Feb. 16, 1932. F. FARREL, JR 1,845,140

CANE MILL

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Fig. 1.

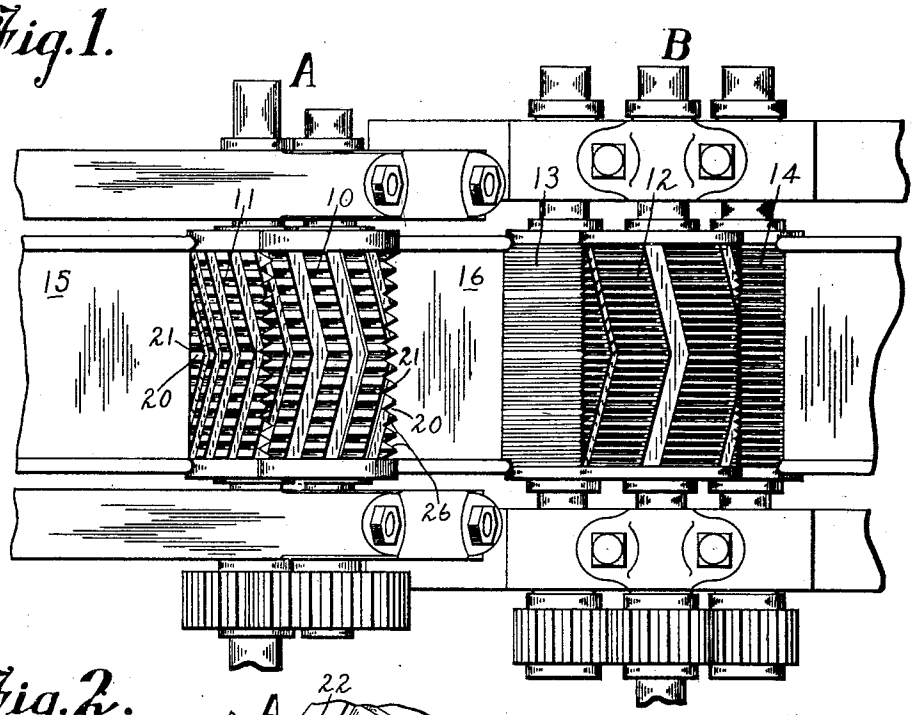
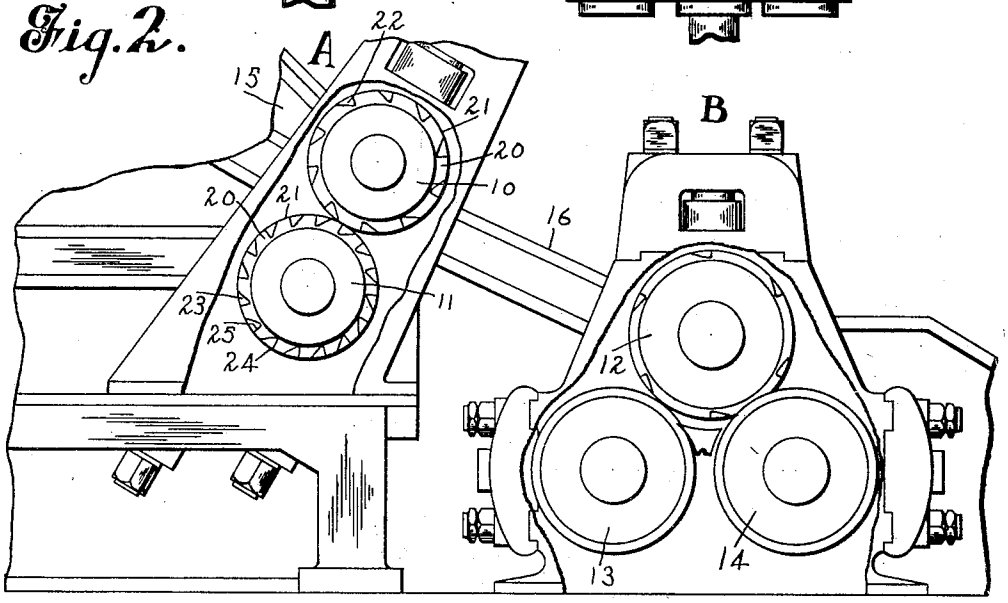


Fig. 2.



