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FEED MECHANISM

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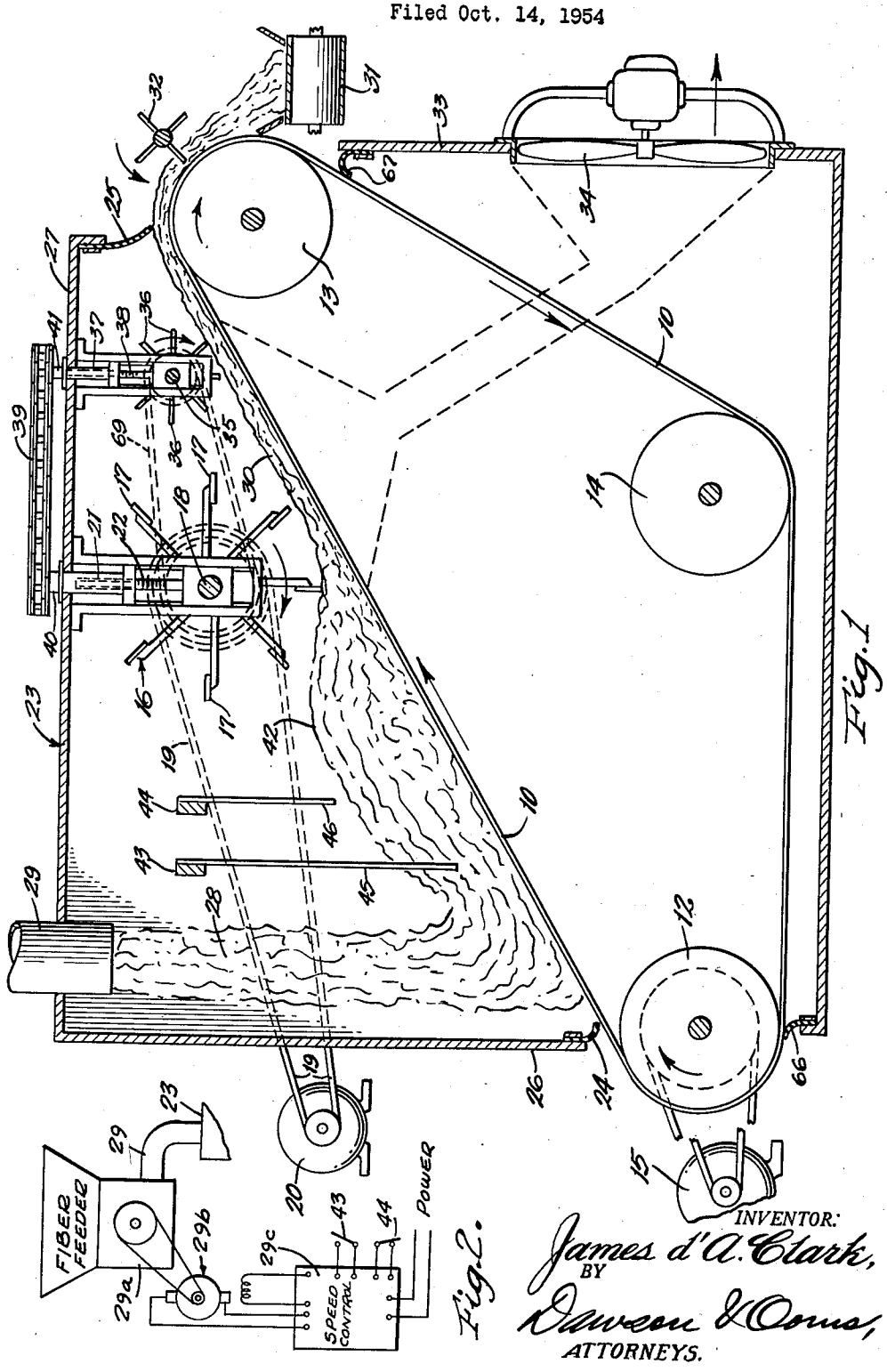


Fig. 1

Fig. 2.

