

Jan. 22, 1963

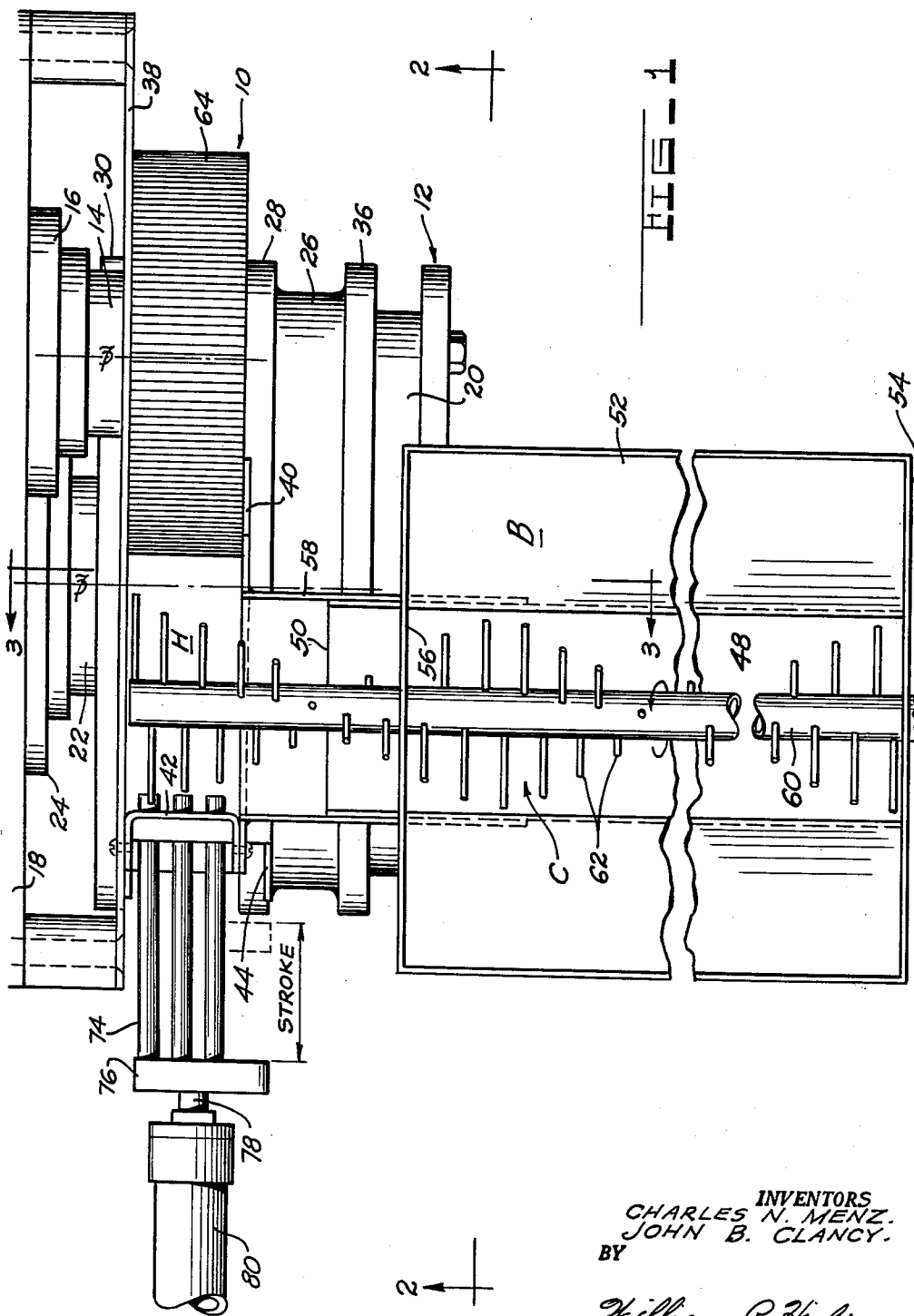
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3,074,105