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Fig. 3.

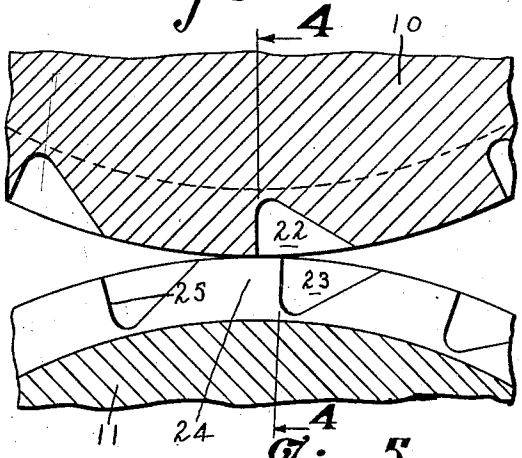


Fig. 4.

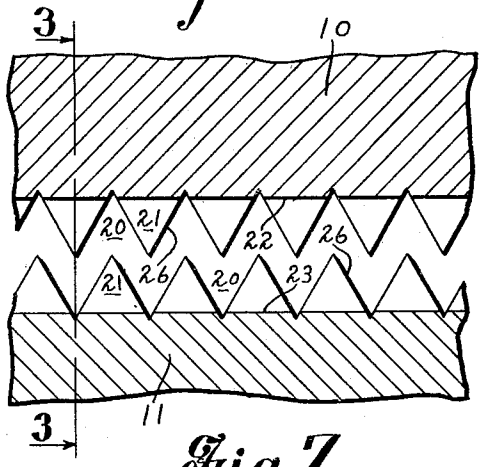


Fig. 5.

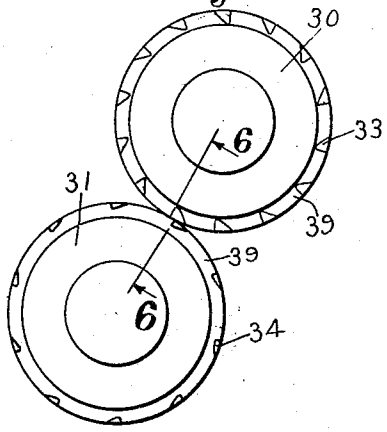


Fig. 7.

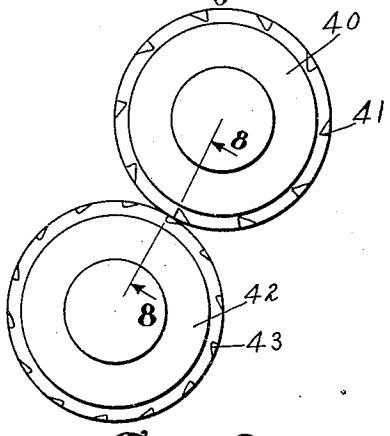


Fig. 6.

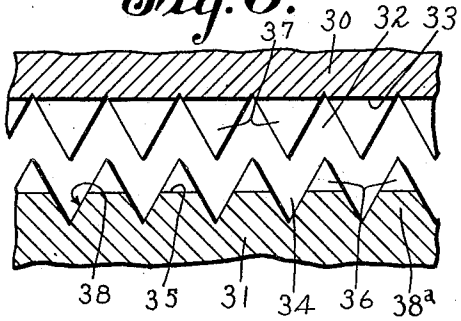
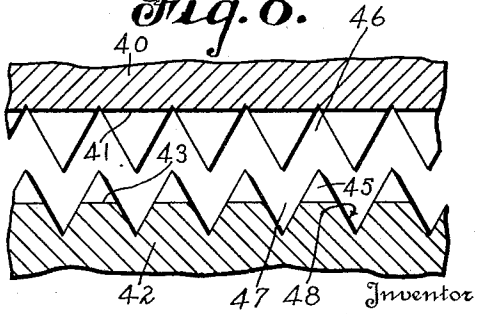


Fig. 8.



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Fig. 9.

