Oct. 18, 1938. A. J. HAUG 2,133,449

MACHINE FOR USE IN THE PREPARATION OF PAPER STOCK

Filed May 5, 1937 3 Sheets-Sheet 1

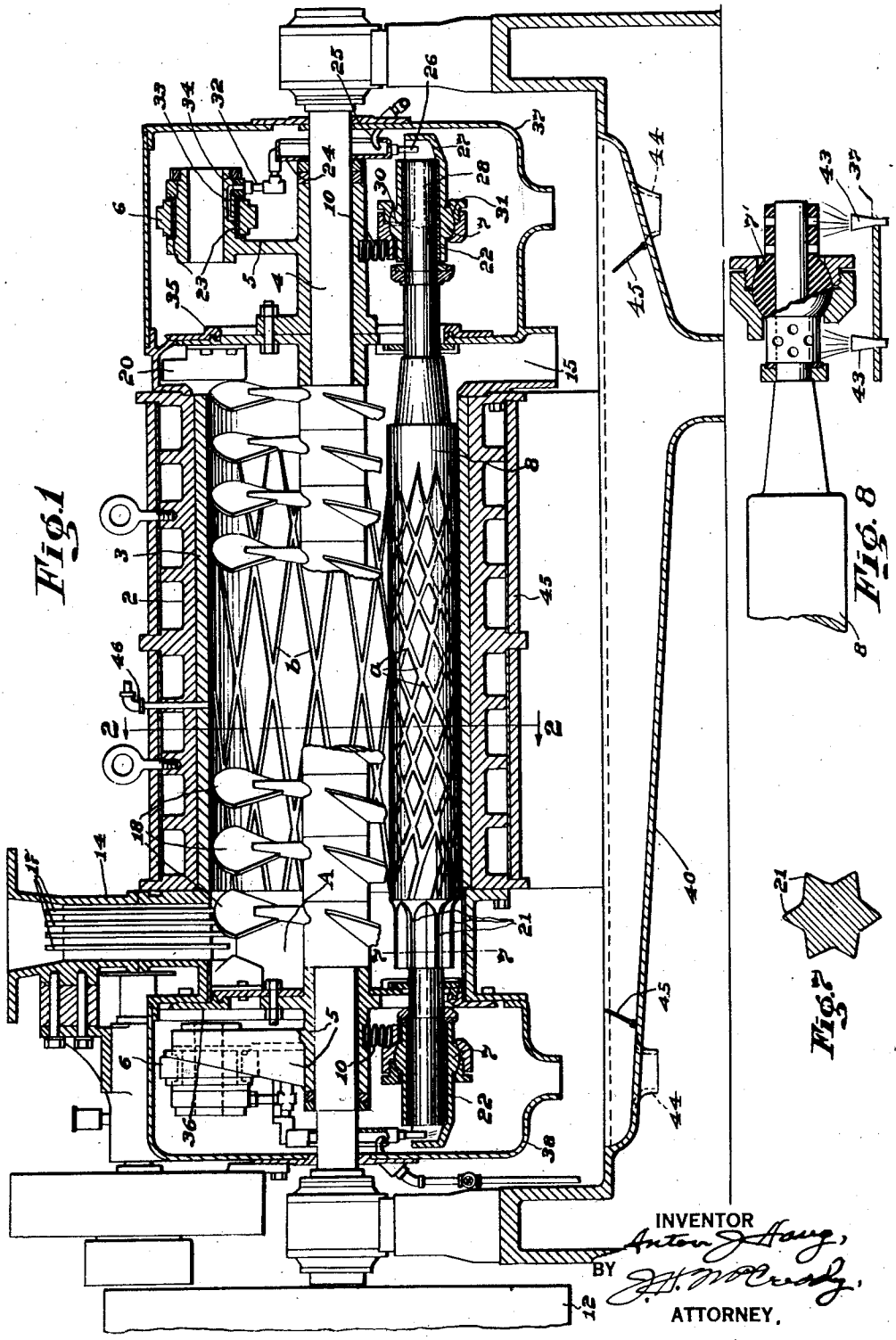


Fig. 1

Fig. 8

Fig. 2

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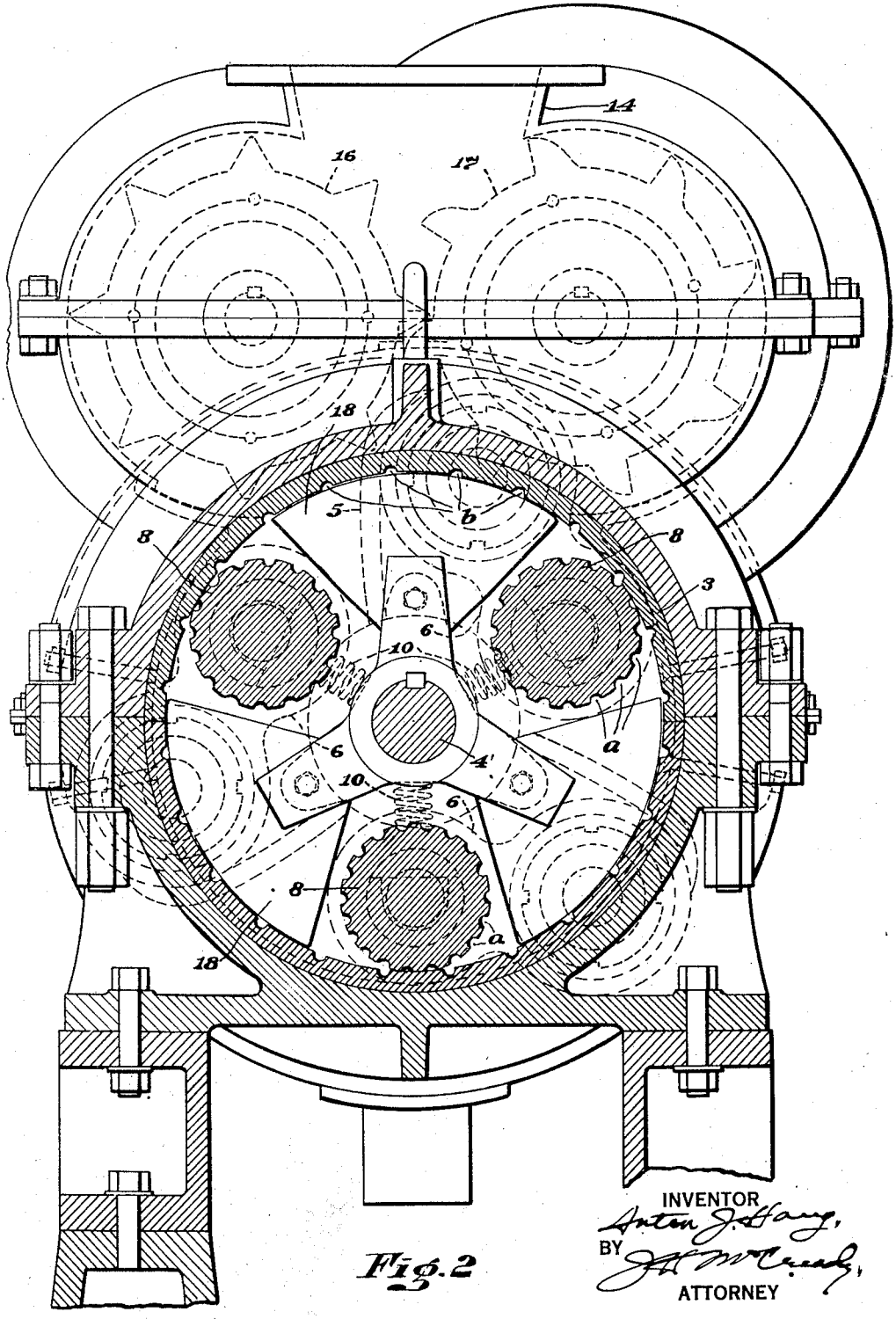