FEEDING MECHANISM CALENDERING MACHINE

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4 Sheets-Sheet 1



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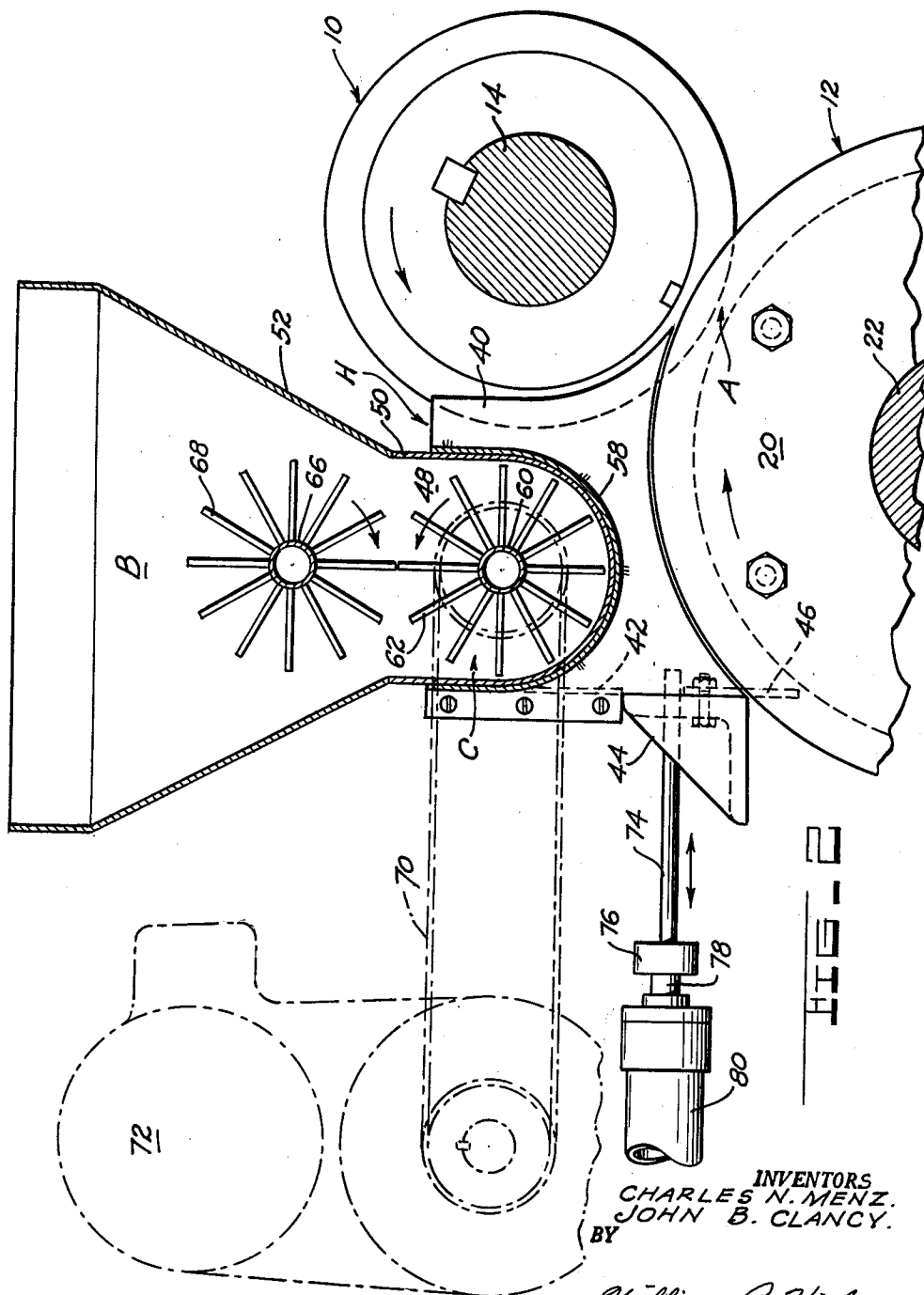
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4 Sheets-Sheet 2



