Sept. 26, 1933. C. G. MUENCH 1,928,601

PULPER

Filed Aug. 19, 1929 3 Sheets-Sheet 1

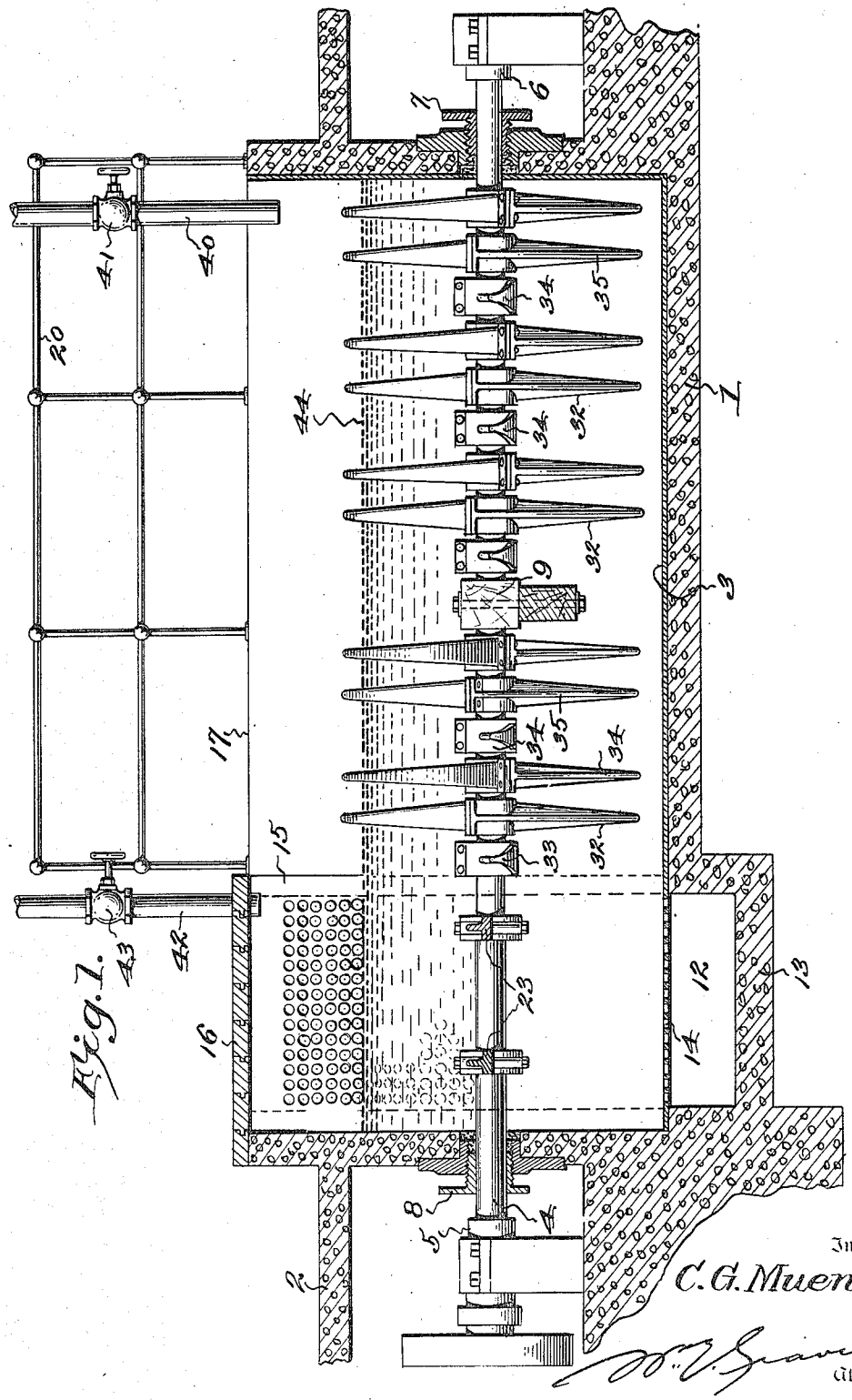

Fig. 1.

