Patented Sept. 27, 1949 2,483,200

UNITED STATES PATENT OFFICE

2,483,200

PULP DRAINER

Anton J. Haug, Nashua, N. H.

Application March 24, 1945, Serial No. 584,619

13 Claims. (Cl. 92—35)

1

This invention relates to that class of machines known as "drainers." They are used, for example, in the paper-making process preceding the refiner to remove excess water from the stock to be refined, and thus to place this stock in better condition for the refining operation.

The present invention aims to improve machines of this type with a view particularly to increasing their efficiency, reducing the cost of manufacture of them, and facilitating the servicing operations on them. The manner in which it is proposed to accomplish these objects will be readily understood from the following description when read in connection with the accompanying drawings, and the novel features will be particularly pointed out in the appended claims.

In the drawings,

Fig. 1 is a vertical, longitudinal, sectional view through one end portion of a drainer constructed in accordance with this invention;

Fig. 2 is a similar view through the opposite end portion of the machine;

Fig. 3 is an end elevation of the part of the machine shown in Fig. 2;

Fig. 4 is a sectional view taken approximately on the line 4—4, Fig. 1;

Fig. 5 is a similar view on substantially the line 5—5 of Fig. 2; and

Fig. 6 is a perspective view of the arm which supports the press roll.

Referring first to Figs. 1 and 2, the construction there shown comprises a casing, indicated in general at 2, and including an end casting 3 provided with an intake chute 4 and also with another end casting 5 having an outlet or discharge passage 6 for the solid constituents of the paper-making stock. Mounted in this casing is a revolving screen drum 7 and inside the drum is a screw conveyor 8 which feeds the stock delivered into the screen lengthwise thereof toward the outlet 6.

Drainers organized in this general manner have been used heretofore, and one of the objections to them has been the fact that the manufacture of the screw conveyor and of the screw and screen assembly is a very expensive matter. Important objects of this invention, therefore, are to overcome this difficulty, to devise a better form of screw conveyor, and to improve the screen and screw combination so that both can be manufactured, assembled and repaired more easily and economically than has been possible in prior art constructions.

In the construction shown in Figs. 1 and 2, the screen assembly comprises two heads or end castings 9 and 10, respectively, both mounted on a shaft 12 which is supported in bearings in the two end frame castings 3 and 5 above referred to. Cooperating with the casting 9 at the intake end of the machine is another casting 9' bolted to the

2

part 9 and cooperating with it to form a chamber in the screen drum into which the stock is initially delivered by the intake chute 4. These two castings 9 and 9' are bolted together so that, in effect, they form a single integral structure, but they are divided on a diametral plane for convenience of manufacture and assembly.

Secured at points spaced equally around the circumference of the two heads 9 and 10 are four bars 13, as best shown in Fig. 4, the ends of these bars being bolted or riveted to ears 14 and 15 which are bolted to the flanges of the heads 9 and 10, respectively. The screen preferably consists of four curved perforated plates, each of the entire length of the main screen section and each having a circumferential extent of approximately 90°. The longitudinal edges of each screen section abut against two of the bars 13 and are secured to them by angle bars 16, two of which are bolted or riveted to opposite sides of each bar 13. Opposite ends of each screen plate overlie the inner reduced marginal peripheral portions of the heads 9 and 10. Thus the installation, removal, or replacement of any screen plate can be readily accomplished.

The screw itself also is of novel form and is made up of several sections of sheet metal, initially pressed to the desired shape, and then butt-welded together, edge to edge. The two ends of this screw are secured, respectively, to the heads 9 and 10 and both of these heads preferably are provided with surfaces which have the same screw formation, contour and pitch as the screw itself, so that the screw assembly includes all three of these elements and all of them contribute to the function of feeding the stock from the inlet to the outlet of the machine.

Circumferential support for the screw is provided by fashioning small bosses *a* on the inner edges of the bars 13 and slotting these bosses at the right angle and at proper distances apart to receive and support the outer edges of the convolutions of the screw. This makes a very sturdy and substantial construction, with a smooth screen surface inside, particularly if care is taken to make the edges of the screen plates substantially flush with the inner edges of the bars 13 where they abut against the latter.

Assembly of this screw and screen unit may be conveniently performed by pressing the heads 9 and 10 on the shaft 12 in their final positions, and threading the screw 8 on to the shaft, starting at one end and revolving it while at the same time twisting it as may be necessary to thread it on to the section of the shaft between the heads. Initially the screw is disposed at about right angles to the shaft, but as the installing operation proceeds, it is twisted so as to maintain the shaft in the hole in successive turns of the screw while this installing operation is completed. There

after the ends are fastened to the two heads 8 and 10 by a few rivets. Later the bars 13 are secured to the heads, the edges of the screw are fitted into the slots provided in the lugs *a* to receive and support them, and the screen sections 7 are secured to the bars as above described.

