

PULP REFINER

Filed March 2, 1933

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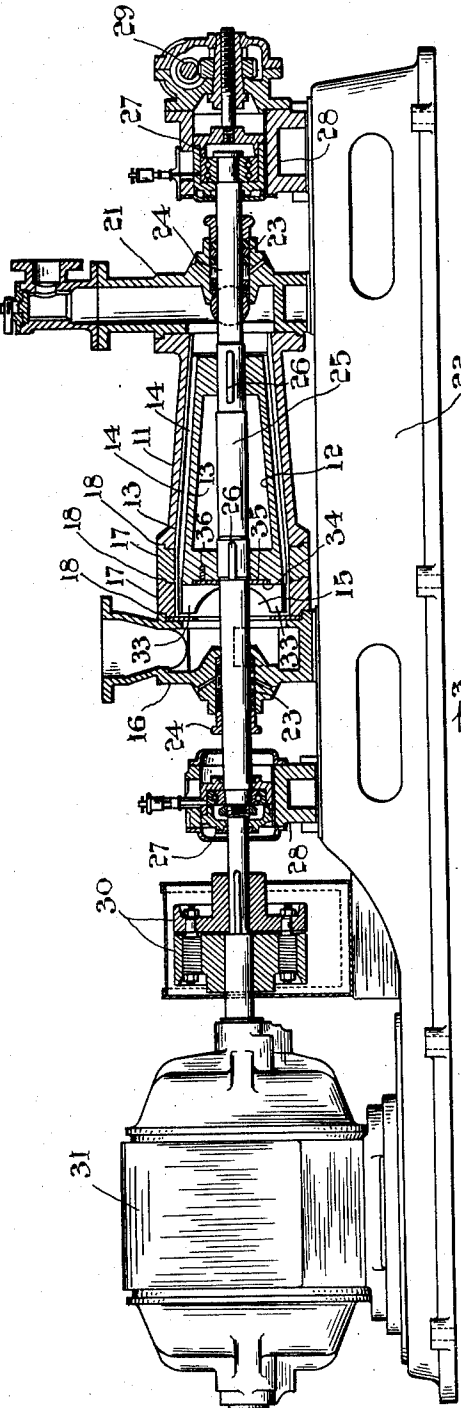


FIG. 1

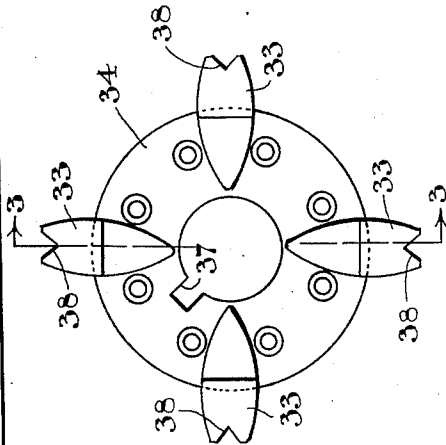


FIG. 2

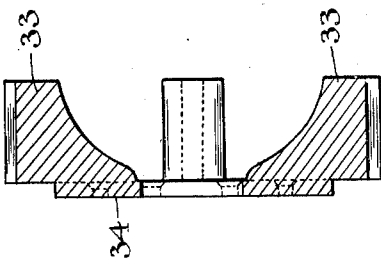


FIG. 3

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1,961,808

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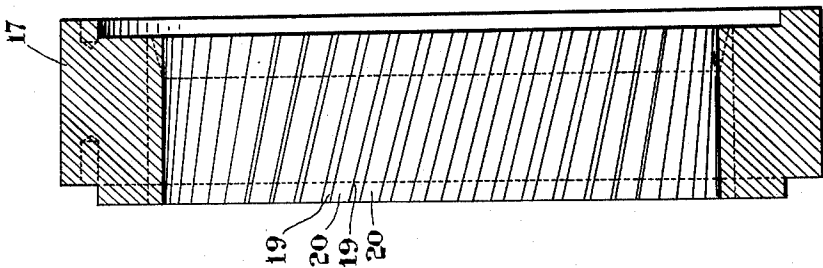


