MACHINE FOR UNROLLING CHOPPING, AND FEEDING MATTED MATERIAL

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ABSTRACT

The machine includes a receptacle for receiving a roll of matted fibrous material, an endless belt conveyor system for feeding the material from the roll, a chopping blade for chopping the material into mats of predetermined length, an air conveyor system for feeding the chopped-off mats, a pair of gates for controlling the flow of the chopped-off mats to another machine, pneumatic actuators for the gates and chopping blade, and photoelectric cells to control the sequence of operation.

28 Claims, 4 Drawing Figures
MACHINE FOR UNROLLING CHOPPING, AND FEEDING MATTED MATERIAL

This invention relates to a machine particularly adapted to feed mats of fibrous material to a second machine which uses the mats to produce air filters for heating and air conditioning systems. The second machine forms no part of the present invention.

Prior to this invention, mats were fed to the air filter producing machine by hand. Large numbers of mats of various sizes had to be stored. When it was desired to make a particular size of air filters, a supply of mats of that size was transported to the air filter producing machine and fed in one at a time by hand. By the use of the machine of this invention, the mat material can be stored in a much more compact roll form. While rolls of a few different widths still need to be stored, the machine of this invention is adjustable to cut the rolls into mats of various lengths. The number of different sizes of mats that had to be stored for hand feeding depended both on the width and the length, while the number of different sizes of rolls that needed to be stored for use with the machine of this invention depends only on the width. Therefore, fewer different sizes of material need to be stored by the use of the machine of this invention, and the rolls are much more compact than the separate mats. Storage space and inventory problems are thus greatly reduced. The number of workers required to feed each air filter producing machine is also reduced.

The principal object of the invention is to provide a machine for unrolling mat material, chopping it into predetermined lengths, and feeding the cut-to-length mats to an air filter producing machine.

Other objects and advantages will become apparent when the following specification is considered along with the accompanying drawings of which:

FIG. 1 is a side elevational view of a machine constructed in accordance with the invention, certain portions being omitted for clarity;

FIG. 2 is a top view of the machine of FIG. 1;

FIG. 3 is a fragmentary sectional view taken generally along the line 3--3 of FIG. 2; and

FIG. 4 is a fragmentary sectional view taken generally along the line 4--4 of FIG. 2.

With reference to the drawings, a machine 10 constructed in accordance with the invention is shown in FIGS. 1 and 2. A rear view generally indicated by the numeral 11 is shown at the left-hand end of the machine 10 as viewed in FIGS. 1 and 2. A rear portion of the receptacle 11 is defined by a plurality of rollers 12a and 12b each rotatable about a horizontal axis. The rollers 12a are vertically spaced from each other to define an upper vertical portion of the rear of the receptacle 11 and the rollers 12b are spaced from each other on an incline to define a lower inclined portion of the rear of the receptacle 11. A front portion of the receptacle 11 is defined by upper inclined portions 13a of a plurality of movable, transversely spaced endless belts 14 forming part of an endless belt conveyor system indicated generally by the numeral 15. The belts 14 travel around three rollers 16, 17, and 18 each rotatable about a horizontal axis. The roller 16 is disposed adjacent the bottom of the receptacle 11. The roller 17 is spaced upwardly and forwardly of the roller 16 to define the angle of inclination of the belt portions 14a. The roller 18 is spaced horizontally forwardly of the roller 17 and is driven intermittently by a motor 20 provided with clutch and brake mechanism for fast stopping of the belts 14. An endless belt 22 connects appropriate pulleys on shafts of the roller 18 and motor 20.

The endless belt conveyor system 15 has its exit end adjacent the roller 18. An air conveyor system generally indicated by the numeral 24 is disposed forwardly of the endless belt conveyor system 15 and includes a blower 26 (FIG. 1) for blowing air into a horizontally extending hollow chamber 28 having an elongated slotted upper plate 28a (FIG. 2) provided with a plurality of generally uniformly dispersed air jets or slots 28b. As will be understood, the slots 28b are forwardly inclined from the inner to the outer surface of the plate 28a.

Further, the slots 28b are arranged in rows extending transversely of the plate 28a, with the slots of one row being staggered from those of adjacent rows. A cover plate 29 is provided to block off the slots 28b not necessary for use as air jets for a roll of matted material of a particular width. A guide bar 30 is secured to a longitudinal edge of the plate 28a (the upper edge as viewed in FIG. 2) and the slots 28b are oriented to direct air upwardly, forwardly along the plate 28a, and slightly toward the guide bar 30.

