

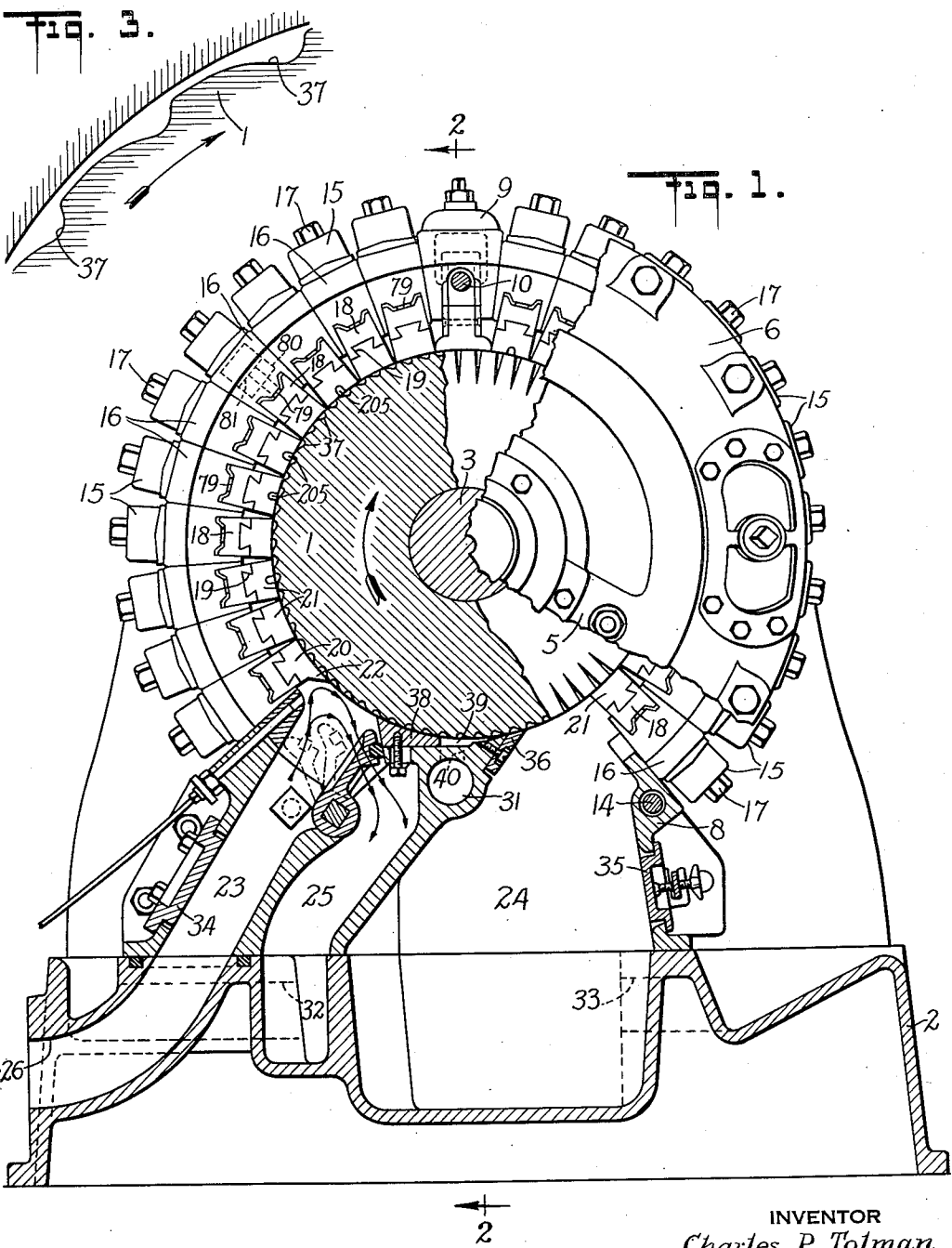
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STUFF TREATMENT APPARATUS