FIG. 5

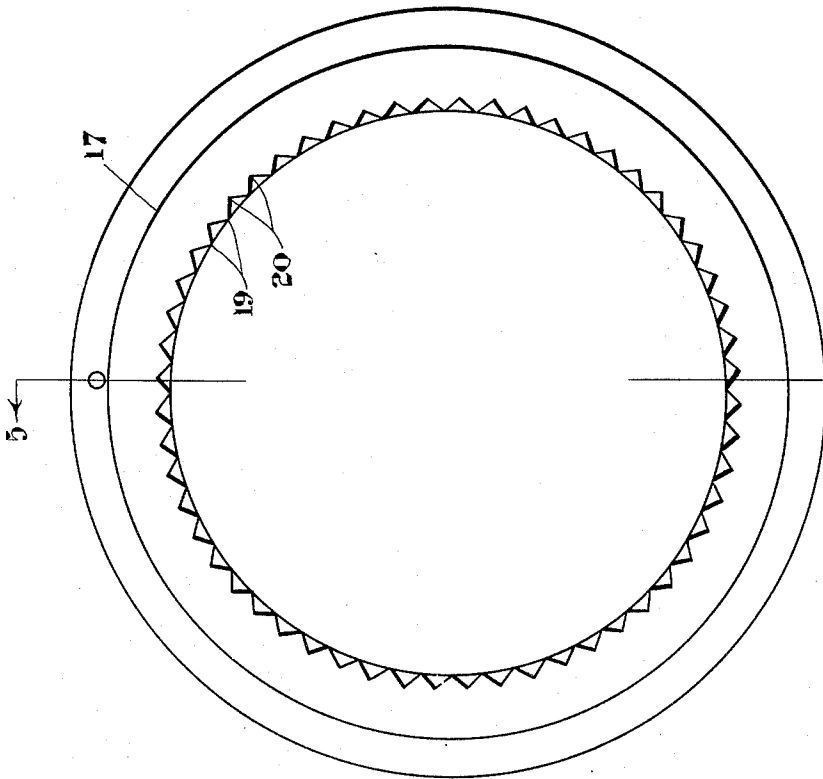


FIG. 4

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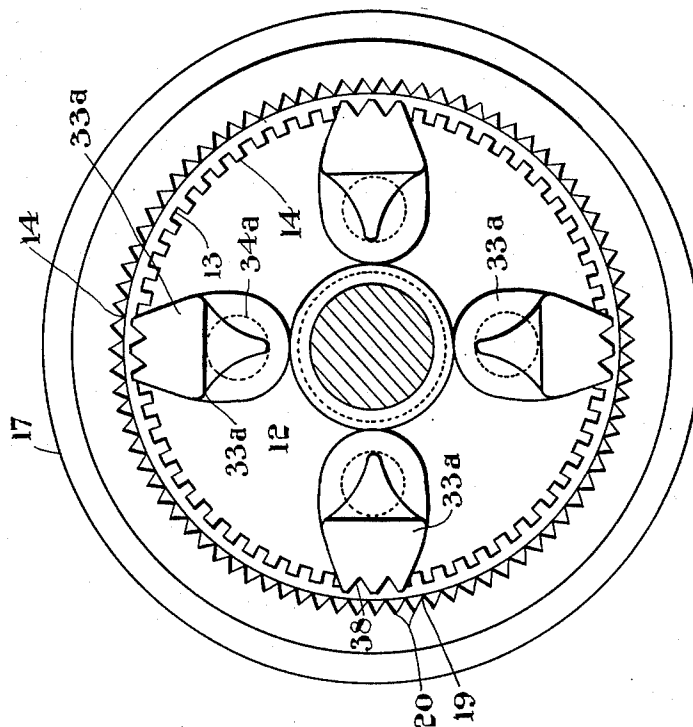
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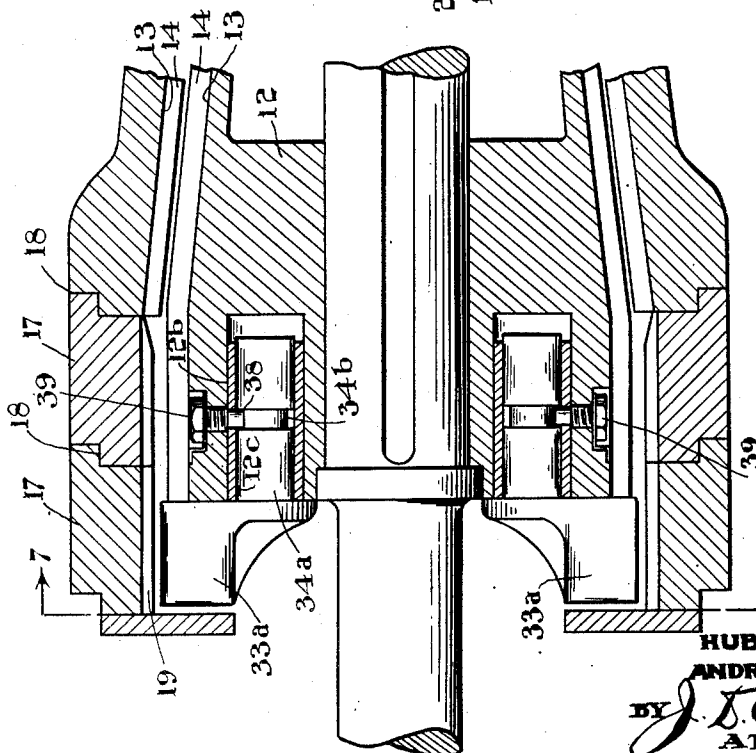
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**FIG. 7**



## FIG. 6

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## UNITED STATES PATENT OFFICE

1,961,808

## PULP REFINER

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Application March 2, 1933, Serial No. 659,373

6 Claims. (Cl. 92—27)

This invention relates to improvements in frusto-conical pulp refiners of the Wiener type described in U. S. Patent No. 1,730,908, dated October 8, 1929.

5 The principal purpose of this invention is to increase the effectiveness of the Wiener refiner with respect to treatment of pulp containing knots, coarse partially uncooked wood chips, or other coarse constituents so that plugging or clogging of the refiner, with its consequent interruption of the refining operation, as ordinarily caused by the presence of these constituents, is avoided.

15 Another purpose is to provide an improved refiner of the Wiener type that is also useful in connection with the preliminary reduction of coarse fibrous materials such as the rejects from wood pulp screens as one stage in the refining of such materials for the manufacture of pulp and paper products.

20 The main features of improvement by which the foregoing objects are attained resides in the provision of a special breaking or reducing zone in which the knots and other coarse constituents of the pulp or fibrous material are broken down or reduced to suitable proportions and then forced into the refining zone between the shell and plug of the refiner. This breaking or reducing zone comprises a breaking chamber formed by a cylindrical wall extension of the refiner shell and one or more breaker or hammer members co-operating with the inner wall surface of said chamber to effect the breaking down or reduction of the coarse constituents of the pulp or fibrous material. The inner wall surface of the breaking chamber is preferably corrugated to provide spirally extending ridges and valleys which are substantially V-shaped in cross section and the co-operating breaker or hammer members are either rigidly or pivotally fastened to the rotating plug or shaft of the refiner so that the operating clearance between these members and the ridges of the surrounding wall surface is so small that it is practically impossible for any particles of the coarse material to become wedged therebetween. After the material has been reduced by the violent impacts and tearing action to which it is subjected between the corrugated wall of the breaking chamber and the co-operating breaker or hammer members, it is positively forced, by the spiral formation of said corrugated surface, into the reducing zone between the opposing surfaces of the plug and the main portion of the shell.

