Aug. 23, 1932. H. W. BROWN 1,873,279

APPARATUS FOR MANUFACTURE OF SHEET MATERIAL

Filed Dec. 27, 1930

Fig. 1

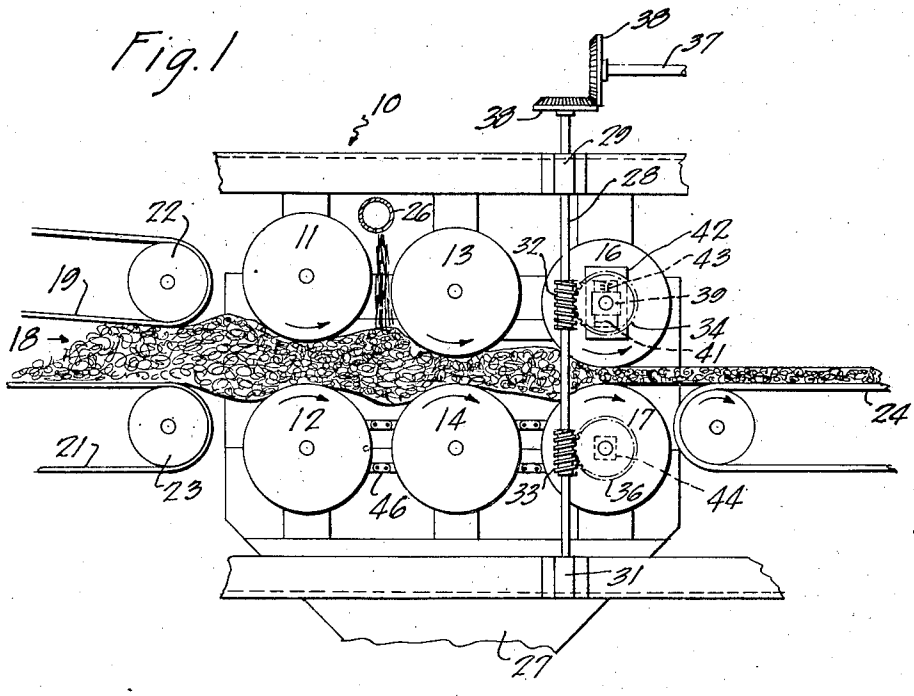
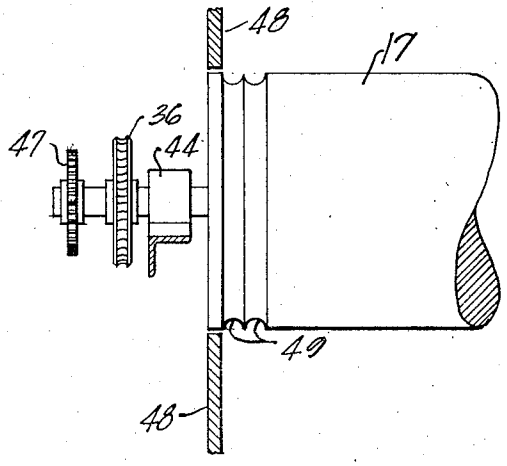


Fig. 2



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UNITED STATES PATENT OFFICE

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APPARATUS FOR MANUFACTURE OF SHEET MATERIAL

Application filed December 27, 1930. Serial No. 505,052.

This invention relates to an improved apparatus for the manufacture of sheet material which is characterized by press rolls between which the sheet or mat passes during its manufacture. More particularly this invention is applicable to a machine for manufacturing artificial lumber from strands of fibrous material, such as excelsior, which are bound together in a reticulated mass by a suitable binder, such as an oxychloride cement.

The present invention more particularly provides a driving arrangement and means generally to facilitate the treatment of fibrous material with the binder, and to drive the press rolls while aiding in urging them toward each other and thus applying pressure to the moving mat. The copending application of Cyrus J. Taylor and Horatio W. Brown, Serial No. 345,077, filed March 7, 1929, illustrates a machine of this general type wherein the excelsior mat is pressed between successive pairs of rolls and a liquid binder is fed thereto before it passes between the last pair of rolls, which afford the highest degree of compression. As disclosed in that application, springs are provided to urge the last pair of press rolls toward each other, and yet to permit slight relative movement therebetween, in response to slight variations in the thickness of the excelsior mat passing between these rolls.