Fig. 2

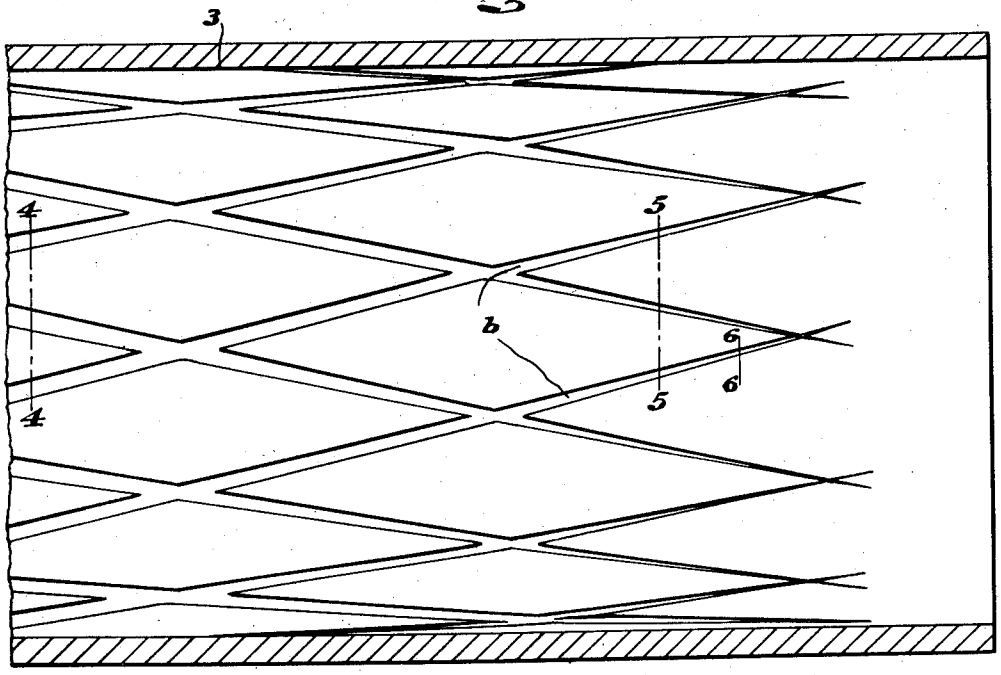
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Fig. 3



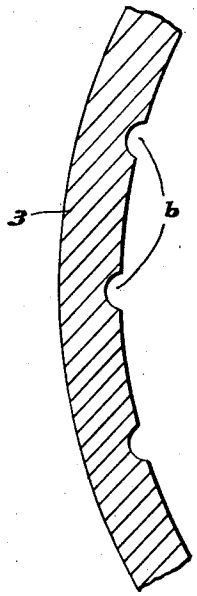


Fig. 4

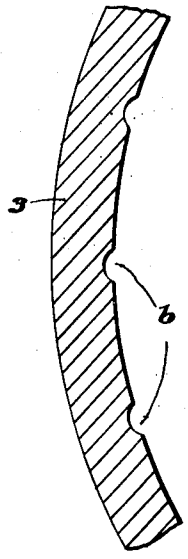


Fig. 5

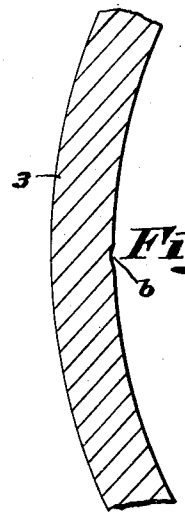


Fig. 6

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MACHINE FOR USE IN THE PREPARATION OF PAPER STOCK

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Application May 5, 1937, Serial No. 140,881

6 Claims. (Cl. 92—26)

This invention relates to machines of the general type disclosed in my prior Patent No. 2,066,107, granted December 29, 1936. While these machines were designed primarily for the purpose of refining the coarser constituents of paper stock such, for example, as the materials rejected by the pulp screens, they have also been found useful for other purposes, especially in certain of the preliminary steps in working up the material from which paper, paper board, and allied products are made. For convenience, such materials will be hereinafter referred to as "paper stock."

The present invention aims to improve machines of this type with a view to making them more efficient, increasing the range of materials which they are capable of handling, reducing the care and attention required by them, and generally increasing their usefulness.

