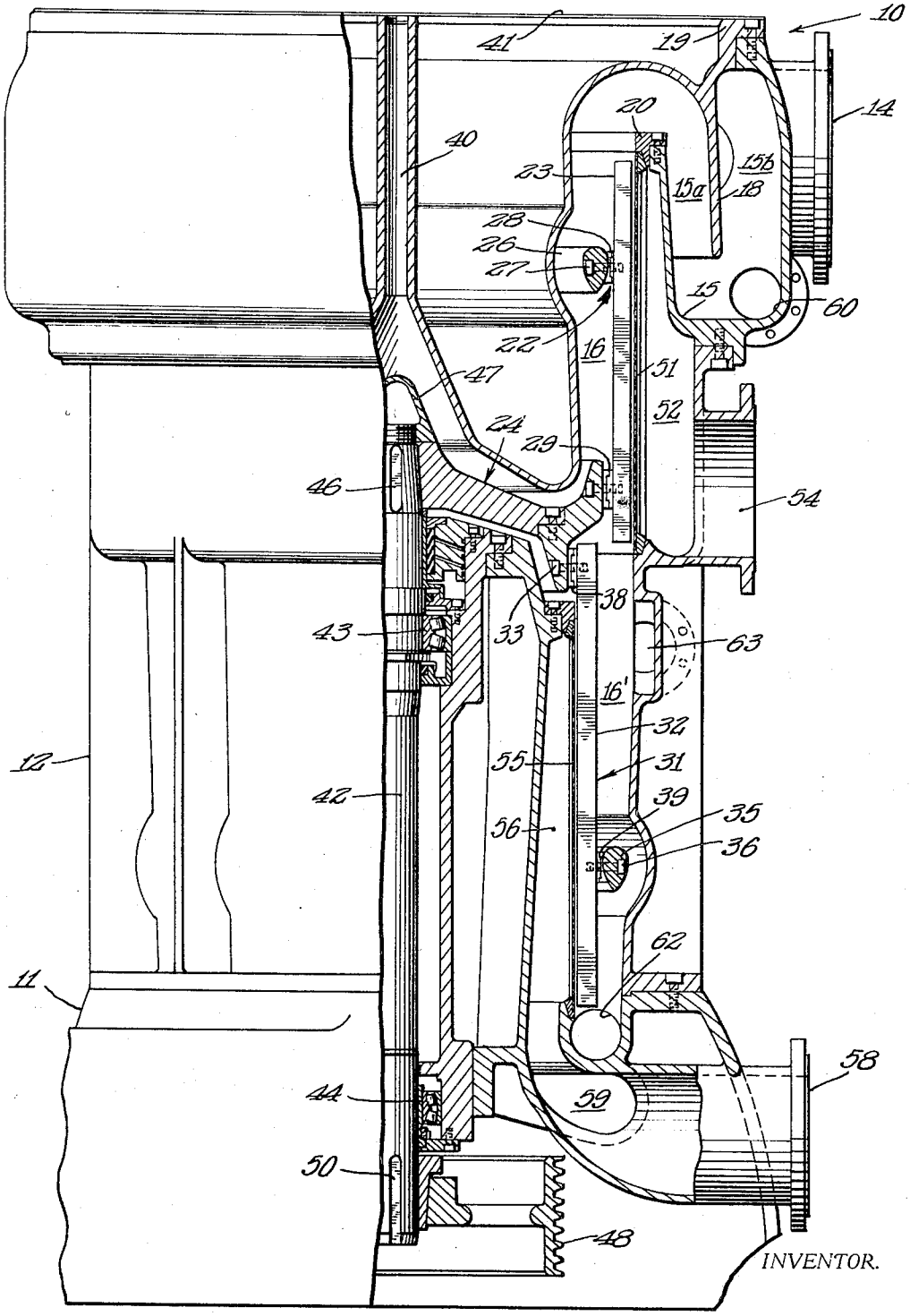
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DUPLEX PULP SCREEN

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DUPLEX PULP SCREEN

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ABSTRACT OF THE DISCLOSURE

A screening apparatus for screening fibrous material in liquid suspension such as paper pulp. The apparatus includes a pair of vertically extending cylindrical screens being radially displaced one from the other and further being axially displaced one from the other. A shaft extends through the screening apparatus and includes a hub secured to the end of the shaft and extending radially outwardly from the shaft. Two groups of foils are secured to the hub and one group of foils extends axially in a direction opposite of the other group of foils. A pair of outlets are provided for receiving desired constituent of material which may be either the same constituent or a different constituent.

