July 26, 1932. H. E. HOLCOMB 1,869,148

APPARATUS FOR FORMING FIBROUS SHEET MATERIAL

Filed May 11, 1929 3 Sheets-Sheet 1

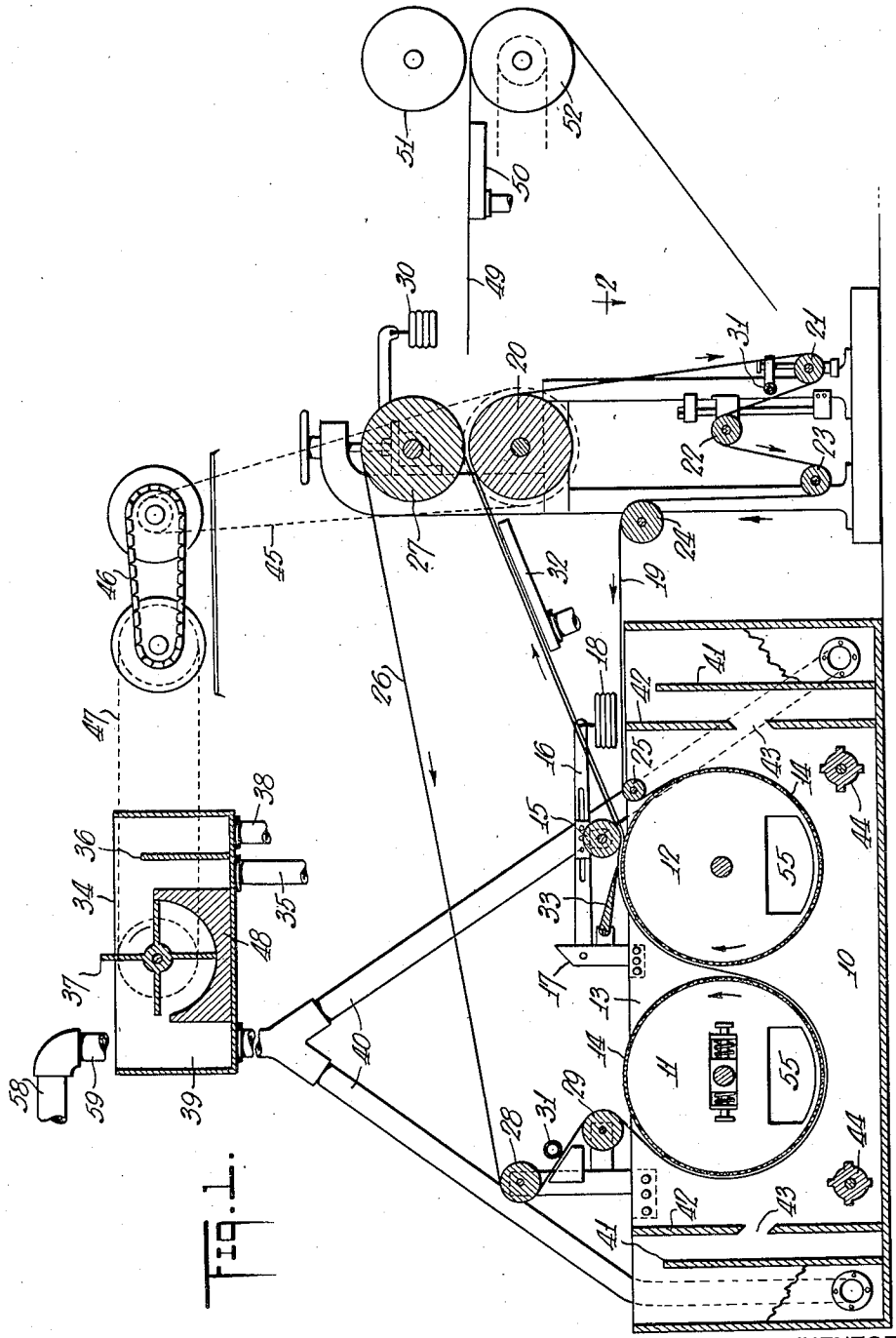

Fig. 1.