In this connection it should be noted that the internal diameter of the screw is considerably larger than that of the shaft, and that fact facilitates the assembling operation just described. When this operation has been completed, the inner edges of the convolutions of the screw are spaced by a considerable radial distance from the shaft 12.

At the end of the main screen section 7 a second screen section 7' is provided which tapers, or is frusto-conical in form, its smaller end being joined to the end casting 10. As shown, the frame for this second section comprises a ring 17, Fig. 2, of channel section, and a body portion 18, made in four 90° sections, which are bolted together and also are bolted to the ring 17 and the end flange of the head 10. These sections of the body portion 18 are flanged or ribbed deeply, both circumferentially and longitudinally, so that, when secured together, they form a very strong, rigid structure. Screen plate sections, similar to those of which the screen 7 is composed, are secured to the inner surfaces of the body portion 18. This section forms the delivery end of the screen drum, and it opens directly into the discharge passage 6 above referred to.

Operating in the conical section 7' of the screen is a press roll 20 which revolves freely on a shaft 21 supported by an arm 22, Fig. 2, 3 and 6. The upper end of this arm is bolted to a bracket 23, and the latter carries a shaft 24, Fig. 3, extending parallel to the shaft 12 and mounted to rock freely in the stationary bracket or trunnion 25 which is bolted on a shelf portion of the end frame casting 5. Secured to the bracket 23 is an elongated arm 26, Fig. 3, on which is slidably mounted a weight 27 adapted to be locked in any position of adjustment by a wing nut 28. As will be readily observed from an inspection of Fig. 3, the weight tends to hold the roll 20 constantly pressed against the inner surface of the conical screen 7'. Usually this roll is provided with a rubber or equivalent surface, and it often is grooved to reduce slip.

In the operation of this drainer, stock derived from several sources such, for example, as the material rejected by the pulp screens, is fed into the intake chute 4, the material at this time usually containing a high percentage of water. That is, the solid constituent, in a typical case, is from about one-third of one percent. to two percent. of the entire weight of the material. It can therefore be flowed through the inlet freely and promptly comes into contact with the inner surface of the screen 7. As the feeding operation continues and the screen revolves, the stock is advanced lengthwise of the screen toward the discharge outlet, and it loses water by gravity during its entire travel. It is finally forced by the screw into the conical section 7' where it is subjected to the action of the press roll 20 which squeezes additional water out of the stock. At this time the water content may be reduced to in the neighborhood of, say, 80% of the total weight of the material. The latter is fairly solid and very crumbly so that it rattles freely through the discharge outlet 6 into the refiner or any other desired apparatus or receptacle.

It is important to the satisfactory operation of the press roll that it be set so as to bear evenly against the inner surface of the conical screen section 7' when no stock is interposed between the roll and the screen. This has been difficult to accomplish in prior constructions, and for this reason the construction above described has been provided. In it the meeting faces of the arm 22 and bracket 23 are located at such an angle that the arm may be moved about an axis perpendicular to said faces, so as to adjust the axis of the press roll 20 angularly in a radial plane passing substantially through the axis of the shaft 12 and then locked in its adjusted position. The latter axis is also the axis of the conical screen section. Consequently, with this adjustment the pressure with which successive longitudinal portions of the press roll bear against the screen can be varied, as desired, to make the roll bear evenly for its entire length on the screen. As shown in Fig. 6, the holes in the upper flanged end of the arm 22, through which the bolts 22' pass, are slotted on a circumference concentric with the axis of the arm to permit this adjustment.

A particularly troublesome problem in the operation of a drainer of this type is the fact that the stock fed into it contains a high proportion of slivers. They find their way into the holes of the screen and get stuck there. As this action continues the efficiency of the screen becomes materially reduced. The usual scraper constructions are thoroughly unsatisfactory in dealing with this condition. I have found, however, that by using a yieldingly surfaced scraper which bends over along the inner circumference of the screen due to the drag of the latter, the slivers will be pulled out by it. Such a construction is shown in Figs. 2 and 5 in which the scraper 28 consists of a strip of thick canvas belting, or the like, secured to the bar 30, this bar being bolted to a bracket 31, Fig. 3. It is made long enough to provide a considerable length which is bent over by its contact with the screen where it exerts a strong dragging action on the slivers serving to pull them backwardly out of the holes in the screen in which they are lodged.

