United States Patent [19]

Messing, deceased

[11] **3,754,658**

[45] **Aug. 28, 1973**

[54] **PULP THICKENER HAVING TWO VERTICAL PERFORATED SCREENS WITH NONMOVING SPIRALLY WRAPPED BLADES THEREBETWEEN**

[76] Inventor: **Hjalmar Messing, deceased,** late of 7 Church St., Fort Fairfield, Maine by Mary Agnes Messing, executrix

[22] Filed: **Oct. 19, 1970**

[21] Appl. No.: **81,867**

[52] **U.S. Cl.** **210/304,** 162/56, 162/232, 209/305, 210/443, 100/110

[51] **Int. Cl.** **D21d 5/02,** B01d 25/20

[58] **Field of Search** 162/18, 52, 56, 55, 162/246, 251, 1, 232; 210/512, 304, 443; 55/203, 191, 452, 456, 457, 236–238, 235; 209/211, 305; 100/110

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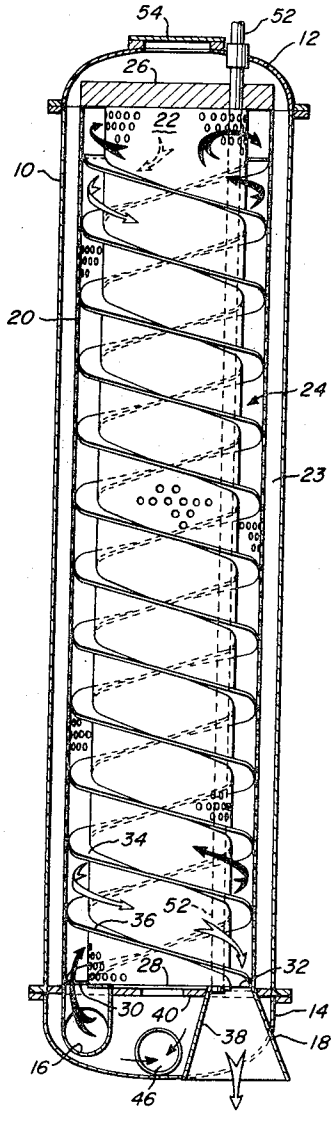
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[57] **ABSTRACT**

A pulp thickener characterized by a vertically oriented housing containing concentric perforated tubular screens which form therebetween a tube-like chamber. Within said chamber are two spirally wrapped blades providing helical flights which have a 180° displacement. At their lowermost extremities one flight is positioned to commence at the inlet to while the other ends at the outlet from said chamber. In a pressured continuing flow through said chamber a pulp slurry is guided by said helical flights from said inlet to said outlet in a manner that a substantial amount of liquid is expressed through the tubular screens in a relatively small amount of space.