This invention relates to apparatus for screening particles from liquids such as papermaking stock and the like.

The invention has special relation to a screening apparatus embodying two vertically extending cylindrical screens being radially displaced one from the other and further being axially displaced one from the other for passing material of desired consistency to one or more outlets of the screening apparatus. Furthermore, the invention has special relation to screening apparatus provided with a pair of outlets for receiving the desired constituents of the material as separated from the stock and having further outlets for receiving the undesired constituents of the material separated from the tsock.

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 constituents.

Another object of the present invention is to provide a screening apparatus for screening paper stock in an improved manner in which cleaned stock is discharged through a plurality of outlets of the apparatus and undesired constituents are discharged through a plurality of different outlets of the apparatus.

Another object of the present invention is to provide a screening apparatus incorporating a pair of cylindrical screens displaced axially and radially from one another so as to form foraminous walls between a receiving chamber and a pair of delivery or output chambers.

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

The single figure is an elevational view which is partly broken away in vertical section to show the screening apparatus constructed in accordance with this invention.

Referring to the drawings, which illustrate a preferred embodiment of the invention, the screening apparatus shown by the single figure is designated generally by reference numeral **10**. The screening apparatus **10** includes a base **11** supporting a main body or housing **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 a liquid such as paper stock. The material from the inlet **14** is

supplied to a trough **15** en route to a main receiving chamber **16**. A baffle **18** is formed on the upper portion **19** of the housing **12** and extends downwardly into the trough **15** as seen on the drawing. The cross-sectional configuration of the trough **15** may change about a common axis through the screening apparatus in such a manner as to form an involute connected to the inlet **14**. On the other hand, the radial position of the baffle **18** from the common axis may serve to divide the trough **15** into substantially two sections **15***a* and **15***b* having continuously changing cross-sectional area to form an involute.

The material to be screened flows over an edge **20**, of the trough **15** and into the receiving chamber **16–16'**. A foil assembly **22** is provided with a plurality of axially extending foils **23** each of which is secured to a hub assembly **24**. A ring **26** is placed radially inwardly of the foil **23** and secured to each of the foils by a suitable means such as a bolt **27**.

In the preferred embodiment of the present invention, the foils **23** are provided with alignment means **28** and **29** for alignment with the ring **26** and the outer periphery of the hub assembly **24** as seen on the drawing. The lower alignment means **29** also serves as a spacer between the hub assembly **24** and the lower portion of the foil **23**, thereby providing passage of the material in the upper portion of the receiving chamber **16** to the lower portion of the receiving chamber **16'**.

A foil assembly **31** is provided with a plurality of axially extending foils such as foil **32** and each foil is secured to the hub assembly **24** by a bolt **33**. A ring **35** is placed radially outwardly of the foils **32** and secured to each of the foils by a bolt as indicated by the reference numeral **36**. The foils **32** are provided with alignment means **38** and **39** for alignment with the rings **35** and the outer periphery of the hub **24**.

The upper portion **19** of the housing **12** is curved over the edge **20** and in the area of the ring **26** so as to allow passage of the material to be screened into and through the chamber **16**. Furthermore, the upper portion **19** is provided with an opening **40** to exhaust any air that may have been caught at the high points of the system. It further serves the purpose for air removal from the liquid slurry since at all times during operation this is the lowest pressure point in the device. A cover **41** is provided at the upper portion of the housing **19**.

A shaft **42** extends into the housing **12** and is journalled therein by a bearing **43** near the upper end of the shaft **42** and by a bearing **44** near the lower end of the shaft **42**. The bearings **43** and **44** may be continuously lubricated by an external supply of lubricant in which case the lubricant is delivered to the bearings by tubing or the like.

The upper end of the shaft **42** is tapered for receiving the hub assembly **24**. Key means **46** are provided at the upper end of the shaft **42** and the hub assembly **24** for preventing rotational movement between the shaft and the hub assembly. A contoured nut **47** is threadedly secured to the shaft **42** for securing the hub assembly **24** to the shaft **42**.

A pulley **48** is secured to the lower end of the shaft **42** and is prevented from moving relative thereto by key means **50**. The pulley **48** is provided with a plurality of grooves for receiving a belt or the like in each of the grooves thereby transmitting power to the shaft **42** from suitable drive means, not shown.

During the operation of the screening apparatus **10**, the material in the receiving chamber **16** passes through a screen member **51** and into a delivery chamber **52** whereupon the desired constituents of the material are delivered to an outlet **54**. The cross-sectional area of the delivery chamber **52**, in the plane of the drawing, may change

successively as the plane of the cross-section rotates about the common axis provided by the shaft **42**. That is, the delivery chamber **52** may take the form of an involute which is connected to the outlet **54**.