The machine may conveniently be supported on channel bars 32—32, set up edgewise, the end castings 3 and 5 being shaped to set on them and having flange or web sections which span the distance between the bars 32—32. Portions of the end castings 3 and 5 determine the shape of the casing 2, and the latter is preferably made up of three sections—a bottom section 2*a*, Fig. 4, and top sections 2*b* and 2*c*. The two latter sections are each of 90° in angular extent and the bottom section is 180°. The water extracted from the stock collects on the upper surface of the bottom section 2*a*, as will be seen from an inspection of Figs. 1 and 2, and it runs by gravity toward the intake end of the machine where it is led off by pipe connections bolted to the flanged ends *d*—*d*, Fig. 1, of the end casting 3. Shower pipes 33—33 are so positioned and arranged as to direct sprays of water more or less tangentially against the on-coming surface of the screen to clean it.

Throughout the body of the screen, if perforated metal plates are used, I prefer, for ordinary pulp, to make the perforations about an eighth of an inch in diameter and to use approximately thirty-two holes per square foot. In the conical section, however, it is sufficient to use a considerably smaller number say, for example, eighteen holes per square foot. The size

and type of perforations necessarily will vary in accordance with the material being handled. In draining some kinds of stock, a wire mesh is entirely suitable. For the screw 8 I have obtained good results by making it of fairly thin stock, say one-eighth or three-sixteenths of an inch in thickness, preferably, but not necessarily, of bronze. It is stiff enough so that no fastenings, other than those necessary to secure it to the heads, are required. It may conveniently be removed for renewal by cutting or drilling out the rivets which secure it to the heads; taking off the bars 13; and reversing the installing operations above described.

It will be evident from the foregoing that this invention provides a drainer of such a construction that the cost of manufacture of it is very materially reduced, other factors being equal, as compared with the prior art constructions. Also, that the servicing or repairing operations which may later become necessary may be performed more easily and economically. In addition, the efficiency of the machine has been increased, more particularly because there is less opportunity for plugging the screen, and for the accumulation of stock in it at points where the draining action would be impeded.

While I have herein shown and described a preferred embodiment of my invention, it will be evident that the invention is susceptible of embodiment in other forms without departing from the spirit or scope thereof.

Having thus described my invention, what I desire to claim as new is:

1. A pulp drainer comprising the combination of an elongated casing provided with a stock inlet at one end and a stock outlet at the other end, a screw for feeding the stock lengthwise of the casing toward said outlet, a screen drum encircling said screw, said screw comprising a metal strip coiled edgewise around its axis of rotation, and a support for said screw comprising a plurality of bars extending lengthwise of and spaced circumferentially around said screw, means for supporting said screen drum on said bars, guide means on the bars adjacent the inner edges thereof for guiding the edges of said screw on said bars but being free from rigid attachment to the bars, whereby the screw can be removed while some of said bars remain in place.

2. A pulp drainer comprising the combination of an elongated casing provided with a stock inlet at one end and a stock outlet at the other end, a screw for feeding the stock lengthwise of the casing toward said outlet, a rotary screen drum encircling said screw, means for supporting said drum for rotary movement, said screw comprising a metal strip coiled edgewise around its axis of rotation, rigid heads at opposite ends of said screw, and a series of bars mounted at their ends on said heads, means for supporting said screen drum on said bars, said bars having transverse slots in which the outer edge portions of said screw are supported but being free from rigid attachment to said bars, whereby the screw can be removed or replaced while some of the bars remain in their normal positions.

3. A pulp drainer comprising the combination of an elongated casing provided with a stock inlet at one end and a stock outlet at the other end, a screw for feeding the stock lengthwise of the casing toward said outlet, a rotary screen drum encircling said screw, means for supporting said drum for rotary movement, said screw comprising a metal strip coiled edgewise around its axis of rotation, a supporting shaft extending through said screw coaxially therewith, two rigid heads mounted on said shaft, a series of bars extending parallel to said shaft and secured to said heads, said bars being spaced circumferentially around said screw, the inner edges of said bars being slotted to receive and support the outer edges of the convolutions of said screw without being fastened rigidly to the screw, said drum also being supported on said bars at the inner edges thereof and having a substantially smooth inner surface.

4. A pulp drainer comprising the combination of an elongated casing provided with a stock inlet at one end and a stock outlet at the other end, a screw for feeding the stock lengthwise of the casing toward said outlet, a screen drum encircling said screw, said screw comprising a metal strip coiled edgewise around its axis of rotation, a supporting shaft extending through said screw coaxially therewith, bearings supporting said shaft, two rigid heads mounted on said shaft, said heads being provided with surfaces which form continuations of uninterrupted screw shape of the stock-propelling surfaces of the screw and which cooperate with the screw to feed the stock lengthwise through the drum, the two heads forming supports for the screen drum and the screw.

