not limited to use in a basket.

The strainer illustrated includes a casing 10 preferably of generally cylindrical form and defining a strainer chamber 11 of generally cylindrical form. One end of the casing, (designated the "inner" end) is permanently closed by an end wall 12. The other end (designated the "outer" end) is formed with an opening 13 which is normally closed by a cover 14. The cover 14 is secured to the end of the casing 10 by screws 15 and has a flange 16 which fits in the opening 13 and is adapted to abut the outer end of a strainer basket 20 as hereinafter described. The closure between the casing 10 and the cover 14 is sealed as by a suitable gasket 17.

Leading into the front of the casing, preferably at the mid-point thereof, is an inlet 15 having a flat outer face for attachment to an inlet pipe (indicated in broken lines in Fig. 2). Projecting inwardly into the chamber 11 in surrounding relation to the inlet 15 is a boss-like portion 17 of generally circular form and having a cylindrically arcuate inner face 18 adapted to provide a seat for the strainer basket 20.

Leading from the strainer chamber 11 is an outlet 18 adapted for connection to an outlet pipe (shown in broken lines in Fig. 3). The casing 10 is formed with two seats 21 and 22 adapted to receive the strainer basket 20 and to retain it in position in the casing. The seat 21 is provided with a cylindrical portion 21a and an annular portion 21b. The seat 22 is formed with a cylindrical portion only which is in alignment with the cylindrical portion 21a of the seat 21.

3

The strainer basket 20 of the present illustrative embodiment is of cylindrical form and includes a rigid shroud 30 and a screen 31 which latter, in the illustrative embodiment shown in Figs. 1 and 2, is disposed within the shroud 30. The shroud 30 preferably is formed from sheet metal of sufficient strength and thickness to provide a rigid structure, which material is provided with perforations 32, preferably uniformly distributed throughout the entire area of the material. The sheet material from which the shroud is formed is of a sufficient thickness to provide the desired rigidity but preferably is sufficiently flexible to permit the material to be rolled up into a cylinder, as hereinafter more fully described.

The perforations 32 in the sheet material from which the shroud is formed may have any suitable size, but preferably they range in size from 0.020 inch to 0.312 inch. In one practical embodiment of the invention, the perforations were $\frac{1}{8}$ inch in diameter and were disposed on $\frac{3}{16}$ inch centers, in staggered relationship (as illustrated for example in Fig. 1). It will be understood that the perforations in the material from which the shroud is formed may be arranged either in staggered relationship as shown, or in aligned columns and rows; preferably, however, the perforations are formed in staggered relationship.

It should be noted at this point that the spacing between adjacent perforations in the shroud material must be sufficient to provide the necessary amount of material to insure that the shroud has sufficient rigidity to accomplish the function of the shroud in supporting the screen. On the other hand, as will appear more fully hereinafter, it is desirable that the perforations be of such size and the total area of the perforations relative to the total area of the material between the perforations be such as to offer a relatively low resistance to the flow of fluid through the shroud material. While the percentage relationship between the area of the shroud which is made up by the solid sheet material between the perforations and the area of the shroud which is represented by the perforations ordinarily is approximately fifty percent, nevertheless this percentage relationship may be varied throughout substantial limits, so long as the other desired characteristics of the shroud material hereinafter described are provided. It will be understood also, that the individual perforations should not be of such large size as to permit the screen to be blown through the perforations under fluid pressure.

The shroud is formed of any suitable sheet material, preferably a metal, having sufficient rigidity to maintain the shape of the strainer basket and to resist the fluid pressures to which the basket may be subjected, which pressures may in certain instances be very substantial. Moreover it is a material which can be perforated by known processes and which can be formed to the desired shape and provided with the beads or other projections hereinabove described. For many uses it has been found that stainless steel is highly desirable, but for uses where the pressure is not great, copper or other materials may be employed.

The perforated sheet material is provided with a series of spaced parallel beads 35 which are so arranged that when the material is formed into a cylinder the beads project inwardly. The beads preferably extend circumferentially around the cylinder, but other arrangements may be provided.

The shroud is formed by rolling the sheet material into a cylinder and suitably securing the ends of the sheet together as by welding or soldering, as indicated at 36, or by lap folding (not shown).

The screen 31 preferably is formed of woven wire screen material such as is commonly employed in forming screens for straining, filtering, screening and the

4

like. The screen may be formed of any suitable material and preferably of one which is not adversely affected by the materials with which the filter is adapted to be employed. For example, the screen may be formed from copper, stainless steel, or other suitable metal, or in certain instances suitable plastics.