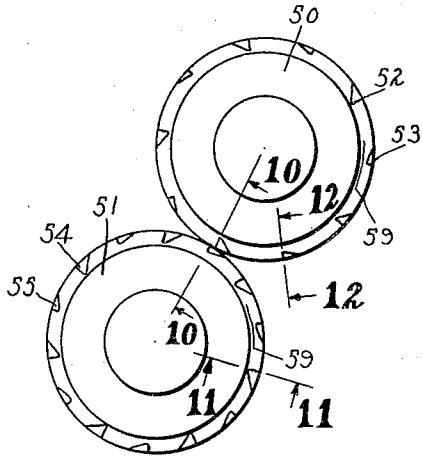


Fig. 13.

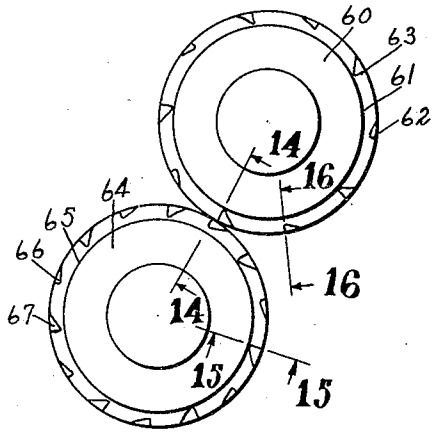


Fig. 10.

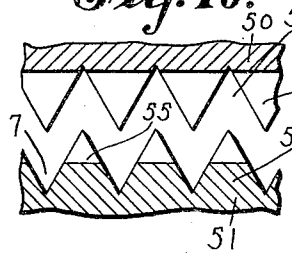


Fig. 11.

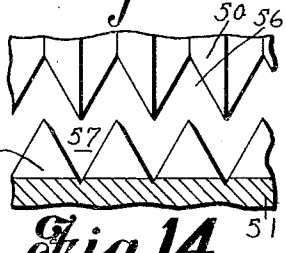


Fig. 12.

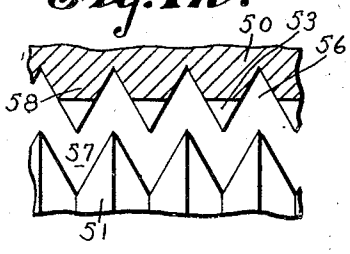


Fig. 14.

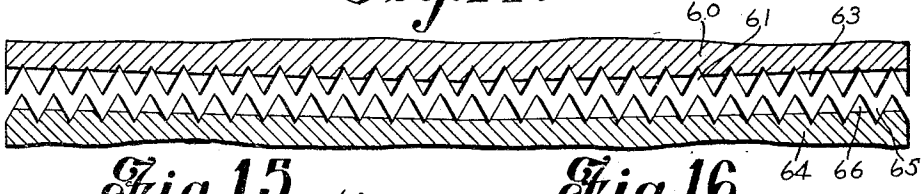


Fig. 15.

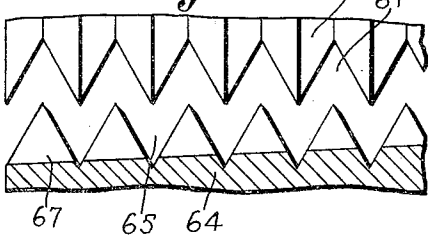
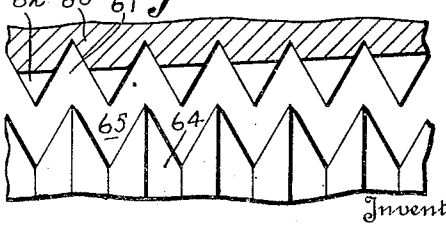


Fig. 16.



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Patented Feb. 16, 1932 1,845,140

UNITED STATES PATENT OFFICE

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CANE MILL

Application filed November 27, 1925. Serial No. 71,737.

This invention relates to cane grinding machinery, of the type employed in extracting the juice from sugar cane. In some of its aspects the invention more particularly relates to the rolls of the first set of such a cane mill through which the cane passes, although it is not limited to the first set but also applies to succeeding sets of rolls.