5. A pulp drainer comprising the combination of an elongated casing provided with a stock inlet at one end and a stock outlet at the other end, a screw for feeding the stock lengthwise of the casing toward said outlet, a screen drum encircling said screw, said screw comprising a metal strip coiled edgewise around its axis of rotation, a supporting shaft extending through said screw coaxially therewith, two rigid heads mounted on said shaft and supporting the opposite ends of said drum, a plurality of bars supported on said heads and extending parallel to the axis of said drum, means on the bars adjacent the inner edges thereof for guiding the screw on said bars and to support the portion of said drum between said heads on said bars at the inner edges thereof, the entire supporting means for that portion of the drum between said heads being located externally of the drum and the inner surface of said drum between said heads being substantially smooth and unobstructed by the parts which support it.

6. A pulp drainer comprising the combination of an elongated casing provided with a stock inlet at one end and a stock outlet at the other end, a screw for feeding the stock lengthwise of the casing toward said outlet, a screen drum encircling said screw, said screw comprising a metal strip coiled edgewise around its axis of rotation, a supporting shaft extending through said screw coaxially therewith, two rigid heads mounted on said shaft and supporting both the opposite ends of said drum and also the opposite ends of said screw, a plurality of bars supported on said heads and extending longitudinally of said drum, said bars being spaced circumferentially around the drum, means on the bars adjacent the inner edges thereof for guiding the screw on said bars to support the portions of said drum between said heads on the inner edges of said bars, the outer edge portions of said screw between said heads also being supported on the inner edges of said bars but free from attachment to said drum, the inner surface of said drum between said heads being smooth and unobstructed by the parts that support it.

7. A pulp drainer comprising the combination of an elongated casing provided with a stock inlet at one end and a stock outlet at the other end, a screw for feeding the stock lengthwise of the casing toward said outlet, a screen drum encircling said screw, said screw comprising a metal strip coiled edgewise around its axis of rotation, a supporting shaft extending through said screw coaxially therewith, bearings supporting said shaft, two rigid heads mounted on said shaft and positioned at opposite ends of said drum, a series of bars extending parallel to said shaft and secured to said heads, said bars being spaced circumferentially around said screw, the ends of said screw being supporting on said heads and the heads being provided with surfaces which form continuations of the stock-propelling surfaces of the screw and which cooperate with the screw to feed the stock lengthwise through the drum, both said drum and said screw being supported by said bars at the inner edges of the bars.

8. A pulp drainer according to preceding claim 6, in which said drum is composed of pre-shaped partial circumferential sections and said means for supporting said drum includes parts releasably secured to said bars and said heads for holding said sections normally but releasably in their operative positions so that any section can be removed and replaced independently of an adjacent section, the entire supporting means for said drum between said heads being external to the drum.

9. A pulp drainer comprising the combination of an elongated casing provided with a stock inlet at one end and with a stock outlet at the end, a rotary screen extending lengthwise of said casing, said screen having a smooth substantially uninterrupted inner surface, means for feeding the stock longitudinally through said screen toward said outlet whereby surplus water drains outwardly, and a scraper blade, means for supporting said scraper in a substantially stationary position in firm but yielding contact against the smooth interior surface of a portion of the screen so that said scraper blade is bent over by its contact with the screen, thereby providing a dragging surface cooperating with the motion of the screen to drag the slivers stuck in the holes in the screen inwardly out of it.

10. A pulp drainer comprising the combination of an elongated casing provided with a stock inlet at one end and with a stock outlet at the other end, a rotary screen drum extending lengthwise of said casing, means for feeding the stock longitudinally through said drum toward said outlet, an additional screen section of frusto-conical form coaxial with said drum and positioned at the delivery end thereof into which the partially drained stock is delivered by the drum, said additional screen section having a substantially smooth interior surface, a press roll mounted in said conical section for swinging movement in to and out of contact with the stock on the screen surface of the latter section, whereby said roll is operable to press the stock against the conical screen section to force additional water out of it, a yieldingly surfaced scraper mounted within the additional screen section, and means supporting it in a substantially fixed position with its yielding surface bearing against the inner surface of the latter screen section, said scraper comprising a blade having a surface shaped to drag the slivers stuck in the screen inwardly out of it.

11. A pulp drainer comprising the combination of an elongated casing provided with a stock inlet at one end and with a stock outlet at the other end, a rotary screen extending lengthwise of said casing, said screen including a portion having a smooth, substantially uninterrupted inner surface, means for feeding the stock longitudinally through said screen toward said outlet whereby surplus water drains outwardly, a scraper, means for supporting said scraper in a substantially stationary position in firm but yielding contact against the smooth interior surface of a portion of the screen, said scraper being bent over by its contact with the screen and thereby providing a dragging surface cooperating with the motion of the screen to drag the slivers stuck in the holes in the screen inwardly out of it, said rotary screen having a section of substantially frusto-conical form and having a screen surface, means supporting a press roll so that said roll is positioned within said conical section for swinging movement toward and from the screen surface of the frusto-conical section, whereby said roll is operable to press the stock against the latter screen surface to force additional water out of it, and means supporting said press roll for angular adjustment relative to said screen surface to vary the degree of pressure with which different portions of the roll bear against said smooth interior surface.