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4 Sheets-Sheet 3

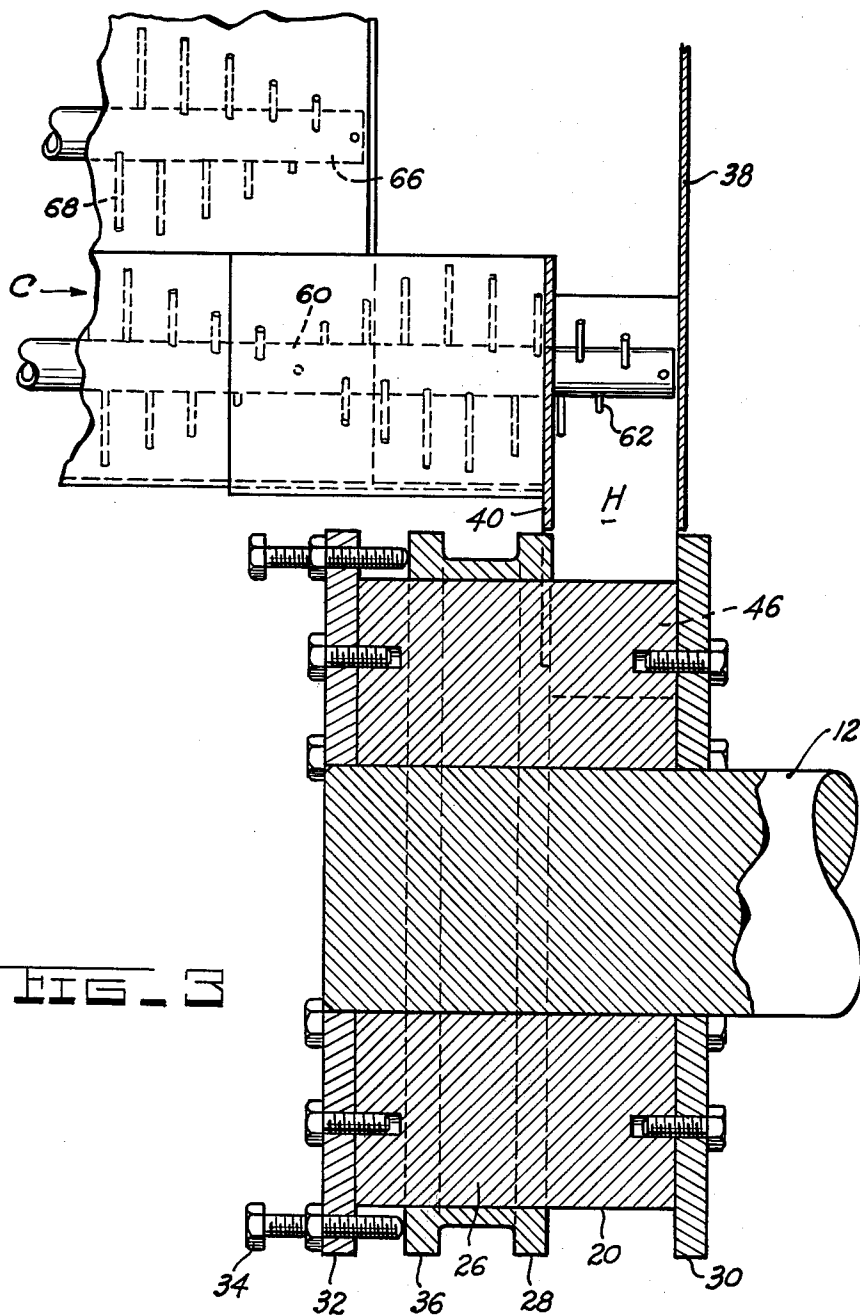


FIG. 3

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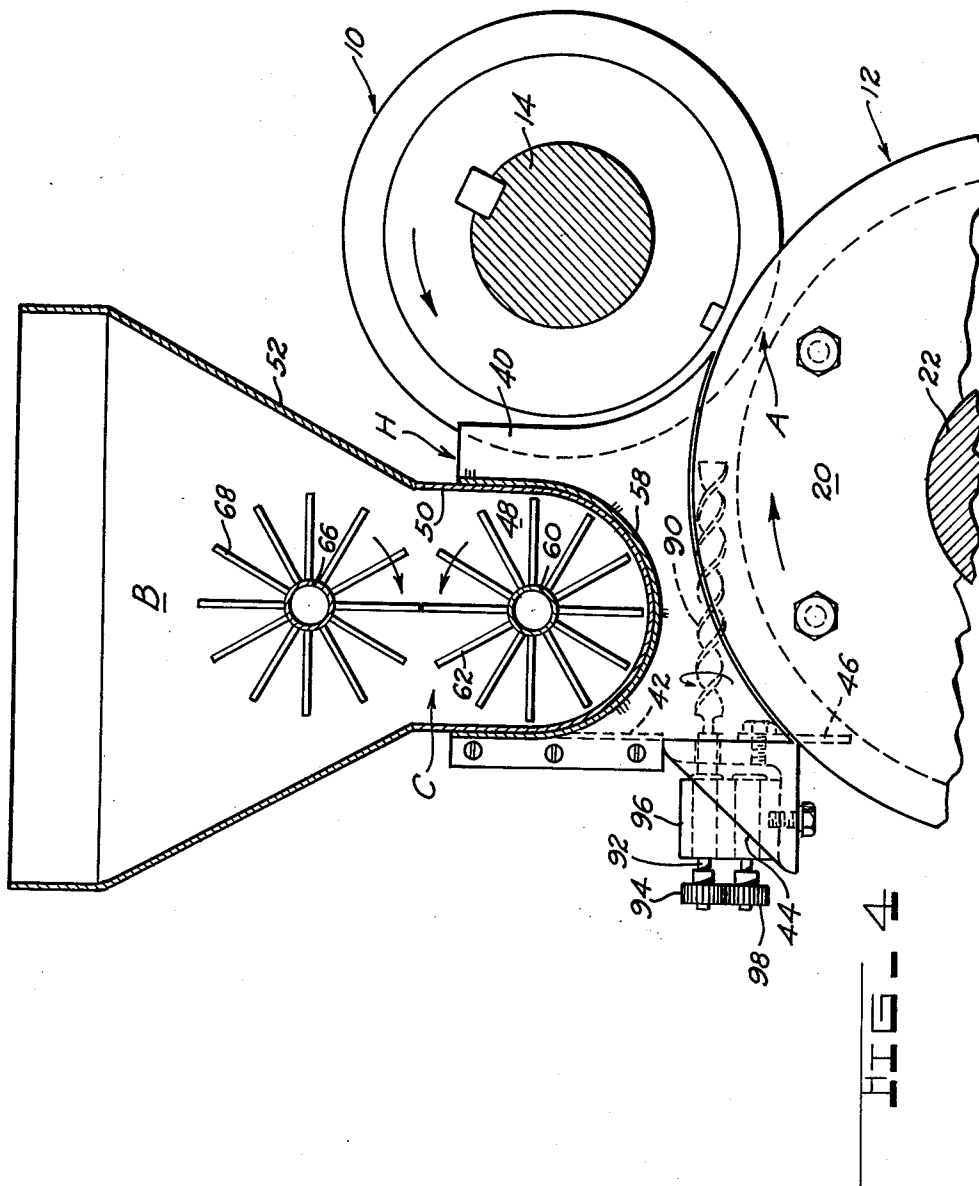
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3,074,105

FEEDING MECHANISM CALENDERING MACHINE

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The present invention relates to calendaring machines; and more particularly to calendaring machines of the type used to compact fibrous materials such as brake linings and the like.

An object of the present invention is the provision of new and improved feeding mechanism for feeding fibrous brake lining materials and the like, uniformly to between the rolls of a calendaring machine.

A further object of the present invention is the provision of new and improved means for compacting fibrous materials into the bite of the rolls of a calendaring machine.

The invention resides in certain constructions and combinations and arrangements of parts; and further objects and advantages of the invention will become apparent to those skilled in the art to which the invention relates from the following description of the several preferred embodiments described with reference to the accompanying drawings forming a part of this specification, and in which:

FIGURE 1 is a fragmentary cross-sectional view of a calendaring machine showing applicants' new and improved feeding mechanism;

FIGURE 2 is a vertical cross sectional view taken approximately on the line 2—2 of FIGURE 1;

FIGURE 3 is a vertical cross-sectional view taken approximately on the line 3—3 of FIGURE 1; and

FIGURE 4 is a vertical cross sectional view corresponding generally to that in FIGURE 2, and showing another embodiment of compacting mechanism.

Organic brake linings generally comprise a fibrous asbestos material which is bonded and held together by a resin binder. Where calendar rolls are to be used to compact the material prior to curing the binder, the ingredients of the brake lining are milled into a fairly fluffy mass to evenly distribute the uncured resin evenly over the fibrous asbestos material. The resin used in the binder is a partially polymerized and tacky material that has been thinned to a consistency which will evenly wet the asbestos fibers by the addition of a solvent, such as xylol. By the time that the material is fed to the hopper of the calendaring machine, most of the xylol has vaporized so that the loose material does not appreciably stick to the fingers, but can be readily compressed into a ball. As previously indicated, it is an object of the present invention to feed this type of material evenly and uniformly to between the rolls of a calendaring machine in a manner preventing any compaction or balling of the fibrous material. None of the prior art feeding mechanism with which applicants are familiar, including that shown and discussed in Fether Patent 2,548,009, will deliver this material to the bite of the rolls in the uniform and homogeneous manner desired without any prior balling of the material.