The present invention provides an improved type of drive means which is not only effective in causing proper rotation of the rolls, but also permits their relative movement and at the same time aids the springs or other yieldable means which tend to urge the rolls toward each other and are effective in applying pressure to the mat. For this purpose I preferably provide a drive shaft having worms thereon engaging gears secured to the ends of the rollers, the worms being arranged so that driving of the rolls will continue despite variation in their center to center distance, and also being arranged so that they are effective in tending to urge the rolls toward each other. For this purpose the worms that drive the upper and lower rolls have opposite pitches, as for example, there may be a right-hand thread upon the upper worm and a left-hand thread upon the lower worm. Furthermore, in order to prevent undesirable leakage of the binder about the press rolls, I preferably provide a novel type of press rolls which include circumferential grooves to receive any surplus binder that otherwise might be squeezed out at the ends of the rolls and wasted.

In the drawing:

Fig. 1 is a view with parts omitted, showing in side elevation apparatus for use in the manufacture of artificial lumber; and

Fig. 2 is a side elevation of an end portion of one of the rolls shown in Fig. 1, and parts associated therewith.

The apparatus selected for illustration comprises a frame indicated generally at 10, which provides supports for a series of compacting and compressing feed rolls 11, 12, 13, 14, 16 and 17, preferably spaced one above the other in successive pairs, substantially as shown, for treating loose material such as the mat 18 which may be composed of reticulated strands of fibrous material, as excelsior. Upper and lower traveling belts 19 and 21 are arranged to operate over end rollers 22 and 23 which are so spaced and positioned with respect to the rolls 11 and 12 of the first pair, that the adjacent runs of these belts may be effective for delivering the mat into the bite of these rolls. The rolls of the succeeding pairs are likewise located to receive the mat from the preceding pair of rolls, in order progressively to compact and compress the same on its passage through the series of rolls. A traveling conveyor 24 may also be provided for carrying the mat away from the rolls 16

and 17, between which the final compression is effected.

A spray pipe 26 is disposed transversely above the path of travel of the mat at some suitable point, preferably between the first and second pairs of rolls. A liquid binder or cementitious material, such as oxychloride cement, may be discharged from this spray pipe and distributed thereby throughout the mat as the latter passes to the rolls 13 and 14. An open trough or container 27 extends beneath the rolls for receiving any excess of the cementitious material which may fall from the mat. The binder so collected may be returned to the spray pipe and used again, thus conserving the supply of this rather expensive material.

In an apparatus of this character it is highly desirable that the greatest compression of the mat should be effected at the final compression stage, as between rolls 16 and 17. More power, therefore, is required to operate these rolls, and greater care should also be exercised at this point to provide adequate compression and yet avoid excess pressures on the thicker portions of the mat. Better results can be obtained by supporting these rolls for relative movement toward and from each other and causing them to exert substantially the same uniform pressure on the mat or other material passing therebetween, even though this material may vary considerably in thickness or in compressibility.

For accomplishing these desirable results there is provided a vertical shaft 28 which is rotatably supported in upper and lower bearings 29 and 31 carried by the frame. Power is transmitted from this shaft to the rolls by means of driving gearing comprising, in the present instance, driving members 32 and 33 in the form of worms of opposite pitch, which are spaced along the shaft for engagement with driven members in the form of worm wheels 34 and 36. The worm wheel 34 is fast on the end of the upper roll 16, while the other worm wheel is fast on the lower roll of this pair. Power may be transmitted to the shaft 28 from a horizontal shaft 37 through bevel gearing 38.

In order to provide for relative bodily movement of these rolls toward and from each other to accommodate material of varying thickness, at least one of the rolls of this pair, as the upper rolls 16, is journaled in movable bearings 39. These bearings are slidable vertically in a slot 41 formed in a block 42 carried by any fixed portion of the apparatus. The slot 41 is so disposed as to guide these movable bearings for movement in a direction substantially parallel to the axis of the driving worm 32, so that the worm gearing operating this roll will remain in mesh during movement of the roll toward and from the other roll 17. A spring 43 may also be disposed between the upper end of each of the slots 41 and the bearing disposed therein for urging the bearing and the upper roll downwardly. While the lower roll of this pair may also be mounted for bodily movement in similar manner this is usually unnecessary, and therefore this roll has been shown as journaled in fixed bearings 44. It will also be evident that the preceding rolls 11, 12, 13 and 14 may be operated in a like manner should this be desired, but it is found that satisfactory results are obtained by supporting these rolls in fixed bearings (not shown) and transmitting power to at least one roll of each pair, as to the lower rolls 12 and 14 through a chain 46 which operates over a sprocket 47 carried by the lower roll 17 and over similar sprockets, (not shown) carried by the rolls to be driven. Although this driving and operating mechanism has been described only with reference to one end of the rolls, it will be understood that like mechanisms may be provided at each end of these rolls for operating the same, said mechanisms being operable in synchronism through common drive shafts.