12. A pulp drainer according to preceding claim 11, in which the supporting means for said press roll comprises a stationary bracket, an arm supporting said roll, and a swinging bracket mounted on said stationary bracket for pivotal movement about an axis parallel with the axis of said screen, said arm being supported on said pivoted bracket for angular adjustment in a plane substantially intersecting the axes of both said frusto-conical screen and said press roll.

13. A pulp drainer according to preceding claim 11, in which the supporting means for said press roll comprises a stationary bracket, an arm supporting said roll, a swinging bracket mounted on said stationary bracket for pivotal movement about an axis parallel with the axis of said screen, means acting on said swinging bracket in a direction tending to force said press roll into contact with said inner peripheral surface of said frusto-conical screen section, said arm being mounted on said swinging bracket for adjustment to vary the degree with which successive longitudinal portions of said press roll bear against said frusto-conical screen surface.

ANTON J. HAUG.

REFERENCES CITED

The following references are of record in the file of this patent:

UNITED STATES PATENTS

Number	Name	Date
649,152	Annandale	May 8, 1900
962,168	Scholl	June 21, 1910
1,493,535	Haug	May 13, 1924
1,843,791	Stadler	Feb. 2, 1932
1,918,621	Thorne	July 18, 1933

FOREIGN PATENTS

Number	Country	Date
146,891	Great Britain	Jan. 13, 1921
381,799	Germany	Sept. 24, 1923

Certificate of Correction

Patent No. 2,483,200 September 27, 1949

ANTON J. HAUG

It is hereby certified that error appears in the printed specification of the above numbered patent requiring correction as follows:

Column 7, line 36, before the word "end", second occurrence, insert *other*;

and that the said Letters Patent should be read with this correction therein that the same may conform to the record of the case in the Patent Office.

Signed and sealed this 31st day of January, A. D. 1950.

[SEAL]

THOMAS F. MURPHY,
Assistant Commissioner of Patents.