55 In the Wiener refiner there is an impeller carried by the rotating plug and operating in a cylindrical wall extension of the refiner shell but the design and diameter of this impeller is such that it serves principally to apply the pressure necessary to force the material through the refining zone and has only a limited breaking action which

is insufficient to enable pulp or other fibrous material containing coarse chips, knots and other coarse constituents to be treated continuously without danger of plugging the refiner to the point where stoppage and clearing of the refiner becomes necessary. In the Wiener refiner the inner surface of the shell, including the cylindrical extension enclosing the impeller, is provided with alternating grooves and bars which are approximately square in cross section and we have discovered that this shaping of the grooves and bars, together with the small diameter of the impeller, are factors that contribute to the "plugging" which ensues when the pulp being refined contains the very coarse constituents previously referred to. In the present invention this difficulty is largely avoided by making the ridges and valleys of the breaking chamber substantially V or saw tooth shape in cross section and by the reservation of minimum clearance between the said ridges and the breaker or hammer members.

Proceeding now to a more detailed discussion of the present invention, reference will be had to the following drawings:—

Fig. 1 is a view, partly in side elevation and partly in longitudinal section, of a Wiener refiner assembly modified in accordance with the present invention.

Fig. 2 is an elevation of the breaker members provided in accordance with this invention.

Fig. 3 is a sectional view along the line 3—3 of Fig. 2.

Fig. 4 is an elevation of a casing ring which forms part of the breaking chamber provided in accordance with this invention.

Fig. 5 is a sectional view along the line 5—5 of Fig. 4.

Fig. 6 is a fragmentary, vertical sectional view of a portion of the refiner, showing a modification of the present invention.

Fig. 7 is a transverse sectional view along the line 7—7 of Fig. 6.

In Figs. 1 to 5 inclusive, 11 designates a frusto-conical shell and 12 a rotary frusto-conical plug operating therein, the opposing surfaces of the shell and plug being provided with the usual lengthwise extending grooves 13 and bars or knives 14. According to the present invention a breaking chamber 15 is provided between the inlet casting 16 and the adjacent large or inlet end of the shell 11. Said chamber is preferably formed by two casing rings 17 which are fastened in place between the inlet casting and the shell by bolts, studs or other fastening means (not shown) and have their perpendicular surfaces stepped to provide the spigot joints appearing at 18. The inner surfaces of the casing rings 17 are shaped (as shown in Figs. 4 and 5) to present alternating spiral ridges and valleys which are substantially saw toothed or V-shaped

in cross section, the ridges being indicated at 19 and the valleys at 20. The direction of inclination of these ridges and valleys is such that material which is crushed or reduced in the valleys by the breaker members hereinafter mentioned is positively forced from the breaking chamber 15 into the communicating refining zone afforded between the opposing surfaces of the plug and shell elements.

The small end of the shell 11 is attached in the usual manner to the outlet casting 21 which, together with the inlet casting 16, is mounted on the base 22. These castings 16 and 21 are provided with openings 23 and packing glands 24 for the passage of a shaft 25 to which the plug 13 is keyed as indicated at 26. Shaft 25 is journaled in longitudinally adjustable bearings 27 which are carried by pedestals 28 rising from the base 22. The bearing 27 supporting the right hand end of the shaft is connected with the usual adjusting means 29 (Fig. 1) through the agency of which the plug 13 is moved axially to vary the clearance between the opposing surfaces of the plug and shell. The opposite end of shaft 25 is coupled as at 30 with the shaft of an operating motor 31, also mounted on the base 22.

The breaker members provided in accordance with this invention operate in the breaking chamber 15 and are indicated at 33. These members are disposed radially with respect to the shaft 25 and are cast integral with or otherwise rigidly secured to the outer surface of a base ring 34. Said base ring 34 is fitted in a recess 35 formed in the large end of the plug 12 and is anchored in place by bolts or studs 36. The base ring 34 is also preferably keyed to the shaft 25 through the agency of the keyway appearing at 37, said keyway receiving therethrough a portion of one of the keys 26 by means of which the plug 12 is keyed in place on the shaft.