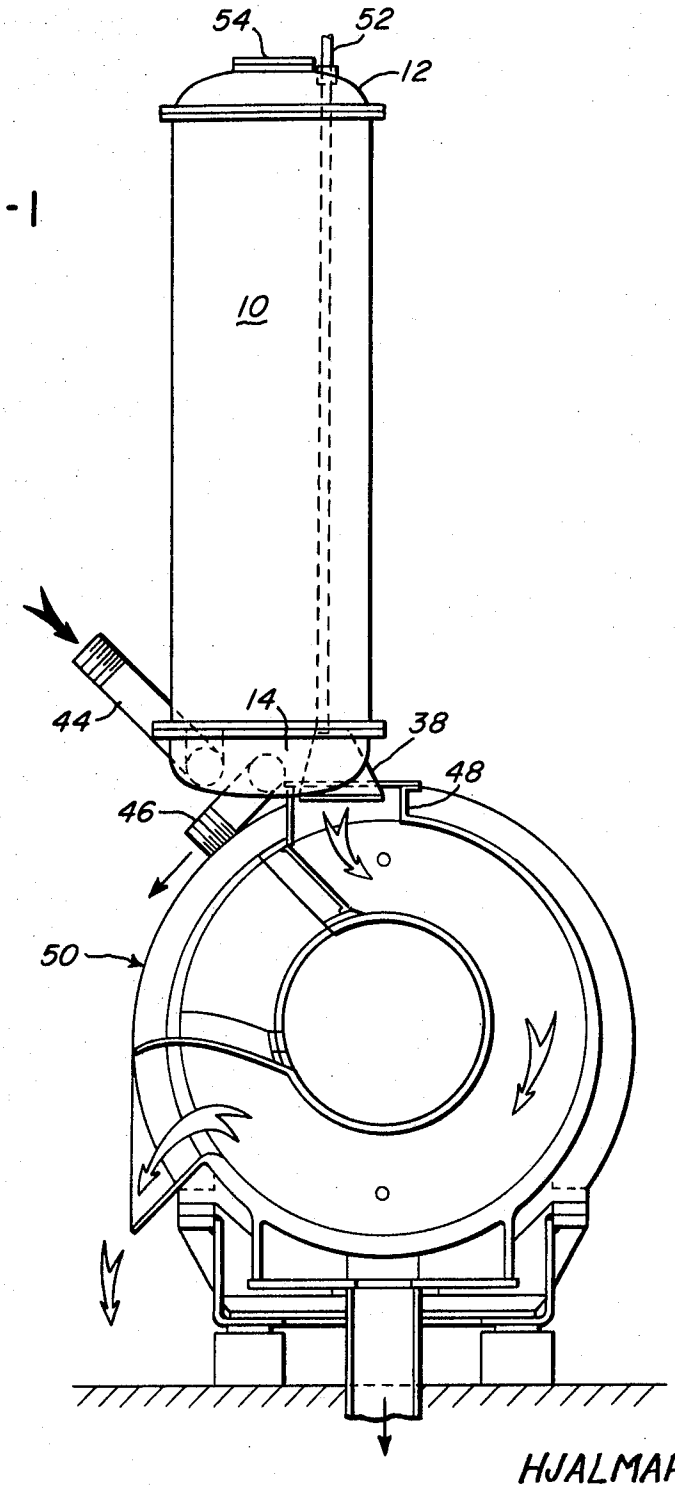
9 Claims, 4 Drawing Figures



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3 Sheets-Sheet 1

FIG-1



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FIG-2

