June 11, 1968 S. M. SALOMON ET AL 3,387,708

PAPER MACHINE SCREEN

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Fig. 1

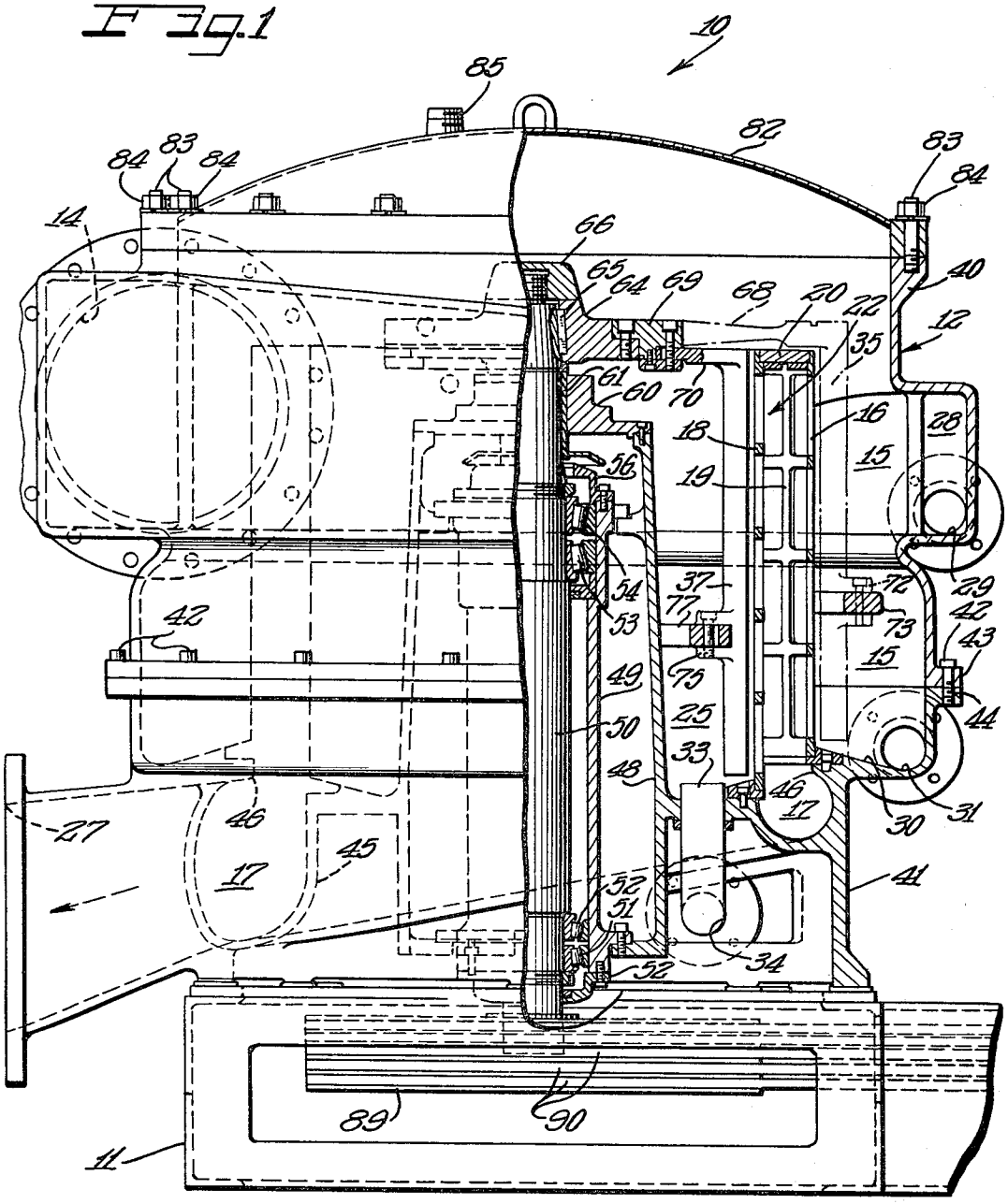

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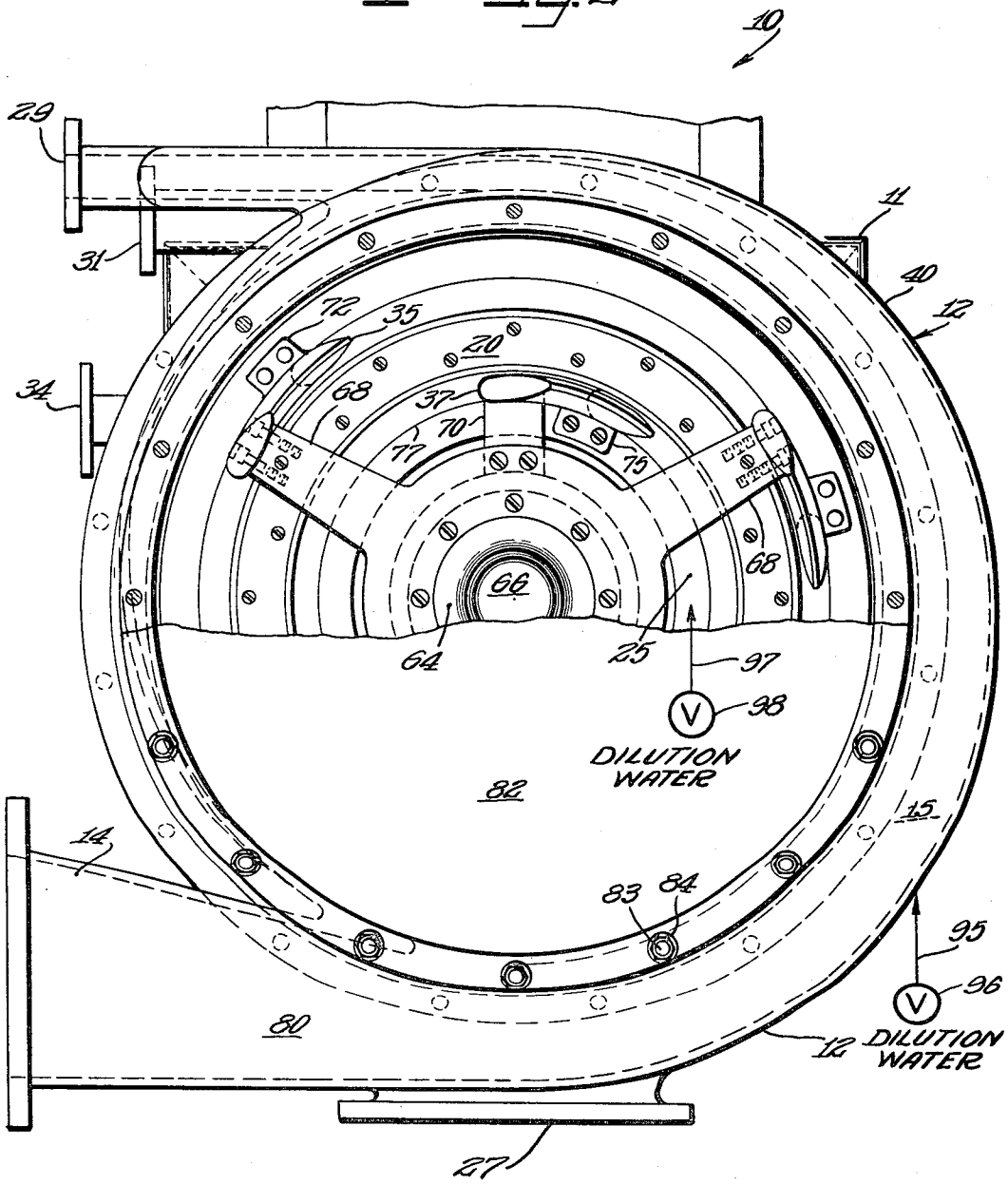
Fig. 2