The nature of the invention 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,

Figure 1 is a vertical, sectional view, with some parts broken away and some in elevation, of a machine embodying this invention;

Fig. 2 is a vertical, transverse, sectional view of the machine shown in Fig. 1 on approximately the line 2—2, Fig. 1;

Fig. 3 is a longitudinal, sectional view of a portion of the drum or cylinder;

Figs. 4, 5 and 6 are sectional views approximately on the lines 4—4, 5—5, and 6—6, respectively, Fig. 3;

Fig. 7 is a vertical, sectional view through an end portion of one of the rolls approximately on the line 7—7, Fig. 1; and

Fig. 8 shows a modified bearing structure.

Referring first to Figs. 1 and 2, the machine there shown comprises a drum or casing 2 which includes a cylindrical lining or shell 3. Extending longitudinally through this casing is a horizontal shaft 4 carrying two spiders 5—5 at its opposite ends, these spiders being rigidly secured to the shaft for rotation therewith. In the particular machine shown, each spider is provided with three radial arms each provided with a bearing at its outer end. Supported on these bearing portions of the arms are additional arms or links 6 which themselves carry bearings, such as those shown at 7 in Fig. 1. A roll 8, Fig. 1, located within and extending longitudinally of the cylinder 3 is mounted in two of these bearings 7—7 at opposite ends of the machine, and two additional rolls are similarly supported, as shown in Fig. 2, the three rolls being spaced apart by equal angular distances. Springs, such as those shown at 10, are interposed between the hub of the spider 5 and the free end portions of the respective links 6 where they serve to hold the rolls 8 continuously in contact with the inner surface of the cylinder 3. During the operation of the machine the shaft 4 is revolved in a counter-clockwise direction, Fig. 2, through power applied to the pulley 12, Fig. 1, and the centrifugal force created in the rolls and their immediate supports by such rotation also serves to hold these rolls against the inner surface of the cylinder. In fact, the pressure so created between the rolls and the cylinder wall is relied upon chiefly in refining the stock, the springs 10 merely preventing the rolls from falling away from the cylinder 3 when the machine is stopped, and acting as shock absorbers.

At one end of the casing 2 it is provided with an intake chute 14 and at its opposite end with a discharge port or opening 15. As the paper stock is fed into the intake chute it passes between two sets of rotary knives or disk cutters 16 and 17, the teeth of which overlap each other, as shown in Fig. 2, so that they serve to break up and shred to a substantial degree the material introduced into the drum. This stock immediately comes into the range of operation of a series of inclined blades 18 mounted fast on the shaft 4 to revolve with it and spaced between the rolls 8. This series of blades extends the entire length of the drum and serves to convey the stock through it from the intake to the discharge port. Ejection of the refined stock through the port 15 is facilitated by a scraper 20, Fig. 1, which is secured to and revolves with the shaft 4 and operates in the annular chamber at the discharge end of the casing.

As the stock moves through the drum, the rolls crush it against the inner surface of the cylinder 3. Referring to Fig. 1 it will be seen that the peripheral surface of the roll 8 is provided with diagonal depressions or grooves, such as those indicated at *a*, and that these grooves are reversely arranged, some of them having a clockwise component around the circumference of the roll, while others have a counter-clockwise component. They intersect each other at frequent intervals and thus divide the greater part of the surface of the roll into a series of diamond-shaped sections. Similarly, the inner surface of the cylinder 3 is provided with diagonal depressions or

grooves, such as those shown at *b*, these grooves being reversely arranged and intersecting each other in substantially the same way as do the grooves *a*. Those in the cylinder, however, are spaced farther apart than are the grooves in the roll. All of the rolls are substantially identical in construction.

The grooving of the rolls, whether reversely or otherwise, is of advantage in producing the rotation of the rolls around their individual axes which is necessary to their proper operation, and also produces a far more effective and efficient refining of the stock. When grooved in one direction only, however, they produce a reaction on the stock which tends both to move the stock axially in the casing and also to move the rolls axially. This produces a thrust on the roll bearings which often tends to make them heat up, and in any event, is undesirable. Such end thrust, however, is avoided, and the efficiency of the rolls is increased by reversely grooving them. The efficiency of the machine is further increased by grooving the cylinder **3**. An additional and important advantage of this feature of the invention is that it enables the machine to handle successfully coarser stock and certain kinds of material which are slippery and which, consequently, could not be successfully treated in the machine without the additional grip afforded by the grooves in the casing cooperating with those in the rolls. The reverse arrangement of the cylinder grooves also eliminates the undesirable axial reaction on the stock which otherwise would be produced.