Referring to FIGURE 1 of the drawings, there is shown therein a pair of calendar rolls 10 and 12 which respectively form the upper and lower rolls of a calendaring machine. The upper calendar roll 10 is formed by means of a sleeve which is removably fixed to the horizontal shaft 14—which is in turn rotatably journaled in a bearing 16 that is mounted on the upright member 18, only a portion of which is shown, of the calendaring machine. The lower calendaring roll 12 comprises an annular drum 20 that is fixed to the horizontal shaft 22—which in turn is rotatably journaled in a bearing 24 that also is af-

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fixed to the upright 18 of the machine. The annular drum 20 has an annular hoop 26 slidably installed over its outer surface to accommodate upper calendar rolls 10 of different widths, and thereby make the machine capable of calendaring lining of different sizes. The annular hoop 26 has an inner radial flange 28 which forms a flat end surface which overlaps the bottom portion of the outer side of the upper roller 10. The annular drum 20 is also provided with an inner flange 30, of the same outside diameter as the flange 28, and which overlaps the bottom portion of the inner side surface of the roll 10 to form a U-shaped groove into which the upper roll 10 extends to compress the lining material. This U-shaped groove can best be seen in FIGURE 3, and it will be understood that the upper roll 10 extends down into the groove and is spaced a predetermined distance away from the surface 20, corresponding to the desired thickness of the brake lining.

As best seen in FIGURE 3, the annular drum 20 also includes an outer flange 32 for the purpose of carrying a plurality of adjustment bolts 34, only one of which is shown, which bear against the outer flange 36 of the hoop 26 to hold the annular hoop 26 adjacent the side surface of the upper roll 10, and thereby prevent the lining material from extruding therebetween. The rolls 10 and 12 are driven in time relation to each other by suitable gearing not shown in the drawings.

The clearance between the rolls 10 and 12 provide the aperture A through which the compressed lining materials continuously flows, and the portions of these rolls that is positioned just forwardly of this aperture (to the left as seen in FIGURE 2) forms what is known as the bite of the rolls. The material which is to be calendared is fed into the bite of the rolls; whereupon the rotation of the rolls picks up the loose material and compresses it as the material is being transferred through the aperture A formed by the minimum clearance between the rolls 10 and 12.

In order to provide a hopper H around the bite of the rolls, the calendaring machine is provided with a side plate 38 which is fitted around the inside flange 30 to form one side of the hopper. The opposite side of the hopper H is formed by means of a side plate 40 which is similarly fitted about the outside periphery of the flange 28, and which overlaps the outer side surface of the upper roll 10. As best seen in FIGURE 2 of the drawings, the forward surfaces of the hopper are, of course, formed by the surfaces of the rolls 10 and 12; and the rear surface of the hopper is closed off by a vertical plate 42 that is fastened to and extends upwardly from a horizontal guide bracket 44 whose purpose will later be explained. The bracket 44 extends horizontally across the top of the flanges 28 and 30 of the bottom roll; and another suitable plate 46 is fastened to the bottom side of the bracket 44 to extend down between the flanges 28 and 30 to adjacent the top surface of the bottom roll 12 to close off the back side of the hopper H. It can now be seen that material that is fed into the hopper H will be confined and directed into the bite of the rolls, and will thereby be caused to be compacted and transferred out through the aperture A by the rotation of the upper and lower rolls.

According to principles of the present invention, the hopper H is fed continuously and uniformly by suitable conveying means which is positioned generally parallel to the axis of the rolls. The conveying means C used comprises a trough 48 having a U-shaped bottom plate 50 that is suitably welded or otherwise attached to the bottom of a V-shaped bin 52 into which the raw fluffy resin coated asbestos material is dumped. The bin 52 has an outer side surface 54 which extends down into and completely closes off the outer end of the trough 48, and has an inner side 56 which terminates at the top edge of the trough 50 to permit material to be conveyed from the bin 52 to the

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bite of the rolls. The bottom plate 50 which forms the trough 48 projects out of the bin toward the rolls 10 and 12 by an appreciable distance so as to provide a suitable adjustable extension for the helical conveyor C between the bin and hopper H. Trough 48 is completed by an adjustable portion comprising a U-shaped plate 58 which is slipped over the outside of the plate 50 and is suitably welded or otherwise affixed to the outer side plate 40 of the hopper H. The outer side plate 40 is of course cut out to receive the U-shaped plate 58 so that the trough 48 opens into the hopper H unrestricted.

The raw brake lining material is fed through the trough 48 by means of a helical conveyor which extends through the trough 48. This conveyor is preferably formed by means of a rotatable shaft 60 having a plurality of pins 62 thereon which are arranged in the form of a helix to move the material along the trough. It has been found that a helix made from a helically shaped plate causes the raw brake material to be compressed between the helical plate and sidewalls of the trough to form lumps or balls. When this lumpy material is calendared by the rolls, the resulting brake lining is not continuously bound together by the asbestos fibers. It has been found that the pins 62 do an adequate job of moving the material along the trough 48 without compacting any of the material into balls; and in fact tend to loosen the material and keep it in at an uncompacted and fluffy state.