A chopping blade 32 operable by a pneumatic actuator 34 is provided between the conveyor systems 15 and 24. A first gate 36 operable by a pneumatic actuator 38 is disposed substantially midway along the length of the plate 28a, and a second gate 40 mounted on a pivotable link 41 operable by a pneumatic actuator 42 is disposed adjacent the forward end of the plate 28a. A drag shoe 44 is pivotally mounted above the belts 14 adjacent the roller 18 and is operable by a pneumatic actuator 46 as best shown in FIG. 4. A sensing means or photoelectric cell 50 is mounted along an edge of the conveyor system 15 adjacent the roller 17. A photoelectric cell 51 best shown in FIG. 3 is mounted along an edge of the conveyor system 24 between the chopping blade 32 and the first gate 36. The photoelectric cells 50 and 51 are adjustable unitarily lengthwise of the conveyor systems 15 and 24 to adjust the length of mats chopped off by the chopping blade 32. A photoelectric cell 52 is mounted along the same edge of the conveyor system 24 rearwardly of the second gate 40. A photoelectric cell 53 is shown forwardly of the second gate 40, the cell 53 actually being mounted in the air filter producing machine (not shown) but controlling the raising of the second gate 40 of the machine of this invention. Suitable framework (not shown) is provided for the mounting of the actuators 34, 38, 42, and 46 and the photoelectric cells 50, 51, and 52.

Two upwardly directed air jet means 56 are provided between the rollers 17 and 18 and between adjacent pairs of the belts 14. A transversely directed air jet means 58 is provided just above the belts 14 along an edge of the conveyor system 15 and substantially between the rollers 17 and 18. A suitably mounted downwardly directed air jet means 60 is provided above the belts 14 adjacent the roller 17. A suitable air supply is provided for the actuators 34, 38, 42, and 46 and the air jet means 56, 58, and 60.

