

May 10, 1955

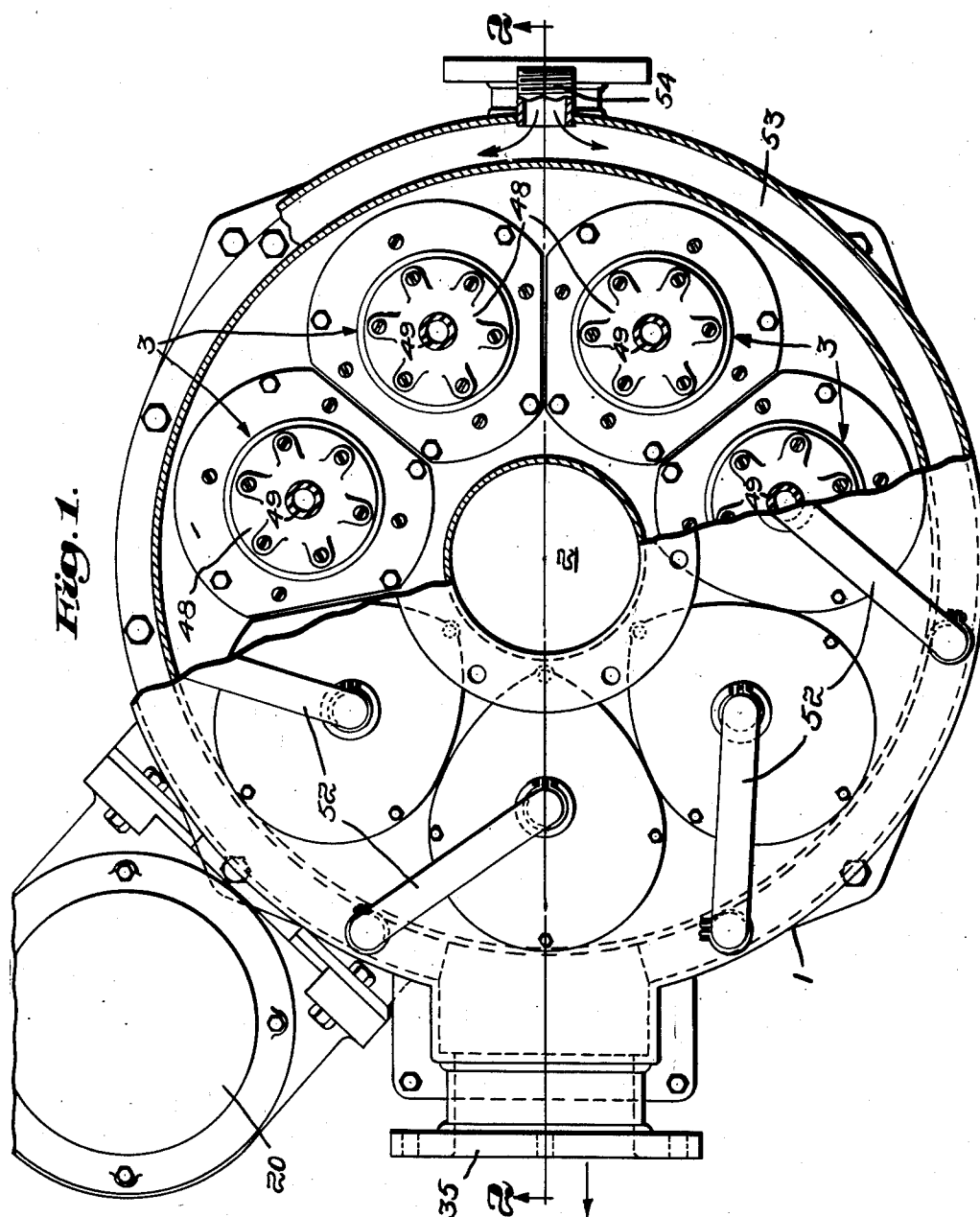
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2,707,905

PULP SCREEN

Filed April 1, 1953

9 Sheets-Sheet 1



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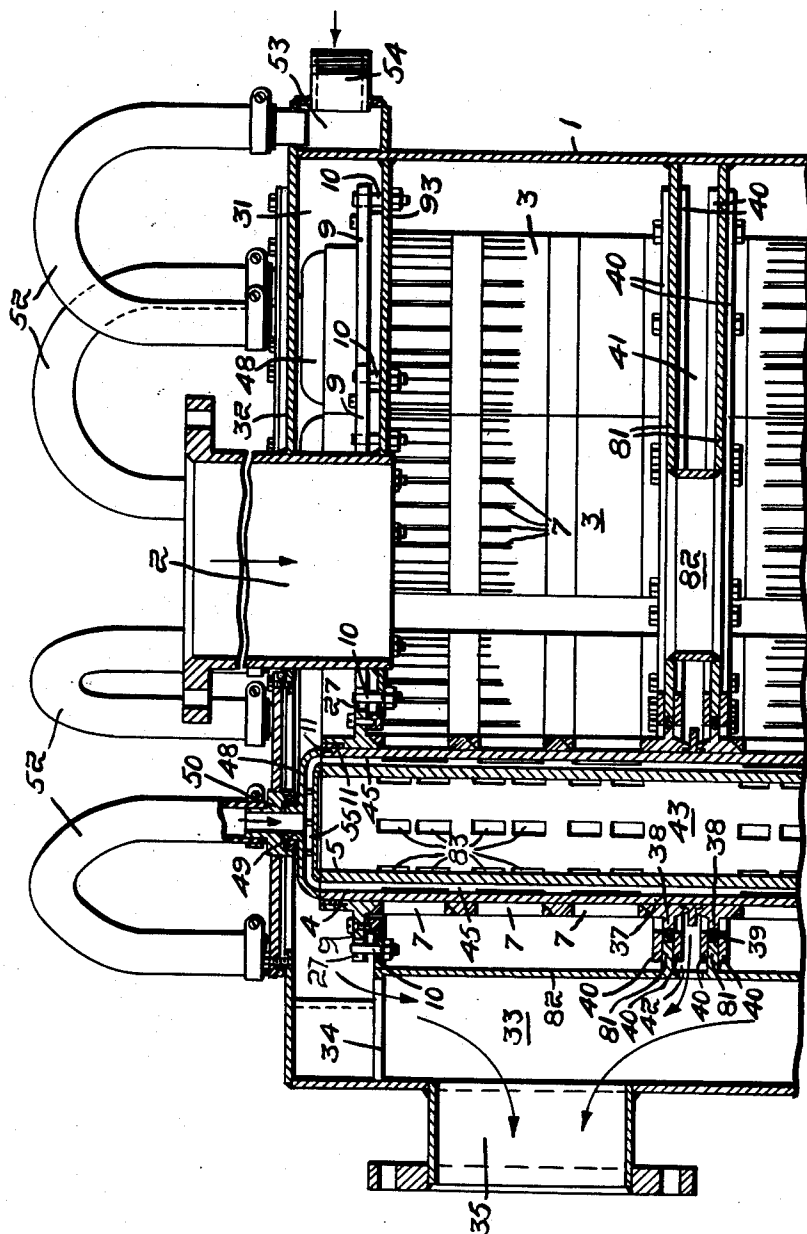
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Fig. 2.