Sept. 27, 1949. A. J. HAUG 2,483,200

PULP DRAINER

Filed March 24, 1945 5 Sheets-Sheet 1

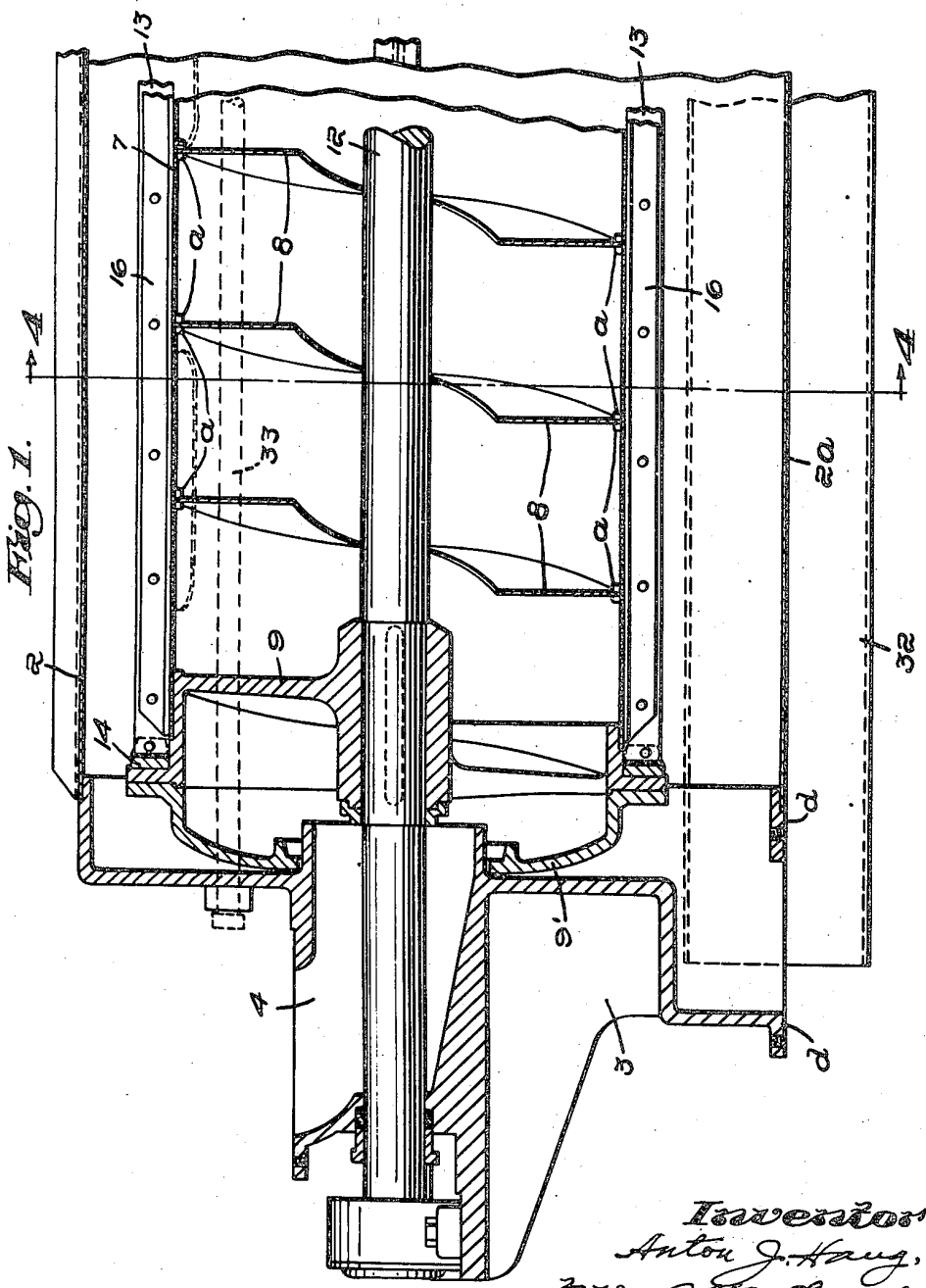


Fig. 1.

Inventor:
Anton J. Haug,
By J. H. McReady,
Attorney.