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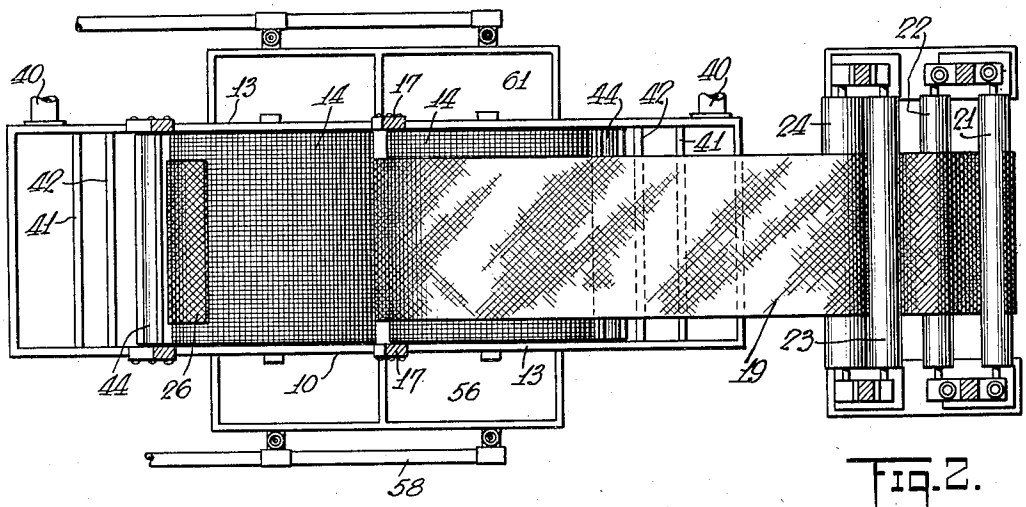

Fig. 2.

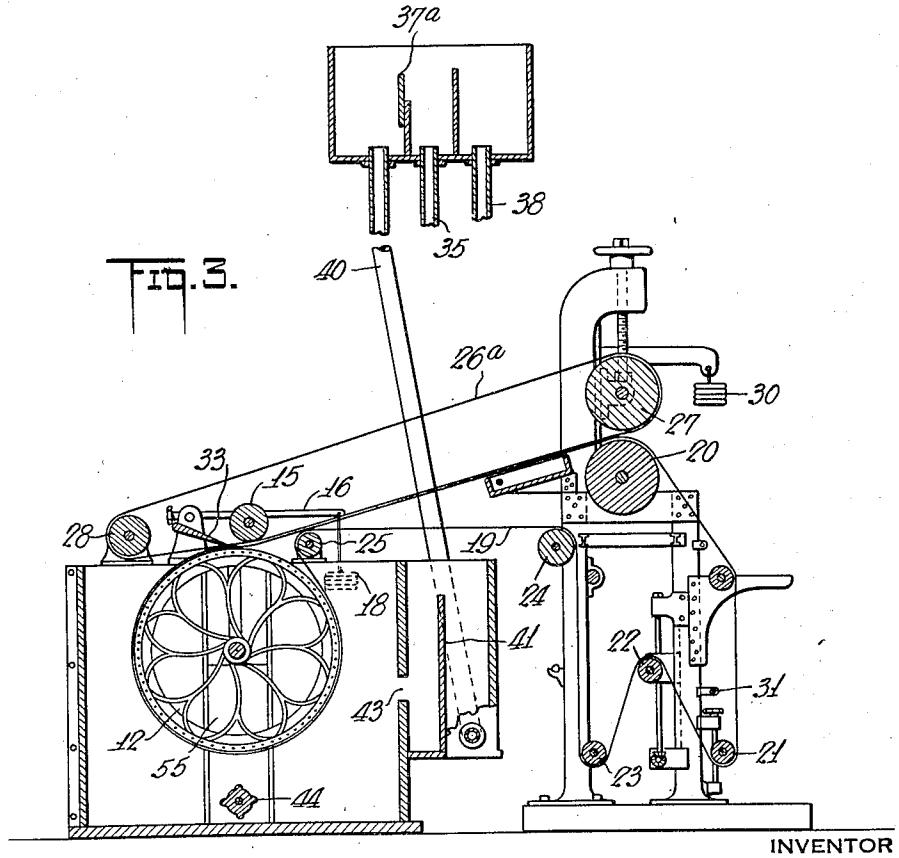

Fig. 3.