Original Filed March 28, 1934 2 Sheets-Sheet 1



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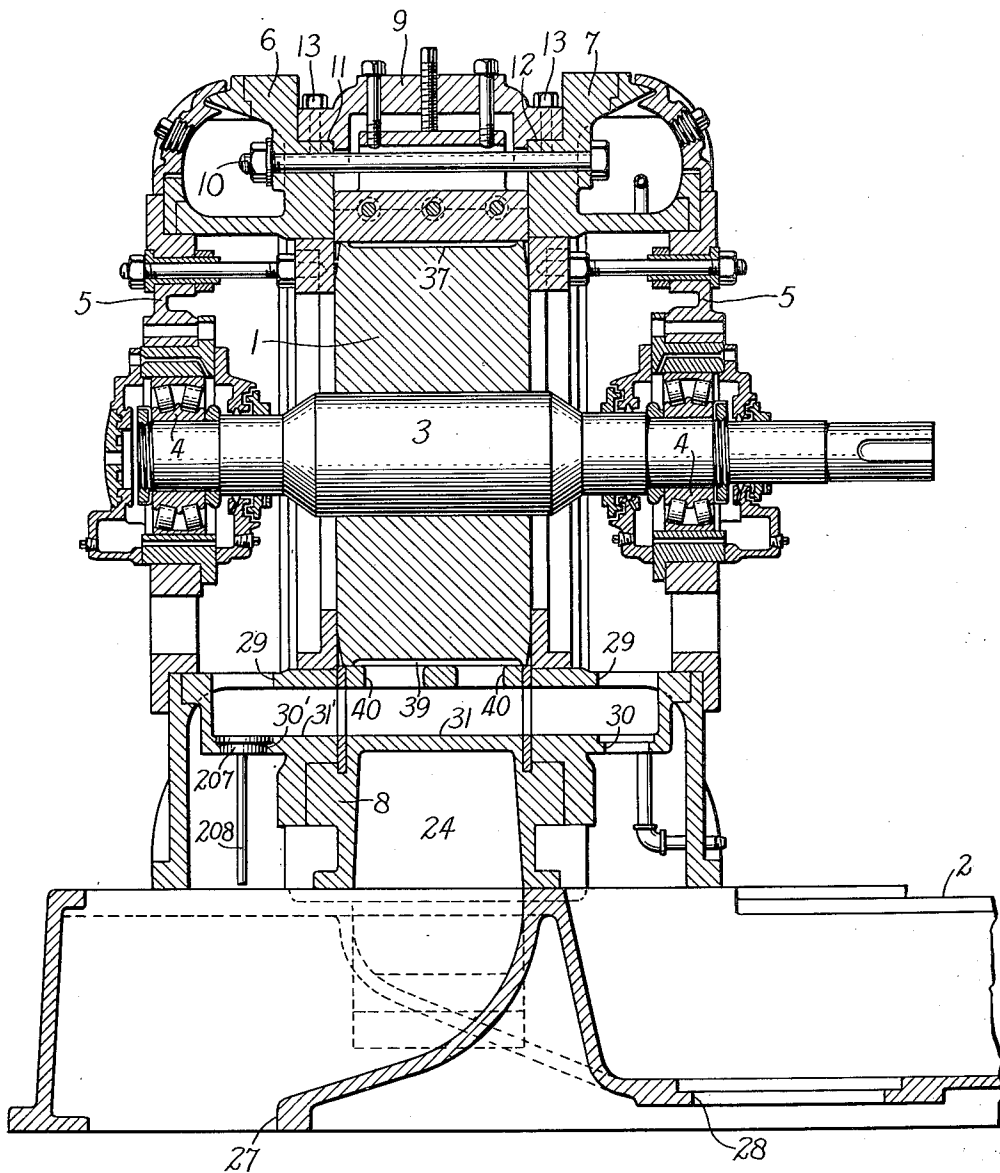
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Fig. 2.