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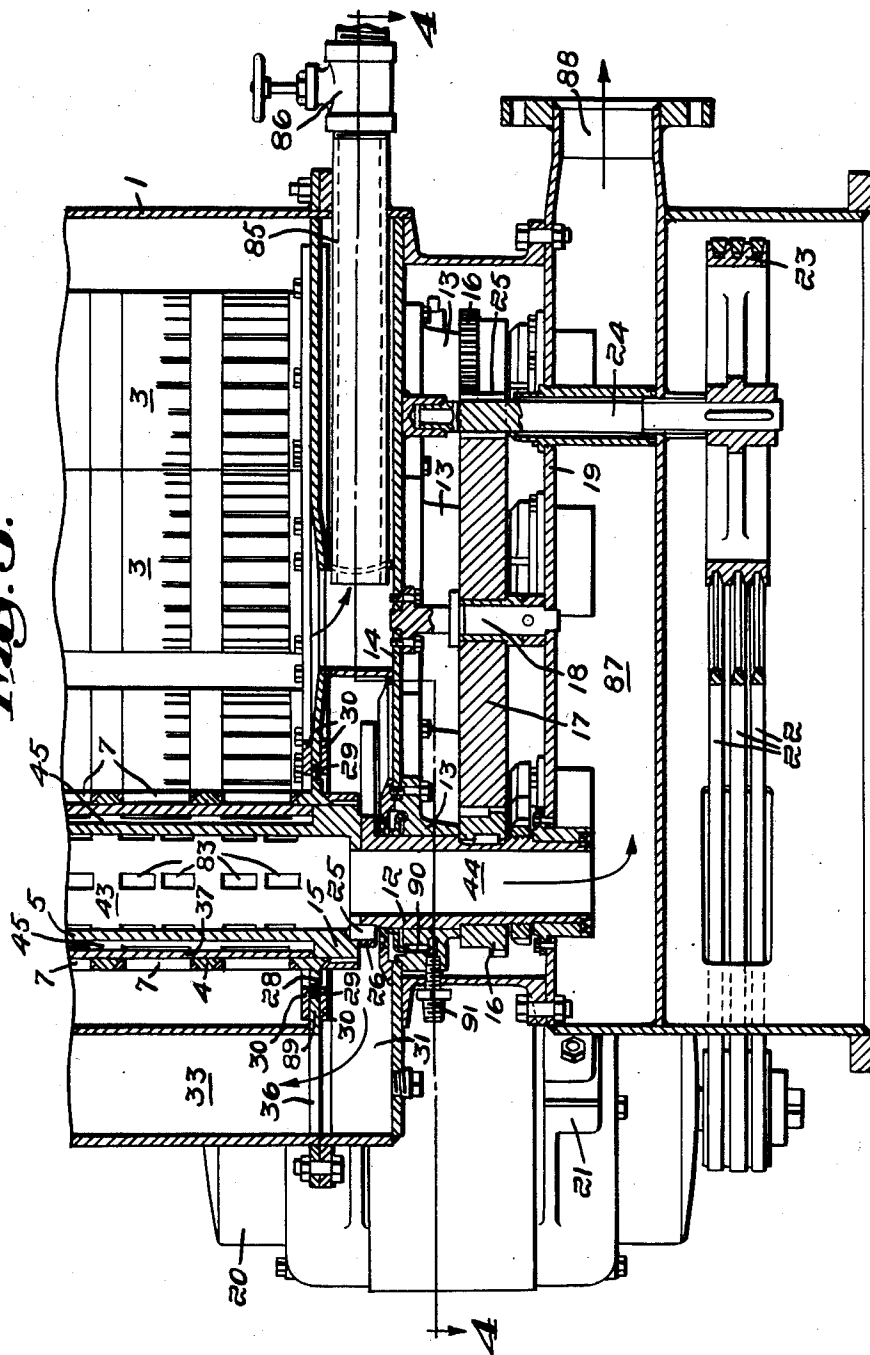
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Fig. 3.