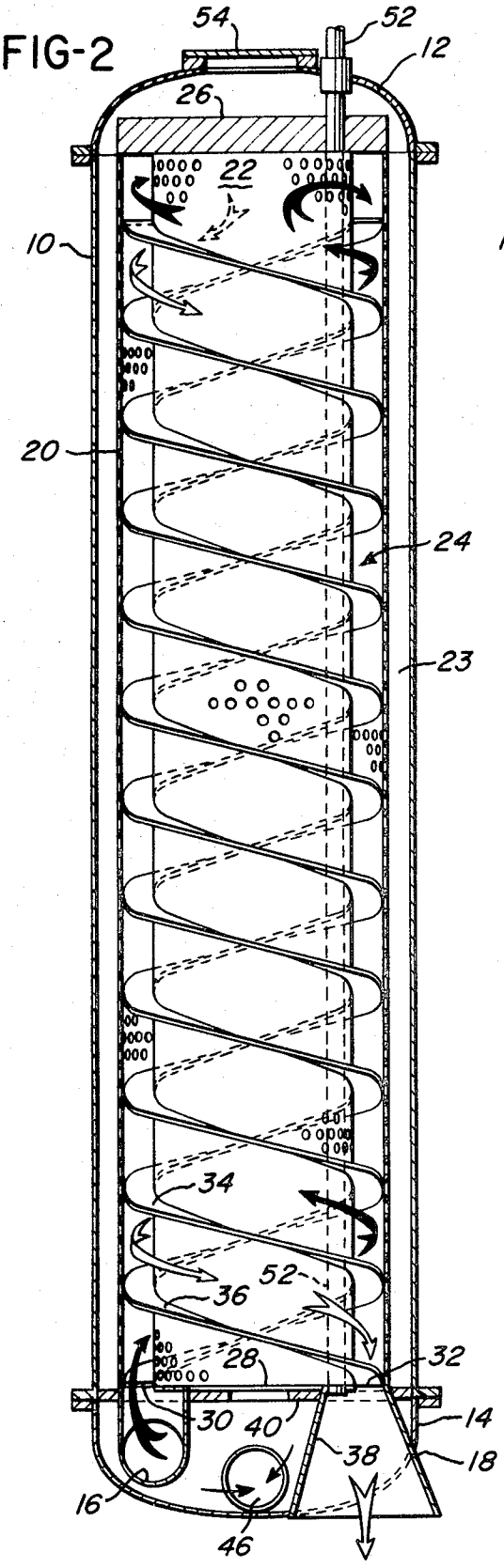
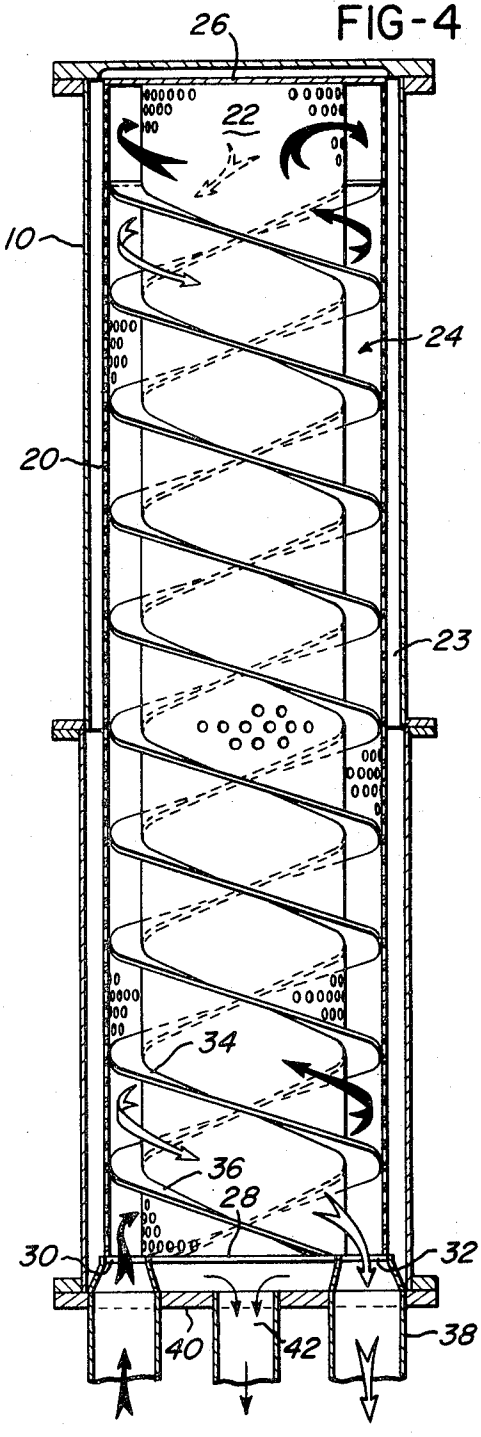


FIG-4



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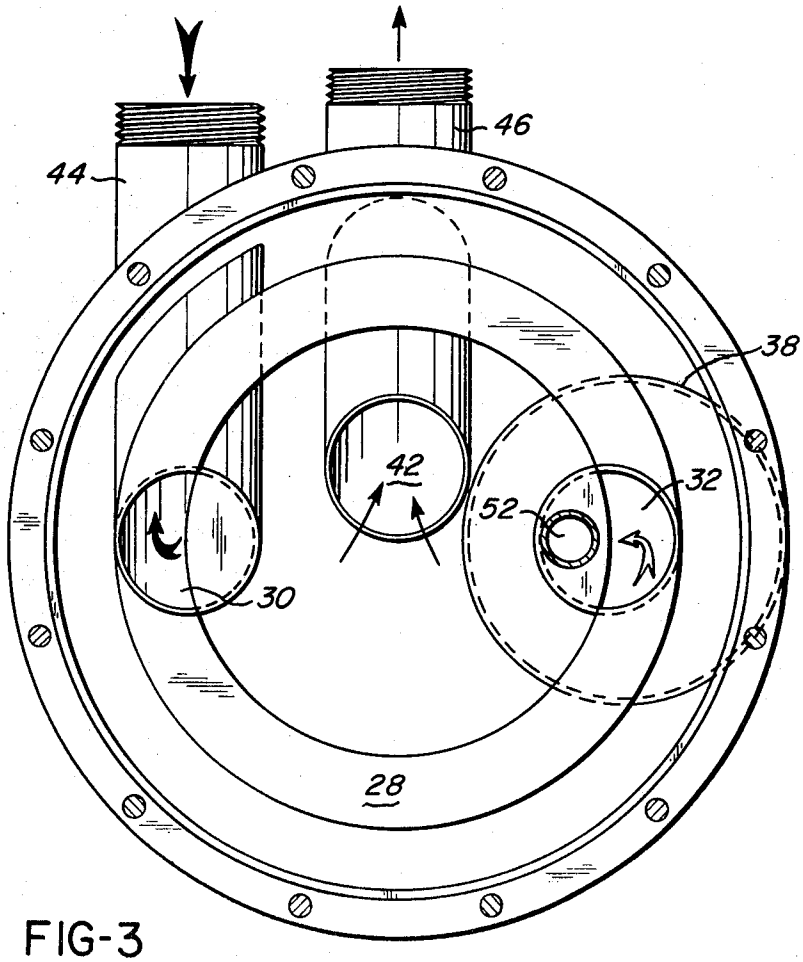