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STUFF TREATMENT APPARATUS

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by mesne assignments, to The Noble & Wood
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ration of New York

Original application March 28, 1934, Serial No.
717,717. Divided and this application January
12, 1937, Serial No. 120,312

1 Claim. (Cl. 92—26)

The present invention relates to an improve-
ment in apparatus for stuff treatment wherein
the material to be treated is passed in fluid form
or in a fluid medium through a treatment zone
and there subjected to suitable forces for pro-
ducing the desired change of condition.

One object of my invention, in so far as it
relates to treating fibrous cellulose material for
making paper, board, or the like, has been to
provide apparatus for defibering and "finishing"
the stock wherein the character and/or extent
of treatment thereof may be effectively controlled
to produce a product having materially improved
quality as compared to stocks treated in beaters
of the Hollander or Jordan types for example.
For a summary of more recent hypotheses bear-
ing on cellulose treatment phenomena in paper
making, I refer to a pamphlet by W. Boyd Camp-
bell, entitled "The Cellulose Water Relationship
in Paper Making", published 1933 by the Depart-
ment of the Interior, Canada. In view of con-
flicting theories as to what takes place in pre-
paring pulp for the paper or board machine, i. e.
whether the effect is chemical and therefore
hydration, or physical and therefore fibrillation
and/or wetting or a combination of these, I em-
ploy the term "finishing" to designate generically
the treatment applied to pulp or the like at the
beater stage, it being understood, however, that
the term is also used by me to include analogous
treatment of other substances.

In accordance with my invention, where fibrous
cellulose material of suitable consistency in a
fluid medium is treated, I deliver a supply of the
stock under pressure into contact with a por-
tion of the peripheral surface of a high speed
rotor provided with transverse peripheral grooves.
For effective operation, the feed pressure used is
sufficient to overcome the centrifugal counter-
force developed by rotation at high speeds, i. e.
of the order of 5000 feet per minute or more. A
quantity of stock is thus forced into each rotor
groove and carried by the rotor into a film shear-
ing gap or treating zone preferably formed be-
tween the rotor periphery and a suitable stator
or stators spaced therefrom a distance of the
order of .005 of an inch or less. In this zone
the entire contents of each groove are subjected
to a uniformly effective defibering and finishing
action under pressure and then discharged from
the treatment zone with sudden or material de-
crease of pressure. Characteristics of this mode
of operation are, in general, that for a given
rotor speed the capacity or rate of throughput
for stock of given consistency varies with the

feed pressure; that for a given feed pressure the
character and/or degree of finishing varies with
the zone or gap pressure and/or the extent or
length of the zone or gap; that the amount of
cutting or shortening of the fibers is uniformly
negligible compared to the amount of fibrillation
and/or wetting or hydration, whatever the feed
and/or gap or zone pressures employed; and
that defibering, i. e. the breaking down of bundles
of fibers into smaller groups or single fibers, is a
constant factor regardless of the degree or charac-
ter of wetting or hydration.

In view of the widely varying peculiarities of
different kinds of stocks and the different treat-
ment characteristics required for various ulti-
mate products, my invention further contem-
plates testing the treated material and then ad-
justing the feed and/or gap or zone pressure
and/or length of gap or zone to increase or
diminish the extent of "finishing" required to
render the material suitable for its intended pur-
pose. The gap or zone pressure may be adjusted
by regulating the rotor speed, by increasing or
decreasing pressure on the stator, or in any
other suitable manner.

To summarize therefore, my invention so far
as it relates to the treatment of fibrous ma-
terials in a fluid medium includes broadly appa-
ratus wherein means are provided for subject-
ing a supply of the stock to initial or feed pres-
sure, removing successively presented small por-
tions of the supply from the initial or feed pres-
sure condition to a treatment zone, and there
subjecting said separated small portions simul-
taneously to treating forces under increased
pressure to effect defibering, wetting and/or
hydration, and fibrillation substantially without
cutting or shortening of the fibers. If the cir-
cumstances require, a further operative step in-
cludes testing a treated portion of the material
and adjusting the time of treatment and/or the
feed or gap or zone pressure to change the
character and/or degree of treatment.

The subject matter of the present application
has been divided out and forms a division of my
pending application Serial No. 717,717 filed
March 28, 1934 for Stuff treatment apparatus.