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FEED MECHANISM

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This invention relates to a device for feeding fibrous elements in controlled amounts and at a uniform rate from a supply source to a unit for processing as in the manufacture of fibrous structures such as webs, mats, bats and the like, wherein the formation of satisfactory fibrous structures depends in part at least on the uniformity of feed of the fibrous elements to the processing unit or the like. It will be understood that devices of the type described for feeding fibrous elements at a constant rate may be adapted for use in other purposes.

It is an object of this invention to provide a device of the type described for feeding fibrous elements from a supply source at a uniform rate which may be varied in a simple and efficient manner.

These and other objects and advantages of this invention will hereinafter appear and for purposes of illustration, but not of limitation, an embodiment of the invention is shown in the accompanying drawing in which—

Figure 1 is a schematic view of apparatus embodying features of this invention.

Figure 2 is a schematic view showing additional details of the apparatus.

Feeding of fibrous elements and the like at a uniform rate is desired for use in a number of processing techniques such, for example, as in the manufacture of endless fibrous structures of the type described and claimed in my copending application Ser. No. 61,674, filed on November 23, 1948. Feeding of a uniform amount of such separated and discrete fibers from bulk storage has been difficult to achieve and such feeding operations have been further complicated when employed for the delivery of separated fibrous elements in a fluffed condition, particularly fibers which tend to cling together and mat on contact with one another. In the past, attempts have been made to feed fibrous elements of the type described at a uniform rate by utilization of the technique of fiberization at a uniform rate at the source. Nevertheless, uniform feed of fibrous elements continues to remain as a problem because of the many variations that exist in the shape, in the character, in the quality or in the quantity of feed stock. In the attempt to overcome the effect of such variables or feed rate, constant supervision is required in processing and even then, optimum conditions of fiber feed rate have not been achieved.

In accordance with the practice of this invention, use is made of a device in which the fibrous elements are supplied onto a moving surface in amounts to maintain fibrous elements on the surface in excess of that capable of being carried forwardly by the surface in amounts and at a rate desired for the feed with the result that the excess remains in a predetermined area on the moving surface so as to insure adequate supply and means are provided in the area wherein the excess is carried for controlling the amount of such excess material to the end that the fibrous elements on the moving surface are of

sufficiently uniform density and orientation as to enable measurement by volume to control feed rate.

Referring now to the drawing, **10** indicates a moving surface in the form of an endless foraminous belt moving constantly in one direction about horizontally disposed rollers **12**, **13** and **14** adapted to be driven at a constant speed by a variable speed motor **15**. The portion of the foraminous surface upon which the described feeding operations at a controlled and uniform rate are achieved is arranged preferably at an upward incline in the direction of movement as illustrated in Figure 1 of the drawing. In the alternative, particularly when used in combination with a vacuum on the underside for withdrawing air through the foraminous belt to hold the fibrous elements onto the moving surface, such conveyor belt or moving surface may be horizontally disposed. The upper flight of the endless belt **10** runs between stationary vertically disposed side walls (not shown) which, with the conveyor belt, defines a rectangularly shaped trough in which the moving belt represents the bottom wall movable in one direction between the stationary side walls.

Located in closely spaced relation above an upper portion of the foraminous belt **10** and extending crosswise from side wall to side wall is a measuring wheel assembly **16** in the form of a drum **18** having a plurality of pins or pickers **17** extending radially from the periphery thereof. The measuring wheel is adapted to be rotated by a belt **19** which interconnects the wheel with a driving motor **20** for rotating the wheel to effect movement of the pins or pickers over the surface of the moving wall in a direction opposite the movement of the wall **10** as indicated by the arrows. The height of the measuring wheel and correspondingly, the spaced relation between the ends of the pins or pickers **17** and the upper flight of the belt **10** may be selectively adjusted by turning movement of a sleeve **21** adapted rotatably to engage a hanger rod **22** from which the drum **18** is rotatably suspended. By turning the sleeve **21** in one direction or the other, the spacing of the measuring wheel may be adjusted relative to the belt for providing a predetermined spaced relation therebetween for controlling the thickness of the ribbon of fibrous elements permitted to pass with the belt between the walls beneath the rotating measuring wheel. While the spaced relation between the tips of the pins or pickers of the measuring wheel from the upper flight of the belt **10** may be selectively varied, it is important to maintain a spaced relation which is less than the height of the side walls so that the measuring wheel may be adapted to cooperate with the side walls to provide a layer of fibrous elements of uniform width crosswise of the belt for passage with the belt in feeding relation.