Sept. 27, 1949. A. J. HAUG 2,483,200

PULP DRAINER

Filed March 24, 1945

5 Sheets-Sheet 2

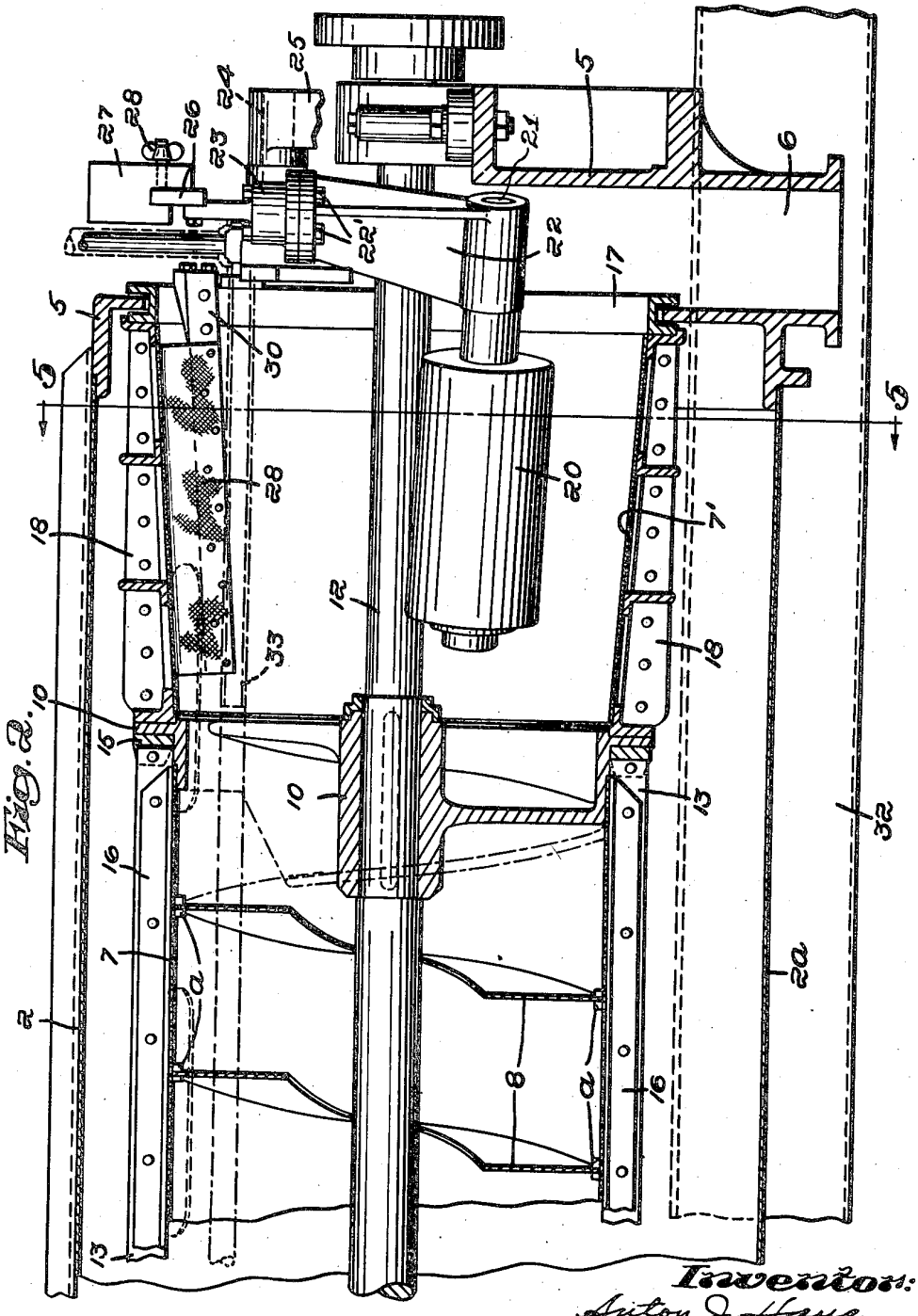


Fig. 2.

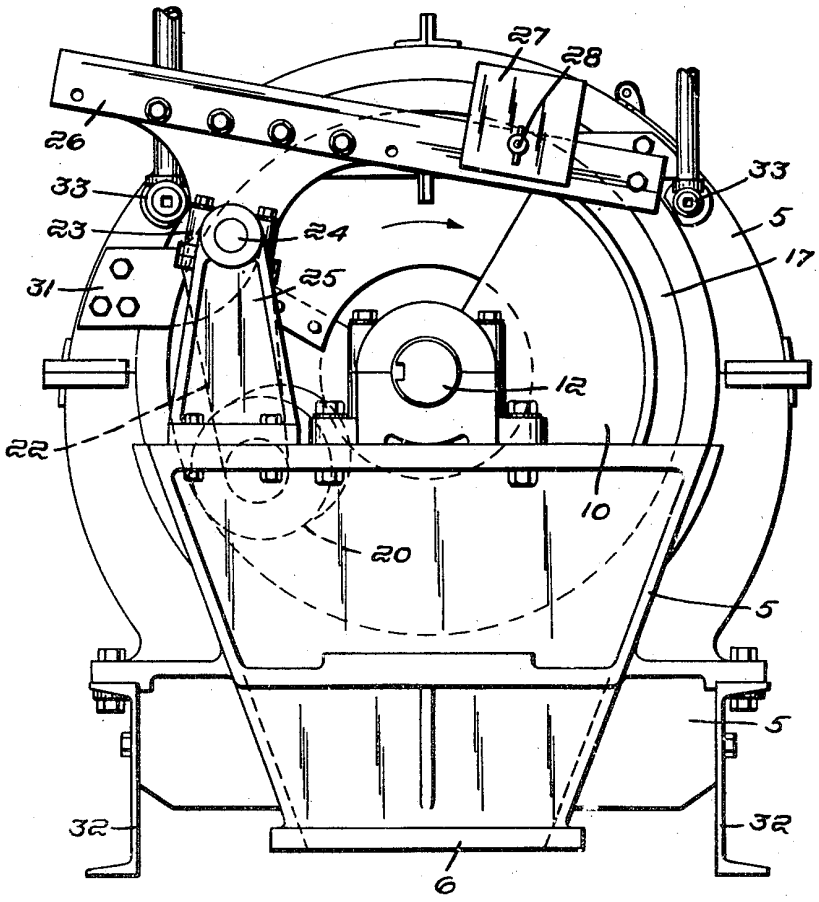
Inventor:
Anton J. Haug,
by J. A. McCready,
Attorney.

Sept. 27, 1949. A. J. HAUG 2,483,200

PULP DRAINER

Filed March 24, 1945 5 Sheets-Sheet 3

Fig. 3.