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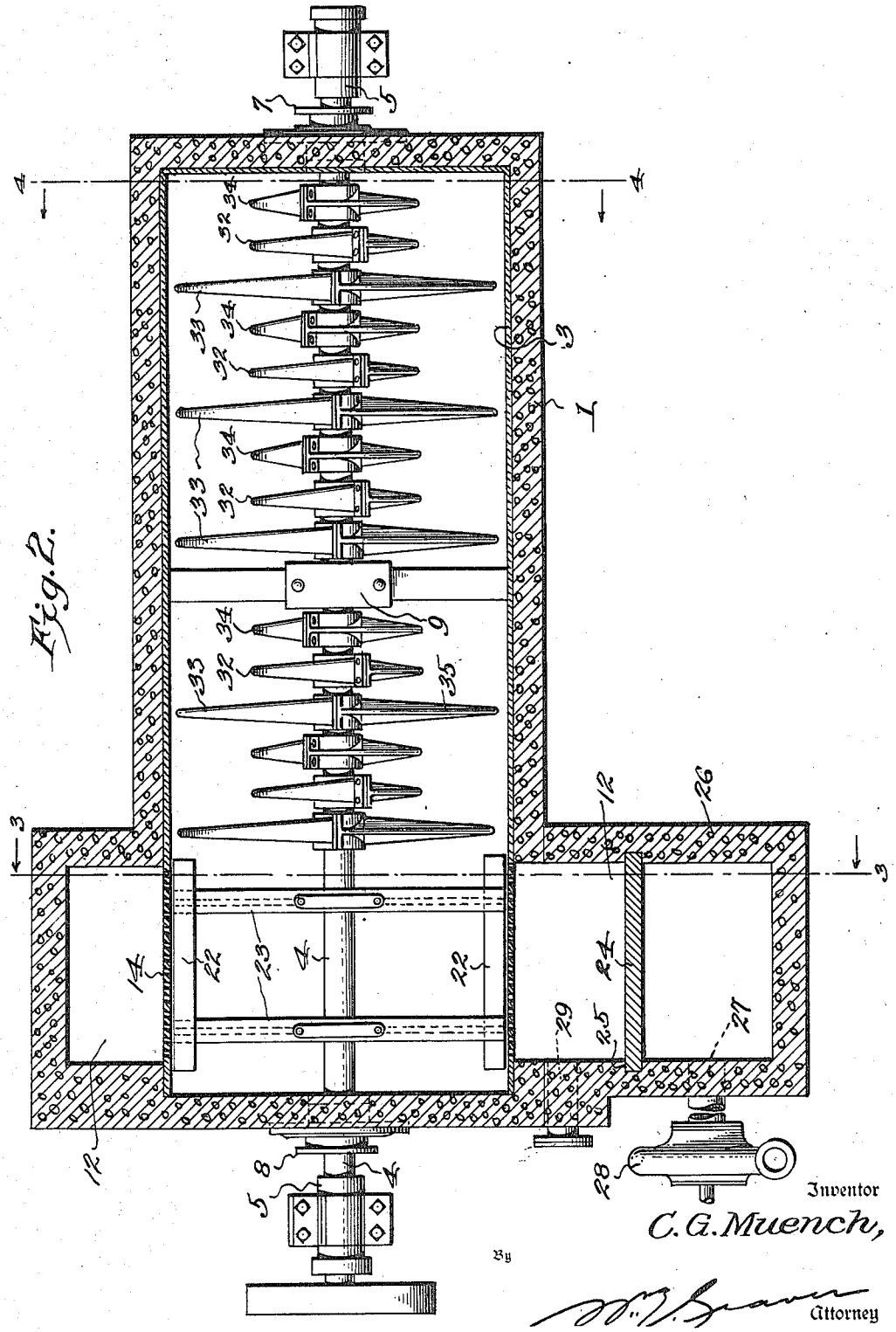