As seen in FIGURE 2, the bottom roll 20 is rotated in a clockwise direction, the top roll 10 is rotated in a counterclockwise direction, and the conveyor shaft 60 is turned in a counterclockwise direction. According to principles of the present invention, conveyor shaft 60 will in some instances preferably extend approximately across the full width of the hopper H so that rotation of the pins 62, keeps the material in the hopper H in a loose and uncompacted form, moves the fibrous material across the full width of the hopper, and generally piles it up against the rear surface of the upper roll 10. The surface of the roll 10 is grooved or fluted across the width of the roll as at 64, so that the material which is forced up against the surface of the top roll 10 is carried down into the bite of the rolls where it is compressed and forced out through the aperture A between the rolls. Conveying means of various types and designs have been tried, heretofore for moving the raw material into the bite of the rolls, and none have produced a lining having as uniform density as does the arrangement taught by the present application.

It is desirable, although not essential in all instances, to provide some means in the bin B for keeping the raw materials in a loose and uncompacted condition prior to the time that the material moves into the conveyor C. One suitable means, as shown in the drawings, comprises a section of conveyor shaft 66 which is very similar and parallel to the shaft 60 of the conveyor C. The conveyor shaft 66 has a plurality of pins 68 arranged in a helix running in an opposite degree of rotation from that of the conveyor C. The shaft 66 extends out of the outer end of the hopper H, as does the shaft 60 of the conveyor C, and the two shafts are connected together by a pair of gears, not shown, which rotates the shaft 66 in the opposite direction from the rotation of shaft 60. The shaft 60 in turn is driven by a sprocket and chain drive, indicated at 70—which in turn is driven by a suitable variable speed electric motor powered gear reduction unit 72. The shaft 66 and pins 68 serve the purpose of distributing the raw material across the width of the bin and at the same time keep it in a loose condition prior to the time it is received by the conveyor C. Inasmuch as the rolls 10 and 20 are of necessity of a limited diameter, there is a limit to the amount of material which can be swept into the bite of the rolls by the grooves 64 of the upper roll 10. The size of the rolls therefore automatically sets an approximate upper limit to the thickness of brake lining which the mechanism so far described can produce.

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According to further principles of the present invention, applicants have produced a means for increasing the thickness range of brake lining which can be produced by a given size of calendar rolls. The mechanism shown in FIGURES 1 and 2 of the drawing, generally comprises a plurality of rods or fingers 74 which are reciprocated endwise towards the bite of the rolls, to compact the material within the hopper against the surface of the rolls. The rods 74 may be reciprocated in any suitable manner provided that the reciprocatory movement is uniform and constant. The means which is provided for reciprocating the rods 74 should preferably be of a type which can be varied to change the speed of reciprocation and length of stroke and thereby change the amount of precompaction of the material which occurs prior to its being calendared. The means shown in FIGURES 1 and 2 of the drawing comprises a cross-bar 76 into which the rods 74 are threaded; and the rod 76 is reciprocated by means of the piston rod 78 of an air cylinder 80. The air cylinder 80 is in turn controlled by a double acting valve structure not shown which in turn is driven by a variable timing mechanism also not shown.

Applicants have found that the use of one solid tamping bar for the plurality of rods 74 will not produce a calendared material of uniform consistency and density. It appears that one solid bar compacts the fibrous material in stages or balls prior to passing through aperture A to align the asbestos fibers and prevent them from extending in all directions throughout the calendared brake lining. On the other hand it has been found that a plurality of small rods can produce the desired compaction of the material while still permitting the asbestos fibers to remain overlapped with one another, so that there will be no cleavage planes in the calendared product. It appears that each stroke of the small diameter rods only compacts material about a portion of each individual fiber while permitting the remaining portion of each fiber to become unlocked with other loose fiber prior to its being compacted by a subsequent stroke of the rods. The above stated mechanism by which the rods are believed to tamp the material is only a theory which may not be entirely correct. Nevertheless it can be stated that regardless of the manner in which the fibrous material is compacted, a calendared lining having interlocked fibers extending in all directions is produced.