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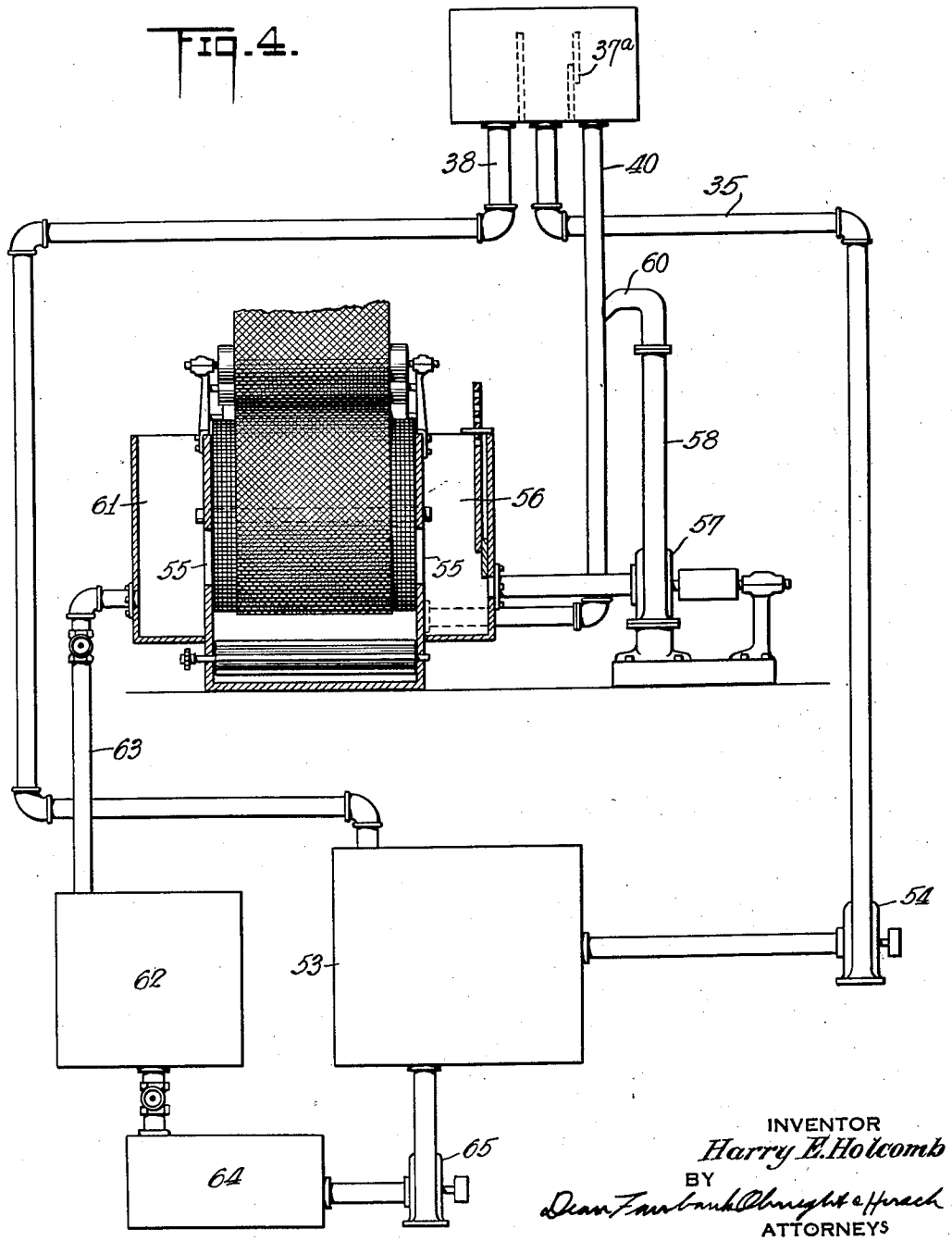
Fig. 4.