The mesh of the screen is selected to provide the necessary fineness in order to screen out particles of the smallest size which it is desired to remove from the fluid flowing through the strainer. In one practical embodiment of a strainer basket constructed in accordance with my invention an 80 mesh screen was employed in which the openings constituted approximately 30 percent of the total screen area. However, it will be understood that the selection of the mesh of the screen may vary throughout a substantial range. In this connection it will of course be understood that the mesh of the screen which is selected will ordinarily be no finer than that necessary to accomplish the desired straining action. Obviously, if the mesh of the screen is finer than that necessary there will be an unnecessary resistance to flow through the strainer.

The screen material is rolled into cylindrical form and the ends secured as by welding or soldering as indicated at 37, or lap folded (not shown). The screen 31 is then inserted in the shroud and these two members are sealingly secured together at their ends, as by welding or soldering (not shown), or they may be secured by crimping (not shown).

The beads or ridges 35 in the shroud are of sufficient height to space the screen away from the shroud so that the imperforate areas of the shroud do not occlude the openings in the screen, and thus all of the openings in the screen are effective for passing liquid except those openings in the screen which abut the imperforate areas of the bead portions of the shroud. Moreover, the beads are of such height as to space the shroud away from the screen a sufficient distance so that liquid may flow not only in a direct line through the perforations in the shroud, and through the directly opposite openings in the screen, but also may flow in a line from each of the perforations in the shroud to areas of the screen which are opposite imperforate areas in the shroud so that in spite of the fact that there are imperforate areas in the shroud, the flow of liquid through the perforations in the shroud and the openings in the screen is not unduly impeded. Thus, not only does the present invention provide for a maximum utilization of the entire screen area for straining or screening, but also the arrangement is such that there is a minimum resistance to flow of liquid through the shroud and screen.

In the practical embodiment hereinabove mentioned in which the holes in the shroud were $\frac{1}{8}$ inch in diameter and located on $\frac{3}{16}$ inch centers, the beads were of such height as to space the screen $\frac{1}{16}$ of an inch from the interior wall surface of the shroud.

The assembled shroud and screen where they are to form a strainer basket preferably are provided at the ends of the assembly with stiffening and reinforcing means which also serves to define seating surfaces adapted to cooperate with seats in the strainer casing. To this end I secure to the ends of the assembly suitable end members. In the particular embodiment illustrated the end members include an outer end ring 40 of flanged form and an inner end plate 41 having a flange 42. The end ring 40 and the end plate 42 are secured to the respective ends of the shroud and screen assembly as by welding, or soldering (not shown), or these members may be crimped to the assembly in a suitable manner (not shown) to provide a leak-tight seal therebetween.

The end ring 40 and the end plate 41 are so formed that they fit in sealing engagement with the seats 22 and 21 when the basket is in place in the casing, and thus no solid particles can pass between the casing and the basket at the seats.

Where the strainer basket is to be used with a strainer having a side opening such as the opening 15 of the casing 10 shown in Figs. 1 and 2, the basket is provided with an opening 50 adapted to register with the side opening 15 when the basket is in place in the casing. In order to seal the opening 50 so that no solids can pass through the casing without being caught by the strainer basket, a seat of cylindrically arcuate form is provided on the basket which is complementary in shape to the seat 18 in the casing. To this end a seating plate 51 is secured to the exterior of the shroud 30 at an appropriate portion of the latter and is provided with an opening 52 which registers with a corresponding opening in the shroud and screen. The plate 51 is suitably secured to the shroud, as by welding or soldering.

The seat plate is provided with a seat portion which is preferably machined so as to fit in a sealing manner against the seat 18 and preferably this is accomplished by providing a raised boss 53 around the opening in the seat plate. The remainder of the seat plate therefore is lower than the surface of the boss and does not contact the casing or interfere in any way with the entry of the strainer basket into the casing.

The strainer basket 20 is readily insertable in the casing by passing it through the opening 13 and seating it against the seats 21 and 22 and against the seat 18. After the basket 20 is seated in the casing the cover 14 is applied and tightened against the sealing gasket 17 whereupon the flange 16 bears against the outer end ring 40 of the strainer basket to secure and hold the strainer basket in its proper position within the casing. If desired, suitable means (not shown) may be provided for restraining the strainer basket against rotation within the casing.