FIGURE 4 of the drawings is a cross-sectional view corresponding to that shown in FIGURE 2 but showing another embodiment of means for compacting the fibrous material prior to be calendared by the rolls 10 and 20. In the embodiment shown in FIGURE 4, the bin B and conveyor C are identical with that of the previous embodiment. The mechanism shown differs principally from that seen in FIGURE 2 by reason of the substitution of a plurality of individual revolving helicies for the rods 74. The helicies 90 are formed by welding wood bits of about the same diameter as the rod 74 to steel shaft sections 92 having small gears 94 on their outer ends. The shafts 92 are in turn received in sleeve bearings that are supported in a pillow block 96 which is suitably supported to the frame of the machine, outside of the hopper H. The individual gears 94 are connected by spur gears 98; and the innermost gear 94 is driven by an electric motor powered variable speed gear reduction unit, not shown in the drawings. By varying the speed of the gear reduction unit, the amount of compaction of the fibrous material in the bite of the rolls can be controlled. Rotation of the plurality of helicies 90 gradually draws and compacts the fibrous material together as it is moved towards the bite of the rolls—at which point the material is further compacted by the rotation of the rolls and forced out through the aperture A.

Describing now the operation of the embodiment shown in FIGURES 1, 2 and 3 of the drawings, the loose resin coated asbestos fibers is placed in the bin B; whereupon the rotation of the shaft 66 keeps the material in its loose

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condition and advances the material to some extent towards the inside of the bin B. Material from the bin B is received in the conveyor C; whereupon the rotation of the pins 62 which are arranged in a helical configuration advances the material to the hopper H. The pins 62 are so arranged, and the shaft 60 is so rotated, so as to distribute the loose material up against the grooved surface 64 of the roller 10; whereupon the material is caught and pulled down into the bite between the rolls 10 and 20. The rolls 10 and 20 are driven in opposite directions, as indicated in the drawing, at about the same peripheral speed, to force the material out through the aperture A in a continuous strip of brake lining.

As previously indicated the thickness of brake lining which can be produced by a given set of calendar rolls, is generally a function of their diameter; and according to further principles of the present invention, the plurality of reciprocating rods 74 are used to increase the density of the loose material prior to being compressed between the rolls. The degree of precompaction of the loose material by the rod 74 can be controlled by varying the rate of their reciprocation as well as by varying the length of the reciprocatory stroke.

As previously indicated, linings of different width may be calendared by changing the width of the upper calendar roll 10. At the same time the position of the annular drum 10 is adjusted on the lower roll until it just provides running clearance with the side edge of the upper roll 10, and the width of the hopper H is adjusted by sliding the attached U-shaped plate 58 lengthwise of the conveyor plate 50 until the plate 40 is positioned over the flange 28 adjacent the side edge of the top roller 10. At the same time the upper plate 42 and bottom plate 46 must be changed to provide plates of the same width as that of the roller 10; and the number of rods 74 are also changed as is dictated by the width of the roll 10.

The operation of the embodiment shown in FIGURE 4 of the drawings is substantially identical with that above described for the embodiment shown in FIGURES 1, 2 and 3 of the drawings, and differs only in that the reciprocatory movement of the rod 74 is replaced by a rotary movement of the helicies 90 to precompact the fibrous material into the bite of the rolls. The speed of rotation of the helicies 90 can of course be controlled to regulate the degree of precompaction; and the number of helicies 90 that are used can be varied to suit the width of the roller 10 that is being used.

It will be apparent that the objects heretofore enumerated, as well as others, has been accomplished; and that there has been provided a calendaring machine having an improved feed mechanism which will uniformly distribute a fibrous material evenly across the bite of the rolls. It will further be apparent that successful means have been provided for producing a precompaction of the material into the bite of the rolls without disrupting the random nature of the asbestos fibers.

While the invention has been described in considerable detail, we do not wish to be limited to the particular constructions shown and described; and it is our intention to cover hereby all novel adaptations, modifications, and arrangements thereof which come within the practice of those skilled in the art to which the invention relates.

We claim:

1. In a machine for compacting fibrous brake lining materials and the like into relatively narrow strips: a pair of generally cylindrical rolls rotatably mounted about a parallel axis; the imaginary plane passing through said axes being inclined between vertical and horizontal planes, said rolls being spaced apart a generally predetermined distance with the upper roll being spaced in a forward direction from a vertical plane passing through the bottom roll; a hopper having a rear side surface which extends downwardly to the top surface of said bottom roll, whose front surface is formed by said upper roll, and whose bottom is formed by the upper surface of said

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bottom roll; an open ended feed trough for said hopper, the open end of which opens into one side of said hopper and extends parallel to said axis of said rolls; and a rotatable shaft extending down said trough to feed material in through the side of said hopper, said shaft having pins spaced apart in a helix to advance and feed said material gently in a uniform and loose condition across the bite of said rolls with the material resting on said bottom roll and laying up against the rear surface of said upper roll.