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PAPER MACHINE SCREEN

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ABSTRACT OF THE DISCLOSURE

A screening apparatus for screening fibrous material in liquid suspension which includes a housing having an inlet and a plurality of outlets. A cylindrical screen which is constructed of inner and outer screen members spaced radially apart from one another is positioned substantially centrally within the housing. The space between the inner and outer screens forms a liquid chamber. Two groups of foils are provided, one group radially outwardly of the outward screen and the other group radially inward of the inner screen for causing the desired constituent of material to pass through the inner and outer screens into the liquid chamber. The liquid chamber between the screens is in fluid communication with an involute-shaped outlet port.

This invention relates to apparatus for screening fibrous materials suspended in liquid such as paper making stock and the like.

The invention has special relation to screening apparatus embodying a vertically extending cylindrical screen having respective inner and outer screen members spaced radially apart to form a chamber therebetween for receiving material of desired consistency and delivering the material to an outlet of the screening apparatus. Furthermore, the invention has special relation to screening apparatus provided with an outlet for receiving the desired material separated from the stock and having further outlets for receiving this undesired material separated from the stock.

It is a primary object of the present invention to provide a screening apparatus of the above type which will effectively and efficiently screen fibrous material suspended in liquid and which is particularly useful in screening paper stock of dirt particles, bark, slivers and other undesirable material.

Another object of the present invention is to provide a screening apparatus for separating fibrous material and delivering the desired constituent of the material at an outlet of the apparatus and for delivering undesired constituents of material of different characteristics to different outlets of the apparatus.

Yet another object of the present invention is to provide a screening apparatus of the character described which provides means for supporting a perforated screen against the pressures of incoming material.

A feature object of the present invention is to provide screening apparatus incorporating rotating foil members radially inwardly and radially outwardly of an annular screen assembly.

Other objects and added features and advantages will become manifest to those versed in the art upon making reference to the description and drawings which follow in which an embodiment of this invention is shown by way of illustrative example.

FIGURE 1 is an elevational view which is partly broken away in vertical section to show the screening apparatus constructed in accordance with this invention; and

FIGURE 2 is a planned view of the apparatus shown in FIGURE 1, with a portion of the top cover broken away.

Referring to the drawings, which illustrate a preferred embodiment of the invention, the screening apparatus shown in FIGURES 1 and 2 is designated generally by a reference numeral 10. The screening apparatus 10 includes a base 11 supporting a main body 12 of substantially cylindrical configuration. An inlet 14 is provided near the upper portion of the body 12 for receiving a supply of fibrous material suspended in liquid such as paper stock. The material is delivered to a chamber 15 within the housing 12 whereupon the desired constituent of the material passes through a screen member 16 and is collected by an outlet receiving chamber 17. The annular screen member 16, an annular screen member 18, a support member 19 disposed between the screen members 16 and 18 and a ring assembly 20 are constructed to form a cylindrical screen assembly 22 as seen in FIGURES 1 and 2. The cylindical screen assembly 22 has the form of a tube having a hollow space between the inner and outer walls of the tube. That is, the cylindrical screen member 16 is placed concentrically about the cylindrical screen member 18 and spaced radially therefrom by the ring 20.

The support member 19 serves to support the screen members 16 and 18 against the pressure exerted thereon by the incoming material. Material will fill the chamber 15 and flow over the cylindrical screen assembly 22 to fill a chamber 25 located radially inwardly of the screen assembly 22. Therefore, the desired constituent of material, which is carried over into chamber 25, will pass through the screen 18 and is collected in the receiving chamber 17, as seen in FIGURE 1. The desired constituent of material collected in the receiving chamber 17 is then delivered to a main outlet 27.