Also, during the operation of the screening apparatus **10**, the material in the receiving chamber **16'** passes through a screen member **55** and into a delivery chamber **56** whereupon the desired constituents of the material are delivered to an outlet **58**. An involute **59** is formed at the lower portion of the delivery chamber **56** and is in fluid communication with the outlet **58**.

As the material to be screened is supplied to the receiving chamber **16** via the trough **15**, undesired constituents of the material may be collected at the bottom of the trough **15** as sediment and removed therefrom through an outlet **60**. However, should undesired constituents of the material be supplied to the receiving chamber **16** the undesired constituents will fall to the bottom of the receiving chamber **16'** whereupon the undesired constituents therein are removed through an outlet **62**.

One or more fluid inlets **63** are provided for delivering the diluting fluid into the receiving chamber **16'** as may be necessary during the screening operation.

The screen members **51** and **55** may be of the same type or different from one another as desired. In the case where the screen members **51** and **55** are different, the desired constituents which are delivered to the outlets **54** and **58** respectively may be substantially different. Therefore, the screening apparatus **10** not only provides means for screening fibrous material in liquid suspensions but also provides means for separating the desired constituents of the material.

During the screening operation, the shaft **42** is rotated by a suitable drive means thereby rotating the foil assemblies **22** and **31** relative to the screen members **51** and **55** respectively thereby preventing the screen members from becoming clogged during the screening operation.

It can be seen, therefore, that the preferred embodiment of the present invention provides means for separating the desired constituents of a material and delivering the desired constituents to a pair of outlets and which delivers the undesired constituents 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 concentrically as well as axially from one another to form portions of separate delivery chambers which deliver the desired constituents of the material to respective outlets. The screen members may be of the same type in which the desired constituents of the material delivered to respective outlets is substantially the same. However, should the screen members be different from one another, the desired constituents of the material which are delivered to the respective outlets would be different.

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.

I claim as my invention:

1. In a screening apparatus of the character described for screening fibrous material in liquid suspension to deliver the desired constituent of the material to one or more outlets of the apparatus and to remove the undesired constituents of the material comprising:

a housing having a plurality of openings defining an inlet and a plurality of outlets,

a shaft extending into said housing and journaled therein to form an axis through said housing,

a single hub means concentrically rotatable in said housing and carried by said shaft,

first and second foil means connected to said hub means for rotation therewith and extending axially in opposite directions,

a first cylindrical screen carried in said housing concentrically about the axis of rotation and displaced axially from said hub means so as to be operationally positioned adjacent said first foil means,

a second cylindrical screen carried in said housing concentrically about the axis of rotation and displaced axially from said hub means so as to be operationally positioned adjacent said second foil means,

outlet means for removing the undesired constituent of material from said housing, and drive means for rotatably driving said shaft within said housing.

2. In a screening apparatus of the character described for screening fibrous material in liquid suspensions comprising:

a housing,

a shaft extended into said housing and rotatable therein,

a single hub means positioned in said housing and carried by said shaft for rotation therewith,

an inlet formed on said housing for receiving fibrous materials to be screened,

first and second outlets formed on said housing for passing desired constituents of the material,

a receiving chamber in said housing and in communication with said inlet for receiving the material to be screened,

first and second delivery chambers in said housing and in communication with said first and second outlets for delivering the desired constituents of the material, said first and second delivery chambers being substantially cylindrically shaped about said shaft and displaced axially in opposite directions from one another,

screen means in said housing positioned over a portion of each of said first and second delivery chambers for passing the desired constituents of the material through said screen means into respective delivery chambers,

foil means carried by said hub means and positioned adjacent said screen means of said first and second delivery chambers respectively,

fluid input means connected to said housing and in communication with said receiving chamber for adding diluting fluid to the fibrous material in said receiving chamber,

trap means in said housing for trapping and removing undesired constituents of the material being screened, and

drive means connected to said shaft for moving said foil means relative to said screen means of said first and second delivery chambers to prevent clogging of said screen means during the operation of the screening apparatus.