The first set or sets of rolls are generally termed pre-crushers and usually consist of a pair of opposing rolls each rotatably mounted and co-operating with the other to draw in and press material, such as sugar cane, which is fed thereto. It has been found desirable to provide each of the opposing rolls with means which is adapted to assist in drawing in the sugar cane between the rolls so that the opposed rolls will more efficiently grind and crush the cane and therefore, open its fibres and juice cells for the extraction of the juice therefrom during this operation and succeeding similar ones. The means generally employed for this purpose is of various forms, the most common possibly being circumferential grooves or ribs crossed by longitudinally extending grooves which are so arranged with respect to the circumferential ribs that teeth are formed upon the rolls properly arranged to greatly assist the drawing in action of the rolls upon the cane as it is fed to the mill or crusher.

Inasmuch as these rolls are also used for the extraction of the juice from the cane, it is desirable that a large amount of pressing surface be retained in order to provide sufficient area of surface so that the mill or crusher will have maximum efficiency in this respect. This invention, therefore, has for its primary object, the provision of a roll or pair of rolls for use as above noted, by the use of which maximum extraction of juice and maximum efficiency in drawing the cane in between the rolls will be obtained, whereby there will be an increase in the general efficiency of the mill or crusher.

Another object of this invention is to provide a novel arrangement of toothed rolls for cane mills or crushers, in which the relation between the circumferential grooves and the longitudinal grooves of one roll to the relation between the corresponding grooves of the opposed roll is such as to bring about a marked increase in the drawing in, crushing and squeezing action of the opposing rolls of a pair of such rolls.

Another object of this invention is to provide a cane mill with improved rolls whereby the sugar cane will be more effectively crushed and squeezed during the first operations thereon and at the same time be more effectively and positively drawn in between the opposing rolls, whereby subsequent operations on the cane will operate to more efficiently extract the juice therefrom.

To these and other ends the invention consists of the novel features and combination of parts to be hereinafter described and claimed.

In the accompanying drawings:

Fig. 1 is a top plan view of a portion of a cane mill embodying the features of my invention;

Fig. 2 is a side view of the part shown in Fig. 1, portions thereof being broken away for the sake of clearness;

Fig. 3 is an enlarged fragmentary section on line 3—3 of Fig. 4, showing the teeth of a pair of opposing rolls;

Fig. 4 is an enlarged section substantially on line 4—4, and following the direction of the longitudinal grooves just forward of the series of teeth formed thereby, shown in Fig. 3;

Fig. 5 is an end view of a pair of similar rolls, having a modified arrangement in respect to the grooving thereof;

Fig. 6 is an enlarged section substantially on line 6—6 and following through the longitudinal grooves just forward of a series of teeth formed thereby of Fig. 5;

Fig. 7 is an end view of a pair of rolls having a somewhat modified arrangement of grooving;

Fig. 8 is an enlarged section substantially on line 8—8 of Fig. 7, which section follows through the longitudinal grooves just forward of a series of teeth formed thereby;

Fig. 9 is an end view of a pair of rolls, which have a somewhat modified arrangement of grooving;

Fig. 10 is an enlarged section substantially on line 10—10 of Fig. 9;

Fig. 11 is an enlarged section substantially on line 11—11 of Fig. 9;

Fig. 12 is an enlarged section substantially on line 12—12 of Fig. 9;

Fig. 13 is an end view of a pair of similar rolls having another modified arrangement of grooving therein;

Fig. 14 is an enlarged section substantially on line 14—14 of Fig. 13;

Fig. 15 is an enlarged section substantially on line 15—15 of Fig. 13, and

Fig. 16 is an enlarged section substantially on line 16—16 of Fig. 13.

I have illustrated in the drawings a pair of pre-crusher rolls to which the novel features of this invention are applied. The pre-crusher, in this instance, comprises a pair of opposing rolls, and is shown in advance of a three roll mill. It will be obvious, however, that although this arrangement possibly is preferable, the advantages hereinafter described and the results and objects contemplated will be obtained in a mill having three rolls, two of which are opposing, and which are provided with the novel features to be hereinafter pointed out. The term "pairs of rolls", therefore, as used hereinafter will be understood to refer to any two opposing rolls in a cane mill whether they are the first pair, or pre-crushers, or subsequent rolls, provided that they draw in, crush, squeeze or otherwise act upon the cane to prepare the same that the juice thereof may be extracted therefrom by these or subsequently acting rolls.