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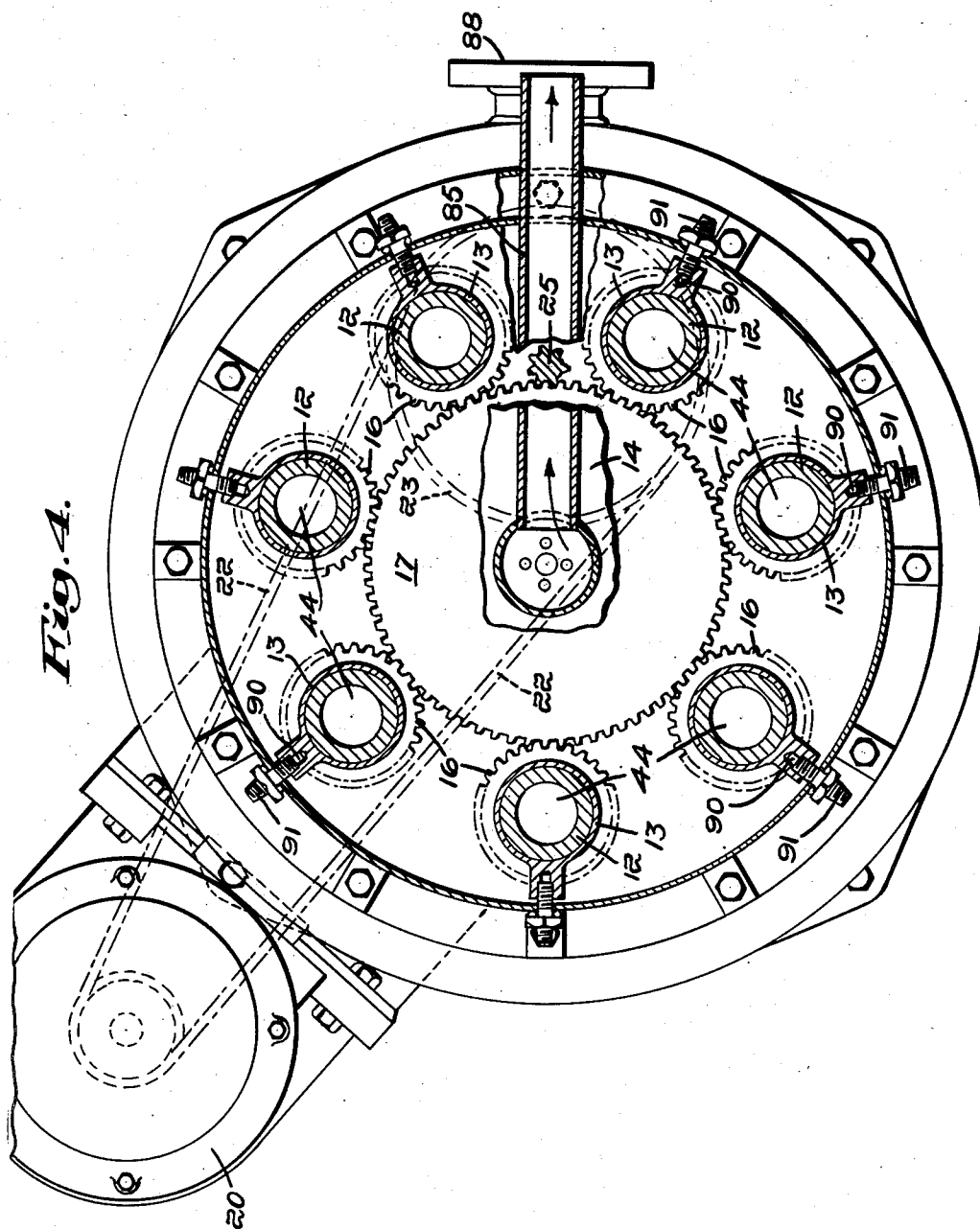
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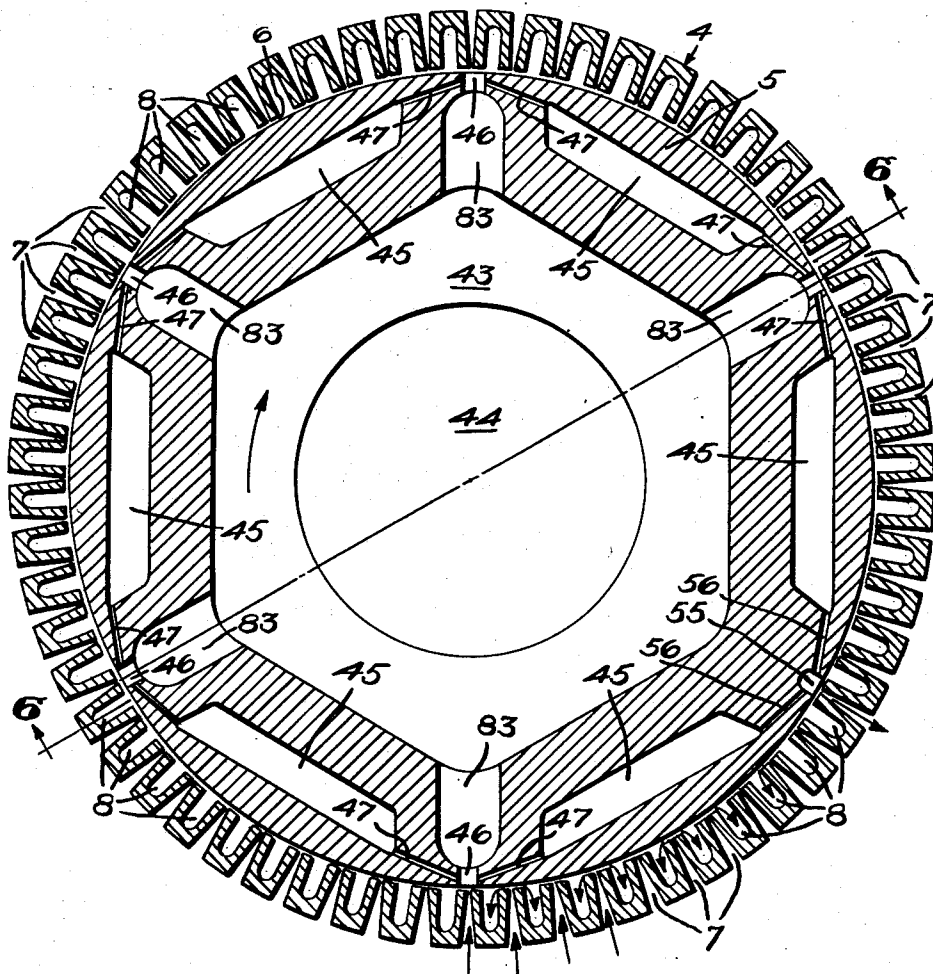
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Fig. 5.