FIG-3

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PULP THICKENER HAVING TWO VERTICAL PERFORATED SCREENS WITH NONMOVING SPIRALLY WRAPPED BLADES THEREBETWEEN

BACKGROUND OF THE INVENTION

Most dewatering presses operate under heavy load. This is neither efficient nor economical, and it necessitates a substantial amount of maintenance. For reasons such as this, efforts have been made to provide press feeders which would accomplish some primary dewatering and thereby reduce the load on the press. Most devices of this type have been screw feeders and have involved, in any event, a number of expensive moving parts. The disadvantages found in use thereof have been substantial. Primarily, they have not reduced power requirements for dewatering. Further, their size has been such they normally require a lot of valuable space for their installation.

In contrast, the subject invention provides a primary dewatering or thickening unit which can be used as a press feeder and which has no moving parts. Embodiments are so designed, moreover, to minimize power and maintenance, and space requirements. Yet they are capable of performing with increased and controlled efficiency.

SUMMARY OF A PREFERRED EMBODIMENT

A pulp thickener here ilustrated to exemplify the invention is characterized by a vertical housing within which is centered a pair of concentrically positioned screens so spaced to define a tubular chamber. A path for slurry flow is defined between said screens by a pair of spirally wrapped helical flights displaced 180° apart. The arrangement provides for a flow of slurry to be guided by one flight the length of the chamber to transfer to the second flight and be reversely guided the length of the chamber. One flight leads from an inlet to said chamber while the other flight terminates at the outlet therefrom. The thickener thus provided is to designed to produce a substantial expression of liquid from a pressured flow of slurry moving through the chamber, in a simple and easy fashion and at minimal cost.

It is therefore a primary object of the invention to provide an improved pulp thickener which is economical to fabricate, more efficient and satisfactory in use, adaptable to a wide variety of applications and unlikely to malfunction.

A further object of the invention is to provide an improved pulp thickener characterized by a tubular chamber the peripheral walls of which are perforate and within which is defined a helical flow path, a pulp slurry being moved through said path under pressure being subjected to compression and gravity forces in a manner to express liquid to a degree to substantially increase the slurry consistency in a single pass.

Another object of the invention is to provide an improved pulp thickener characterized by a lack of moving parts.

Additional object of the invention is to provide a new and improved pulp thickener or the like characterized by means defining a spiral flow path for a continuing flow of slurry, the form of which path dictates controlled and predeterminable application of compression and gravity forces to influence a predictable and substantial increase in slurry consistency in a single pass.

Another object of the invention is to provide a pulp thickener possessing the advantageous structural features, the inherent meritorious characteristics and the means and mode of use herein described.

With the above and other incidental objects in view, as will more fully appear in the specification, the invention intended to be protected by Letters Patent consists of the features of construction, the parts and combinations thereof, and the mode of operation as hereinafter described or illustrated in the accompanying drawings, or their equivalents.

Referring to the drawings wherein are shown some but not necessarily the only forms of embodiment of the invention,

FIG. 1 is a generally schematic representation of a pulp thickener in accordance with the invention as utilized in conjunction with a disc-cone press;

FIG. 2 shows, schematically, a vertical section of the thickener of FIG. 1;

FIG. 3 is a cross sectional view taken on line 3—3 of FIG. 1;

FIG. 4 is a diagrammatic illustration of the flow path defined in a pulp thickener of the invention, slightly modified.

Like parts are indicated by similar characters of reference throughout the several views.