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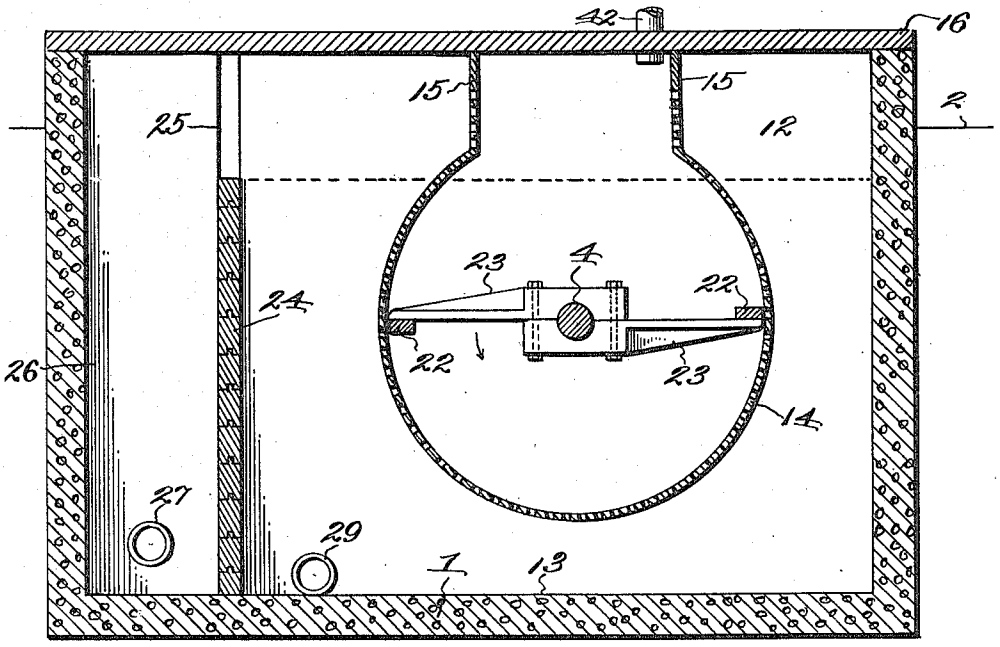

Fig. 3.