A housing **23** is provided over the upper flight of the belt from which the vertically adjustable measuring wheel is suspended and which conforms in length and width to that of the belt. The ends of the housing defining the beginning and end of the top flight of the belt are substantially sealed from the atmosphere by resilient aprons **24** and **25** secured to the lower end portions of the end walls **26** and **27** respectively of the housing. The resilient apron **24** bears against the surface of the belt while the resilient apron **25** rides over the surface of the layer of fibrous elements advanced in feeding relation on the belt surface.

Fibrous elements **28** are introduced into the housing **23** onto a lower end portion of the belt **10** through feed pipes **29**. It will be understood that various defibering, storage or fiber feeding means may be employed in connection with the inlet conduit **29** for introducing fibrous elements into the housing **23**. For this purpose, a fiber

feeder 29*a* is shown diagrammatically in the drawings. The illustrated feeder 29*a* is driven by a variable speed motor 29*b* to provide for adjustment of the rate at which fiber is fed through the conduit 29. A conventional or suitable speed control unit 29*c* is electrically connected to the motor 29*b*. The fibrous elements introduced by flowing down from the feed pipe 29 tend to collect in a fluffed aggregation on the surface of the belt in the region of its lowermost position within the housing. As the conveyor belt or bottom wall of the housing carries the layer of collected fibrous elements between the side walls forwardly with the belt, all of the fibrous elements at a level above the tips of the pins or pickers are displaced rearwardly upon engagement by the plurality of pins or pickers extending radially from the drum whereby the displaced fibers collect on top of the layer of fibers collected on the belt surface from the feed to form a mound in the area between the feed and the measuring wheel. Depending on the relative spaced relation of the pins or pickers above the surface of the belt, a layer 30 of fibrous elements of predetermined thickness uniformly across the belt is allowed to continue up with the belt for delivery to further processing elements such as to a conveyor belt 31 traveling in a transverse direction. The fibrous layer 30 which passes beyond the measuring wheel may be removed from the belt as it turns about the roller 13 or such removal may be assisted as by a revolving kicker wheel 32 illustrated schematically in the drawing.

The underside of the belt 10 is also adapted to be substantially completely enclosed within a housing 33 in which subatmospheric conditions may be provided as by an exhaust fan 34 to create a suction of air through the foraminous belt for holding the layer of fibers firmly onto the surface of the belt 10 as it travels forwardly. The utilization of such suction means maintained at a relatively uniform level functions further to achieve uniform packing of the fibrous elements on the surface of the belt so that the volumetric means employed results in the feed of fibrous elements at a uniform and constant rate on a weight basis as well as on a volumetric basis. The aprons 66 and 67 which resiliently engage the lower flights of the endless belt 10 adjacent the idler rollers 12 and 13 prevent infiltration of such amounts of air into the lower housing 33 as might interfere with the withdrawal of air in substantially uniform volumes through the foraminous belt. Instead of making use of a lower and upper housing for enclosing the upper flight of the belt upon which measurements for volume and fiber feed rate are achieved, use may be made of ductwork from which air may be exhausted, as in the manner described, with a suction box located against the underside of the foraminous belt in the area immediately below the measuring wheel, as illustrated by the broken lines in Figure 1.