2. In a machine for compacting fibrous brake lining materials and the like into strips: a pair of generally cylindrical rolls rotatably mounted about parallel axis; the imaginary plane passing through said axes being inclined between vertical and horizontal planes, said rolls being spaced apart a generally predetermined distance with the upper roll being spaced in a forward direction from a vertical plane passing through the bottom roll; a hopper having a rear side surface which extends downwardly to the top surface of said bottom roll, whose front surface is formed by said upper roll, and whose bottom is formed by the upper surface of said bottom roll; a feed trough for said hopper extending parallel to said axis of said rolls; and a rotatable shaft extending down said trough and over said cylindrical surfaces of said rolls to feed material uniformly across said rolls, said shaft having pins spaced apart in a helix to advance and feed said material gently in a uniform and loose condition across the bite of said rolls with the material resting on said bottom roll and laying up against the rear surface of said upper roll.

3. In a machine for compacting fibrous brake lining materials and the like into strips: a pair of generally cylindrical rolls rotatably mounted about parallel axis; the imaginary plane passing through said axes being inclined between vertical and horizontal planes, said rolls being spaced apart a generally predetermined distance with the upper roll being spaced in a forward direction from a vertical plane passing through the bottom roll; a hopper having a rear side surface which extends downwardly to the top surface of said bottom roll, whose front surface is formed by said upper roll, and whose bottom is formed by the upper surface of said bottom roll; a feed trough for said hopper extending parallel to said axis of said rolls; a rotatable shaft extending down said trough and over said cylindrical surfaces of said rolls to feed material uniformly across said rolls, said shaft having pins spaced apart in a helix to advance and feed said material gently in a uniform and loose condition across the bite of said rolls with the material resting on said bottom roll and laying up against the rear surface of said upper roll; and a plurality of relatively thin members in said hopper arranged generally perpendicularly to and equally spaced across the width of said rolls, said members being reciprocated in the general direction of the bite of said rolls.

4. In a machine for compacting fibrous brake lining materials and the like into strips: a pair of generally cylindrical rolls rotatably mounted about parallel axis; the imaginary plane passing through said axes being inclined between vertical and horizontal planes, said rolls being spaced apart a generally predetermined distance with the upper roll being spaced in a forward direction from a vertical plane passing through the bottom roll; a hopper having a rear side surface which extends downwardly to the top surface of said bottom roll, whose front surface is formed by said upper roll, and whose bottom is formed by the upper surface of said bottom roll; a feed trough for said hopper extending parallel to said axis of said rolls; a rotatable shaft extending down said trough and over said cylindrical surfaces of said rolls to feed material uniformly across said rolls, said shaft having pins spaced apart in a helix to advance and feed said material gently in a uniform and loose condition across the bite of said rolls with the material resting on said bottom

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roll and laying up against the rear surface of said upper roll; and a plurality of relatively thin rods in said hopper arranged generally perpendicularly to and equally spaced across the width of said rolls, said rods being reciprocated in the general direction of the bite of said rolls.

5 5. In a machine for compacting fibrous brake lining materials and the like into strips: a pair of generally cylindrical rolls rotatably mounted about parallel axis; the imaginary plane passing through said axes being inclined between vertical and horizontal planes, said rolls being spaced apart a generally predetermined distance with the upper roll being spaced in a forward direction from a vertical plane passing through the bottom roll; a hopper having a rear side surface which extends downwardly to the top surface of said bottom roll, whose front surface is formed by said upper roll, and whose bottom is formed by the upper surface of said bottom roll; a feed trough for said hopper extending parallel to said axis of said rolls; a rotatable shaft extending down said trough and over said cylindrical surfaces of said rolls to feed material uniformly across said rolls, said shaft having pins spaced apart in a helix to advance and feed said material

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gently in a uniform and loose condition across the bite of said rolls with the material resting on said bottom roll and laying up against the rear surface of said upper roll; and a plurality of relatively small helical screw conveyors in said hopper extending generally toward the bite of said rolls, said screw conveyors extending generally perpendicularly to the axis of said rolls and being spaced generally uniformly across the width of said rolls; and whereby said fibrous material is uniformly compacted without any appreciable balling of the material.

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