The heaviest undesired constituent of the material is separated by a plurality of actions but chiefly by centrifugal force and is collected in a receiving chamber 28 whereupon this undesired constituent of the material is delivered to an outlet 29. Still a further undesired constituent of the material, which is heavier than the desired constituent of material, is separated by gravitational means and falls to the bottom of chamber 15. The bottom of chamber 15 forms a trough 30. An outlet 31 communicates with the trough 30 for receiving the undesired material collected thereby. Another trough 33 is located at the bottom of chamber 25 for collecting the constituent of material unacceptable to the process and which is carried over the top of the screen assembly 22. An outlet 34 communicates with the trough 33 for receiving the undesired constituent of material collected thereby.

One or more rotatable foils 35 extend axially of the screen assembly 22 and radially outwardly thereof and immediately adjacent thereto as indicated by the dotted lines shown in FIGURE 1. In the preferred embodiment of the present invention a plurality of foils 35 are spaced equally apart around the periphery of the screen assembly 22. The foils 35 are rotated to clean the surface of the screen member 16 of materials which would otherwise clog the screen. Some of the undesired constituents of the material which are removed from the screen members 16 will fall to the bottom of the chamber 15 into trough 30 and be removed by outlet 31, and some of the undesired material will be carried in suspension over the top of the screen assembly 22 and ultimately collected within the trough 33 and removed by outlet 34.

In a similar fashion a plurality of equally spaced foils 37 extend axially and radially inwardly of the screen 18 and immediately adjacent thereto as seen in FIGURE 1. The foils 37 are also rotated to remove undesired constituents of the material from the surface of the screen

member 18 which would otherwise clog the screen. This undesired constituent of material is ultimately collected within the trough 33 and removed via outlet 34.

A better understanding of the detailed construction of the screening apparatus shown in FIGURES 1 and 2 can be had by reference to the following description.

The housing 12 consists of an upper portion 40 and a lower portion 41 which are fastened together by a plurality of screws 42 engaging flanges 43 and 44 of the upper and lower portions 40 and 41 respectively. The receiving chamber 17, which communicates with the main outlet 27, is formed by an involute 45 which has the major diameter thereof at the outlet 27, as seen in FIGURE 1. An opening 46 is provided in one side of the involute 45 in a plane perpendicular to the axis thereof and concentric therewith. The opening 46 is in direct communication with the space between the screen members 16 and 18 of the screen assembly 22.

A support member 48 is formed concentrically and integrally within the lower portion 41 and extends upwardly within the upper portion 40. Located concentrically within the support member 48 is a sleeve 49. A shaft 50 is journalled by bearings 51, 52, 53 and 54 which are carried within the sleeve 49. Retainer caps 56 and 57 are secured respectively to the upper and lower ends of the sleeve 49 for retaining the bearings 51, 52, 53 and 54 and the shaft 50 therein. A cover 60 is secured to the upper end of the support member 48, and a seal 61 is carried between the shaft 50 and the cover 60.

A hub 64 is removably connected to the upper end of the shaft 50 and is prevented from rotating relative thereto by a key 65. A contoured nut 66 threadably engages the shaft 50 to retain the hub 64. One or more arms 68, indicated by dotted lines in FIGURE 1, extend outwardly from a ring 69 which is secured to the hub 64. Each of the arms 68 serves to carry one of the foils 35, as seen in FIGURE 1. Also connected to the ring 69 are one or more arms 70, and each of the arms 70 serves to carry one of the foils 37. It will be understood that each of the foils 35 or 37 may be fixedly connected to their associated arm or may be removably connected thereto.

The foils 35 have bosses 72 which engage a stiffener ring 73 located radially outwardly of the foils. The ring 73 is connected to all of the foils 35 and serves to prevent the foils 35 from flexing axially thereby causing a gap between the foil 35 and the bottom portion of the screen member 16. The foils 37 have bosses 75 which are connected to a stiffener ring 76 radially inwardly of the foils 37. The ring 77 has substantially the same function as the ring 73.

The top portion 40 of the housing 12 is provided with an inlet passage 80 which is formed as an involute as best seen in FIGURE 2. The involute 80 has an opening on the inside arcuate portion thereof communicating with the interior of the housing 12 for delivering the material to be screened to the interior of the housing 12.

