Dec. 27, 1960 J. R. DUNBAR 2,966,267

APPARATUS FOR MATERIALS CLASSIFICATION

Filed Aug. 21, 1958 2 Sheets-Sheet 1

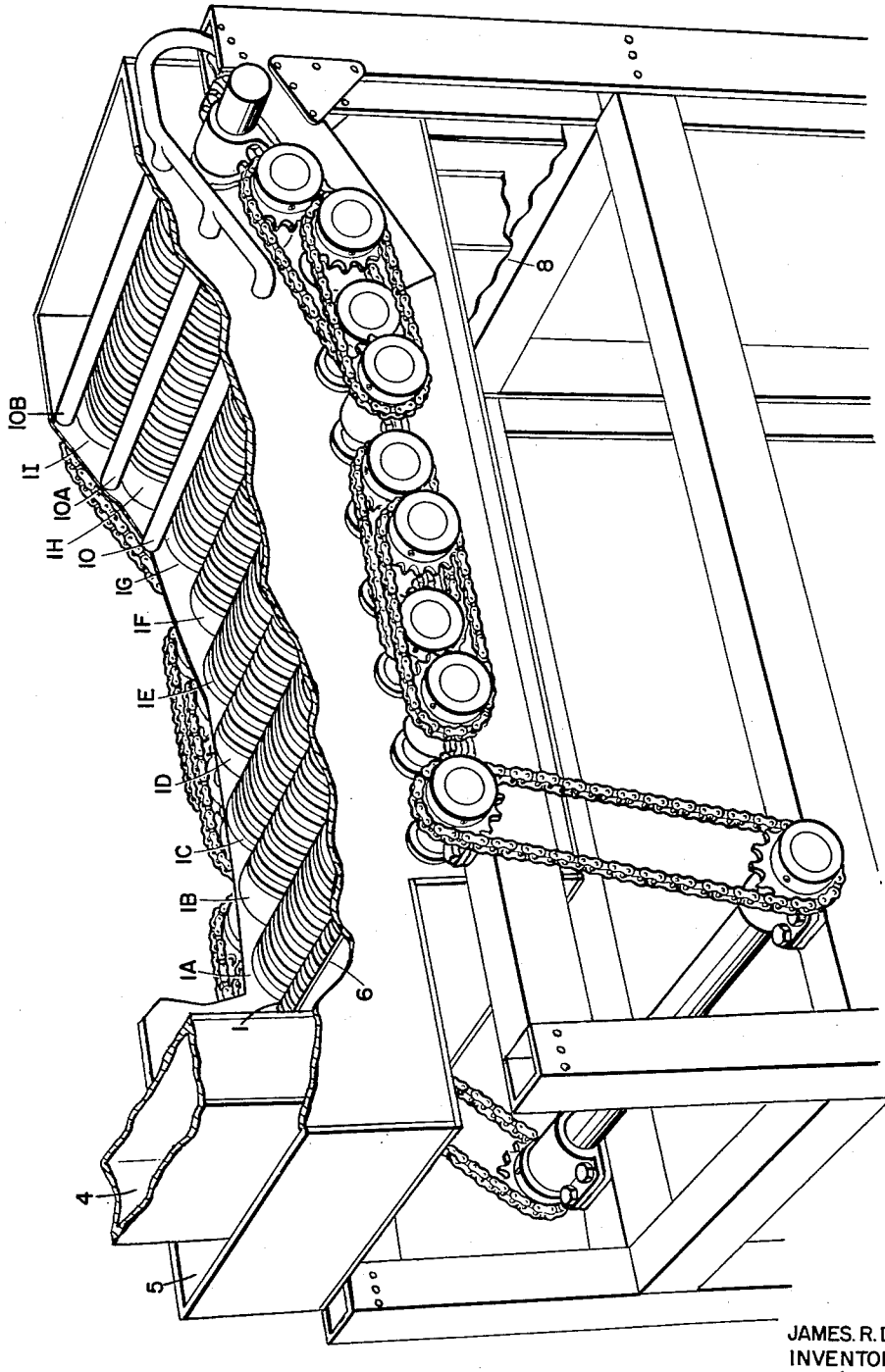


FIG 1

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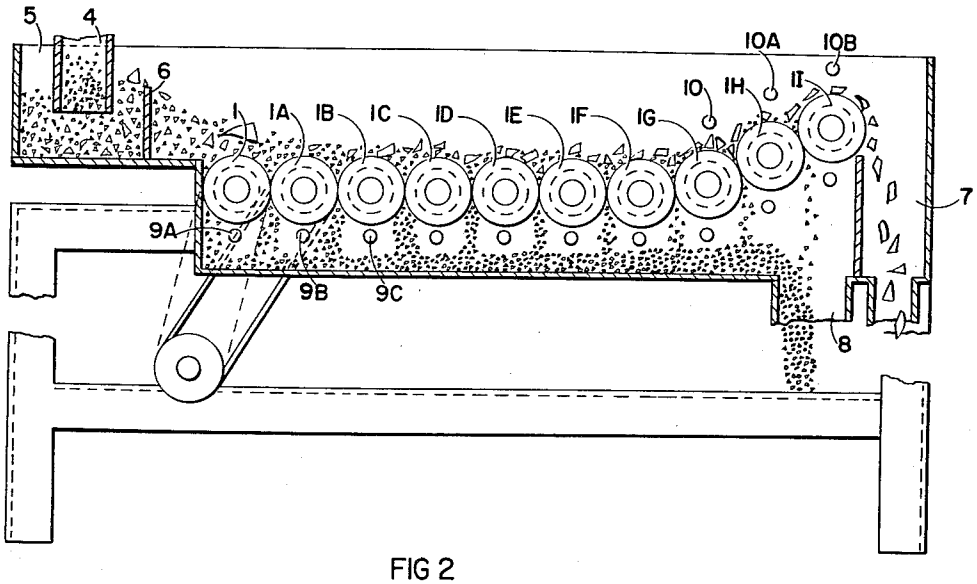


FIG 2

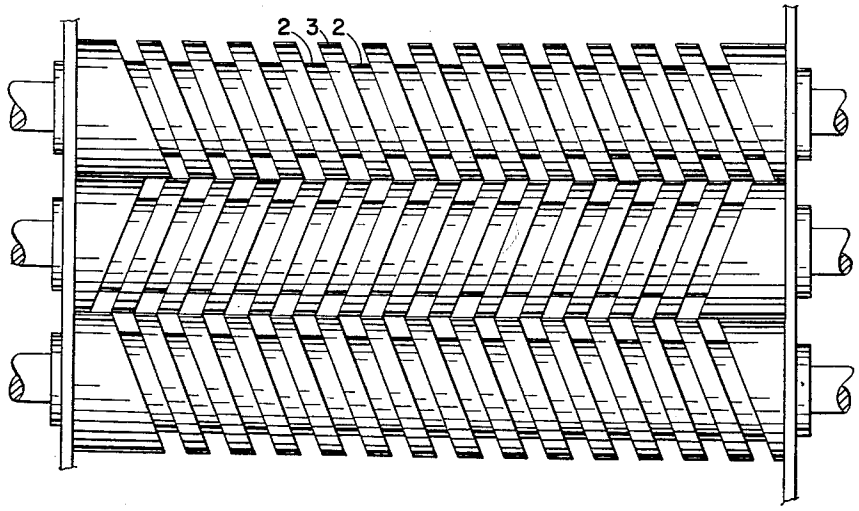


FIG 3

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APPARATUS FOR MATERIALS CLASSIFICATION

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10 Claims. (Cl. 209—271)

This invention relates to the uniform classification of materials and in a particular embodiment is directed to a coarse pulp classifier employable in the first stage of pulp screening, to remove uncooked chips, knots, and other coarse material.

In the coarse classification of materials in the pulp and paper industry as well as other industries, vibrating screens are the most commonly employed apparatus. These screens generally consist of screen plates, a surrounding frame and a vibrating mechanism adapted to agitate the screen and facilitate the passage of material through the screen.

There are many notable disadvantages to this type of apparatus. Initially, the installation cost is high as due to the vibration involved, heavy foundations and supports are required. Also maintenance cost is high for the same reason. In addition, the perforations in the plate become plugged and require frequent cleaning, which is not always possible or practical. Also, any rejects passing over the screen openings and of a size greater than the screen openings, blank off the screen openings they cover until such time as they have passed, thus decreasing the capacity of the screen.

It is an object of this invention to provide an apparatus as a substitute for a coarse vibrating screen which has no vibration, is self-cleaning, and does not require use of pluggable screen plates.

It is another important object of the invention to provide such an apparatus in which the openings cannot be blanked off by rejects covering them during their passage along the apparatus and thus increasing capacity over conventional screens.

The apparatus which forms the subject of this invention was designed primarily for use in the pulp and paper industry. As is well known in this industry, it is necessary to classify the pulp and a preliminary screening is usually effected to remove uncooked wood chips, knots or other coarse material. It will be understood, however, that the principles of the invention have application in fields other than the pulp and paper industry and that while for ease of description the invention is outlined as applicable to this industry, it is not to be construed as limited thereto.