The portion of a cane mill illustrated in Figs. 1 and 2, comprises the pair of rolls 10 and 11, in this instance arranged for use as a pre-crusher A, to crush and prepare the cane for further action thereon by the rolls 12, 13 and 14 of a mill B. A suitable guiding chute 15 guides the cane into proper position for the rolls 10 and 11 to engage the same and draw it in between them. Another chute 16 leads from the rolls 10 and 11 to the rolls 12 and 13, and from the rolls 12 and 14 the cane is conducted in a well known manner to further rolls of the train.

The rolls 10 and 11 of the pre-crusher A are provided with V-shaped grooves 20, forming ribs 21, which are of the same pitch longitudinally in each roll so that the ribs in one roll will be received in the grooves of the other roll in meshed relation with the adjacent ribs. Other grooves are formed in each roll and extend generally longitudinally across the roll. These longitudinally extending grooves, shown at 22, upon roll 10, and at 23 upon roll 11, are preferably in the form of what is known as a double helix, and are of such form and cross-section that in connection with the peripheral ribs 21, teeth 24 are formed having faces 25 which face toward the direction in which the rolls are rotated so as to engage the cane and draw it in between the rolls.

The portions of the circumferential or annular ribs of one roll which cooperate with the portions of the ribs upon the other roll, are constituted by the sides 26 of the ribs and it is the area of the surface of these cooperating portions which determines the efficiency of the rolls in crushing and extracting juice from the cane. It has been found that by decreasing the number of longitudinal grooves in one roll of a pair of cooperating rolls, part of this effective surface is retained and that when the other roll is provided with more longitudinal grooves than the first mentioned roll, the effective drawing-in action of the pair of rolls is not adversely affected.

In Figs. 1, 2, 3 and 4, longitudinal grooves 22 and 23 of rolls 10 and 11, respectively, are of the same depth and although the number of longitudinal grooves in roll 11 is greater than the number of grooves 22 in roll 10, equally efficient operation might be obtained if this arrangement was reversed and roll 10 was provided with a greater number of longitudinal grooves than roll 11.

In Figs. 5 and 6, I have illustrated a somewhat modified arrangement of the grooving between two opposing rolls 30 and 31. In this arrangement, roll 30 is provided with the peripheral grooves 32 and with the greater number of longitudinal grooves 33, and roll 31 with peripheral grooves 34 and with a lesser number of longitudinal grooves 35. To still further provide increased side surface area upon the ribs 36 formed by the peripheral grooves 34 of roll 31, the longitudinal grooves 35 thereof are not formed or cut into the peripheral ribs 36 as deeply as the longitudinal grooves 33 are formed or cut into the ribs 37 of roll 30. This provides a solid bottom portion having a continuous area 38 extending peripherally about the roll 31 at the side of each rib 36 adjacent the bottom or base 38^a thereof against which the cane is pressed by the coacting side surface of the opposing ribs 37 of the roll 30. As in the previously described form shown in Figs. 1 to 4, inclusive, the drawing-in action of the teeth 39 formed by the intersection of the longitudinal and peripheral grooves of the respective rolls is not interfered with.

Figs. 7 and 8 illustrate an arrangement somewhat similar to the arrangement shown in Figs. 5 and 6, but with the difference that the roll 40 in this instance, has the lesser number of longitudinal grooves 41 which intersect the circumferential grooves 46, and the roll 42 the greater number of longitudinal grooves 43 which intersect the circumferential grooves 47. The grooves 43 are shallower in roll 42 than are the grooves 41 of roll 40. The increased rib side surface area which is produced by this arrangement is divided between the roll 40 and the roll 42.

In roll 40 the increased area is provided by the increased space between the longitudinal grooves 41 because of there being fewer of them, and in roll 42 by the peripherally extending surface 48 at the base of the ribs 45, produced by the shallow depth of the longitudinal grooves 43.

Fig. 9, 10, 11 and 12 illustrate another arrangement of roll grooving whereby the advantages contemplated are obtained. In this instance, the roll 50 has a lesser number of longitudinal grooves and roll 51 the greater number of longitudinal grooves. The longitudinal grooves 52 and 53 are alternately deep and shallow and intersect the circumferential grooves 56 of roll 50, and the longitudinal grooves 54 and 55 are likewise alternately deep and shallow and intersect the circumferential grooves 57 of roll 51. By this arrangement substantially all the advantages of the continuous side surface area at the base 58 of a rib, extending peripherally around the roll, is obtained for each roll, while the advantages obtained from the difference in number of longitudinal grooves between the rolls is also retained. The rib side surface area in this instance, however, is not continuous peripherally but is interrupted at every other longitudinal groove and, therefore, is disposed about the roll in a series of spaced rib side surface areas 59 of a length substantially equal to the circumferential dimension between two longitudinal grooves, or in other words, double the circumferential pitch of the longitudinal grooves.