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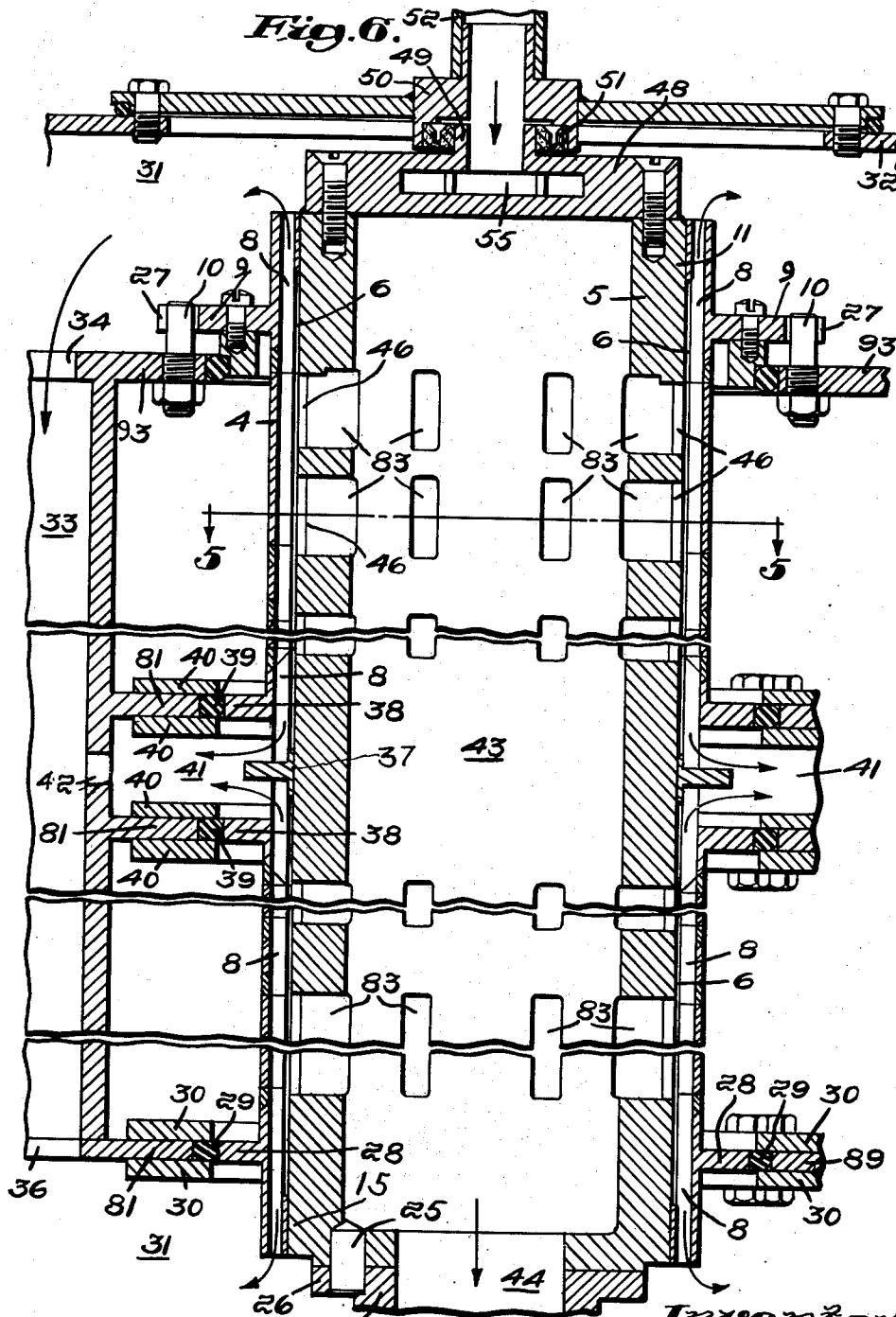
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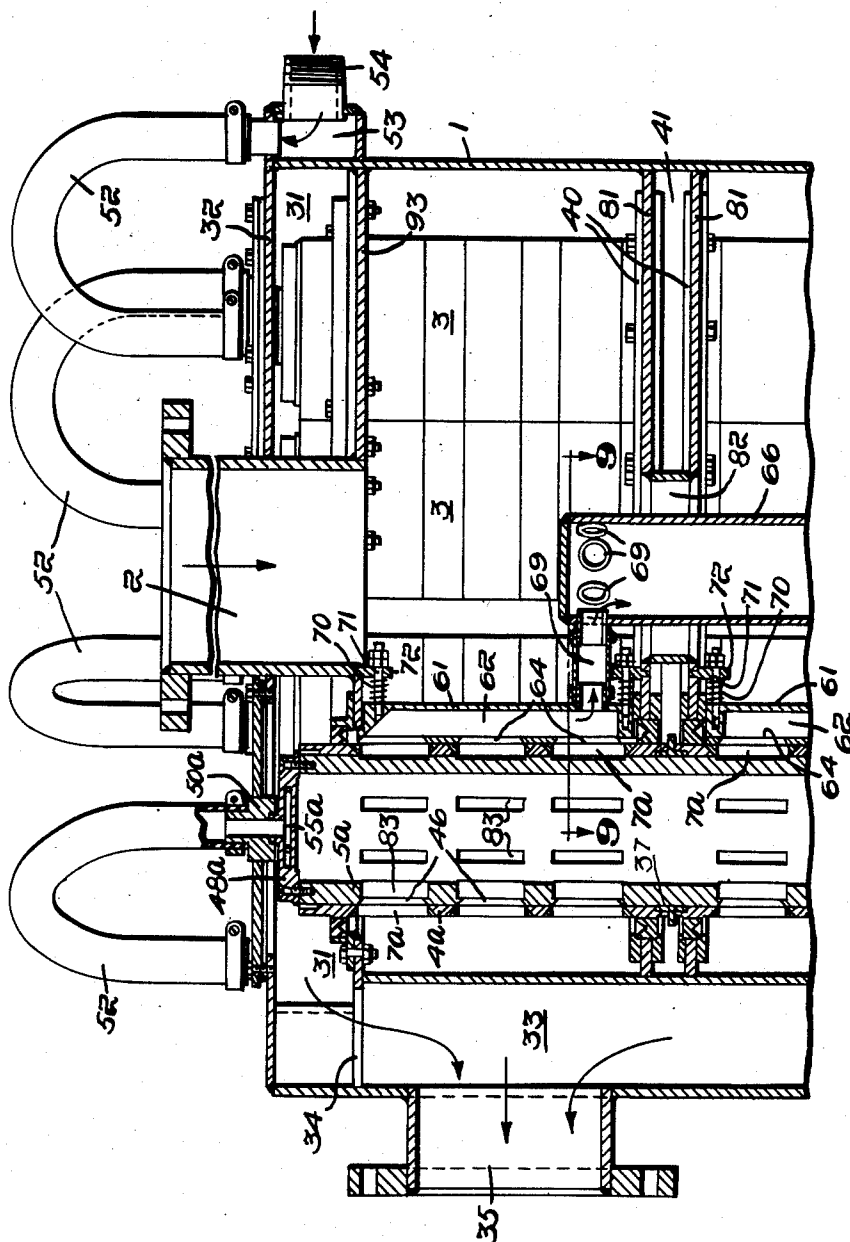
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Fig. 2.



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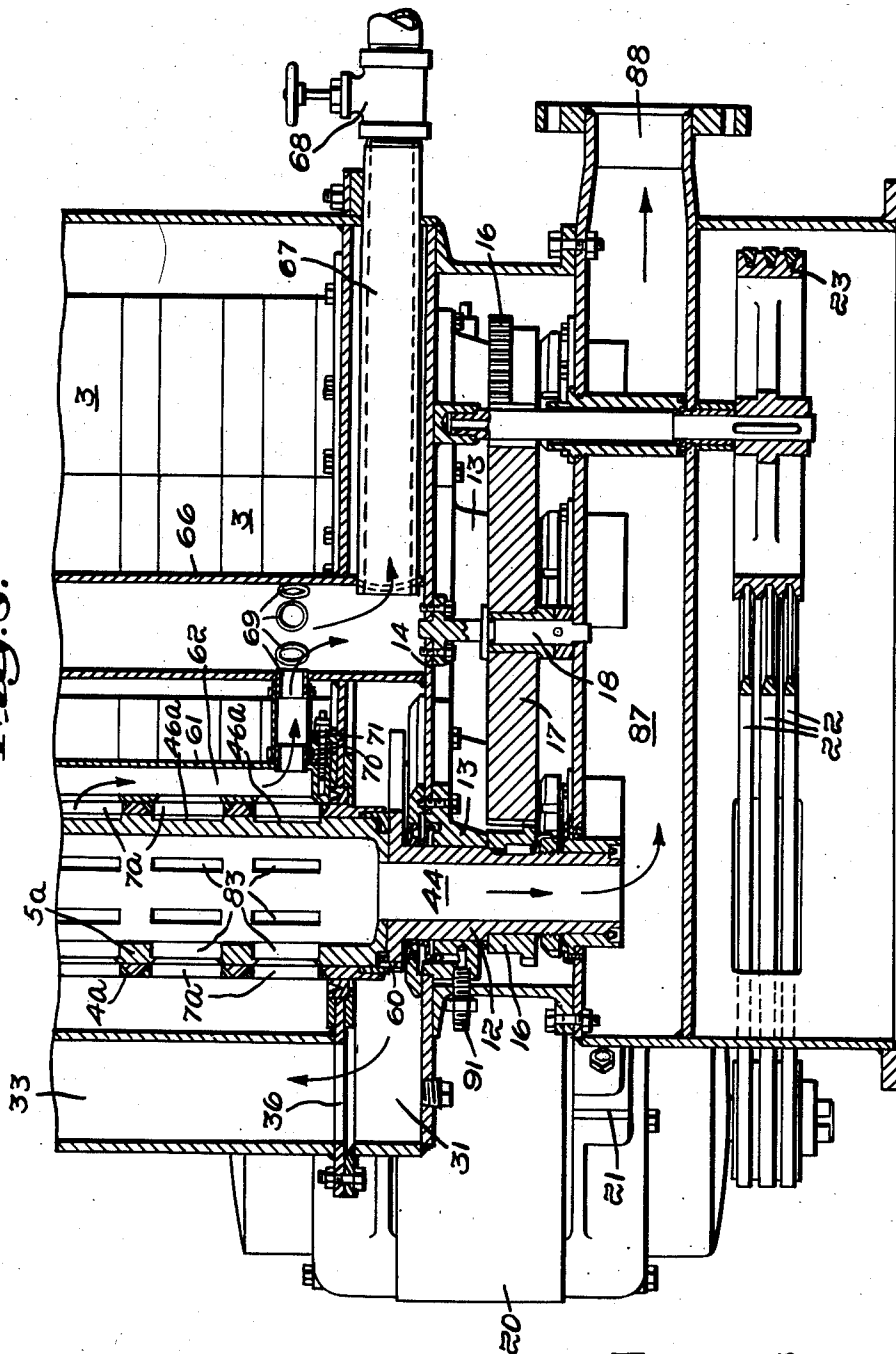
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Fig. 8.