One embodiment of apparatus adapted for use
in connection with the treatment or preparation
of paper stock or the like is illustrated in the ac-
companying drawings attached to and forming
a part of the present specification and in which—

Figure 1 is a front end elevation with outer
parts thereof removed to disclose interior por-

tions and with other structural features shown in vertical section;

Figure 2, a section on the line 2—2 of Figure 1; and

5 Figure 3, a fragmentary detail in section illustrating, on an enlarged scale, the rotor groove and land contours.

In the machine shown in the drawings, a rotor 1, having peripheral grooves 37, is mounted to rotate in the direction of the arrow, Figure 1, in a superstructure supported on a base 2 and is driven through shaft 3 by a motor or other power source, not shown. Shaft 3 is journaled in bearings 4 mounted in spiders 5, one of which is opposite a front frame 6 and the other of which is opposite a rear frame 7, said frames being spaced apart by suitable means, as, at the bottom, by a casting 8 and at the top by a spacer 9. A tie bolt 10 passes through upper portions of both frames and the spacer 9. Another tie bolt 14, Figure 1, passes through lower portions of said frames and through said casting 8.

The inner face of frame 6 forms an annular shoulder 11 and the inner face of frame 7 forms an annular shoulder 12. Bolts 13 secure the spacer 9 in operative position between the frames 6 and 7. As shown in Figure 1, the mill is provided with a plurality of radially arranged stator units removably mounted between frames 6 and 7 and including cylinder caps 15 secured to the shoulders 11 and 12 by bolts 17 passing through end portions of cylinder blocks 16. Each stator unit also includes a shoe carrier 18 movable in a radial direction toward and from rotor 1 and having a dovetail slot 19 adapted to releasably retain a shoe, as 20 or 21. The shoe 20, hereinafter designated the first shoe, is preferably of suitable metal and fitted with a projecting nose 22. The shoes 21 may be made of wood, metal or other suitable material, depending on the conditions of use.

The working faces of the shoes may be continuous or plain for some purposes, or, as shown in Figure 1, may be provided with grooves 205. It has been found that with the grooved and/or recessed shoe a greater amount of power can be effectively applied to the same character of stock under treatment.

In the space between the first shoe 20 and the last shoe 21, suitably formed castings provide a feed inlet chamber or passage 23, a stock discharge or outlet passage or chamber 24, and a trash discharge passage or chamber 25. The inlet chamber 23 communicates with a feed inlet opening 26 at one side of the base 2, and, as shown in Figure 2, the discharge chamber 24 communicates with a discharge opening 27 near the front end of the base. A drain opening 28, in base 2, connects with the trash discharge passage 25 and also receives waste or leakage through seal ring drain passages 29, 30, 31, Figure 2, and other drain passages 32 and 33, Figure 1. A removable cover 34 closes an opening into the feed inlet chamber 23 and a removable cover 35 closes an opening into the discharge passage or chamber 24. A doctor bar 36 extends across said chamber opposite the last shoe 21 and is adjustable toward and from the rotor periphery. Another transverse bar 38 is mounted in the feed chamber 23 opposite the first shoe 20 and is adjustable toward and from the rotor periphery. A small chamber 39 between said bars 36 and 38 connects with the drain passage 31 through openings or ducts 40.

The drain passage 31' connects with the stock discharge chamber and opening 27 so that, under

some circumstances, leakage stock may be carried into the finished stock. A removable plug 207 having a handle 208 is seated in the drain passage 30' when it is desired to route the leakage material to drain 28 through passage 30. By opening passage 30' and closing passage 30 by means of plug 207, the leakage material runs into the stock discharge chamber.