The strainer is suitably connected to a line through which the liquid to be strained is adapted to flow, whereupon liquid enters the casing through the inlet opening 15 and passes through the opening 50 into the strainer. From thence the liquid passes outwardly through the walls of the strainer basket and through the discharge outlet from the strainer casing to the connected line or other member in the line into which the strainer is adapted to discharge. In passing through the walls of the strainer basket, the liquid first passes through openings in the screen and thence through the perforations 32 in the shroud. In view of the fact that the screen and shroud are neutrally spaced, except that those points of contact along the beads of the shrouds, the liquid is free to pass from the strainer, not only in a direct line through the screen and perforations 32, but also may pass relatively freely from those portions of the screen which are opposite the imperforate portions of the shroud to the perforations in the shroud in a more or less streamline flow, so that there is a maximum flow of liquid through the walls of the strainer basket and a minimum pressure drop through such walls. Such flow of liquid through the wall of the strainer basket is indicated somewhat diagrammatically by the arrows in Fig. 3 of the drawings.

I have found that while a certain area of straining or screening material is desired, the space limitations of the casing in which the strainer basket is to be inserted are such that a basket of conventional cylindrical form and construction will not provide the desired screening or straining area. In order to provide a desirably large straining or screening area, in a strainer of relatively small diameter, I employ a novel form of straining element such as shown in Figs. 4 and 5, to which reference now is made.

The strainer basket 100 includes a shroud 101 which is formed from perforate sheet material of sufficient rigidity and which is generally similar to the perforate sheet material from which the previously described strainer basket 20 is formed, except that the shroud 101 is not provided with the beads or ribs such as those of the basket shown in Figs. 1 to 3. The shroud 101 is made

in the desired form, as for example, cylindrical (as shown) by rolling up a sheet of perforate material and suitably securing the ends together, as by welding or soldering 102, to maintain the perforate sheets in the desired cylindrical form. A screen member 103 of corresponding form is disposed in the shroud 101 and secured thereto in a suitable manner, as explained herein-after, with the screen engaging and overlying the inner face of the shroud 101.

The screen member 103 is formed from suitable sheet screen material such as woven wire screen, similar to that from which the previously described screen member is formed. The sheet screen material being rolled into cylindrical form is secured along its ends in a suitable manner, as by welding or soldering 104.

However, before forming the sheet screen material into a cylindrical form the material is corrugated, as by passing through corrugating rolls, whereby the total surface area of the material forming the sheet is substantially greater than the total area of the corrugated sheet measured along its length and breadth. Thus, for any cylindrical screen member of any given length and diameter, the screen member formed from corrugated material provides a substantially greater surface area than a screen member of the same length and diameter formed from planar (uncorrugated) sheet screen material. After the screen member has been formed as above described, it is inserted in the shroud and suitably secured thereto, as by welding or soldering (not shown). Preferably an end ring or flange 105 and an end plate 106 which may be similar to the end members above described in connection with the basket of Figs. 1 and 2, are secured to the two ends of the assembled shroud and screen respectively, as illustrated in Fig. 4, to provide the desired rigidity at the ends of the basket and to provide, where desired, the necessary seating surfaces, as will be understood from the preceding description of the first embodiment of the invention.

While the height and breadth of the corrugations formed in the screen member 103 may vary throughout a substantial range, it is desirable that they be of sufficient height and breadth to provide a desirable increase in the effective area of the screen over that which would be provided by an uncorrugated screen member of similar diameter. However, the height and breadth of the corrugations should not be so great as to result in a screen member which does not have the required stiffness and which does not remain in engagement with the face of the shroud which the screen member abuts. The height and breadth of the corrugations will of course be determined somewhat by the operating characteristics desired, and also by the strength and rigidity of the screen material. I have shown the corrugations in the screen material as running longitudinally along the strainer basket, as this is deemed the preferred arrangement in most instances. However, in certain cases it may be found desirable to corrugate the screen in a direction whereby the corrugations run circumferentially around the strainer basket instead of longitudinally, as shown.

In both of the forms of the strainer basket above described and shown in Figs. 1 to 5 the shroud is disposed exteriorly of the screen member. It will be obvious to those skilled in the art that this arrangement is designed for a strainer basket for use in a strainer where the liquid passes from the inside of the basket to the outside of the basket during the straining action and wherein, therefore, the pressure on the screen is in an outward direction. This arrangement insures that the shroud reinforces and supports the screen against bursting or displacement due to the pressure of the liquid passing through the screen. Moreover, the arrangement is such that the pressure of the liquid on the screen tends to force it against the shroud and hold it in place so that it is not necessary to secure the screen member to the shroud except at a few points such as above described. There are certain types of strainers wherein the liquid passes from the outside through the

shroud and screen to the inside of the basket. In such cases it is desirable that the screen be disposed on the outside of the shroud, which reversal of members is entirely practicable and within the teaching of the present invention.