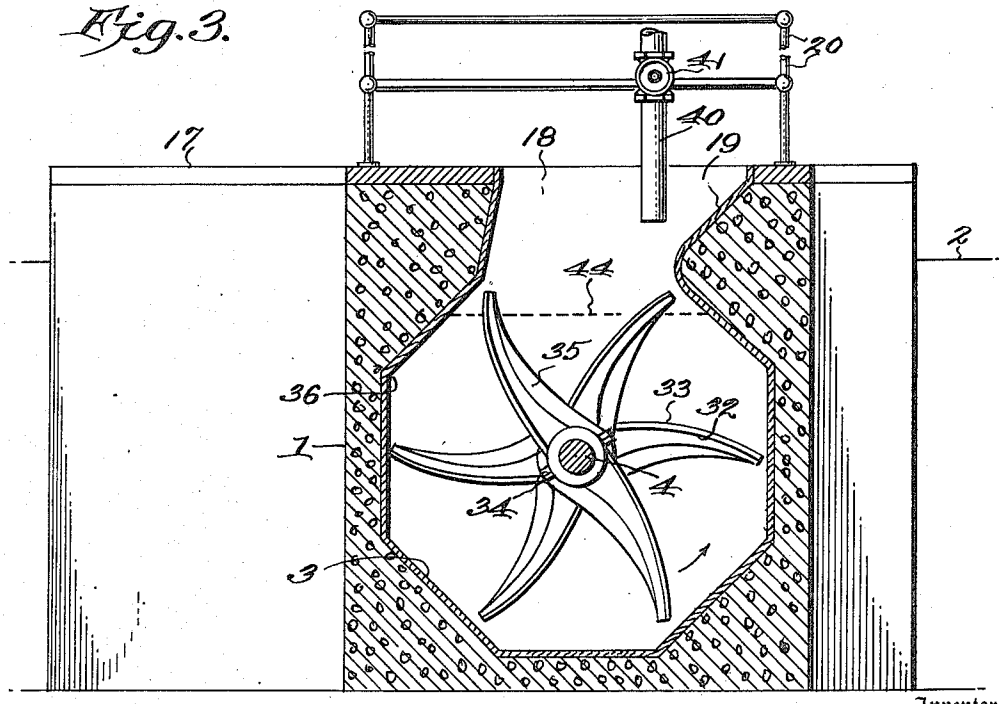

Fig. 4.

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UNITED STATES PATENT OFFICE

1,928,601

PULPER

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23 Claims. (Cl. 92—20)

This invention relates to pulpers and more particularly to pulpers for refuse material known as broke usually found around paper and pulp mills or the like, said invention having for its object to provide a device as well as a method for handling said material which are more efficient in use and less costly of operation than those heretofore proposed.

With these and other objects in view the invention consists in the novel details of construction and combinations of parts constituting the apparatus, and the novel steps and combinations of steps constituting the method all as will be more fully hereinafter disclosed and particularly pointed out in the claims.

Referring to the accompanying drawings forming a part of this specification in which like numerals designate like parts in all the views,—

Fig. 1 is a longitudinal vertical section of a device made in accordance with this invention;

Fig. 2 is a sectional view of the parts shown in Fig. 1 on a horizontal plane immediately above the shaft 4;

Fig. 3 is a transverse sectional view taken as on the line 3—3 of Fig. 2 and looking in the direction of the arrows; and

Fig. 4 is a transverse view of the device taken as on the line 4—4 of Fig. 2 and looking in the direction of the arrows.

In order that this invention may be the better understood it is said that in mills where paper or fiber stock is being worked there accumulates from time to time quite a quantity of ends, tailings, malformations of pulp stock, cuttings, and odd shapes of the material undergoing manufacture which in many instances has been treated as waste. Such waste material as just described is commonly known in the art as broke, but this material in practically all instances is composed of preformed fibers or fibers which have been refined to the point where they are ready for felting or otherwise forming into the material being manufactured. The present invention has to deal with a suitable device for disassembling the broke to recover the fibers which may again be utilized in forming material, as well as the method by which the broke is handled to obtain such a result.

Referring more particularly to Fig. 1 it will be readily seen that the device comprises an agitating tank 1 made of concrete or other suitable material which is disposed below the floor 2 of the mill and preferably provided with a metallic lining 3. This tank is preferably polygonal in transverse cross section and as illustrated in Fig. 4 has eight sides, although this number of sides may be increased or diminished as desired and in fact a tank having a basically circular cross section with inwardly extending projections may serve equally well. The purpose of this construction is to provide a tank having some definite type of obstructions to prevent the stock from freely circulating, thereby obtaining better action upon the fibrous mass. Extending longitudinally through the tank is a shaft 4 driven by any suitable source of power, said shaft supported in suitable journals 5 and 6 exteriorly of said tank with stuffing boxes 7 and 8 respectively to prevent the escape of liquid from the tank. If desired an intermediate cross support 9 may be provided substantially midway the ends of the tank in order to give more rigidity to said shaft.