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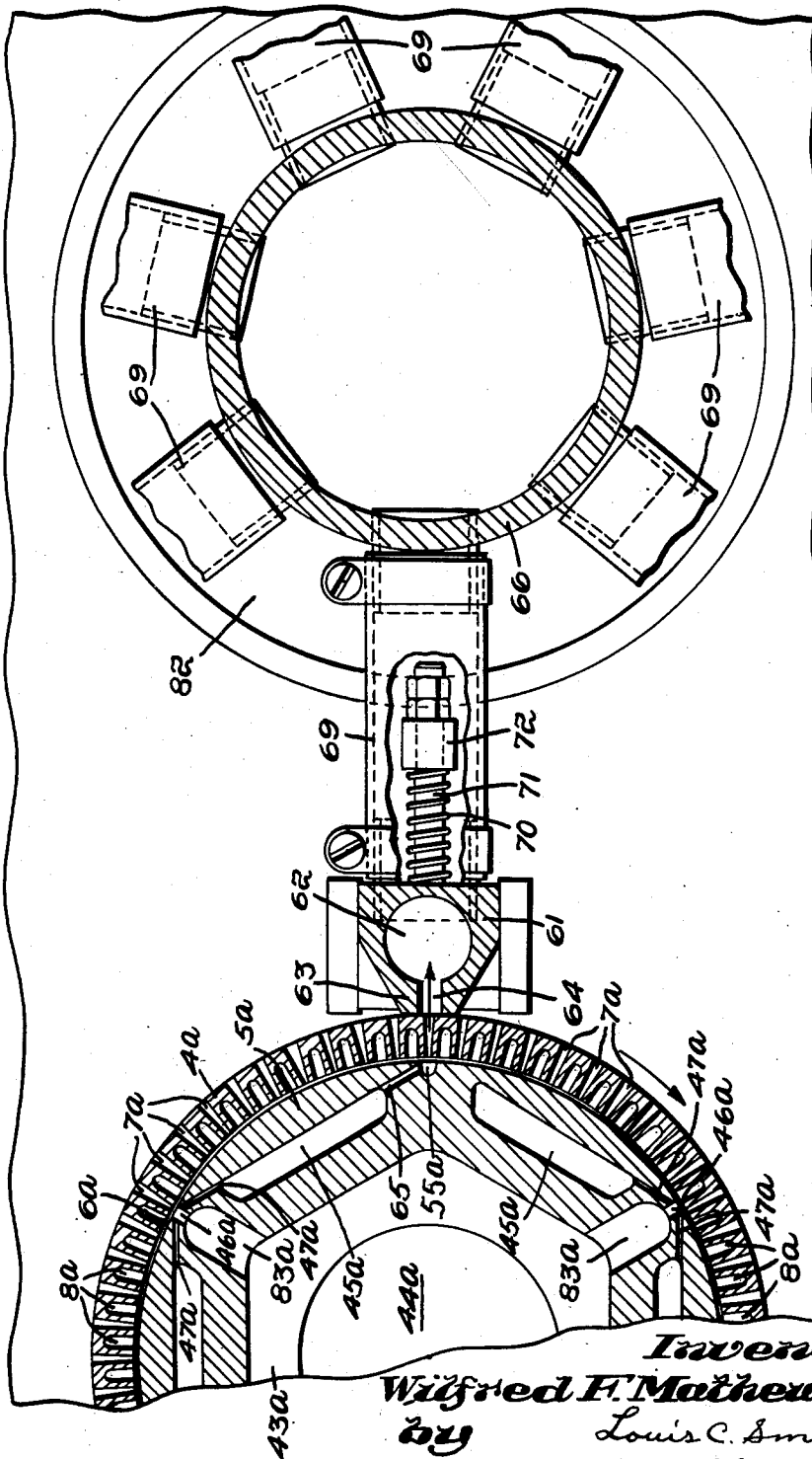
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Fig. 9.



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PULP SCREEN

Wilfred F. Mathewson, Boston, Mass.

Application April 1, 1953, Serial No. 346,194

13 Claims. (Cl. 92—35)

This invention relates to pulp screens, and especially to pulp screens of the type shown in my Patents Nos. 2,450,838, dated October 5, 1948; 2,525,701, dated October 10, 1950, and 2,682,812, dated July 6, 1954.

The pulp screen shown in each of said patents and application comprises a casing to which unscreened pulp is delivered and which encloses a screening unit provided with two concentrically arranged cylindrical screening elements forming between them an annular clearance space of a size to permit the acceptable portion of unscreened pulp to pass therethrough, but of insufficient size to allow the unacceptable portion of such pulp to pass. One of the said two screening elements is provided with a plurality of inlet slots which extend parallel to the axis of said element and provide passages through which the pulp flows from the mass of unscreened pulp into said clearance space. Said screening element is also provided with a plurality of discharge grooves which are parallel to the slots and which are open to the clearance space, the slots and grooves preferably being alternately arranged.

The screening operation involves the passage of the unscreened pulp through the inlet slots into the clearance space and the flow of the acceptable portion of said pulp through the clearance space and into the discharge grooves which deliver the screened pulp into a receiving chamber with which the grooves communicate. One or both of the screening elements are rotated about the common axis during this pulp-screening operation.

In the patents above referred to there is a single screening unit in the casing, while in the device shown in my Patent No. 2,682,812 there are a plurality of separate, independent screening units located within the casing and arranged in circular formation, the screened pulp from each screening unit being delivered to a common receiving chamber.

When the pulp screen is in use there is a possibility that during the screening operation some fibres or flocks may get caught on the edge of the partition dividing an inlet slot from a discharge groove either at the point where the inlet slot opens into the clearance space or at the point where the clearance space communicates with the discharge groove. The accumulation of fibres at this point will clog the clearance space and unless the clogging fibres are removed, the clearance space may become obstructed to such an extent as to materially interfere with the screening operation.

It is, therefore, one object of the present invention to provide means for progressively flushing the clearance space of the screening unit in a circumferential direction, such flushing operation serving to flush from the clearance space any obstruction to the flow of the stock into said clearance space which may interfere with the screening operation.