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UNITED STATES PATENT OFFICE

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APPARATUS FOR FORMING FIBROUS SHEET MATERIAL

Application filed May 11, 1929. Serial No. 362,231.

This invention is an improvement in that type of apparatus in which a continuous screen or belt is caused to travel through a tank containing fibrous material, and this material is caused to collect on the screen and be removed as a continuous layer from the tank. Although my improved apparatus may be used for forming sheets of various different kinds of fibrous material, it is of special advantage in the forming of felt.

As one important feature I make the belts of wire cloth or screening which has very much longer life and is less affected by chemical action than is the usual belt which is commonly employed.

As another feature I employ a pair of wire cloth screens between which the layer of fibres is compressed and subjected to the action of a partial vacuum to remove the surplus water.

By means of my invention a very superior type of felt for roofing purposes is produced due to the openness or high porosity of the sheet. The sheet when saturated with hot asphalt or analogous composition, will absorb a very much greater amount of the asphalt than the rag stock sheets now manufactured for this purpose. This is of importance because the larger the amount of asphalt which a sheet can carry the greater will be its resistance to moisture, the less its liability to rot or deteriorate and the greater will be the life of the sheet when applied as roofing.

By means of my improved apparatus I make a very light weight felt of the required thickness whereby there is a saving in raw material and a correspondingly lower cost in the production of felt for roofing purposes.

In the use of my improved machine there is no waste of water due to the fact that the water coming from the machine itself is used over again and flows in a continuous cycle. There is no waste of material due to the fact that the water coming from the inside of the filtering area or cylinder mold is re-used and therefore any material which leaves the machine with the water is returned to the stock and it is not necessary to employ any save-all such as is commonly used in paper mills to salvage stock which would otherwise go to the sewer.

As a further important feature I pick up the fibre from the vat on a pair of wire cloth screens which come together below the surface of the liquid in the tank, and I use one of the cylinder molds as a backing for the couch roll whereby the excess water is removed at a point only a short distance above the surface of the liquid in the vat and before the material can flow or shift position in the layer.

Other important features will be pointed out hereinafter or will be apparent from a consideration of the constructions illustrated in the accompanying drawings.

In these drawings:

Fig. 1 is a vertical longitudinal section through an apparatus constructed in accordance with my invention;

Fig. 2 is a horizontal section on the line 2—2 of Fig. 1;

Fig. 3 is a vertical longitudinal section of a second form; and

Fig. 4 is a vertical transverse section of the form shown in Fig. 3 and showing the circulating system which is also employed with the form shown in Figs. 1 and 2.

In the construction shown in Figs. 1 and 2 there is provided a tank or vat 10 in which there are mounted two cylinder molds 11 and 12 of a type commonly employed in paper making machinery. These have their open ends engaging the side walls 13 of the vat and their peripheral walls 14 reticulated, as for instance by being formed of spaced parallel rods and coarse wire mesh. These two cylinder molds are mounted with their axes parallel and their peripheries spaced only a short distance apart. The molds are so mounted that they project to only a slight extent above the top of the vat. Directly above the cylinder mold 12 is a couch roll 15 which is yieldingly mounted for vertical movement, as for instance in a pair of levers 16 pivoted on brackets 17 and having adjustable weights 18. A belt 19 formed of woven wire cloth extends around substantially the entire periphery of the mold 12, beneath the couch roll 15 over a roll 20, thence around belt tightening rolls 21, 22 and 23, a guide roll 24 and a final guide

roll 25 adjacent to the couch roll and at the upper part of the vat 10. A second belt of woven wire cloth 26 extends approximately one-half of the way around the cylinder mold 12, thence along a portion of the upper surface of the cylinder mold 12 above the belt 19 on the latter, beneath the couch roll 15, around a roll 27, and guide rolls 28 and 29. These two rolls 28 and 29 are mounted directly above the vat in such positions that the run of the belt therebetween has a horizontal component.