By way of modification for use in achieving a more exact control in the amount of fibrous material fed with a device of the type described, particularly when the fibrous elements constitute soft and fluffy materials embodying springy characteristics, a second leveling wheel may be provided for use in cooperation with the measuring wheel. The second wheel, as illustrated in the drawing, may be in the form of a rotating drum 35 having a plurality of radially extending fingers 36 arranged about the periphery of the drum. Rotational movement in a direction corresponding to that of the measuring drum is imparted by direct connection to the measuring drum, as through a belt 69. When such auxiliary leveling wheel is employed, it has been found best to rotate the wheel at a higher peripheral speed than the measuring wheel 16.

The described successive arrangement of leveling and metering elements makes it less likely that clots or other fibrous bundles will advance with the fibrous elements beyond the drums because those aggregates which succeed in passing beyond the measuring wheel will have sufficient opportunity to expand before being confronted

by the second leveling element whereby such fibrous elements as extend above the predetermined level will be engaged by the pins thereof and returned stepwise downwardly along the belt. The leveling device operating in combination with the measuring device is intended further to function in a manner whereby the tips of the fingers or pickers which are adjusted to brush the surface of the layer of fibers operate to cause sufficient displacement of the fibrous elements for filling any indentations which might exist in the layer or to remove any protuberances thereby to insure a more uniform rate of delivery. Adjustment of the second leveling device may be made by turning movement of the sleeve member 37 which threadably engages rod 38 from which the drum is suspended. The sleeves 37 and 21 may, if desired, be interconnected by a linking mechanism 39 operating between sprockets 40 and 41 on the end of sleeves 21 and 37 respectively for conjoint movement in corresponding amount of both of the wheels relative the conveyor belt for effecting the desired spaced relation therebetween.

Because of the fact that the amount of fibrous elements supplied to the conveyor belt is present in quantities greater than that adapted to be delivered by the belt, a mound 42 of fibrous elements will be formed in the region immediately in advance of the measuring wheel 16. Control of the quantity of excess fibers on the conveyor is preferably regulated for purposes of maintaining a uniform compacting relation of the fibers directly to influence the amount of fibers per unit volume on the belt. Control of the height of the mound may be regulated by a pair of limit switches 43 and 44 with suspended rods 45 and 46 respectively. The switches 43 and 44 are suitably connected to the speed control unit 29*c*. Switch 44 and switch 43 are normally open. When the excess of fiber is of the desired quantity, as indicated by the height of the mound, the rod 45 of the limit switch 43 is retained in a forward position by the mass of material so that both switches remain open. In the event that the supply of fibers exceeds that which is desired, the height of the mound 42 builds up until the rod 46 is engaged in a manner to cause displacement thereof for closing the limit switch 44. Closing of switch 44 imparts a signal to the feed mechanism which causes a reduction in the speed of the feeder 29*a* and a corresponding reduction in the amount of fibers being introduced into the housing from the feeder. In the event that the amount of fibers being fed into the housing is insufficient, the height of the mound 42 recedes gradually until the surface falls below the end of rod 45 thereby to permit the rod 45 to work in the rearward direction to close switch 43 and accordingly to increase the speed of the feeder 29*a* and thus increase the amount of fibers being introduced into the housing thereby.

It will be understood that various defibering, storage or fiber feeding means may be employed in connection with the inlet conduit 29 for introducing fibrous elements into the housing in response to controls as by means of the control switches 43 and 44. Instead of switches 43 and 44, use may be made of photo-electric cells and the like responsive to the height of the mound for increasing or decreasing the amount of fibers being fed through the inlet into the housing.

It will be apparent from the foregoing description that I have provided means whereby the rate of feed of fibrous elements or other discrete particles may be varied simply by increasing or decreasing the spaced relation between measuring wheels with the top flight of a conveyor between confining walls to enable a greater or lesser thickness in the fibrous layer capable of passing beneath the measuring wheels and that the rate of feed may also instead be varied by the linear speed of the conveyor belt to increase the amount of fiber being fed directly in proportion to the rate of movement of the conveyor belt. Thus there are provided two simple and expedient means

for effecting adjustments in the rate of feed of fibrous elements to other units for processing.