As illustrated, a preferred pulp thickener device in accordance with the invention includes a vertically mounted housing in the form of a cylindrical shell **10.** The shell has a first dome shaped cap **12** at its top and a second dome shaped cap **14** at its bottom. A housing inlet **16** and its outlet **18** are both formed in the bottom cap **14,** at substantially diametrically opposite positions.

Positioned concentrically within the shell **10** are two perforate tubular formed screens of generally cylindrical configuration. In a preferred embodiment the outermost screen **20** is radially spaced from the innermost screen **22** approximately **3** inches. In turn the outer screen is concentric with and suitably spaced from the interior wall of the shell **10,** forming thereby a peripheral drainage chamber **23.**

The screens **20** and **22** thus provided form a tubular chamber **24** capped to its top by an imperforate plate **26.** The chamber **24** is similarly capped to its bottom by a plate **28.** Formed in the plate **28,** in communication with the tubular chamber **24,** at positions respectively spaced **180°** apart, is a first aperture providing an inlet opening **30** and a second aperture providing an outlet opening **32.** Fitted in and bridging the space between the screens defining the chamber **24** are two continuous spirally wrapped blades forming flights **34** and **36.** The flights **34** and **36** are commenced at the bottom of the chamber **24** at positions displaced 180° apart. Their lower extremities respectively terminate at the inlet **30** and the outlet **32.** The flights **34** and **36** are so wrapped to be helically formed and define therebetween a uniform spiral flow path. The path so defined commences at the inlet **30,** and provides that, on inflow, pulp slurry will be guided directly onto the lower end of flight **34** to move upwardly, guided in a helical flow path by the flight **34.** As the flow reaches the top of the chamber **24** and the flight **34,** it is transferred directly across to the upper end of the flight **36.** Thereafter the slurry moves down the flight **36,** in helical flow path to and through the outlet opening **32.** A down-

wardly expanding funnel element **38** forms an extension of the outlet opening **32.**

Note that there is in connection with the interior wall of the shell **10,** immediately above the lower cap **14** and in bridging relation to the shell, a transversely disposed support plate **40.** The plate **40** is suitably formed to receive and nest the lower end of the screen assembly and to provide passage to and from its inlet **30** and outlet **32.** The support plate is also fixed, both to the screen assembly and to the shell wall so as to mount the screen assembly in a stable vertically disposed position interiorly of the shell **10.** Centrally of the plate **40** is a drain outlet **42** the purpose of which shall soon become obvious.

As seen in FIG. **1** and **3,** externally of the shell **10** is a conduit **44** including an adapter connecting its discharge end to the inlet **30.** The remote end of conduit **44** may be suitably connected to means providing for delivery therethrough of a pressured flow of a pulp slurry.

Through the medium of the conduit **44,** a pulp slurry, under pressure, may be caused to enter the chamber **24** through the inlet **30** adjacent the lower terminus of one helical flight **34** to move immediately upward thereon from adjacent its lower end in a path the vertical limits of which are defined between the upper surface of flight **34** and the undersurface of flight **36.** Thus, the slurry introduced will be pressured to move through a spiral path defined between the flights **34** and **36** which have a 180° displacement. In the course of its upward flow, the slurry will be continuously based on the one helical flight **34** until it reaches its upper terminus, at which point it will be caused to cross over and to move in a descending spiral pattern, guided in this instance by the upper surface of the second helical flight **36.** The latter, as has been previously described, conducts the flow to discharge by way of the outlet **32** and through the funnel shaped discharge element **38,** directing the flow to eventually exit from the housing **10** at its bottom.

The construction is such that in the course of the above described upward and then downward spiral movement of a pulp slurry under pressure there is produced on the slurry a constantly increasing compressive force due to both friction and the influence of gravity. The diverse forces attendant the flow and the compression effect acting on the slurry to an extent and to a degree dictated by the hydrostatic forces involved in the pressured flow slurry induce a substantial amount of the liquid content of the slurry to be expressed through the perforations in both the inner screen **22** and outer screen **20.** As will be obvious concentric spaces are formed interiorly of and about the screen assembly in the shell **10** to provide for the expressed fluid to drop downwardly to the bottom of the shell. From the central space fluid exits by way of the central drain opening **42** and a liquid discharge conduit **46** in connection therewith. The extremity of the latter is directed outwardly of the housing or shell **10** for suitable transfer or disposal of the expressed fluid. Suitable passages (not shown) may be provided for drain of the peripheral drainage area within the housing and about the outer area of the screen assembly.