3. In a screening apparatus of the character described for screening fibrous material in liquid suspensions comprising:

a housing,

a shaft extended into said housing for rotation therein to form an axis through said housing,

a single hub means in said housing and secured to said shaft for rotation therewith,

inlet means at the upper portion of said housing for passing fibrous material to be screened,

a receiving chamber in said housing and being annularly shaped having upper and lower sections,

upper and lower delivery chambers in said housing, said upper delivery chamber being radially outwardly of said receiving chamber and said lower delivery chamber being radially inwardly of said receiving chamber,

first screen means cylindrically shaped and positioned about the axis through said housing at the upper portion thereof between the upper section of said

receiving chamber and said upper delivery chamber,
second screen means cylindrically shaped and positioned about the axis through said housing at the lower portion thereof between the lower section of said receiving chamber and said lower delivery chamber,
foil means rotatably carried by said hub means and positioned adjacent said first and second screen means for rotational movement relative thereto,
first outlet means at the lower portion of said housing and in fluid communication with said lower delivery chamber for receiving desired constituents of the material,
second output means on said housing axially intermediate said inlet means and said first outlet means and in fluid communication with said lower delivery chamber for receiving desired constituents of the material, and
drive means connected to said shaft for moving said foil means relative to said first and second screen means to prevent clogging of said screen means during the operation of the screening apparatus.

4. In a screening apparatus of the character described for screening fibrous material in liquid suspensions comprising:

a housing,
a shaft extended into said housing for rotation therein to form an axis through said housing,
a single hub means in said housing and secured to said shaft for rotation therewith,
inlet means at the upper portion of said housing for passing a fibrous material to be screened,
a receiving chamber in said housing and being annularly shaped about the axis through said housing and having upper and lower sections,
trough means in said housing near the upper section of said receiving chamber and in fluid communication between the inlet means and said receiving chamber for receiving the materials to be screened so as to remove undersired constituents of the material as sediment from the bottom of said trough means,
first outlet means on said housing in fluid communication with the bottom of said trough means for passage of undesired constituents of the material accumulated by said trough means,
upper and lower delivery chambers in said housing, said upper delivery chamber being radially outwardly of the said receiving chamber and said lower delivery chamber being radially inwardly of said receiving chamber,
first screen means cylindrically shaped and positioned substantially concentrically about the axis through said housing at the upper portion thereof between the upper section of said receiving chamber and said upper delivery chamber,
second screen means cylindrically shaped and positioned substantially concentrically about the axis through said housing at the lower portion thereof between the lower section of said receiving chamber and said lower delivery chamber,
foil means rotatably carried by said hub means and positioned adjacent said first and second screen means for rotational movement relative thereto,
second outlet means at the lower portion of said housing and in fluid communication with said lower delivery chamber for receiving desired constituents of the material,
third outlet means on said housing axially intermediate said inlet means and said second outlet means and in fluid communication with said upper delivery chamber for receiving desired constituents of the material, and
drive means connected to said shaft for moving said foil means relative to said first and second screen means to prevent clogging of said screen means during the operation of the screening apparatus.

5. In a screening apparatus of the character described for screening fibrous material in liquid suspensions comprising:

a housing,
a shaft extended into said housing for rotation therein to form an axis through said housing,
a single hub means in said housing and secured to said shaft for rotation therewith,
inlet means at the upper portion of said housing for passing the fibrous materials to be screened,
a receiving chamber in said housing and being annularly shaped having upper and lower sections about the axis through said housing,
first outlet means on said housing in fluid communication with the lower section of said receiving chamber for passing undesired constituents of the material collected at the bottom of said receiving chamber,
upper and lower delivery chambers in said housing, said upper delivery chamber being radially outwardly of said receiving chamber and said lower delivery chamber being radially inwardly from said receiving chamber,
first screen means positioned about the axis through said housing at the upper portion thereof between the upper section of said receiving chamber and said upper delivery chamber,
second screen means positioned about the axis through said housing at the lower portion thereof between the lower section of said receiving chamber and said lower delivery chamber,
foil means carried by said hub means and positioned adjacent said first and second screen means for movement relative thereto,
second outlet means at the lower portion of said housing and in fluid communication with said lower delivery chamber for receiving desired constituents of the material,
a third outlet means on said housing intermediate said inlet means and said second outlet means and in fluid communication with said upper delivery chamber for receiving desired constituents of the material, and
drive means connected to said shaft for moving said foil means relative to said first and second screen means.