In normal operation of a mill of the type thus far described, the furnish or material for treatment, where it comprises up to 10% of wood pulp in water for example, is forced in a continuous supply under suitable pressure through inlet opening 26 and feed chamber 23 into contact with the grooved periphery of rotor 1 which, in a preferred embodiment, attains a peripheral speed of about 12,000 feet per minute. Particles of suitable size are forced by the feed pressure into the peripheral grooves 37 each of which, in the mill as shown in Figures 1 and 3 is around $\frac{3}{16}$ ths inch wide, decreasing in depth rearwardly from a maximum of approximately .08 inch near its leading edge to the land between its rear edge and the next groove and defining a substantially stream line contour of the leading face of the land which is believed to produce a combined scouring and wiping effect in operation. It will be understood that these dimensions and the shape of the grooves may be varied to meet different conditions of use. During rotation, each groove of the rotor, as it passes the feed chamber 23, picks up a small amount of pulp, depending on the amount of the feed pressure, which therefore determines the mill's capacity or rate of throughput, and carries it into the treatment zone or shearing gap where it is subjected to the intended treatment, provided the material presented is of suitable size to pass the inlet opening to said zone. In respect to any given kind of stuff, the insufficiently reduced particles and foreign objects such as pieces of wire, gravel, glass, etc. and other trash therein accumulate against or adjacent to the front face of shoe 20 and, unless removed, eventually obstruct the supply of stock to the treatment zone.

As applied to the preparation, refining or finishing of fibrous cellulose material in paper and board manufacture, apparatus of the types shown in Figures 1 to 3 inclusive, when operated in connection with suitable methods, provides a stock refining action which produces a high degree of "wetting" in relation to the amount of "cutting". For practical purposes, it may be said that the apparatus produces wetting without cutting, the reduction in fiber length being so small as to be negligible. In this respect said apparatus is free from the operating limitations inherent in machines of the Hollander and Jordan types and others in which increased "wetting" effect is always accompanied by increased cutting.

To achieve effective control over the character and/or extent of treatment of the stuff fed to the mill, each shoe carrier 18 is mounted at the ends of rods 79 of pistons 81 operating in cylinders 80 of the cylinder block 16, and means are provided to controllably move said pistons and therefore the shoes 21 toward and away from the treatment zone or gap.

In the treatment of sulphite pulp, for example, this being one of many uses for which a mill embodying my improvements may be employed, feed pressures of from 5 to 35 pounds have been used with hydraulic pressures of from 75

30 to 100 pounds per square inch applied to the shoes through the pistons and thence to the stuff under treatment in the treatment zone, these figures being illustrative and in no sense intended as limitations.

5 I have found that by employing my apparatus hereinabove described in the preparation of paper stock I have produced an intermediate product having novel properties which present material advantages in paper manufacture and the like. For example, the described treatment permits the refining, wetting, or finishing of pulp to be carried to any desired degree without cutting or reducing the fiber length, which means that hydration or wetting may be effected independently of cutting. If for any given paper machine or paper product, more cutting is needed to facilitate sheet formation after the stock has reached approximately the desired degree of wetting, this can be done by a relatively short treatment in a Jordan or other cutting machine, or the required amount of a shorter fibered pulp may be added to the run either before or after the wetting or finishing treatment.

Furthermore, my improved apparatus produces a completely defibered pulp, i. e. a finished pulp practically free of "fish eyes", slivers, lumps, or other defects, as the necessary result of practically any degree of finishing treatment

sufficient or suitable for paper making purposes. Pulp defects of this kind, according to known paper mill practice, are avoided or disposed of only by long and most exacting and consequently expensive beater or equivalent treatment. Some other advantages among many residing in the defibering capabilities of my apparatus are that the pulp may be finished with less prolonged previous cooking and, under proper conditions, broke may be refinished after a simple breaker treatment instead of rerouting it through beaters or other time and power consuming devices.

Numerous other advantages and beneficial results in the operation of my above described apparatus, including substantial economies in time and power, will be clearly apparent to the skilled paper maker.

I claim:—

In stuff treatment apparatus, the combination of a rotor having transverse peripheral grooves alternating with lands to form an irregular peripheral contour, each of said grooves having its maximum depth near its trailing edge with a diminishing depth gradient toward its leading edge to produce in effect a succession of substantially stream line land and groove contours around the rotor periphery.

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