As shown schematically in FIG. **1,** in the use thereof illustrated on the thickener unit is so mounted to provide that its discharge funnel **38** opens to the feed inlet **48** of a press **50.** In the example illustrated the press shown is in the nature of a disc cone press, such as that contemplated in the United States Letters Patent No. 3,204,551 of Hjalmar S. Messing. It should be noted, however, that the press could just as well be a continuous screw type press and the pertinence and advantage of the invention application would be substantially equal. Of course, the details of the press per se, are not essential to an understanding of the present invention and are therefore not further described. Suffice it to say that with the thickener of the invention the press will function under minimal load and optimal efficiency.

The invention contemplates that pulp slurry will be fed to an embodiment such as illustrated at a one to five percent (1 to 5 percent) consistency and the effective operation of the unit will produce a thickening such that on discharge of the pulp slurry it will have from an eight to 12 percent (8 to 12 percent) consistency.

Thus, using the invention one can introduce slurry at a consistency as low as 1 percent and discharge slurry at a consistency, for example, as high as 12 percent.

Substantial significance of the invention structure here defined within the shell **10** resides in the fact it contemplates no moving parts. The advantages are self-evident. Further, the unit provided is quite obviously a space saver.

It should be further obvious that, with the application of the present pulp thickener in advance of a press, a press system will be provided capable of handing a substantially higher capacity of feed and of producing a substantially higher solid yield from a given slurry than would be possible in absence of the thickener. The economy and efficiency of the thickener of the invention is particularly evident when used in such a situation.

Attention is now directed to a further element that may be introduced in the invention system, though the same is not essential. Referring to FIG. **1** there shown is a pipe **52** which depends vertically through the housing to extend from its upper cap **12** and to open at its lower end to discharge interiorly of an expanded portion of the funnel element **38** providing for slurry discharge. In this case, the pipe **52** is adapted to be connected to a source of water, air or steam under pressure. It is useful where the range of consistency developed in use of the invention thickener so requires. Where the developed consistency is high, one may utilize the pipe **52** and apply a fluid such as described to produce in exit thereof within the discharge funnel element **38** a draw-down effect. This will have, where required, the beneficial effect of pulling down the material moving down the flight **36** and expediting thereby the flow through the thickener.

It is emphasized that here an invention embodiment is only schematically illustrated. The invention does contemplate various modifications may be made within the framework of the structural concept here presented. Of course, suitable stiffening means (not shown) may be placed between the screen assembly and the wall of the shell or housing **10,** as required to insure stability and concentricity of the screen assembly and for its optimal position and function.

As seen in FIG. **2,** the top cap **12** of the housing **10** has a central opening sealed by a releasable closure plate **54.** On removal of the latter one can effect clean out or maintenance procedures as may be required.

The invention very simply provides, in the course of a helical flow of slurry moving up and down a tubular

chamber, a net result of substantial thickening or dewatering without the need for other than the application of hydrostatic pressure on the slurry introduced to the thickener.

From the above description it will be apparent that there is thus provided a device of the character described possessing the particular features of advantage before enumerated as desirable, but which obviously is susceptible of modification in its form, proportions, detail construction and arrangement of parts without departing from the principle involved or sacrificing any of its advantages.

While in order to comply with the statute the invention has been described in language more or less specific as to structural features, it is to be understood that the invention is not limited to the specific features shown, but that the means and construction herein disclosed comprise but one of several modes of putting the invention into effect and the invention is therefore claimed in any of its forms or modifications within the legitimate and valid scope of the appended claims.

Having thus described my invention, I claim:

1. A pulp thickener comprising means defining a flow chamber having an inlet thereto and an outlet therefrom, said flow chamber being defined by at least pair of tubular elements one of which is positioned within the other and at least one of which is apertured, two helically wrapped blade elements displaced about 180°, one leading from said inlet and the other terminating at said outlet, said blade elements having a spiral disposition between said tubular elements and a fixed position inhibiting movement thereof within said chamber, said blade elements forming flow guides and individually defining the base of a separate portion of a flow path extending from said inlet to said outlet, a pulp slurry moved through said path from one portion to another having fluid expressed therefrom through an apertured portion of said flow chamber, said inlet and said outlet being to the same end of said flow chamber and said means defining said flow chamber further including a housing forming a drain receptacle for expressed fluid.