My invention consists broadly in a materials classifier comprising a plurality of co-operating rolls aligned with their axes parallel and rotatable at the same speed and in the same direction, each roll being provided with a plurality of equally spaced square cut grooves of uniform depth, and with adjacent rolls being so arranged that each space between the grooves on one roll substantially covers the opening made by a groove in an adjacent roll.

My invention may be better understood and will be described in greater detail with reference to the attached drawings in which:

Figure 1 is a perspective view of a coarse pulp screening mechanism constructed so as to embody features of the invention.

Figure 2 is a vertical schematic showing a materials classifying apparatus constructed so as to embody features of this invention.

Figure 3 is a plan view of some of the rolls which form one of the principal components of the apparatus in Figure 1.

Referring to the drawings the apparatus which forms the subject of this invention comprises a plurality of rolls, 1, 1(*a*), 1(*b*), 1(*c*), etc. to 1(*i*) in the embodiment shown. Each of these rolls as may be seen by reference to Figure 3 is formed with a plurality of square cut grooves 2 of uniform depth, the width of the grooves being equal to the space or land 3 between the grooves in the embodiment shown and with the grooves being so arranged that each space or land 3 on one roll substantially covers the opening made by the groove 2 on an adjacent roll. As will be seen hereafter, the grooves thus covered by a space between the grooves on an adjacent roll define the acceptable stock opening, an opening which will remain constant despite rotation of the rolls in a manner which will be fully seen hereafter.

The juxtaposition of adjacent rolls is an important feature of the practice of the invention. Each space on one roll must be in alignment with and preferably substantially cover the space between the grooves on the adjacent roll. As will be appreciated by a consideration of the following description any other arrangement, i.e. an arrangement where the grooves on one roll are contiguous with grooves in another roll, will result in a constantly changing opening and would, moreover, impart an undesirable shearing action to the stock passing through the rolls.

It will be appreciated that while in the embodiment shown, the grooves are the same width as the spaces between the grooves, this is not necessary to the practice of the invention. The grooves can be substantially narrower than the spaces therebetween depending upon the type of material being secured and the degree of fineness and separation required. If the grooves are narrower than the spaces therebetween they must be equally spaced so that each space between the grooves in one roll substantially covers the opening made by a groove in an adjacent roll.

In the preferred embodiment of the invention, which is in fact the embodiment illustrated in the drawings, the grooves are angularly disposed with relation to the longitudinal axis of the shaft and adjacent rolls are set with their groove angles oppositely disposed as may readily be seen by reference to Figure 2.

As has been suggested, however, this is merely the preferred embodiment, and if for any reason it is preferred that the grooves be cut at right angles to the longitudinal axis of the shaft, this may be done. The embodiment shown does, however, offer certain advantages which will become apparent hereafter.

The provision of a roll with grooves so disposed and arranged must be distinguished from a worm or screw gear. A worm or screw cut groove would not be acceptable for the practice of this invention since, as will be appreciated later, such a construction would move unacceptable stock continuously to one side of the screen rather than give it the uniform lateral agitation afforded by this invention and pointed out in detail hereafter. This uniform lateral agitation comprises one of the principal features of this invention and will be specifically referred to hereinafter.

The effect of angularly disposed square cut grooves can be achieved if each roll is formed from a plurality of discs of two different diameters, the discs being of the same thickness and being mounted at an angle to the longitudinal axis of the roll. Thus the square cut angular grooves hereinafter referred to in the specification and claims are to be construed as indicating the cross sectional appearance or effect of the rolls only and not necessarily the method of formation thereof.

The shafts 1(*a*) to 1(*i*) are rotatable in the same direction and at the same speed and the rolls are connected to

a source of rotative power to cause such a rotation of the rolls.

The shafts may be so caused to rotate by a chain drive or by belts or by gears, connected in any convenient manner and with the necessary reduction to a motor. Since the precise connecting mechanism and actuating means does not in itself form part of this invention, such means being well within the skill of the art are not illustrated in detail herein.

Pulp stock or other material to be classified is fed into the top of the rotating rolls. The fact that the rolls are rotating in the same direction and at the same speed means that the opening defined by the sides and bottom of a groove and the space between two grooves on an adjacent roll remains constant, and generally this opening determines the size of acceptable stock which may pass through the rolls to be collected therebeneath. Moreover, if the rolls are set at an angle as shown in Figure 1, the material above the rolls will oscillate back and forth due to the action of the grooves, this uniform lateral agitation ensuring a constant agitation of the material above the rolls, and a consequent thorough classification. This also tends to prevent plugging of the openings.