In my Patent No. 2,525,701 and also in my Patent No. 2,682,812 the inlet slots are shown as tapered, said slots being widest at the entrance edge and narrowest at the edge that opens into the clearance space. With inlet

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slots having this construction there is a possibility that some unacceptable portion of the pulp stock or some flocks resulting from the flocculation of the pulp may flow into the wider entrance edge of the slot and become lodged therein because of the decreasing width of the slot, thereby clogging the slot and interfering with the screening operation.

It is, therefore, another object of my invention to provide means for periodically back-washing the various inlet slots by delivering into the narrow edge of the slot water under pressure which will serve to flush the slot and force back out of the slot any flocks or other material which is clogging the slot, thereby freeing the slot for continued screening operation.

Referring now to the drawings, wherein I have illustrated some selected embodiments of my invention:

Fig. 1 is a plan view of a pulp screen embodying the invention with a portion broken out.

Fig. 2 is a section through the upper part of the casing on the line 2—2, Fig. 1.

Fig. 3 is a section through the lower part of the casing on the same line.

Fig. 4 is a section on the line 4—4, Fig. 3.

Fig. 5 is an enlarged cross sectional view through one of the screening elements.

Fig. 6 is a section on the line 6—6, Fig. 5.

Fig. 7 is a section similar to Fig. 2 but illustrating a different embodiment of the invention.

Fig. 8 is a section similar to Fig. 3 but illustrating said different embodiment of the invention.

Fig. 9 is an enlarged section on the line 9—9, Fig. 7.

Referring first to Figs. 1 to 6, 1 indicates a casing having in its upper end an inlet opening 2 through which unscreened pulp is delivered to the interior of the casing, and also having located therewithin a plurality of separate screening units 3, said screening units being illustrated as being arranged in circular formation, as shown best in Fig. 1.

Each screening unit is of the type illustrated in my above mentioned patents and application, and comprises two concentrically arranged screening elements 4, 5 having a common axis and providing between them a clearance space 6 which is of a size to permit acceptable portions of the pulp stock to pass therethrough but which is insufficient in size to allow unacceptable portions of the stock to pass. The outer screening element 4 is provided with a plurality of vertical inlet slots 7 which lead from the exterior of the screening element into the clearance space 6, and said outer screening element also is provided with a plurality of discharge grooves 8 which communicate with the clearance space and extend parallel to the inlet slots 7. The inlet slots and discharge grooves are preferably arranged alternatively as best seen in Fig. 5.

As stated above, the screening operation involves the flow of the stock to be screened through the inlet slots 7 into the clearance space 6, and from the clearance space into the discharge grooves 8, all of which communicate with a receiving chamber into which the screened stock is delivered.

In the construction shown in Figs. 1—6, the outer screening element 4 is stationarily mounted and the inner screening element 5 is rotatively mounted. The outer screening element of each screening unit is provided at its upper end with a flange 9 which is anchored to an upper partition 93 with which the casing 1 is provided.

The upper end 11 of the inner screening element 5 is of a size to fit the interior of the outer screening element 4, said screening element 4 thus providing a bearing for the upper end of the rotating inner screening element 5. The clearance space 6 above referred to does not extend clear to the upper end of the screening units,

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said clearance space terminating at its upper end just below the bearing portion 11.

The lower end of the inner screening element 5 is provided with a hollow shaft 12 which depends through a bearing 13 carried by a lower partition 14 with which the casing 1 is provided. The lower end 15 of the inner rotary screening element has a bearing in the lower end of the outer screening element 4, the clearance space between said elements terminating at its lower end just above the bearing portion 15.

Since the inner screening element has a bearing in the outer screening element at both the top and the bottom thereof, the clearance space 6 between said elements will always be maintained at a constant dimension.

As stated above, the inner screening element is a rotary element and to provide for its rotation the hollow shaft 12 has mounted thereon a gear 16 which meshes with a large gear 17 rotatably mounted on a stud 18 which is secured at its upper end in the partition 14 and in its lower end in a partition 19 which forms the bottom of a gear chamber in which the gears are enclosed. The large gear 17 is driven from a suitable motor 20 which is mounted on a supporting bracket 21 secured to the casing, the shaft of said motor being belted by driving belts 22 to a pulley 23 carried by a drive shaft 24 that is mounted in suitable bearings carried by the casing. The shaft 24 has a small pinion 25 thereon which meshes with and drives the gear 17.

The gear 17 is centrally located and it meshes with and drives the gear 16 for each of the screening units, as best seen in Fig. 4, said gear 17 thus being common to all of the screening units.

The hollow shaft 12 for each screening unit is shown as connected to its inner screening element 5 through the medium of a driving pin 25 which is mounted in a flange 26 with which the shaft 12 is provided and the upper end of which is received in a socket formed in the lower end of the screening unit 5.

The outer screening unit 4 of each screening element is yieldingly mounted in the casing so as to allow for a certain amount of lateral movement during the rotation of the inner screening element provided there is even the least deviation between the axis of the shaft 12 and the axis of the inner screening unit 5. For this purpose, the anchoring pins 10 for each outer screening element 4 occupy slots 27 in the flange 9, and the lower end of the outer screening element is provided with a flange 28 which is surrounded by a ring 29 of rubber or other yielding material that is confined between two annular plates 30.

By thus yieldingly mounting the outer screening element, the latter will have sufficient lateral movement to prevent any binding action between the screening elements in case there is any disalignment between the axis of the inner screening element 5 and the axis of the shaft 12.

The discharge grooves 8 of all of the screening units 3 open at their upper ends into an upper receiving chamber 31 which is located between the upper partition 23 and the top 32 of the casing, said upper receiving chamber 31 communicating with a vertically extending space 33 through an opening 34, said space 33 also communicating with a screened pulp discharge opening 35. The discharge grooves 8 open at their lower ends into a lower receiving chamber 31 which is common to all the screening elements, and said chamber 31 communicates through an opening 36 with the lower end of the vertical passage 33, as shown in Fig. 3.

By this means the screened pulp from all of the screening units is delivered into the common receiving chambers 31, and from said chambers is delivered to the screened pulp discharge opening 35 through the vertical passage 33.

If desired, I may provide the inner and outer screening elements with a central bearing, as shown at 37 in Fig. 2, and where this construction is employed the

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central portion of the outer screening element will have a yielding mounting of the character used for the lower end thereof. As shown in Fig. 2, the central portion of the outer screening element has two spaced flanges 38, each of which is encircled by a cushioning ring 39 held between two annular plates 40.

The discharge grooves 8 of the outer screening element are divided into two sections, an upper section above the central bearing 37 and a lower section below said central bearing. The casing is provided with an auxiliary receiving chamber 41 into which the lower ends of the upper sections of the discharge grooves open and into which the upper ends of the lower sections of the discharge grooves likewise open, so that the screened pulp will be delivered into this auxiliary receiving chamber 41. Said chamber 41 opens into the vertical space 33 through a discharge opening 42, as seen best in Fig. 2.

This inner rotary screening element 5 is provided with a central chamber 43 which communicates at its lower end with the opening 44 through the hollow shaft, as shown in Fig. 3, and said inner screening element is also provided with a plurality of flushing chambers 45 which extend longitudinally of the screening element. Said inner screening element 5 is further provided in its periphery with vertically extending flushing grooves 46 that open into the clearance space 6, said grooves also communicating with the chamber 43 through openings 83.