The two rolls 20 and 27 are mounted in superposed relationship and deliver the sheet from between the two belts. The journals of the upper roll 27 may be adjustable and the two rolls may be pressed together by the action of a suitable weight 30. These two rolls 20 and 27 are so positioned in respect to the vat that the superposed runs of the two wire cloth belts from beneath the couch roll 15 to these two delivery rolls is approximately horizontal, that is, it has a very substantial horizontal component.

Over a section of the belt 26 between the two rolls 28, 29 is a washing device in the form of a spray pipe 31. As previously noted this section of the belt goes over the vat so that the water which is sprayed onto the upper side of the belt will wash any adhering fibres from the belt directly into the vat.

Beneath the double run of belts between the couch roll 15 and the delivery rolls 20, 27 is a suction box 32 with suitable pipe connections whereby partial vacuum may be created therein and air drawn through the two belts and the interposed fibre layer to withdraw a very considerable portion of the water left in after the belts leave the couch roll 15.

Closely adjacent to the couch roll is a sluice board 33 extending the full length of the mold 12 and preferably pivoted at one edge so that the free edge may rest lightly on the belt 26 at a point closely adjacent to the nip between the couch roll and the mold.

Above the vat is a feed chamber 34 to which the stock is continuously delivered through a pipe 35. Within the feed chamber and at one side of the inlet pipe 35 is a partition 36 and at the opposite side is a rotary feed device 37. The partition 36 serves as an overflow so that the surplus stock may be continuously drawn from the feed chamber through a pipe 38. The rotary feed device carries the stock to a compartment 39 from which it may be delivered through pipes 40 to opposite ends of the vat 10. As illustrated there is a partition 41 adjacent to each end of the vat and at the inner side of this partition is a second partition 42 having an aperture 43 therein. The stock enters the compartment at the outer side of each partition 41, flows over the top of the latter and thence into the main chamber of the vat through the aperture 43. By admitting it in this way there is the minimum direct action of the incoming stream on the cylinder molds. To prevent settling of the fibre to the bottom of the vat the latter may be provided with suitable agitators 44.

In order that the rate of delivery of the material to the vat may be properly regulated in accordance with the speed of rotation of the cylinder molds the rotary feed device 37 is driven by some rotary part of the machine and the drive connections include a speed varying device. The shaft of the roll 20 may be the main drive shaft of the machine and may be operatively connected to the rotary feed device 37 through a drive chain 45, a Reeves drive 46, and a chain 47. The rotary member of the feed device includes a plurality of radially disposed plates which follow the curved surface of a bottom section or bed block 48 so that as the device rotates it carries successive measured quantities into the compartment for delivery to the vat. The speed of the device will be directly proportional to that of the cylinder molds, but this proportion may be varied by means of the Reeves drive 46 or any other equivalent speed varying device which might be employed in place thereof.

The material as it is delivered from between the rolls 20 and 27 may be received by any suitable form of apparatus and preferably conducted to a drier. In Fig. 1 I have illustrated conventionally a receiving apparatus including a conveyor belt 49, a second suction box 50, and a pair of rolls 51 and 52. The belt represented as 49 may be merely an additional section of the belt 19 so that the latter will pass from the roll 20 around the roll 52 and thence to the roll 21 instead of directly from the roll 20 to the roll 21.

In Fig. 3 I have illustrated a machine somewhat similar to that shown in Fig. 1, except that there is only a single cylinder mold. The upper belt 26*a* instead of passing around a cylinder mold 11 on its way to the couch roll 15 passes directly to the couch roll, and the sluice board 33 rests upon this run of belt adjacent to the couch roll. In this construction I have illustrated the spray pipe 31 located between the two runs of the belt 19 to and from the roll 21 as in Fig. 1, but as the belt 26*a* does not pass into the vat I have not shown any spray pipe for this belt. In Figs 3 and 4 I have shown a feed device in which the rotary feed device is omitted and an adjustable partition 37*a* is employed for regulating the feed to the machine.