The tank 1 has an enlarged end portion constituting a second tank 12 the floor 13 of which is below that of the tank 1. Concentrically disposed about the shaft 4 in the tank 12 is a perforated screen 14 which, as clearly shown in Fig. 3 has vertically extending spaced walls 15 at its uppermost portion said walls extending to removable sectional covers 16 disposed slightly above the floor level 2 of the room in which the device is located. These covers lie in the plane of a platform 17, see Fig. 4, from which the broke may be dumped from wheelbarrows or the like through the open longitudinally extending mouth 18 of the tank 1, said mouth constituting a hopper, the broke so dumped being downwardly directed into the tank by the inclined surface 19 of one side of said hopper. A suitable guard such as the railing 20 may be provided surrounding said mouth on all sides but one thereof.

Within the perforated screen 14 and working against the inner surface thereof there are provided scrapers comprising wooden cleats 22 rigidly connected across the ends of arms 23 rigidly mounted for revolution with the shaft 4, the purpose of the cleats being to aid the passing of the separated fibers of the broke through the perforations of said screen into the second or flotation tank 12. A wier 24 which can be made of variable height due to its sectional formation is disposed in vertical guideways 25 near one end of the flotation tank 12 to provide a third or drainage tank 26 having an outlet 27 near its bottom which is connected to a centrifugal suction pump 28 by means of which the freed fibers which have flowed over the wier can be recovered. Another outlet 29 is provided near the bottom of the flotation tank, on the opposite side of the wier from the outlet 27, by means of which the tanks 1 and 12 may be drained.

Also mounted on the shaft 4, but within the tank 1, is a plurality of agitator or beater arms 32 each having a flat face 33 which contacts with the broke as the arms are being rotated in the direction of the arrow, see Fig. 4. These arms are preferably made in two halves secured together as at 34 and each arm is slightly curved to cause a drawing action on the broke as it is forced around and around in the tank. These arms are placed in staggered relation throughout the length of the shaft and are placed with their hub portions almost contacting each other so that quite a number of said arms are disposed within the agitating tank. By having the arms staggered, the broke is caused not only to move in a circular path in the direction of rotation of the arms, but it is caused to move laterally from the rotational plane of each arm which latter action, when augmented by the flow of water through the device, causes a positive movement of the broke in the tank in a direction toward the perforated screen 14. The blade of each arm is substantially of T shape formation providing a strengthening rib 35 to withstand the resistance of the broke being worked.

Thus it will be seen that the arms 32 will cause the broke, which has a tendency to settle, to be moved upwardly and around the polygonal sides of said tank during which movement the arms, by their curvilinear shape, will cause said broke to move in a direction from the shaft 4 to the sides of the tank, thus coming in contact with said polygonal sides and the pockets 36 formed therebetween. In other words, the broke is not given an entirely smooth and uninterrupted tank surface over which to travel, with the result that adjacent portions of the broke act upon each other under the impeller action of the arms 32 and thus cooperate to further aid in the disassociation of the individual fibers.

Water is admitted to the agitating tank 1 through the pipe 40 having a valve 41 therein, and a second water supply through pipe 42 may be controllingly admitted to the flotation tank 12 as by the valve 43. The two tanks are filled with water to the level indicated at 44 and which is controlled by the wier 24 which should be of sufficient height to have the water completely cover the rotating arms 32. The broke, fed into the device through the hopper 18, is submerged by the rotating arms 32 and worked thereby against the irregular sides of tank 1 and against other particles of the broke as a result of which the original sizes of the broke are reduced and the fibrous nature thereof exposed to the action of the water which softens the fiber bundles whereby the individual fibers may ultimately be freed. Sufficient water is added from the pipe 40 either continuously or from time to time to maintain a thick saturated mixture which works its way slowly but positively by the hereinbefore mentioned action towards the perforated plate 14. Additional water is added from the pipe 42 to dilute the material to whatever point may be desired for handling the material at the flotation end of the device. The fibers, which are thoroughly broken apart, are caused by fluid action to be washed through the perforations of the plate 14, being assisted by the scrapers 22 and will ultimately flow over the wier 24 into the tank 26 from which they are recovered by the centrifugal pump 28 and delivered to a desired point.