The reversal of screen and shroud is illustrated in Figs. 6 to 9, to which reference now is made. Referring now to Fig. 6, a shroud 200 is provided which is generally similar to the shroud 30 above described, except that no side opening is provided. A screen 201 of a form corresponding to that of the shroud is disposed exteriorly of the shroud and is secured thereto in a suitable manner, as by welding or soldering (not shown). Beads or ribs 202 are formed in the shroud 200, which project outwardly from the remainder of the shroud rather than inwardly of the shroud as in the case of the shroud 30. Thus, in the embodiment shown in Fig. 6 the beads serve to space the screen 201 from the shroud 200 in a manner which is equivalent to but reversed from that in which the screen 31 is spaced from the shroud 30. The strainer basket shown in Figs. 6 and 7 may take various forms, as will be understood, and preferably is provided with end members which, in the embodiment shown, are a flanged ring 203 and an end plate 204 similar to the end members shown in Fig. 1.

The strainer basket of Figs. 4 and 5 may likewise be formed with the screen member outermost, as illustrated particularly in Figs. 8 and 9, to which reference now is made. In this embodiment of the invention the shroud 300 may be generally similar to the shroud 101, and screen 301 may be generally similar to the screen 103. However, the screen 301 is disposed exteriorly of the shroud 300 and is secured thereto in a suitable manner. An end ring 302 and an end plate 303 may be provided if desired and secured to the shroud and screen members in a manner generally similar to that described in connection with the previous embodiments of the invention.

It will be understood that in certain applications of the straining element of the present invention the shroud and screen may be suitably assembled in mutually overlying relation as above described with their surfaces spaced except at spaced areas, but wherein they are arranged in a shape other than cylindrical. For example, the assembly may be arranged in planar or other form (not shown) and may serve as a straining element in various applications.

It will be understood that where the term "overlying" is used herein to describe the relation between the shroud and the screen, such term is not limited in respect to which of the members is uppermost or outermost but is descriptive of any arrangement of shroud and screen in accordance with the invention.

I claim:

1. A screening element comprising a screening member formed from sheet screen material and a reinforcing member formed from perforate sheet material of substantially uniform thickness and substantially more rigid than said screen material overlying a face of said screening member and secured to said screening member, one of said members having a plurality of spaced projections engaging the other of said members and spacing said members apart except at the areas of engagement between said projections and the other member.

2. A screening element comprising a screening member formed from sheet screen material and a reinforcing member formed from perforate bendable sheet material of substantially uniform thickness and substantially more rigid than said screen material overlying a face of said screening member and secured to said screening member, one of said members having a plurality of spaced parallel beads formed thereon providing ribs engaging the other of said members and spacing said members apart except at the areas of engagement between said ribs and the other member.

3. A screening element comprising a screening member formed from sheet screen material and a reinforcing member formed from perforate bendable sheet material of substantially uniform thickness and substantially more rigid than said screen material overlying a face of said screening member and secured to said screening member, one of said members being corrugated with its corrugations engaging the other of said members and spacing said members apart except at the areas of engagement between said corrugations and the other member.

4. A strainer basket comprising a straining member of generally cylindrical shape formed from sheet screen material and thereby having openings therein, a rigid unitary shroud member of generally cylindrical shape formed from bendable perforate sheet material of substantially uniform thickness and thereby having openings therein, said shroud member being concentric with and overlying a face of said straining member, one of said members having a plurality of spaced projections engaging the other of said members and spacing said members except at the areas of engagement between said projections and said other member and rigid circular end members secured to the ends of said screen and shrouds the inner one of said cylindrical members defining an unobstructed interior chamber into which the openings in said inner cylindrical member open directly.

5. A strainer basket comprising a straining member of generally cylindrical shape formed from sheet screen material, a rigid shroud member of generally cylindrical shape formed from bendable perforate sheet material concentrically around said straining member, said shroud having a plurality of spaced projections engaging said straining member and spacing said members except at the areas of engagement between said projections and said straining member, each of said members having an inlet opening in a side wall registering with the inlet opening in the other member, a seating plate secured to the outer face of said shroud surrounding said inlet opening and having surface portions providing a seating surface, and rigid circular end members secured to the ends of said screen and shroud and having surface portions providing seating surfaces for seating said basket in a housing.

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