Operation

Assuming that the machine is not running, an operator places a roll of matted fibrous material in the receptacle 11 and turns on both conveyor systems 15 and 24. The belts 14 carry the leading edge of the matted material up and over the roller 17. The air jet means 60
blows the material against the belts 14 to bend it around the roller 17. After the leading edge of the material passes under the photoelectric cell 50, the air jet means 60 is shut off and the leading edge of the material passes under a cover (not shown). The belts 14 continue to feed the material until the leading edge passes under the photoelectric cell 51. The belts 14 are then stopped, the actuator 46 moves the drag shoe down into contact with the material, and the actuator 34 reciprocates the chopping blade 32 to chop off a mat of material. The chopped-off mat is carried by the air conveyor system 24 past the raised first gate 36 into contact with the closed second gate 40 and under the photoelectric cell 52. As the trailing edge of the chopped-off mat passes under the photoelectric cell 51, the belts 14 are again started, and as the leading edge of the chopped-off mat passes under the photoelectric cell 52, the actuator 38 closes the first gate 36. As the new leading edge of the matted material passes under the photoelectric cell 51, the belts 14 are again stopped and the actuator 34 reciprocates the chopping blade 32 again to chop off a second mat of material. The second mat is carried by the air conveyor system 24 into contact with the closed first gate 36. Both of the chopped-off mats are also pressed lightly against the guide bar 30. Further operation of the machine of this invention depends on the air filter producing machine to which the chopped-off mats are to be fed. When a cardboard frame passes under the photoelectric cell 53 of the air filter producing machine, the actuator 42 raises the second gate 40 and the first chopped-off mat is carried into contact with a gate (not shown) of the air filter producing machine. The latter gate is raised and gripping fingers pull the chopped-off mat into the cardboard frame. When the trailing edge of the first chopped-off mat passes under the photoelectric cell 52, the actuator 42 closes the second gate 40 and the actuator 38 raises the first gate 36. The second chopped-off mat is then carried by the air conveyor system 24 past the raised gate 36 into contact with the closed second gate 40 and under the photoelectric cell 52. As the trailing edge of the second chopped-off mat passes under the photoelectric cell 51, the belts 14 are again started, as the leading edge of the second chopped-off mat passes under the photoelectric cell 52, the actuator 38 closes the first gate 36. As the new leading edge of the matted material passes under the photoelectric cell 51, the belts 14 are again stopped and the actuator 34 reciprocates the chopping blade 32 again to chop off a third mat of material which is carried by the air conveyor system 24 into contact with the closed first gate 36. Further operation of the machine of this invention then again depends on the passing of a cardboard frame under the photoelectric cell 53 of the air filter producing machine. If the trailing end piece of the roll of matted material is too short for the required size of mat, as the trailing edge of the too-short piece passes under the photoelectric cell 50, the actuator 46 raises the drag shoe 44 and the air jet means 56 and 58 blow the too-short piece off the belts 14 sideways into a scrap box. The operator then places another roll of matted fibrous material in the receptacle 11. As a roll of matted fibrous material unwinds, it presents less resistance to further unwinding. The drag shoe 44 compensates for this effect and prevents the length of successive chopped-off mats from increasing as the roll size and weight decreases. While the machine of this invention has been described with reference to an air filter producing machine, it is evident that it could be used to feed chopped-off mats of fibrous material to other machines for making different end products. Various modifications may be made in the structure shown and described without departing from the spirit and scope of the invention as set forth in the appended claims. I claim: 1. A machine for unrolling a roll of matted fibrous material, chopping the material successively into mats of predetermined length, and feeding the chopped-off mats out in a controlled manner, the machine comprising a receptacle for loosely receiving a roll of matted fibrous material in a position for the feeding of the material from the bottom of the roll as the roll is rotated, an endless belt conveyor system including an endless movable belt, an upper portion of the belt defining an upwardly and forwardly inclined movable front portion of the receptacle, whereby movement of the belt rotates the roll and unwinds and feeds the matted fibrous material upwardly and forwardly from the bottom of the roll, a reciprocable chopping blade disposed forwardly of the endless belt and operable to chop the matted fibrous material successively into mats of predetermined length, an air conveyor system disposed forwardly of the chopping blade and including a plate for receiving the matted fibrous material after it passes the chopping blade and before it is chopped thereby, the air conveyor system being operable for feeding the chopped-off mats forwardly off the plate, and a movable gate associated with the plate for controlling the flow of the chopped-off mats. 2. A machine as claimed in claim 1 including a drag shoe disposed rearwardly of the chopping blade for engaging the matted fibrous material and compensating for decreasing resistance to unwinding as the roll unwinds. 3. A machine as claimed in claim 1 wherein the air conveyor system includes a guide bar and the chopped-off mats are urged sideways against the guide bar as they are fed forwardly by the air conveyor system. 4. A machine as claimed in claim 1 wherein the endless movable belt includes an upper horizontal portion forwardly of and joined to the inclined portion defining a front portion of the receptacle, and downwardly directed air jet means is provided to maintain a leading portion of the roll of matted fibrous material in contact with the belt as the belt and the matted fibrous material transverse the angle between the inclined and horizontal portions of the belt. 5. A machine as claimed in claim 4 including sensing means operable to effect shutting off of the air jet means upon the passing of a leading portion of the roll of matted fibrous material under the sensing means. 6. A machine as claimed in claim 1 wherein the endless movable belt includes an upper horizontal portion forwardly of and joined to the inclined portion defining a front portion of the receptacle, and sideways directed air jet means is provided adjacent the upper horizontal portion of the belt to blow a trailing end portion of the roll of matted fibrous material shorter than the predetermined length of chopped-off mats sideways off the belt.
7. A machine as claimed in claim 6 including sensing means operable to effect turning on of the air jet means upon the passing of a trailing edge portion of an end portion of the roll of matted fibrous material shorter than the predetermined length of chopped-off mats under the sensing means.

8. A machine as claimed in claim 1 including sensing means operable to effect stopping of the movable belt and reciprocation of the chopping blade upon the passing of a leading edge of the matted fibrous material under the sensing means.

9. A machine as claimed in claim 1 including a second movable gate disposed forwardly of the first-mentioned gate, the second movable gate also controlling the flow of the chopped-off mats.

10. A machine as claimed in claim 9 including a drag shoe disposed rearwardly of the chopping blade for engaging the matted fibrous material and compensating for decreasing resistance to unwinding as the roll unwinds.

11. A machine as claimed in claim 9 wherein the air conveyor system includes a guide bar and the chopped-off mats are urged sideways against the guide bar as they are fed forwardly by the air conveyor system.

12. A machine as claimed in claim 9 including sensing means operable to effect stopping of the movable belt and reciprocation of the chopping blade upon the passing of a leading edge of the matted fibrous material under the sensing means.

13. A machine as claimed in claim 9 wherein the endless movable belt includes an upper horizontal portion forwardly of and joined to the inclined portion defining a front portion of the receptacle, and downwardly directed air jet means is provided to maintain a leading portion of the roll of matted fibrous material in contact with the belt as the belt and the matted fibrous material traverse the angle between the inclined and horizontal portions of the belt.

14. A machine as claimed in claim 13 including sensing means operable to effect the shutting off of the air jet means upon the passing of a leading portion of the roll of matted fibrous material under the sensing means.