Thus it will be seen that by this construction there is provided an apparatus which is designed to receive relatively large quantities of broke or other fibrous material which can be dumped upon the platform 17 and which will automatically feed through the hopper 18 into the agitating tank 1 due to the constantly rotating impeller blades 32. Also it is an object of this invention to provide a device whose top is entirely open thereby permitting a constant and ready inspection of the condition of the stock, which is a great advantage since in heretofore known types of pulpers which are inclosed it has been impossible to see the condition of the stock while it is being disintegrated as a result of which too little or too much water would be present; in the case of too little water the pulper would become plugged, and when too much water was present the stock would pass through without being properly reduced. Further it will be seen that the agitation of the material in said tank in the presence of water will cause a softening of the broke as a result of which the blades 32 will separate the broke portions into relatively small fiber bundles which subsequently become still further reduced to produce a total disassociation of the fibers. Also, the separation or fibrillation of the broke is peculiarly augmented by the shape of the receiving tank which, in cross-section, is basically cylindrical with longitudinally extending enlargements outside of the basic cylindric form, forming pockets retaining some of the broke material and against which the remainder of the broke frictionally contacts in its agitation by the impellers thus producing frictional separation of the fibers. This mechanical separation of the fibers is augmented by the broke portions acting upon other broke portions as well as the action of the broke in being squeezed by the extremities of the blades 32 against the polygonal sides of the agitating tank or the other obstructions thereof.

A further aid in the disassociation of the fibers occurs in the flotation tank within the circular screen 14 in that fibers extending from bundles will catch in the perforations of said screen and be subjected to a tearing apart action from their associated fibers and this in turn is augmented by the scrapers 22 in dragging a portion of the fibrous pulpy mass over other portions thereof as well as said perforations since the excess water escapes through the screen. After the fibers have become disassociated they have a natural tendency to float on the surface of the water in the flotation tank and thus will easily cascade over the top of the wier 24 with the excess water from said tank.

It is obvious that those skilled in the art may vary the details of construction constituting the apparatus as well as the steps constituting the method, within the scope of this invention and therefore it is not desired to be limited to the foregoing disclosure except as may be demanded by the claims.

What is claimed is:—

1. A pulper comprising a water supply; a tank to receive material for fiber liberation, said tank having polygonal sides assisting in said liberation; impellers in said tank; a second tank communicating with said first tank; a screen in said second tank; a rotor engaging the inner surface of said screen; and a wier at one end of said second tank to limit the water level in said first and second tanks.

2. A pulper comprising a water supply; a tank to receive material for fiber liberation, said tank having polygonal sides assisting in said liberation; impellers in said tank coacting with said

sides to cause disassociation of the material; a second tank communicating with said first tank; a screen in said second tank; a rotor engaging the inner surface of said screen; and a wier at one end of said second tank to limit the water level in said first and second tanks.

3. A pulper comprising a water supply; a tank to receive material for fiber liberation, said tank having polygonal sides with pockets therebetween assisting in said liberation; impellers in said tank substantially meeting each of said sides when actuated, said impellers adapted to move the material through said pockets into contacting relation with said sides; a second tank communicating with said first tank; a screen in said second tank; a rotor engaging the inner surface of said screen; and a wier at one end of said second tank to limit the water level in said first and second tanks.

4. A pulper comprising a water supply; a tank to receive material for fiber liberation, said tank having polygonal sides with pockets therebetween assisting in said liberation; impellers in said tank adapted when actuated to move the material through said pockets and squeeze it against said sides; a second tank communicating with said first tank; a screen in said second tank; a rotor engaging the inner surface of said screen; and a wier at one end of said second tank to limit the water level in said first and second tanks.