A cover 82 is secured to the upper portion 40 of the housing 12 by a plurality of studs 83 and nuts 84. A threaded fitting 85 is provided on the cover 82 and may be connected to suitable piping means.

The lower end of the shaft 50 extends into a space within the base 11 and is connected to a multiple V-belt pulley 89. The pulley 89 is rotated by a plurality of belts 90 which are connected to a suitable power source.

Although the specific embodiment of the present invention shows single outlets 29, 31 and 34, it is not to be construed in the limiting sense. The housing 12 may have a plurality of outlets for receiving undesired constituents of material that is delivered to the outlet 29. Furthermore, the housing 12 may have a plurality of outlets around the housing to receive the undesired constituent of material which is received by the outlet 31. Similarly, the housing 12 may have a plurality of outlets in communication with the chamber 25 for receiving the undesired constituents of material therefrom.

As seen in FIGURE 2, the housing 12 may be provided with water dilution means as indicated by arrow 95. The water dilution is introduced into the chamber 15 in a direction substantially tangential to the direction of rotation of the foils 35 and 37. The water dilution means indicated by arrow 95 is provided with a valve 96 for controlling the quantity of water which is to be added to the chamber 15. Water dilution means may be connected to the chamber 25 as indicated by the arrow 97. A valve 98 is connected to the water dilution means for controlling the quantity of water delivered to the chamber 25.

Furthermore, the size of the apertures in screen 16 may be different than the size of the apertures in the screen 18. By using screens having different sized apertures one from the other, the constituents of the material can flow inward or outward of the screen assembly 22.

It will be noted that the rotating foils 35 and 37 at no time pass over the outlet openings of the housing 12. Also, the rotating foils 35 and 37 at no time pass over the inlet opening 14 of the housing 12. This will allow the inlet opening 14 to be moved upwardly as seen in FIGURE 1 if necessary. Furthermore, this feature decreases the amplitude of pulsations of the material delivered to the inlet 14.

It can be seen, therefore, that the preferred embodiment of the present invention provides means for separating the desired constituent of a material and delivering the desired constituent to a main outlet and which delivers the undesired constituent of the material to one or more different outlets. Specifically, the invention shows an improved screening apparatus whereby the material to be screened passes through screen members which are disposed concentric one within the other to form an annularly shaped cylindrical chamber between the inner and outer screened members. The inner and outer screened members are spaced radially apart by means of a support spacer which, in conjunction with the inner and outer screen members, forms the screen assembly.

Although a specific embodiment of the invention has been described herein, it is not intended to limit the invention solely thereto, but to include all of the obvious variations and modifications within the spirit and scope of the appended claims.

We claim as our invention:

1. In a screening apparatus of the character described for screening fibrous material in liquid suspensions to deliver the desired constituent of the materials at an outlet of the apparatus and to remove the undesired constituent of material comprising,
   - a housing having a plurality of openings defining a single inlet and a multiplicity of outlets,
   - a cylindrical screen having respective inner and outer screen members spaced radially apart to form a chamber therebetween which is disposed concentrically within said housing,
   - means connecting said chamber formed by said cylindrical screen to one of said outlets for passing the desired constituent of material,
   - the other of said outlets communicating with the area radially inside and outside of said screen,
   - first and second foil means concentrically rotatably carried within said housing adjacent said inner and outer screen members respectively for preventing clogging of said screen members, and
   - drive means for driving said first and second foils within said housing.