15. A machine as claimed in claim 9 wherein the endless movable belt includes an upper horizontal portion forwardly of and joined to the inclined portion defining a front portion of the receptacle, and sideways directed air jet means is provided adjacent the upper horizontal portion of the belt to blow a trailing end portion of the roll of matted fibrous material shorter than the predetermined length of chopped-off mats sideways off the belt.

16. A machine as claimed in claim 15 including sensing means operable to effect turning on of the air jet means upon the passing of a trailing edge portion of an end portion of the roll of matted fibrous material shorter than the predetermined length of chopped-off mats under the sensing means.

17. A machine as claimed in claim 9 including first sensing means operable to effect stopping of the movable belt and reciprocation of the chopping blade upon the passing of a leading edge of the matted fibrous material under the first sensing means and operable to effect starting of the movable belt upon the passing of a trailing edge of a chopped-off mat under the first sensing means, and second sensing means operable to effect closing of the first-mentioned gate upon the passing of the leading edge of a chopped-off mat under the second sensing means and operable to effect closing of the second gate and opening of the first gate upon the passing of the trailing edge of a chopped-off mat under the second sensing means.

18. A machine as claimed in claim 17 including third sensing means operable to effect the opening of the second gate upon the occurrence of a particular operating condition thereof.

19. A machine as claimed in claim 17 including a drag shoe disposed rearwardly of the chopping blade for engaging the matted fibrous material and compensating for decreasing resistance to unwinding as the roll unwinds.

20. A machine as claimed in claim 17 wherein the air conveyor system includes a guide bar and the chopped-off mats are urged sideways against the guide bar as they are fed forwardly by the air conveyor system.

21. A machine as claimed in claim 17 wherein the endless movable belt includes an upper horizontal portion forwardly of and joined to the inclined portion defining a front portion of the receptacle, and downwardly directed air jet means is provided to maintain a leading portion of the roll of matted fibrous material in contact with the belt as the belt and the matted fibrous material traverse the angle between the inclined and horizontal portions of the belt.

22. A machine as claimed in claim 17 wherein the endless movable belt includes an upper horizontal portion forwardly of and joined to the inclined portion defining a front portion of the receptacle, and sideways directed air jet means is provided adjacent the upper horizontal portion of the belt to blow a trailing end portion of the roll of matted fibrous material shorter than the predetermined length of chopped-off mats sideways off the belt.

23. A machine as claimed in claim 17 wherein the endless movable belt includes an upper horizontal portion forwardly of and joined to the inclined portion defining a front portion of the receptacle, wherein the air conveyor system includes a guide bar and the chopped-off mats are urged sideways against the guide bar as they are fed forwardly by the air conveyor system, and including a movable drag shoe disposed rearwardly of the chopping blade for engaging the matted fibrous material and compensating for decreasing resistance to unwinding as the roll unwinds.

24. A machine as claimed in claim 23 including downwardly directed air jet means for maintaining a leading portion of the roll of matted fibrous material in contact with the belt as the belt and the matted fibrous material traverse the angle between the inclined and horizontal portions of the belt, sideways directed air jet means adjacent the upper horizontal portion of the belt for blowing a trailing end portion of the roll of matted fibrous material shorter than the predetermined length of chopped-off mats sideways off the belt, and third sensing means operable to effect the shutting off of the downwardly directed air jet means upon the passing of a leading portion of the roll of matted fibrous material under the third sensing means and operable to effect the raising of the drag shoe and the turning on of the sideways directed air jet means upon the passing of a trailing edge portion of an end portion of the roll of matted fibrous material shorter than the predetermined length of chopped-off mats under the third sensing means.

25. A machine as claimed in claim 24 including fourth sensing means operable to effect the opening of
the second gate upon the occurrence of a particular operating condition thereof.

26. A machine as claimed in claim 1 wherein the plate of the air conveyor system is provided with a plurality of slots inclined upwardly and forwardly through from the bottom thereof and the chopped-off mats are fed forwardly off the plate by flow of air upwardly and forwardly through the slots.

27. A machine as claimed in claim 26 wherein the air conveyor system includes a guide bar and the slots in the plate are also inclined sideways, whereby the chopped-off mats are urged toward the guide bar as well as forwardly by the flow of air through the slots.

28. In a machine for processing a roll of matted fibrous material, a receptacle for loosely receiving the roll of matted fibrous material in a position for the feeding of the material from the bottom of the roll as the roll is rotated, and an endless belt conveyor system including an endless movable belt, an upper portion of the belt defining an upwardly and forwardly inclined movable front portion of the receptacle, whereby movement of the belt rotates the roll and unwinds and feeds the matted fibrous material upwardly and forwardly from the bottom of the roll for further processing.

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