5. A pulper comprising a water supply; a tank to receive material for fiber liberation, said tank having polygonal sides assisting in said liberation; curvilinear impellers in said tank mounted for rotation to move the material into contact with said sides for cooperative disassociation of the fibers; a second tank communicating with said first tank; a screen in said second tank; a rotor engaging the inner surface of said screen; and a wier at one end of said second tank to limit the water level in said first and second tanks.

6. A pulper comprising a water supply; a tank to receive material for fiber liberation, said tank having polygonal sides assisting in said liberation; impellers mounted on a rotating shaft in staggered relation in said tank, each impeller of a length to substantially meet said sides during rotation; a second tank communicating with said first tank; a screen in said second tank; a rotor engaging the inner surface of said screen; and a wier at one end of said second tank to limit the water level in said first and second tanks.

7. A pulper comprising a water supply; a tank to receive material for fiber liberation, said tank having polygonal sides assisting in said liberation; impellers in said tank; a second tank transversely disposed of and freely communicating with said first tank; a screen in said second tank in substantial prolongation of the sides of said first tank; a rotor engaging the inner surface of said screen; and a wier at one end of said second tank to limit the water level in said first and second tanks.

8. A pulper comprising a water supply; a tank to receive material for fiber liberation, said tank having polygonal sides assisting in said liberation; impellers mounted on a rotating shaft in said tank; a second tank communicating with said first tank; a screen in said second tank; a rotor mounted on the impeller shaft and engaging the inner surface of said screen; and a wier at one end of said second tank to limit the water level in said first and second tanks.

9. A pulper comprising a water supply; a tank to receive material for fiber liberation, said tank having polygonal sides assisting in said liberation; impellers in said tank; a second tank formed at the end of and freely communicating with said first tank; a substantially cylindrical screen in said second tank concentric with said first tank into which the stock from the impellers is passed; a rotor engaging the inner surface of said screen; and a wier at one end of said second tank to limit the water level in said first and second tanks.

10. A pulper comprising a water supply; a tank to receive material for fiber liberation, said tank having polygonal sides assisting in said liberation; impellers in said tank; a second tank communicating with said first tank; a foraminous screen in said second tank disposed to receive the partly fibrillated stock; a rotor engaging the inner surface of said screen to further fibrillate the stock and force the freed fibers through said screen; and a wier at one end of said second tank to limit the water level in said first and second tanks.

11. A pulper comprising a water supply; a tank to receive material for fiber liberation, said tank having polygonal sides assisting in said liberation; impellers in said tank; a second tank communicating with said first tank; a screen in said second tank; a rotor engaging the inner surface of said screen; and a wier at one end of said second tank to limit the water level in said first and second tanks said wier forming a third tank into which the liberated fibers flow with the excess water.

12. In a machine for disintegrating fibrous material, a longitudinally arranged tank receiving the material for fiber liberation, the walls of the tank basically substantially cylindrical in cross section in a plane at right angles to its longitudinal axis, but having in substantially regular arrangement and extending longitudinally, spaced enlargements outside of the basic cylindric form, surfaces of such enlargements merging into the general circular form of the tank as tangents.

13. In a machine for disintegrating fibrous material, a longitudinally arranged tank receiving the material for fiber liberation, the walls of the tank basically substantially cylindrical in cross section in a plane at right angles to its longitudinal axis, but having in substantially regular arrangement and extending longitudinally, independent enlargements outside of the basic cylindric form, said enlargements formed by the intersection of the wall surfaces substantially the entire top of the tank open for reception of material.

14. In a machine for disintegrating fibrous material, a longitudinally arranged tank receiving the material for fiber liberation, the walls of the tank basically substantially cylindrical in cross section in a plane at right angles to its longitudinal axis, but having in substantially regular arrangement and extending longitudinally, independent, spaced enlargements outside of the basic cylindric form, said enlargements formed by the intersection of the wall surfaces and a shaft arranged axially in the tank with substantially radially extending beater arms mounted on the shaft.