Since the stock at the intake end of the drum is relatively coarse and is reduced to a more finely divided condition as it progresses toward the outlet, I have found it advantageous to taper the grooves both in the cylinder and in the rolls. That is, the grooves are relatively large at the intake end of the machine and taper gradually toward the opposite end. In the cylinder this construction is well shown in Figs. 3 to 6, and essentially the same relationship is satisfactory in the rolls. Naturally the size of the grooves used will vary somewhat with the nature of the stock and other practical details of individual installations. A typical depth is approximately five-sixteenths of an inch at the larger end and they taper uniformly to zero at or adjacent to the opposite end of the roll or the cylinder. They preferably are cut spirally.

A further feature of this invention which is useful in refining stock containing coarse chips and other relatively large pieces of material, consists in providing that portion of the roll **8** which lies in the chamber A, and into which the material drops from the chute **14**, with relatively large and prominent teeth **21**, Figs. 1 and 7. These teeth cooperate with the adjacent wall of the drum to break up the larger pieces of stock and thus reduce them to such a size that they can be more effectually handled by the rolls.

The lubrication of the rolls and other bearing surfaces in a machine of this type is especially troublesome because of the necessity for keeping water out of the bearings and also preventing any substantial amount of lubricating oil from finding its way into the refined stock. I have found that this difficulty can be effectually overcome by replacing the metal bushings of the bearings with non-metallic bushings, such as those made of fiber indurated by heat and impregnation with rubber, synthetic resins, and similar materials, such that water forms a satisfactory lubricant for machine parts made from them. "Micarta" is a typical example of a satisfactory commercial material from which to make these bushings and other bearing elements. Such bushings are shown in the drawings at **22** and **23**, Fig. 1. In order to supply water substantially continuously to these surfaces at the right-hand end of the shaft, Fig. 1, a collar **24** is secured fast on the shaft, this collar being hollow and provided at one end with a circular cut-out portion through which a nozzle **25** projects. Water from any convenient source of supply is fed through this nozzle into the collar at the desired rate. From the collar it is discharged into the respective roll bearings through nozzles cooperating with them, one of these nozzles being shown at **26**. It delivers its water into a receptacle **27** formed in the bearing at the end of the shaft. This water may find its way along the bearing surface through grooves in the shaft or through a hole **28** formed centrally in the shaft, radial ducts leading from this hole to the outer surface of the journal. Also, additional radial holes, one of which is shown at **30**, conduct the lubricating water to the spherical bearing surface **31**. Pipe connections **32** also lead water from the collar **24** into a duct **33** formed in the bearing boss **34** at the outer end of the spider arm, this duct leading the water to the surface of the bushing **23**. The same arrangement is repeated for the other journals and spider arms, and is duplicated at the opposite end of the machine.

Partitions, such as those shown at **35** and **36**, preferably are provided also at the opposite ends of the drum to separate the chamber containing the paper stock from the compartments in which the spiders and the bearings are mounted. This partition arrangement may be like that shown in my prior patent above designated, and it may also be equipped with packing devices around the ends of the shaft of the same general nature as those shown in said patent. While it is important to keep the paper stock out of the bearing chambers, it is not at all important to keep the water used as a lubricant from entering the stock working chamber since this stock is always mixed with water. In fact, the lubricating water may either be discharged directly into the pan **40** into which the refined stock is ejected, or into supplemental discharge chutes.

Another arrangement which may conveniently be used for supplying water to the bearing surfaces, and which is somewhat simpler than that above described, is shown in Fig. 8. Here the bearing bushing **7'**, corresponding to the member **7** shown in Fig. 1, is made of "Micarta" or other suitable non-metallic bearing material capable of being lubricated by water, and the portions of this member extending beyond its support are provided with holes drilled radially therethrough. Spray nozzles **43** are led through the casing **37** and positioned to direct sprays of water against the perforated sections of the bushings **7'** for the different bearings as they swing through their paths of movement. Essentially the same idea can be applied to the other bearings. While this arrangement does not directly apply water to the spherical surfaces of the bushing **7'**, enough spray works on to these surfaces to lubricate them satisfactorily.