In order to prevent the liquid cementitious material from spraying over the rolls and working out over the sides of the machine, side boards 48 are disposed longitudinally along the sides of this apparatus and are provided with openings which fit about the outer ends of the rolls. Each roll is preferably provided with one or more circumferential grooves 49 disposed adjacent its ends, but in a position to be within the side boards 48. As the liquid spreads lengthwise of the roll, it is collected and retained by the grooves 49 and thereby prevented from working out about the ends of these rolls.

In the operation of the apparatus it will be observed that the material to be treated, such as the mat 18, is delivered by the travelling belts 19 and 21 into the bight of rolls 11 and 12 and passes through the succeeding pairs of rolls being compressed and compacted in passing through each pair. Furthermore, after the cementitious material is applied by the spray pipe 6, the succeeding rolls function to force this binder throughout the mat and to compress the mat sufficiently to remove any excess of the binder, thereby effecting a firm bond between the reticulated fibers composing the mat, and at the same time avoiding waste of the cementitious material.

As power is delivered through the shaft 28, it will be observed that as the worms 32 and 33 are of opposite pitch, the thrust of these worms will be substantially equalized. Furthermore, as this shaft is disposed approximately normal to the path of material passing between these rolls and the worms engage the worm wheels adjacent the material receiving sides of the rolls, it will be seen that the driving torque tends to move

the rolls toward each other. This makes it possible to use a smaller spring 43, than could otherwise be employed, and thus to this extent eliminates the effect of the spring in producing a variable pressure. It is also contemplated that in some instances this spring may be replaced by apparatus of the type disclosed in the copending application of Cyrus J. Taylor, filed January 16, 1931, Serial No. 509,081, which produces a substantially constant and unvarying pressure on these bearings. Moreover, as thicker portions of the mat are encountered, the worm wheel 34 of the upper roll may roll over the driving worm in the same manner that a pinion might move along a rack, and thus relative movement of these rolls may take place without disengaging the driving mechanism, while at the same time the driving torque is constantly effective for tending to effect relative movement so as to cause the rolls to move toward each other.

As the upper and lower rolls constitute in effect, cooperating travelling surfaces it will be understood that in some modifications, either or both of these rolls may be replaced by a travelling belt of some approved type, preferably having means for reinforcing the material engaging run thereof so that it may present a relatively rigid and unyielding travelling surface to the material. Obviously where a travelling belt is employed it may also be in the form of a hinge conveyor section or it may be bodily movable toward and from the material to be treated. As these specific features of construction are well known in the art they are only briefly referred to here, for it is clear that a person skilled in this art when informed by this specification would be able readily to adapt such constructions and arrangements for use in an apparatus embodying the present invention.

It should be understood that the present disclosure is for the purpose of illustration only and that this invention includes all modifications and equivalents which fall within the scope of the appended claims.

I claim:

1. The combination with rolls spaced for feeding material therebetween, and means for supporting the rolls for relative movement toward and from each other, of means for driving the rolls in opposite directions and for utilizing the driving torque for tending to effect relative movement of the rolls toward each other.

2. The combination with rolls spaced for feeding material therebetween, and means for supporting the rolls for relative movement toward and from each other, of means for driving the rolls in opposite directions and for utilizing the driving torque for tending to effect relative movement of the rolls toward each other, and other means tending to effect relative movement of the rolls toward each other.

3. The combination of a pair of rolls arranged for feeding material therebetween and driving means therefor, said driving means comprising a shaft normal to the path of the material passing between the rolls, worm gears at the ends of the rolls and worms of opposite pitch in engagement with the respective worm gears, and means for rotating the shaft whereby the rolls are driven in opposite directions and the thrusts of the worms tend to be equalized.

4. The combination with rolls spaced for feeding material therebetween, and means for supporting the rolls for relative movement toward and from each other, of means for driving the rolls in opposite directions and for utilizing the driving torque for tending to effect relative movement of the rolls toward each other, means providing for relative movement of the rolls away from each other in response to pressure of material therebetween while maintaining the driving means effective, and other means tending to effect relative movement of the rolls toward each other.

5. The combination with a feed roll, and means for supporting the roll for movement toward and from the path of material to be fed, of means for driving the roll and for utilizing the driving torque for tending to move the roll toward the material being fed thereby.

6. The combination with rolls spaced for feeding material therebetween, and means for supporting the rolls for relative movement toward and from each other, of driving gearing comprising a driven member fast on each roll, and driving members engageable with the driven members at points adjacent the material receiving sides of the rolls, whereby the driving torque may be effective for tending to cause relative movement of the rolls toward each other.

7. The combination with rolls spaced for feeding material therebetween, and means for supporting the rolls for relative movement toward and from each other, of means tending to effect relative movement of the rolls toward each other, driving gearing comprising a driven member fast on each roll, and driving members engageable with the driven members at points adjacent the material receiving sides of the rolls so that the driving torque may be effective for tending to cause relative movement of the rolls toward each other.