Another arrangement of grooving is illustrated in Figs. 13, 14, 15 and 16. In this arrangement, roll 60 is provided with circumferential grooves 61 and longitudinal grooves 62 and 63, and roll 64 is provided with circumferential grooves 65 and longitudinal grooves 66 and 67. Roll 60 is illustrated as having the fewer number of longitudinal grooves and roll 64 as having the greater number, although as in the previous arrangements the reverse is substantially equally effective in operation to obtain the results contemplated.

The longitudinal grooves 62 and 63 of roll 60 differ somewhat in form from the longitudinal grooves of the preceding arrangements, in that groove 62 intersects the circumferential grooves 61, first as a shallow cut at the end of the roll and gradually deepens as it approaches the center from both ends, while groove 63 is the reverse by being a deep cut at the end of the roll and gradually growing shallower as it approaches the center. In this manner the longitudinal grooves 62 and 63 alternate at the edges as shallow and deep cut and at the center as deep and shallow, respectively. The longitudinal grooves 66 and 67 of roll 64 are arranged and formed in a similar manner as the longitudinal grooves 62 and 63 above described.

While it is preferable to have a difference between the opposing rolls of two coacting ones in regard to the number of longitudinal grooves, this feature is not always necessary, and the invention contemplates the grooving arrangements of a roll as described above relative to Figs. 9 to 12, inclusive, and Figs. 13 to 16, inclusive, as being effective to a degree in obtaining the advantageous results noted, without reference to the difference in the number of longitudinal grooves in the rolls of a pair.

While I have shown and described preferred embodiments of my invention, it will be understood that it is not to be limited to all the details shown, but is capable of modification and variation which will lie within the spirit of the invention and the scope of the appended claims.

What I claim is:

1. In a cane mill, a pair of rolls, each of said rolls having circumferential grooves intersected by longitudinal grooves, the longitudinal grooves of each roll being alternately deep and shallow, one roll having a greater number of longitudinal grooves than the other.

2. In a cane mill, a pair of rolls, each of said rolls having circumferential grooves intersected by longitudinal grooves, one of said rolls having a greater number of longitudinal grooves than the other, the longitudinal grooves in the roll having the greater number of longitudinal grooves being alternately deep and shallow.

3. In a cane mill, a pair of rolls each having circumferential grooves forming peripheral ribs intersected by longitudinal grooves, the longitudinal grooves of one roll being arranged therein in spaced relation about the periphery of the roll and provided therein in such a manner to form spaced apart continuous rib base surfaces at the sides of the ribs, the length of said rib base surfaces being substantially equal to twice the peripheral distance between the longitudinal grooves of said roll.

4. In a cane mill, a pair of rolls, each roll having circumferential grooves forming peripheral ribs, and longitudinal grooves intersecting said ribs, the longitudinal grooves in each roll being alternately deep and shallow at the ends thereof, and respectively becoming alternately shallower and deeper as the groove approaches the portion of the roll intermediate its ends.

5. In a cane mill, a pair of rolls, each roll having circumferential grooves forming peripheral ribs, and longitudinal grooves intersecting said ribs, the longitudinal grooves in each roll being alternately deep and shallow at the ends thereof, and respectively becoming alternately shallower and deeper as

the groove approaches the portion of the roll intermediate its ends, one of said rolls having a greater number of longitudinal grooves than the other.

6. In a cane mill, a pair of rolls, each roll having circumferential grooves forming peripheral ribs, and longitudinal grooves intersecting said circumferential grooves and ribs, the longitudinal grooves of one of said rolls being alternately deep and shallow at the ends thereof, and respectively becoming alternately shallower and deeper as the groove approaches the portion of the roll intermediate its ends.

In witness whereof, I have hereunto set my hand this 23d day of November, 1925.

FRANKLIN FARREL, JR.