The circulation of the water in a closed cycle is illustrated this Fig. 3, but it will be understood that the same circulating system is used with the form shown in Figs. 1 and 2.

The water carrying the fibre stock is delivered from a stock chest 53 or any suitable source of supply, by a suitable pump 54 at a

rate somewhat greater than that needed by the machine and the overflow through the pipe 38 takes the excess back to the stock chest. The water and stock pass from the feed device through the pipe 40 to the vat 10 and the water flows through the woven wire belt or belts and the wall of the cylinder mold and thence through an outlet opening 55 in the end wall of the vat to an outer chamber 56. The stock delivered through the pipe 40 has a somewhat larger percentage of fibre than it is desired to employ in the vat and therefore a pump 57 withdraws water from the chamber 56 and delivers it through a pipe 58 for return to the machine. In Fig. 1 I have shown the pipe 58 terminating in an outlet 59 discharging into the compartment 39 of the feed device, whereas in Fig. 4 I have shown the pipe 58 provided with an elbow 60 discharging into the pipe 40 at a downwardly inclined angle. The excess water from the inside of the mold or molds may flow out into a compartment 61 on the side opposite to the compartment 56 and return to a storage tank 62 through a pipe 63. From this storage tank the water may be delivered to a beater 64. The rags are inserted at this point and after the beating is completed the stock is delivered by a pump 65 to the stock chest.

The stock which collects on the woven wire belt 19 of Figs. 1 and 3 and on the woven wire belt 26 of Fig. 1, is pressed between the two belts at the upper side of the cylinder mold 12 and is squeezed between the cylinder mold and the couch roll. As a result of this squeezing or pressing action a very considerable amount of water is forced out through the upper and lower belts. The water which passes through the lower belt goes through the peripheral wall of the mold 12 to the interior of the latter and flows out through the opening 55, while that which goes out through the upper belt is deflected laterally by the sluice board and delivered into either the compartment 56 or 61 or both.

It will thus be noted that the water flows in a closed cycle and that all fibre which passes through the woven wire belts or which escapes at the ends of the cylinder molds is returned either to the feed device or to the stock chest. Additional fibre is added to the stock chest either continuously or from time to time as required to maintain the stock of the desired character and any additional water which may be added with the rags to the beater or which is added by the spray pipe 31 will compensate for evaporation, spilling and the moisture content in the sheet as it is delivered from the machine. Thus no water is wasted, none is delivered to the sewer and there is no necessity for a save-all or other fibre salvaging device.

It will be noted that the fibre which collects on the woven wire belt travels only a very short distance on its way to the couch roll and that the direction of travel has a very substantial horizontal component, so that there is practically no tendency of the wet fibre to flow back into the vat before the water is squeezed out by the couch roll. As the sluice board is closely adjacent to the couch roll the water which is squeezed out by the latter will not flow back into the vat countercurrent to the upwardly traveling fibre on the belt, but will be deflected laterally.

In the form shown in Fig. 1 the fibre which collects on the two belts is squeezed together into a single layer as the belt 26 engages the belt 19 in the vat and below the liquid level. Thus the fibre is held between the two belts until it reaches the couch roll and here again the direction of travel of the fibre after leaving the surface of the liquid is approximately horizontal.

By means of my improved apparatus I am able to make from rag stock a felt of very high porosity which is capable of absorbing a very much larger amount of hot asphalt or other analogous bituminous compound for making roofing sheets. Furthermore the sheet is of uniform thickness and without streaks or thin or thick sections as the fibre does not shift in position from the time it collects on the belt until the water is squeezed out.