6. In a screening apparatus of the character described for screening fibrous material in liquid suspensions comprising:

a housing,
a shaft extended into said housing for rotation therein to form an axis through said housing,
a single hub means in said housing and secured to said shaft for rotation therewith,
inlet means at the upper portion of said housing for passing fibrous material to be screened,
a receiving chamber in said housing and being annularly shaped about the axis through said housing and having upper and lower sections,
upper and lower delivery chambers in said housing, said upper delivery chamber being radially outwardly of said receiving chamber and said lower delivery chamber being radially inwardly of said receiving chamber,
first screen means positioned about the axis through said housing at the upper portion thereof between the upper section of said receiving chamber and said upper delivery chamber,
second screen means positioned about the axis through said housing at the lower portion thereof between the lower section of said receiving chamber and said lower delivery chamber,
foil means rotatably carried by said hub means and

positioned adjacent said first and second screen means for rotational movement relative thereto,

first outlet means at the lower portion of said housing and in fluid communication with said lower delivery chamber for receiving desired constituents of the material,

second outlet means on said housing in fluid communication with said upper delivery chamber for receiving desired constituents of the material,

fluid input means connected to said housing and in communication with said receiving chamber for adding diluting fluid to the fibrous material in said receiving chamber, and

drive means connected to said shaft for rotating said foil means relative to said first and second screen means.

7. In a screening apparatus of the character described for separating different constituents of fibrous material in liquid suspensions comprising:

a housing,

a shaft extended into said housing for rotation therein to form an axis through said housing,

a single hub means in said housing and secured to said shaft for rotation therewith,

inlet means on said housing for passing fibrous materials to be screened,

a receiving chamber in said housing and being annularly shaped about the axis through said housing and having upper and lower sections,

trough means in said housing near the upper section of said receiving chamber in fluid communication between the inlet means and said receiving chamber for receiving the material to be screened so as to remove undesired constituents of the material as sediment from the bottom of said trough means,

a first outlet means on said housing in fluid communication with the bottom of said trough means for passage of undesired constituents of the material accumulated at said trough means,

second outlet means on said housing in fluid communication with the lower section of said receiving chamber for passage of undesired constituents of the material collected at the bottom of said receiving chamber,

upper and lower delivery chambers in said housing, said upper delivery chamber being radially outwardly of said receiving chamber and said lower delivery chamber being radially inwardly of said receiving chamber,

first screening means positioned about the axis through said housing at the upper portion thereof between the upper section of said receiving chamber and said upper delivery chamber,

second screen means positioned about the axis through said housing at the lower portion thereof between the lower section of said receiving chamber and said lower delivery chamber,

foil means extended axially in said housing and carried by said hub means adjacent said first and second screen means for movement relative thereto,

a third outlet means on said housing and in fluid communication with said lower delivery chamber for receiving desired constituents of the material,

a fourth outlet means on said housing and in fluid communication with said upper delivery chamber for receiving desired constituents of the material,

fluid input means connected to said housing and in communication with said receiving chamber for adding diluting fluid to the fibrous material in said receiving chamber, and

drive means connected to said shaft for moving said foil means relative to said first and second screen means to prevent clogging of the said screen means during the operation of the screening apparatus.

8. In a screening apparatus of the character described for separating different constituents of fibrous material in liquid suspensions comprising:

a housing,

a shaft extended into said housing for rotation therein to form an axis through said housing,

a single hub means in said housing and secured to said shaft for rotation therewith,

inlet means on said housing for passing fibrous materials to be screened,

a receiving chamber in said housing and being annularly shaped about the axis through said housing and having upper and lower sections,

annular trough means in said housing near the upper section of said receiving chamber in fluid communication between the inlet means and said receiving chamber for receiving the material to be screened so as to remove undesired constituents of the material as sediment from the bottom of said trough means,

a baffle means formed at the upper portion of said housing and extending downwardly into said annular trough means,

a first outlet means on said housing in fluid communication with the bottom of said trough means for passage of undesired constituents of the material accumulated at said trough means,

second outlet means on said housing in fluid communication with the lower section of said receiving chamber for passage of undesired constituents of the material collected at the bottom of said receiving chamber,

upper and lower delivery chambers in said housing, said upper delivery chamber being radially outwardly of said receiving chamber and said lower delivery chamber being radially inwardly of said receiving chamber,

first screening means positioned about the axis through said housing at the upper portion thereof between the upper section of said receivivng chamber and said upper delivery chamber,

second screen means positioned about the axis through said housing at the lower portion thereof between the lower section of said receiving chamber and said lower delivery chamber,

foil means extended axially in said housing and carried by said hub means adjacent said first and second screen means for movement relative thereto,

a third outlet means on said housing and in fluid communication with said lower delivery chamber for receiving desired constituents of the material,

a fourth outlet means on said housing and in fluid communication with said upper delivery chamber for receiving desired constituents of the material,

fluid input means connected to said housing and in communication with said receiving chamber for adding diluting fluid to the fibrous material in said receiving chamber, and

drive means connected to said shaft for moving said foil means relative to said first and second screen means to prevent clogging of the said screen means during the operation of the screening apparatus.

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