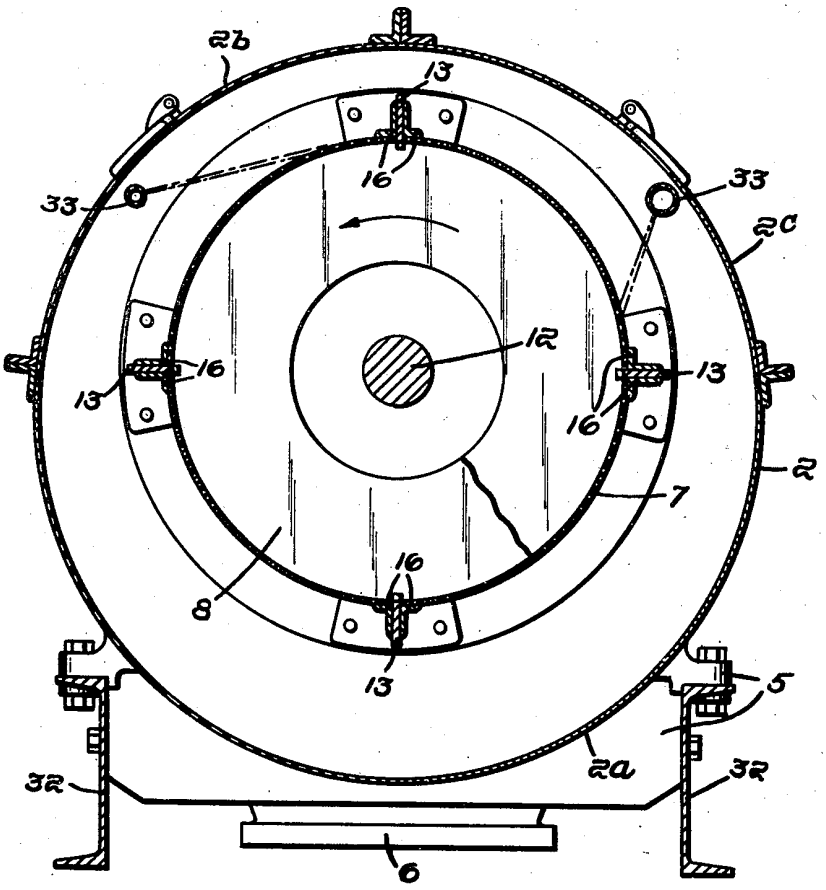
Inventor:
Anton J. Haug,
by J. H. McCaddy,
Attorney.

Sept. 27, 1949. A. J. HAUG 2,483,200

PULP DRAINER

Filed March 24, 1945 5 Sheets-Sheet 4

Fig. 4.



Inventor:
Anton J. Haug,
by J. H. McCready,
Attorney.

Sept. 27, 1949. A. J. HAUG 2,483,200

PULP DRAINER

Filed March 24, 1945

5 Sheets-Sheet 5

Fig. 5.

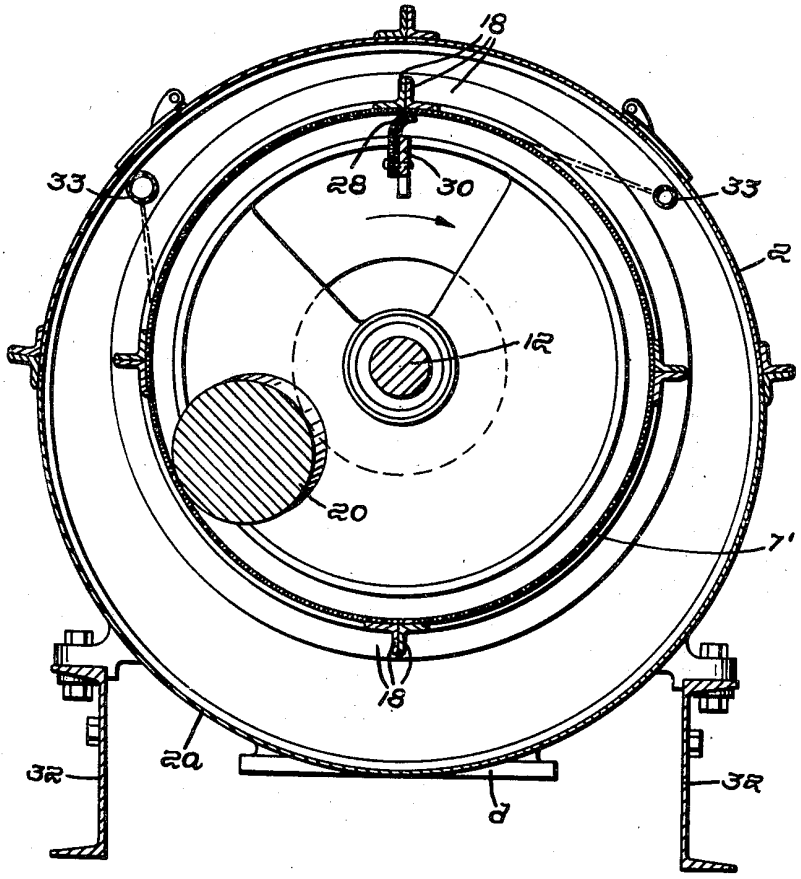
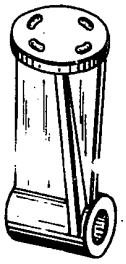


Fig. 6.



Inventor:
Anton J. Haug,
by J. H. McBride,
Attorney.