2. A pulp thickener without moving parts and located in a system flowing a pulp slurry under pressure, including a vertically oriented shell, a pair of concentric tubular screens mounted on end in said shell and defining with said shell inner and outer annular spaces as well as a central space in the inner one of said screens, both the outer annular space as well as said central space, draining to the bottom of said shell, means defining a reversing spiral channel in said inner annular space in simultaneous continuous communication through said screens with said outer annular space and said central space, and inlet and outlet means in said shell located at one end of said shell to admit a relatively thin pulp slurry to said spiral channel and to discharge a thickened slurry therefrom, the consistency of the pulp slurry being affected by an expression of liquid through said screens.

3. A pulp thickener according to claim **2,** wherein said spiral channel is formed by helical means disposing in said inner annular space having opposite side edges in substantially contacting relation to respective screens and providing a continuously inclining surface over which the pulp slurry flows in moving from said inlet means to said outlet means.

4. A pulp thickener according to claim **3,** wherein said helical means defines a flow path having said inlet means and said outlet means at opposite terminals thereof.

5. A pulp thickener without moving parts and located in a system flowing a pulp slurry under pressure, including a vertically oriented shell, a pair of concentric tubular screens mounted on end in said shell and defining with said shell inner and outer annular spaces as well as a central space in the inner one of said screens, both the outer annular space as well as said central space, draining to the bottom of said shell, means defining a spiral channel in said inner annular space in simultaneous continuous communication through said screens with said outer annular space and said central space, said spiral channel being formed by helical means disposing in said inner annular space having opposite side edges in substantially contacting relation to respective screens and providing a continuously inclining surface defining a flow path, and inlet and outlet means in said shell located at opposite terminals of said flow path to admit a relatively thin pulp slurry thereto and to discharge a thickened slurry therefrom, the consistency of the pulp slurry being affected by an expression of liquid through said screens, said inlet means and said outlet means being at the same end of said shell, the flow path defined by said helical means extending continuously in a direction outward of said one end of the shell and then reversely back to said one end.

6. A pulp thickener according to claim **5,** wherein said helical means in the form of two helically wrapped blade elements forming separate flow path portions in respectively separate communication at their one ends with said inlet and outlet means and in open communication with another at their opposite ends.

7. A pulp thickener according to claim **6,** wherein said inlet and outlet means are in the lower end of the shell, characterized by closure means for said lower end of the shell providing a seat for said screens and incorporating openings providing said inlet and outlet means and a drain for expressed liquid.

8. A pulp thickener without moving parts comprising a flow chamber defined by at least one pair of tubular elements one of which is positioned within the other and at least one of which is apertured, a plurality of helically wrapped blade elements displaced from one another between said tubular elements and defining therewith a reversing flow path in said flow chamber, inlet means for directing a thin slurry into one end of said flow path at one end of said chamber, and outlet means for discharging a thickened slurry from a remote end of said flow path at the same said end of said chamber.

9. A pulp thickener according to claim **8,** wherein both said tubular elements are apertured, characterized by a shell surrounding said tubular elements and defining therewith inner and outer annular spaces, said inwardly positioned tubular element defining a central space, both said outer annular space and said central space draining to the bottom of said shell and said helically wrapped blade elements occupying said inner annular space, said thickener orienting to dispose one end relatively lower than the other, the lower end of the shell defining the bottom thereof, and closure means at the said bottom end of said shell providing therein said slurry inlet and outlet and a drain for fluids escaping from said inner annular space into said outer annular space and said central space.

* * * * *

UNITED STATES PATENT OFFICE

CERTIFICATE OF CORRECTION

Patent No. 3,754,658 Dated August 28, 1973

Inventor(s) Hjalmar S. Messing (Deceased) Mary Agnes Messing, Executrix

It is certified that error appears in the above-identified patent and that said Letters Patent are hereby corrected as shown below:

Col. 3, line 65, delete "on".

Signed and sealed this 5th day of March 1974.

(SEAL)
Attest:

EDWARD M.FLETCHER,JR.
Attesting Officer

C. MARSHALL DANN
Commissioner of Patents

USCOMM-DC 60376-P69
★ U.S. GOVERNMENT PRINTING OFFICE : 1969 O—366-334.