8. The combination with rolls spaced for feeding material therebetween, and means for supporting the rolls for relative movement toward and from each other, of driving gearing comprising a driven member fast on each roll, driving members engageable with the driven members at points adja-

cent the material receiving sides of the rolls so that the driving torque may be effective for tending to cause relative movement of the rolls toward each other, and means for maintaining the driving and driven members in positive driving engagement during relative movement of the rolls toward and from each other.

9. The combination of rolls spaced for feeding material therebetween, means for supporting the rolls for relative movement toward and from each other, driving means for each roll, the driving means for at least one of the rolls comprising a worm wheel fast on this roll and a driving worm disposed approximately normal to the path of material being fed and meshing with the worm wheel at a point adjacent the material receiving side of this roll so that the driving torque may be utilized for urging the roll toward the material.

10. The combination of means providing a relatively rigid travelling surface, a feed roll spaced from this travelling surface for cooperating therewith to feed material, movable bearings for supporting the feed roll, driving gearing for operating the feed roll comprising a driven member fast on the feed roll, a driving member engaging the driven member at a point adjacent the material receiving side of the roll so that the driving torque may be utilized for urging the roll toward the travelling surface, and means for guiding the movable bearings for movement through a predetermined path, all points of which are substantially equidistant from the axis of the driving member of the driving gearing whereby the driving and driven members may remain in driving engagement during bodily movement of the feed roll toward and from the traveling surface.

11. The combination of rolls spaced for feeding material therebetween, a worm wheel fast on each roll, a shaft disposed approximately normal to the path of material passing between the rolls and adjacent the material receiving sides of the rolls, worms of opposite pitch fast on the shaft and spaced therealong to mesh with the worm wheels for driving the latter so that the thrust of the worms will be substantially equalized and the driving torque may be utilized for urging the rolls toward each other, bearings for supporting the rolls, the bearings for at least one of the rolls being movable, and means for guiding the movable bearings for movement in a direction substantially parallel to the axis of the shaft for maintaining the gearing in mesh during bodily movement of this roll.

12. The combination of rolls spaced for feeding material therebetween, a worm wheel fast on each roll, a shaft disposed approximately normal to the path of material passing between the rolls and adjacent the material receiving sides of the rolls, worms of opposite pitch fast on the shaft and spaced therealong to mesh with the worm wheels for driving the latter so that the thrust of the worms will be substantially equalized and the driving torque may be utilized for urging the rolls toward each other, bearings for supporting the rolls, the bearings for at least one of the rolls being movable, means for guiding the movable bearings for movement in a direction substantially parallel to the axis of the shaft for maintaining the gearing in mesh during movement of this roll, and resilient means for urging the movable bearings toward the path of material passing between the rolls.

13. Means for compacting and bonding loose material comprising rolls spaced for feeding material therebetween, means for applying a liquid binder to the material as it passes to these rolls, side boards having openings fitting the ends of the rolls, and means carried by the rolls at points within and adjacent the side boards for retaining the liquid binder to prevent the latter from working through the openings in the side boards.

14. Means for compacting and bonding loose material comprising rolls spaced for feeding material therebetween, means for applying a liquid binder to the material as it passes to these rolls, side boards having openings fitting the ends of the rolls, the rolls having one or more circumferential grooves disposed within and adjacent the side boards for collecting the liquid binder to prevent the latter from working through the openings in the side boards.

15. Means for compacting and bonding loose material comprising rolls spaced for feeding material therebetween, means for applying a liquid binder to the material as it passes to the rolls, and means carried by the rolls adjacent the ends thereof for collecting the liquid binder to prevent the latter from spreading over the ends of the rolls.

16. Means for compacting and bonding loose material comprising rolls spaced for feeding material therebetween, means for supporting the rolls for relative bodily movement toward and from each other, means for applying a liquid binder to the material as it passes to the rolls, means for driving the rolls and for utilizing the driving torque for urging the rolls toward each other and squeezing excess binder out of the material, and means carried by each roll adjacent the ends thereof for collecting the liquid binder to prevent the latter from spreading over the outer ends of the rolls.

17. Means for compacting and bonding loose material comprising rolls spaced for feeding material therebetween, means for supporting the rolls for relative bodily movement toward and from each other, means for driving the rolls and for utilizing the driving

torque for urging the rolls toward each other, means for applying a liquid binder to the material as it passes to the rolls, and side boards having openings fitting over the ends of the rolls, each roll having one or more circumferential grooves disposed adjacent the ends thereof and within the side boards for collecting the liquid binder to prevent the latter from passing through the openings in the side boards.

Signed by me at Boston, Massachusetts, this 23rd day of December, 1930.

HORATIO W. BROWN.