2. In a screening apparatus of the character described for screening fibrous material in liquid suspensions to deliver the desired constituent of the material at an outlet of the apparatus and to reject the undesired constituents of the material according to different characteristics at respective different outlets of the apparatus comprising,
   - a housing having a plurality of openings defining a single inlet and first, second, third and fourth outlets,
   - a cylindrical screen having respective inner and outer

screen members spaced radially apart to form a chamber therebetween which is disposed concentrically within said housing,

an involute formed within said housing and substantially concentric therewith having an opening on one side thereof in a plane perpendicular to its axes for communication with the chamber formed by said cylindrical screen,

said involute having a portion extending outwardly from said housing to form said first outlet,

trough means disposed within said housing radially outwardly of said cylindrical screen and communicating with said second outlet for removing undesired constituents which are collected in said trough means,

receiving means formed within said housing outwardly of said cylindrical screen for receiving the material to be separated,

said receiving means communicating with said third outlet, and

trough means disposed within said housing radially inwardly of said cylindrical screen for communicating with said fourth outlet.

3. In a screening apparatus of the character described for screening fibrous material in liquid suspensions to deliver the desired constituent of material at an outlet of the apparatus and to remove the undesired constituents of material according to different characteristics at respective different outlets of the apparatus comprising,

a housing having a plurality of openings defining a single inlet and first, second, third and fourth outlets,

a cylindrical screen having respective inner and outer screen members separated radially apart to form a chamber therebetween which is disposed concentrically within said housing,

a first involute formed within said housing and substantially concentric therewith having an opening on one side thereof in a plane perpendicular to its axis for communication with the chamber formed by said cylindrical screen,

said involute having a portion extending outwardly from said housing to form said first outlet,

a trough disposed concentrically within said housing radially outwardly of said cylindrical screen for communication with said inlet at an upper axial extent of said housing and for communicating with said second outlet at a lower axial extent of said housing,

a second involute formed within said housing radially outwardly of said cylindrical screen and substantially concentric therewith having a portion of said involute extending outwardly of said housing to form said inlet,

a portion of said second involute communicating with said third outlet for receiving particles which are centrifugally separated from the material,

a trough disposed within said housing radially inwardly of said cylindrical screen for communicating with said fourth outlet,

first and second foil means concentrically rotatably carried within said housing adjacent said inner and outer screen members respectively, and

drive means for driving said first and second foil means within said housing.

4. A screening device comprising,

a housing,

an inlet connected to said housing for receiving material in liquid suspension to be separated,

a cylindrical screen having respective inner and outer screen members spaced radially apart to form a chamber therebetween which is disposed concentrically within said housing,

a first involute formed within said housing and substantially concentric therewith having an opening on one side thereof in a plane perpendicular to its axes for communicating with the chamber formed by said cylindrical screen,

said first involute communicating with a first outlet,

a second outlet connected to said housing for receiving undesired particles of the material which settles to the bottom of said housing radially outwardly of said cylindrical screen,

a third outlet connected to said housing for receiving particles which are centrifugally separated from said material,

a fourth outlet connected to said housing for receiving heavy particles which settled to the bottom of said housing radially inwardly of said cylindrical screen,

first and second foil means concentrically rotatably carried within said housing adjacent said inner and outer screen members respectively, and

drive means for driving said first and second foil means within said housing.

5. A screening mechanism for screening paper stock comprising in combination,

an outer vertical annular screen,

an inner vertical annular screen of smaller diameter defining a stock receiving chamber therebetween,

an outlet conduit means communicating with said stock receiving chamber and receiving screened stock,

inner and outer foils positioned radially inwardly of the inner screen and radially outwardly of the outer screen for rotating past the screens,

a housing defining a first chamber radially outwardly of the outer screen and a second chamber radially inwardly of the inner screen with the chambers communicating over the top of the screens,

a stock inlet communicating with the first chamber with heavier particles dropping down beside the outer screen and a portion of the stock flowing through the outer screen into the chamber between the screens with the remainder of the stock flowing over the top of the screens into the second chamber, and

reject outlet means at the lower portion of said first and second chambers for removing particles screened from the stock.

6. A stock screening mechanism in accordance with claim 5 wherein said foils are mounted on a common central rotor coaxial with the screens for moving the foils in rotation.

7. The screening apparatus of claim 5 wherein said reject outlet means comprises a plurality of individual outlets.

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