With regard to the grooving of the rolls and the inner surface of the drum, applicant has shown a construction which he prefers, but it will be evident that either, or both, of these members can be roughened in other ways so that they

will perform essentially the same operations on the stock as do the grooved members. The important point is that the construction shall be adapted for this purpose and that the grooves or other roughening elements in the two members shall not be such that the rolls can interlock with the drum. So long as these conditions are met, the shape given to these elements to make them perform these functions can take a wide variety of forms. In the construction shown any interlocking of the rolls with the drum is prevented by the fact that the lands intervening between grooves in the surface of the roll are always opposed to lands on the drum.

In refining some kinds of stock, the factor of temperature is important, and in such cases I prefer to equip the drum with a jacket **45**, Fig. 1, so that hot or cold water, steam, or the like, can be circulated through the jacket space to produce the desired temperature conditions.

In some cases, also, it is of advantage to spray hot water, steam, or the like, upon the stock as it travels through the drum, and this member may be equipped with any desired number of spray nozzles such, for example, as that shown at **46** for this purpose. In the event that it is undesirable to discharge the water used for lubricating purposes into the pan **40**, this pan may be provided with supplemental discharge chutes, such as those shown at **44—44**, and also with a deflector or gate **45** adjustable into an approximately upright position, as shown, or into a flat inoperative position, the deflector serving to guide the lubricating liquid into its discharge ports.

While I have herein shown and described a preferred embodiment of my invention, it will be evident from the foregoing that the invention may be embodied 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. In a machine for refining paper stock and the like, the combination of a drum having an approximately cylindrical inner surface and adapted to hold a quantity of said stock, a plurality of rolls mounted in said drum and extending longitudinally thereof for engaging the stock and crushing it against said surface, means supporting said rolls for bodily rotation around the axis of said drum, for rotation around their individual axes, and for lateral movement toward and from the inner surface of said drum, the peripheral surfaces of said rolls and the inner surface of said drum both being provided with depressions, the depressions of one being so disposed as to leave intervening lands falling opposite lands on the other as the rolls rotate around the axis of the drum, whereby the relative bodily rotation of the rolls in the cylinder revolves them around their own axes due to their contact with the stock and the crushing action of the rolls on the stock is increased.

2. A machine according to preceding claim 1, in which said depressions in both the rolls and said drum are diagonally disposed with reference to radial planes, respectively, of said rolls and drum.

3. A machine according to preceding claim 1, in which said depressions in both the rolls and said drum are reversely disposed and intersect with each other diagonally so that the crushing action exerted on the stock by the rolls does not create any substantial degree of end thrust on the rolls.

4. A machine according to preceding claim 1, in which said drum is provided with inlet and outlet passages near opposite ends thereof, and the surfaces of both the rolls and the drum are reversely grooved, the grooves diagonally intersecting each other in each of said surfaces to produce substantially diamond-shaped sections in them, and said grooves in both the rolls and the drum are larger at the inlet end of the drum than at the outlet end thereof.

5. In a machine for refining paper stock and the like, the combination of a drum adapted to hold a quantity of said stock, a roll in said drum for acting upon the stock, said roll extending longitudinally of the stock chamber in the drum, means supporting said roll for rotation about its own axis in contact with the stock and for movement toward and from the inner surface of said drum to cause it to crush said stock against said surface, means for revolving said roll around the axis of said drum, the peripheral surface of said roll being roughened to grip said stock, said drum having an inlet at one end thereof and an outlet for the stock at the opposite end, and said roll having teeth thereon at the portion thereof adjacent to said inlet, said teeth being relatively large and serving to exert a severe breaking action on the large pieces of stock.

6. A machine according to preceding claim 1, in which said drum is provided with inlet and outlet passages near opposite ends thereof, and said rolls having coarse and prominent teeth on the portions thereof at the inlet end of the drum.

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