Having thus described my invention, what I claim as new and desire to secure by Letters Patent is:

1. A machine of the class described including a vat adapted to receive fibrous pulp stock, a cylinder mold mounted for rotation therein, a reticulated belt passing around said mold for collecting a layer of fibrous material from the stock in the vat and carrying it out of the vat, a couch roll above the mold for pressing the belt and fibre layer directly onto the mold, and a sluice board closely adjacent to the couch roll for preventing return flow of water down along the belt counter to the path of movement of the fibre on the belt to the couch roll.

2. A machine of the class described comprising a vat, a cylinder mold mounted therein, an endless reticulated belt passing around said cylinder mold along nearly the entire circumference of the latter for collecting a layer of fibrous material from the stock in the vat and carrying it out of said vat, a couch roll and a guide roll above the cylinder mold and around which said belt passes, and a sluice board directly above the cylinder mold and adjacent to the couch roll for preventing return flow of water down along the belt counter to the path of movement of the fibre on the belt to the couch roll.

3. A machine of the class described including a vat having a pair of cylinder molds mounted therein, an endless reticulated belt extending around one of said molds, a sec-

ond endless reticulated belt extending around the other cylinder mold, and thence along a portion of the periphery of the first mentioned mold to retain a fibre layer between the two belts in superposed relationship along the upper portion of the first mentioned mold, and a couch roll for pressing the two belts and the fibre layer together onto the first mentioned mold.

4. A machine of the class described including a vat having a pair of cylinder molds mounted for rotation therein, a pair of endless reticulated belts extending in superposed relationship along a portion of the periphery of one of said molds and thence in a direction having a horizontal component, said belts saparately extending along portions of the peripheries of their respective cylinder molds, a couch roll for pressing the stock and the two belts onto the first mentioned cylinder mold, and a sluice board for preventing return flow of water from the couch roll directly into the vat.

5. A machine of the class described including a vat having a pair of cylinder molds mounted for rotation therein, a pair of endless reticulated belts extending in superposed relationship along a portion of the periphery of one of said molds and thence in a direction having a horizontal component, said belts separately extending along portions of the peripheries of their respective cylinder molds, a couch roll for pressing the stock and the two belts onto the first mentioned cylinder mold, and a vacuum chamber beneath the two belts along the path of their approximately horizontal parallel runs.

6. A machine of the class described including a vat having a cylinder mold mounted for rotation therein, an endless reticulated belt extending around said mold for receiving and delivering a layer of fibrous material, a rotary feed device for delivering stock to said vat, means for rotating said mold and advancing said belt, and driving connections between said last mentioned means and said rotary feed device.

7. A machine of the class described including a vat having a cylinder mold mounted for rotation therein, an endless reticulated belt extending around said mold for receiving and delivering a layer of fibrous material, a rotary feed device for delivering stock to said vat, means for rotating said mold and advancing said belt, and driving connections between said last mentioned means and said rotary feed device, said driving connections including a variable speed device.

8. A machine of the class described, including a vat for pulp stock, a cylinder mold mounted for rotation therein, a woven wire belt passing around said mold for collecting a layer of material from the stock in the vat, and having a run above the vat from said cylinder mold, a second woven wire belt having a run above and parallel with said run of the first mentioned belt, a couch roll above the mold for pressing said belt together with said layer between and against said cylinder mold, and a sluice board closely adjacent to said couch roll and adjacent to the upper surface of the second mentioned belt.

9. A machine of the class described, including a vat for pulp stock, a cylinder mold mounted for rotation therein, a woven wire belt passing around said mold for collecting a layer of material from the stock in the vat, and having a run above the vat from said cylinder mold, a second woven wire belt having a run above and parallel with said run of the first mentioned belt, a couch roll above the mold for pressing said belt together with said layer between and against said cylinder mold, a sluice board closely adjacent to said couch roll and adjacent to the upper surface of the second mentioned belt, and a vacuum chamber adjacent to said run of one of said belts for sucking water from said layer through said belt.

Signed at New York in the county of New York and State of New York this 2nd day of May, A. D. 1929.

HARRY E. HOLCOMB.