Means are provided for maintaining water under pressure in the flushing chambers 45, and there is provided jet openings 47 between the flushing members 45 and the flushing grooves 46. As illustrated in Fig. 5, there is a flushing groove 46 between each two adjacent flushing chambers 45, and each chamber 45 communicates with the adjacent flushing grooves 46 through the jet openings 47.

Means for maintaining the flushing chambers 45 filled with water under pressure will be presently described.

With this construction it will be observed that the jets of water under pressure issuing from the jet apertures 47 will serve to flush the clearance space 6, and since the inner screening element 5 is rotating, this flushing action through each flushing groove 46 will be carried on progressively in a circumferential direction. Such continuous progressive flushing will serve to keep the clearance space clear from any flock or obstruction that tends to accumulate at the point where the inlet slots 7 open into said clearance space.

The material flushed from the clearance space, which constitutes the rejects and tailings, will pass into the chamber 43 through the openings 83. From said chamber the rejects and tailings flow through the shaft 12 into the chamber 87 and are drained off through the drain pipe 88.

The upper end of each inner screening element is closed by a cap member 48 which is rigidly secured thereto, as shown in Fig. 6. Said cap is provided at its upper end with a hub 49 which extends into the lower end of a fixed support member 50 which has a through opening, an annular cushion seal member 51 being interposed between the hub 49 and the member 50. The member 50 for each screening unit has connected thereto one end of a U-shaped supply pipe 52, the other end of said supply pipe leading into an annular chamber 53 surrounding the top of the casing. This chamber 53 is supplied with water under pressure through an inlet opening 54. The head 48 of each screening unit is provided with interior chambers 55 which communicate with the various flushing chambers 45. By this means all the flushing chambers 45 of each of the screening units is supplied with the flushing water under the desired pressure.

In addition to the means for progressively flushing the clearance space in a circumferential direction, there is also provided means for back-washing the inlet slots 7 to flush backwardly out of each slot any flock or accumulation of unacceptable stock which may enter the

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wide end of any slot and become lodged therein because of the progressively decreasing width of the slot. For this purpose the inner screening element is provided with a back-washing slot 55 which is similar to the flushing slots 46 but has no communication with the chamber 43. This back-washing slot 55, however, communicates through jet openings 56 with the adjacent flushing chambers 45, said jet openings 56 having a larger diameter than the jet openings 47. As the inner screening element rotates, the back-washing slot 55 will move progressively past the various inlet slots, and as said flushing opening comes into registry with any inlet slot the jets of water under pressure delivered through the opening 56 will provide a back-washing flow of water through the clearance space and into the inner narrow end of the inlet slot, and thereby any material which may have become lodged in said inlet slot will be forced back through the slot into the space outside of the screening unit.

This back-washing slot 55 operates to back-wash the inlet slots sequentially, and hence each slot will have a back-washing operation for each rotation of the inner screening element 5.

In the construction shown in Figs. 1-6 the material which is back-washed from any inlet slot is delivered into the mass of unscreened pulp within the casing.

In Figs. 7-9 I have shown a different embodiment of the invention in which a back-wash receiving chamber is provided to receive the back-wash from each inlet slot. In the construction shown in Figs. 7-9, the outer screening element is mounted for rotation and the inner screening element is held stationary. The device of Figs. 7-9 is also provided with a stationary back-wash receiving chamber located exteriorly to the rotating outer screening element and with which the inlet slots come into registry sequentially as the outer screening element rotates. The back-washing groove of the stationary inner screening element is located opposite the back-wash receiving chamber so that as the various inlet slots move between the back-wash groove and the back-wash receiving chamber, the material in the inlet grooves is forced into the back-wash chamber.

In the construction shown in Figs. 7-9 the outer screening element is indicated at 4a and the inner screening element at 5a. In this construction the outer screening element 4a is secured to the hollow shaft 12 by means of a coupling pin 60, and the head 48a of the inner screening element is secured to the supporting member 50a. The shaft 12 is rotated by the same driving means above described and illustrated in Figs. 3 and 4.

Located exterior to the rotating outer screening member 4a of each screening unit is a back-wash receiving member 61 having a central vertically extending chamber 62 and provided with lip portions 63 which bear against the exterior of the rotating outer screening element 4a and form between them a slot 64 which opens into the chamber 62. In this embodiment the stationary inner screening element 5a is provided with a vertically extending back-washing slot 55a similar to the slot 55 of Fig. 5, said slot being connected to one of the flushing chambers 45 through a jet opening 65.

As each inlet slot 7a passes between the flushing groove 55a and the throat 64, the force of the water delivered through the jet openings 65 will establish a back-washing current from the back-washing groove 55a through the slot into the chamber 62, so that as each inlet slot is back-washed the discharge from said slot is delivered into the back-wash receiving chamber 62.

It will be understood that there is a similar back-wash receiving chamber for each of the screening units 3 and each back-wash receiving chamber 62 has communication with a central chamber 66 so that the back-wash from each of the screening units is delivered into said chamber 66. Said chamber has a discharge pipe 67 extending from its lower end through which the accumulated back-wash may be discharged, said pipe being

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controlled by a suitable valve 68. For connecting each back-wash receiving chamber 62 to the central chamber 66 there is provided a series of pipe connections 69.

In order to provide a proper contact of the lips 63 with the exterior of the rotating outer screening element 4a I have provided a mounting for the back-wash receiving chambers which includes springs 70 that yieldingly press the back-wash receiving member toward the screening element. Each back-wash receiving member 61 is provided with pins 71 which extend through lugs 72 carried by the casing, said spring 70 being confined between the lugs and the member 61.

Where the screening elements are provided with a central bearing and the discharge grooves and inlet slots are formed in upper and lower sections, I propose to employ an upper and a lower back-wash receiving member for each screening unit, the upper back-wash receiving member delivering into the upper end of the central chamber 66 and the lower back-wash receiving chamber delivering into the lower portion of said chamber 66, as shown in Fig. 8.

I claim:

1. A pulp screen comprising two concentrically arranged screening elements forming between them an annular clearance space of a size to permit acceptable portions of pulp stock to pass therethrough but of insufficient size to permit unacceptable portions of said stock to pass therethrough, the outer screening element having a plurality of inlet slots leading to said clearance space through which pulp stock to be screened is delivered thereto, and also having a plurality of discharge grooves extending parallel to the slots and open to said clearance space, whereby acceptable portions of the pulp stock may pass through the inlet slots to the discharge grooves through the clearance space, a chamber communicating with all of said discharge grooves and into which the screened stock is delivered through said grooves, means for rotating one of said screening elements about its axis, the inner screening element having an interior tailings-receiving chamber which communicates with the clearance space, and means separate from the tailings-receiving chamber to deliver jets of flushing water into said annular clearance space progressively in a circumferential direction while maintaining the normal forward flow of pulp stock through the inlet slots and the normal flow of tailings into the tailings-receiving chamber.