According to one embodiment of the invention manufactured for the purpose of coarse screening of pulp, the rolls were an outside diameter of two inches and the grooves were one quarter of an inch wide and one quarter of an inch deep, the space between the grooves being also one quarter of an inch. These grooves were set at an angle of between 70° and 72° to the longitudinal axis of the shaft. The shaft is provided with means to supply the pulp to be screened to one end of the rollers. In the embodiment shown a pulp inlet **4** discharges the pulp into a reservoir **5** where it overflows a baffle **6**, and passes onto the upper surface of the rotating rolls.

As will be seen by reference to the drawings, the final three rolls in the series, namely rolls **1**(*g*), **1**(*h*) and **1**(*i*) are elevated and the rejects which travel along the apparatus from roll to roll are carried upwardly and pass through a rejects outlet **7**, while the accepted stock passes through an outlet **8** below the rolls. A plurality of showers, **9**, **9**(*a*) and **9**(*b*) may be supplied beneath the rolls for the purpose of removing acceptable stock from the rolls and of passing it towards the outlet, and a plurality of showers, **10**, **10**(*a*), **10**(*b*) can be provided preferably towards the end of the apparatus above the rolls for the purpose of insuring that all acceptable stock is washed through the outlets, thus permitting its passage under the rolls. If necessary or advisable, flexible fingers or scrapers could be substituted for either or both of these sets of sprays.

The size of the rollers and the dimensions of the grooves will be selected in accordance with the exigencies of the particular screening characteristics desired. Obviously the smaller the openings the smaller the acceptable material and a battery of rolls of successively diminishing acceptable size could be used in any particular application.

The complete absence of vibration from the apparatus which forms the subject of this invention constitutes one of its principal features, as well as the fact that the rotating rolls are self cleaning and have no tendency to become plugged as do the pulp screens for which they are intended to substitute.

The invention has been described with reference to a preferred embodiment. It is to be understood that the invention is not limited to precise constructional details and such embodiments of the invention as come within the scope and purview of the appended claims are to be considered as part of this invention.

What I claim as my invention is:

1. Apparatus for the uniform classification of materials comprising a plurality of co-operating rolls rotatable at the same speed and in the same direction, each said roll shaped to provide a plurality of spaced apart independent grooves, said grooves being formed at an angle to the longitudinal axis of the rolls, the rolls being set with their groove angles oppositely disposed to those on adjacent rolls and so arranged that each space between the grooves on one roll substantially covers the groove on an adjacent roll, whereby openings of at least substantially constant cross-section are formed between said rolls, said openings traversing back and forth at least substantially parallel to said longitudinal axis of said rolls when said rolls rotate.

2. Apparatus for the uniform classification of materials comprising a plurality of co-operating rolls rotatable at the same speed in the same direction, each roll being formed of a plurality of alternate discs of two different diameters, the discs being set at an angle to the longitudinal axis of the roll providing thereby a plurality of equally spaced angular grooves, the grooves being so arranged that the angles of the grooves on adjacent rolls are oppositely disposed and so that each large disc substantially covers the opening made by a small disc on an adjacent roll, whereby openings of at least substantially constant cross-section are formed between said rolls, said openings traversing back and forth at least substantially parallel to said longitudinal axis of said rolls when said rolls rotate.

3. An apparatus as claimed in claim 1 wherein the rolls are aligned with their longitudinal axes parallel.

4. Apparatus as claimed in claim 2 wherein the width of the grooves is substantially equal to the spaces between the grooves.

5. Apparatus as claimed in claim 3 wherein the discs of two different diameters are of substantially the same thickness.

6. Apparatus as claimed in claim 1 wherein the grooves are square cut.

7. A coarse classifier for pulp stock comprising a stock inlet communicating with the first of a plurality of co-operating axially aligned rolls rotatable at the same speed and in the same direction, each roll being formed with a plurality of independent grooves of uniform depth angularly disposed to the longitudinal axis of the roll, the rolls being so arranged that the groove angles on adjacent rolls are oppositely disposed to each other and so that each space between the grooves on one roll substantially covers the opening made by a groove on an adjacent roll, whereby openings of at least substantially constant cross-section are formed between said rolls, said openings traversing back and forth at least substantially parallel to said longitudinal axis of said rolls when said rolls rotate an outlet beneath the rolls for acceptable stock and an outlet following the last of said rolls for the passage of rejected stock.

8. Apparatus as claimed in claim 7 wherein the grooves are square cut.

9. Apparatus claimed in claim 7 wherein said rolls have an outside diameter of about two inches and said grooves are from about ⅛ to ¼ inch wide and from ⅛ to ¼ inch deep.

10. Apparatus as claimed in claim 9 wherein said grooves are disposed at an angle of between 70° and 72° to the longitudinal axis of the rolls.

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