As shown in Figs. 2 and 3 the tips of the breaker members 33 are provided with notches 38 which are preferably made V shaped so that these notches will be self clearing as regards accumulation of crushed material therein. The breaker members are mounted and proportioned so that only a relatively small clearance is reserved between the tips of these members and the opposing ridges 19 of the breaking chamber. The advantage of this small clearance is that it prevents knots, chips and other coarse particles, which enter the breaking chamber through the inlet casting 16, becoming wedged between the breaker members and the surrounding casing ring 17.

In operation the material to be treated is delivered from the inlet casting 16 into the breaking chamber 15 where the knots, coarse partially uncooked wood chips and other coarse constituents are violently impacted and torn between the tips of the breaker members 33 and the ridges 19 of the surrounding casing ring 17. As these constituents become sufficiently reduced they are positively forced, by reason of the inclination of the ridges 19, into the refining zone between the opposing surfaces of the plug and shell from which the refined material is ultimately delivered to the outlet casting 21.

It is essential that the breaker members 33 rotate relative to the surrounding wall of the breaking chamber but it is not essential that these breaker members be directly attached to the plug as described herein. They may, for example, be attached in any suitable manner directly to the rotary shaft 25 so that they travel

with but not as a part of the plug 12. It is also not essential that the breaker members be rigidly secured in their radial positions with respect to the shaft 25 since satisfactory results are obtained when the breaker members are mounted to have a slight swinging movement permitting them to act in the manner of hammers as they are carried around the interior of the breaking chamber. One example of the latter construction is shown in Figs. 6 and 7 where in the breaker members 33a are pivotally secured to the plug 12a by means of the trunnions 34a. In this case the large end of the plug 12a is provided with axially extending bores 12b fitted with bushing 12c in which the trunnions 34a are rotatably mounted. Set screws 39 are threaded through radial openings of the plug so that the inner ends of these screws engage in annular grooves 34b formed in the trunnions 34a and serve to hold the latter against axial displacement. The heads of the set screws are seated in recesses formed in the bottom walls of certain of the grooves 13 of the plug as clearly shown in Fig. 6.

Having thus described our invention, what we claim is:—

1. A refiner comprising a frusto-conical shell, a rotary frusto-conical plug operating therein, said shell having a cylindrical extension at its inlet end projecting beyond the corresponding end of the plug and presenting a serrated inner surface and a plurality of breaker members mounted to revolve with said plug, the tips of said members being opposed to the serrated surface of the shell extension and being spaced a minimum distance therefrom so that coarse fibrous constituents supplied to said refiner are subjected to a preliminary refining treatment between the serrated surface of the shell extension and the breaker members and then forced into the main refining zone afforded by the opposing refining surfaces of the plug and shell.

2. A refiner as claimed in claim 1 in which the serrations at the inner surface of the shell extension present relatively sharp edges opposing the tips of the breaker members and are spirally inclined with respect to the longitudinal axis of the shell.

3. A refiner as claimed in claim 1 in which the tips of the breaker members are provided with one or more V-shaped notches.

4. A refiner as claimed in claim 1 in which the tips of the breaker members are serrated.

5. A pulp refiner of the frusto-conical plug and shell type including a breaking chamber formed as a continuation of the inlet end of said shell, the inner wall surface of said chamber being formed to present alternating spiral ridges and valleys of triangular cross-section and a plurality of breaker members mounted in said chamber so as to travel with said plug, said breaker members being so proportioned and mounted as to leave only a minimum clearing between said members and the apices of the aforesaid ridges.

6. A pulp refiner comprising a frusto-conical shell and a frusto-conical plug rotatably mounted therein, said shell having an annular extension at its inlet end forming a breaking chamber and a plurality of breaker members arranged in said chamber, said members being mounted to travel with said plug and to have an independent swinging movement.

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