2. A pulp screen as defined in claim 1 in which the inner screening element has a flushing chamber separate from the tailings-receiving chamber and extending longitudinally thereof and means are provided for supplying said chamber with water under pressure, and in which the inner screening element has a plurality of jet openings leading from the flushing chamber and adapted to deliver water under pressure from said flushing chamber into the clearance space, thereby flushing therefrom any pulp material which has become lodged therein while maintaining the normal forward flow of pulp stock through the inlet slots.

3. A pulp screen as defined in claim 1 in which the inner screening element has a central chamber and a slot which provides communication between said chamber and the clearance space, and means are provided to deliver jets of water under pressure into said slot thereby to flush into said chamber any flocks or unacceptable portions of the pulp stock which may have become lodged in the clearance space.

4. A pulp screen as defined in claim 1 in which the inner screening element has a central tailings-receiving chamber and a plurality of slots, each of which provides a passageway between the clearance space and said chamber, and which includes means for delivering jets of water under pressure into each slot thereby to flush into said chamber flocks and unacceptable portions of the pulp stock which may have become lodged in the clearance space while maintaining the normal forward

flow of pulp stock through the inlet slots and the normal flow of tailings into the tailings-receiving chamber.

5. A pulp screen as defined in claim 1 in which the inner screening element has a central tailings-receiving chamber and also has a plurality of flushing chambers, each of which is connected to the clearance space through a plurality of jet openings, and means are provided to supply the flushing chambers with water under pressure whereby the jets of water delivered from the jet openings flush from said clearance space into the central tailings-receiving chamber any portions of the pulp stock that become lodged in the clearance space.

6. A pulp screen comprising two concentrically arranged screening elements forming between them an annular clearance space of a size to permit acceptable portions of pulp stock to pass therethrough but of insufficient size to permit unacceptable portions of said stock to pass therethrough, the outer screening element having a plurality of inlet slots leading to said clearance space through which pulp to be screened is delivered thereto, and also having a plurality of discharge grooves extending parallel to the slots and open to said clearance space, whereby acceptable portions of the pulp stock may pass through the inlet slots to the discharge grooves through the clearance space, a chamber communicating with all of said discharge grooves and into which the screened stock is delivered through said grooves, means for rotating one of said screening elements relative to the other, said inner screening element having a tailings-receiving chamber which communicates with the clearance space, and means separate from the tailings-receiving chamber to deliver water under pressure into the delivery side of the inlet slots successively thereby to back-wash the slots sequentially and clear therefrom any flocks or unacceptable portions of the pulp stock that may become lodged therein.

7. A pulp screen as defined in claim 6 in which the means for delivering the water under pressure into the delivery side of each slot is carried by the inner screening element.

8. A pulp screen as defined in claim 6 in which the water under pressure is delivered into the delivery side of the slots one at a time and successively.

9. A pulp screen comprising two concentrically arranged screening elements forming between them an annular clearance space of a size to permit acceptable portions of pulp stock to pass therethrough but of insufficient size to permit unacceptable portions of said stock to pass, the outer screening element having a plurality of inlet slots leading to said clearance space through which pulp to be screened is delivered thereto, said slots being wider at the input side than at the delivery side that opens into the clearance space, said outer screening element also having a plurality of discharge grooves extending parallel to the slots and open to said clearance space, whereby acceptable portions of the pulp stock may pass through the inlet slots to the discharge grooves through the clearance space, a chamber communicating with all of said discharge grooves and into which the screened stock is delivered through said grooves, means for rotating the outer screening element, means for delivering water under pressure into the narrow delivery sides of the various slots successively to back-wash said slots sequentially and clear them from any flocks or unacceptable portions of pulp stock that may have become lodged therein, and a stationary back-wash receiving chamber situated exterior to the outer screening element closely adjacent thereto and in position to receive the back-wash from each slot as it passes said member.

10. A pulp screen comprising two concentrically arranged screening elements forming between them an annular clearance space of a size to permit acceptable portions of pulp stock to pass therethrough but of insufficient size to permit unacceptable portions of said stock

to pass therethrough, the outer screening element having a plurality of inlet slots leading to said clearance space through which pulp to be screened is delivered thereto, and also having a plurality of discharge grooves extending parallel to the slots and open to said clearance space, whereby acceptable portions of the pulp stock may pass through the inlet slots to the discharge grooves through the clearance space, a chamber communicating with all of said discharge grooves and into which the screened stock is delivered through said grooves, means for rotating the outer screening element about its axis relative to the inner screening element, means carried by the inner screening element to deliver water under pressure through the clearance space into the delivery side of each inlet slot in succession, thereby to back-wash the slots sequentially and clear therefrom any flocks or unacceptable portions of pulp stock that may have become lodged therein, and a stationary back-wash receiving member situated exterior to the outer screen element closely adjacent thereto and having an elongated throat which is parallel to the inlet slots and which is in position to receive the back-wash from each slot as it passes said throat during the rotation of the inner screening element.

11. A pulp screen as defined in claim 10 in which the inner screening element is stationary and has a groove in its periphery which parallels the inlet slots in the outer screening element, and which has means to deliver water under pressure to said groove whereby as each inlet slot of the outer screening element passes the groove during the rotation of the outer screening element, water under pressure will be delivered into the slot thereby to back-wash it and clear it from any flocks or unacceptable portion of the pulp stock that may have become lodged therein.

12. A pulp screen as defined in claim 11 and which includes a back-wash receiving chamber situated exteriorly to the outer screening element and having an elongated throat which parallels the inlet slots of the outer screening element and is located opposite the groove in the inner stationary screening element, whereby as each inlet slot of the outer screening element comes into registry with both said groove of the inner screening element and the throat of the back-wash receiving chamber, water under pressure will be delivered into the delivery side of said inlet slot, thereby back-washing the latter and delivering the back-wash into the throat of the back-wash receiving member.

13. A pulp screen comprising a casing having an inlet opening through which unscreened pulp stock is delivered, a plurality of screening units situated within said casing, each screening unit comprising two concentrically arranged cylindrical screening elements forming between them a clearance space of a size to permit acceptable portions of the pulp stock to pass therethrough but insufficient in size to permit unacceptable portions of said stock to pass, the outer screening element of each screening unit having a plurality of inlet slots extending therethrough and communicating with the clearance space thereof, and also having a plurality of discharge grooves open to the clearance space, said casing having a chamber with which all of the discharge grooves of all of the screening units have communication and into which the screened pulp from all of said grooves is delivered, means to rotate the outer screening element of each screening unit, the inner screening element of each unit being stationary and having an interior tailings-receiving chamber which communicates with the clearance space, means separate from the tailings-receiving chamber to deliver jets of flushing water into the annular clearance space of each screening unit, a back-wash receiving member for each screening unit located exterior to and closely adjacent the outer screening element, each back-wash receiving member having a throat which communicates with each slot of the outer screening member as it ro-

tates, means to deliver flushing water under pressure into each inlet slot as it passes the throat of the back-wash receiving member, and a collecting chamber common to all the back-wash receiving members for collecting the tailings delivered therein by the flushing operation.

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