15. A pulper comprising a water supply discharging to a tank receiving material for fibre liberation, the tank having a cross section substantially circular but having longitudinally arranged enlargements assisting in fibre liberation; substantially radial beater arms in said tank mounted for rotation to move the material into contact with the interior surfaces of the tank; a second tank communicating with said first tank; a

classifying member in said second tank; a rotor engaging the inner surface of said classifying member; and a weir at one end of said second tank to maintain a predetermined level of the water and fibre in said first and second tanks.

16. The method of pulping fibrous materials wherein in a longitudinally extending receiver the raw material is introduced at points throughout the length of the receiver agitated and disintegrated by mechanical action at substantially the loci of introduction of the material without appreciable movement thereof longitudinally of the receiver, the material when reduced floated off from the surface of the mass in fluid suspension.

17. The method of pulping fibrous materials wherein in a receiver the raw material is agitated and disintegrated by mechanical action at substantially the loci of introduction of the material without appreciable movement thereof longitudinally of the receiver, the reduced material subsequently floated off from the surface of the mass in fluid suspension, unreduced material restrained from escape from the receiver, the depth of the material in the receiver maintained at a substantially constant predetermined depth.

18. The method of disintegrating fiber stock which consists in softening the stock in a fluid stream while subjected to agitation, the agitation such that unreduced stock is at times projected outside the direct sphere of action of the agitator means comprising substantially radial arms positioned in an arrangement not to impel the stock longitudinally and is at times returned to within the sphere of action of the agitator means, through the urge of unreduced stock impelled bf the agitator means, to frictionally contact such unreduced stock to cause partial reduction thereof and its return into the sphere of action of the agitator means.

19. The method of disintegrating fiber stock which consists in softening the stock in a fluid stream while subjected to agitation, the agitation such that unreduced stock is at times projected outside the direct sphere of action of the agitator means comprising substantially radial arms positioned in an arrangement not to impel the stock longitudinally and is at times returned to within the sphere of action of the agitator means, through the urge of unreduced stock impelled by by the agitator means, to frictionally contact such unreduced stock to cause partial reduction thereof and its return into the sphere of action of the agitator means, fibers as freed permitted to escape from the undisintegrated mass through fluid flotation from the top surface thereof.

20. A pulper comprising a water supply, a tank to receive material for fiber liberation, said tank having polygonal sides assisting in said liberation, agitating members in said tank; a second tank communicating with said first tank, a classifying member in said second tank and means associated with the second tank to maintain therein and in the first tank a predetermined liquid height.

21. In a machine for disintegrating fibrous material, a longitudinally arranged open top tank to receive material for fiber liberation, a shaft longitudinally mounted of the tank for rotation therein, disintegrating arms on the rotatably mounted shaft, the disintegrating arms rotated by the shaft to describe circular areas substantially perpendicular to the shaft axis, and associated with the tank means maintaining a predetermined level of material therein.

22. A fiber pulper comprising an open top, elongated pulper tank of generally circular cross section, projections from the general circular contour of the tank, a shaft journaled axially of the tank, substantially radial arms mounted on the shaft and of a length to clear the tank structure when revolved, a second tank in unrestricted communication with one end of the pulper tank, fiber classifying means in the second tank and said second tank having an escape wier to limit the water level in the tanks.

23. A fiber pulper having an elongated pulper tank of generally circular cross section, the tank open at the top throughout its length, projections from the general circular contour of the tank, a shaft rotatably journaled axially of the tank, pulp disintegrating arms mounted on the shaft and rotating therewith, said arms of a length and spaced along the length of the shaft to clear the projections from the general circular contour of the tank, a water supply adjacent to one end of the tank, a classifying tank adjacent to the other end of the pulper tank and in free communication therewith, to receive pulp therefrom, a wet fiber classifier in the classifying tank to allow the escape of fully pulped material therefrom and an escape wier in said classifying tank and serving to maintain a definite minimum water level in said pulper and classifier tanks.

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