An important advantage of feeding fibrous elements in the manner described resides in the technique which provides for a gentle brushing action of the measuring wheels on the excess material which assists in maintaining the fibrous elements in a fluffy condition. When the brushed layer of fibrous elements return for passage as a part of the fibrous layer beneath the fingers of the measuring wheels, it has been found that a minimum amount of compression is imparted to the fibrous elements and that the amount of compression to which the layer is subjected remains substantially uniform under the conditions described thereby to provide a homogeneous layer of fibrous elements of uniform and low density. Apparatus of the type described has the advantage over the gravimetric systems which have heretofore been employed from the standpoint of simplicity of operation and sensitivity, particularly in the measurement of a light and fluffy fibrous element. In a volumetric feed system of the type described, there is little need for concern of the moisture content of the material as is required in gravimetric systems because moisture has little effect on the volumetric relation of the fibrous elements and has vastly greater effect on the weights thereof.

This application is a continuation-in-part of my copending application Ser. No. 200,041, filed on December 9, 1950, now abandoned, entitled "Feed Mechanism."

It will be understood that numerous changes may be made in the details of construction, operation and arrangement without departing from the spirit of the invention, especially as defined in the following claims.

I claim:

1. Apparatus for feeding discrete fibrous elements at a constant and uniform rate comprising a foraminous conveyor moving in one direction at a contant speed between confining side walls, a metering wheel mounted between the side walls over an intermediate portion of the conveyor and in predetermined spaced relation with the surface thereof and having a plurality of fingers extending radially from the periphery of the wheel, means for applying suction to the underside of the portion of the conveyor beneath the metering wheel, driving means for rotating the metering wheel in a direction for movement of the portion adjacent the conveyor in a direction opposite the movement of the conveyor to displace fibrous elements above a predetermined level backwardly directly onto the oncoming layer of fibrous elements on the conveyor to form a mound in advance of the metering wheel, means for introducing fibrous elements onto the conveyor in advance of the metering wheel to provide an amount of fiber greater than that capable of passing beneath the wheel thereby to form a mound of fibrous elements on

the conveyor in advance of the metering wheel, and means responsive to the height of the mound for controlling the addition of fibrous elements to the conveyor so as to maintain the height of the mound between narrow predetermined limits whereby the layer of fibrous elements between the underside of the metering wheel and the surface of the conveyor is compressed by the mound above and the suction below to a corresponding narrow variation in density said means comprising a pair of switch operating members arranged in vertically spaced apart relation with the upper switch operating member being positioned to be engaged by the fibers in the mound when the height of the mound exceeds a predetermined maximum and with the lower switch operating member being positioned to be disengaged when the height falls below a predetermined minimum whereby the means for introducing fibers is retarded upon engagement of the upper switch operating member and wherein the means for introducing fibers is increased when the lower switch operating member is disengaged.

2. Apparatus as claimed in claim 1 in which the foraminous conveyor is inclined in a direction to position the feed end at the lower level and the delivery end at the higher level with the mound of fibrous elements formed by displacement at a lower portion of the conveyor than that beneath the metering wheel.

3. Apparatus as claimed in claim 1 which includes means for manually adjusting the spaced relation between the metering wheel and the upper surface of the conveyor to vary the thickness of the layer of fibrous elements capable of being advanced with the conveyor beyond the metering wheel.

4. Apparatus as claimed in claim 1 which includes a leveling wheel having a plurality of fingers extending radially from the periphery thereof beyond the metering wheel and with the fingers spaced a corresponding distance from the surface of the foraminous conveyor, and means for rotating the leveling wheel in the same direction as the metering wheel.

References Cited in the file of this patent

UNITED STATES PATENTS

561,689	Patterson	June 9, 1896
562,338	Patterson	June 16, 1896
628,878	Waring	July 11, 1899
1,259,524	Kelly	Mar. 19, 1918
2,221,396	Evoy	Nov. 12, 1940
2,544,019	Heritage	Mar. 6, 1951
2,589,008	Lannan	Mar. 11, 1952
2,632,554	Wilcox	Mar. 24, 1953

FOREIGN PATENTS

17,574	Netherlands	Feb. 15, 1928