June 26, 1962 A. R. JEE 3,040,387

APPARATUS FOR DISINTEGRATING A DENSE MASS OF FIBERS

Filed July 5, 1960 3 Sheets-Sheet 1

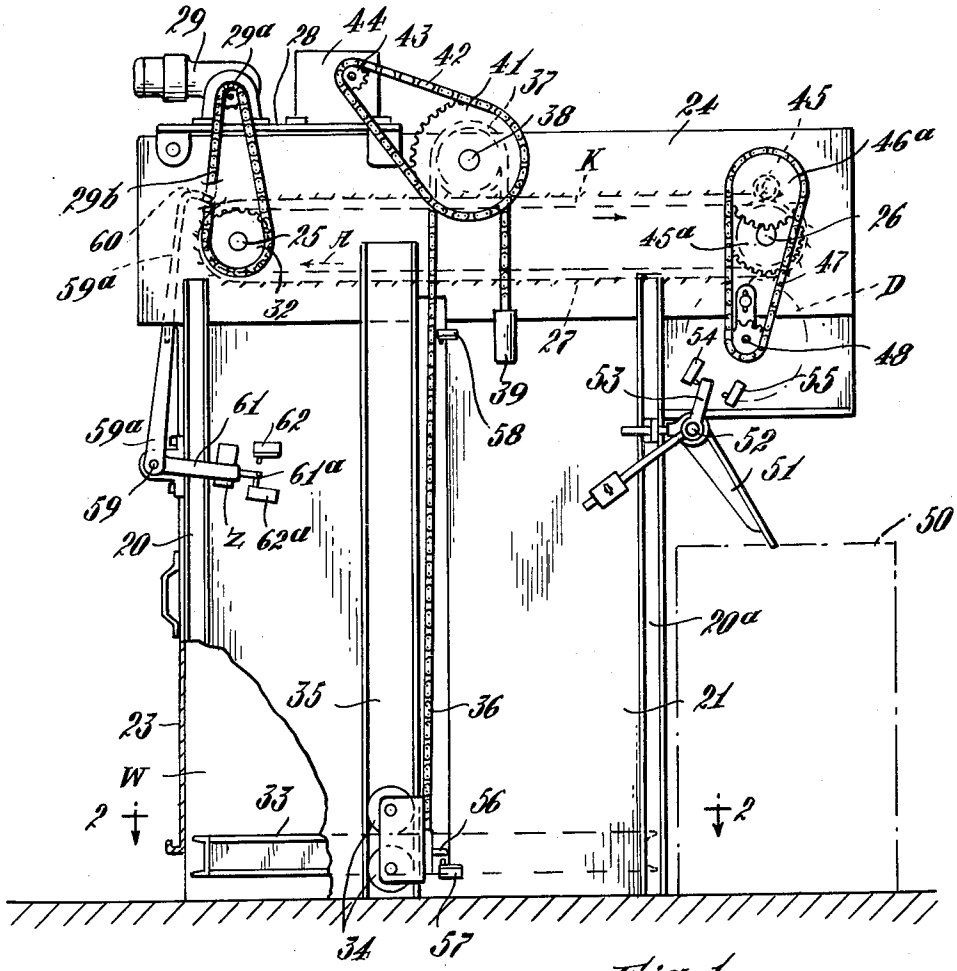


Fig. 1

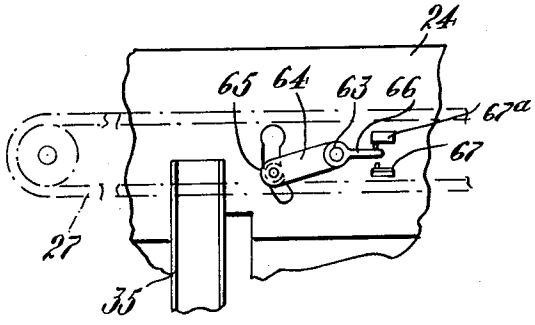


Fig. 4

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APPARATUS FOR DISINTEGRATING A DENSE MASS OF FIBERS

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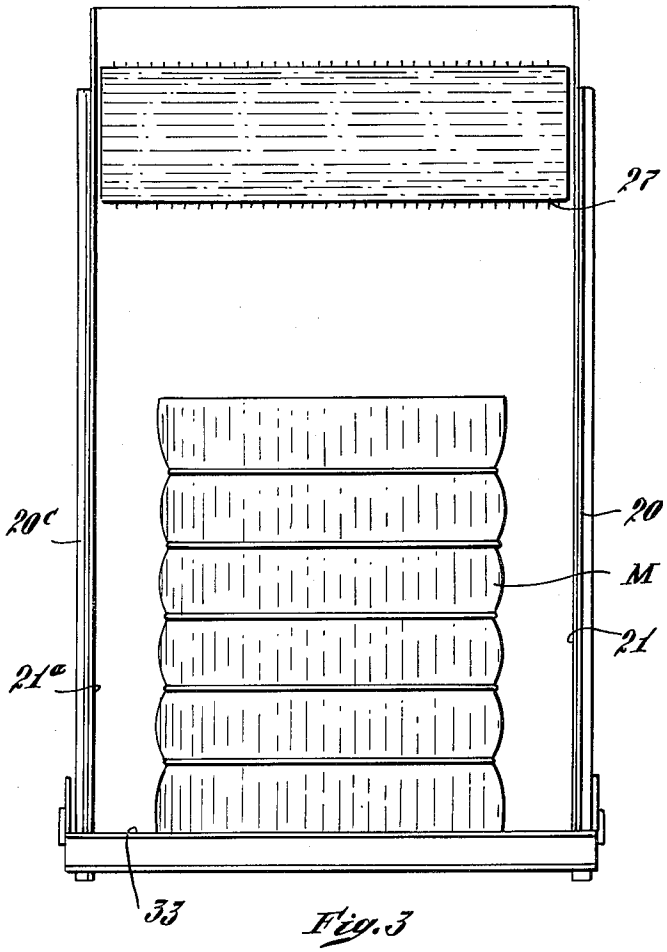


Fig. 3

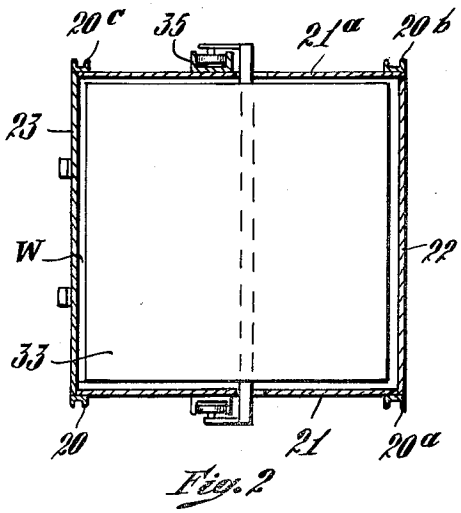


Fig. 2

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APPARATUS FOR DISINTEGRATING A DENSE MASS OF FIBERS

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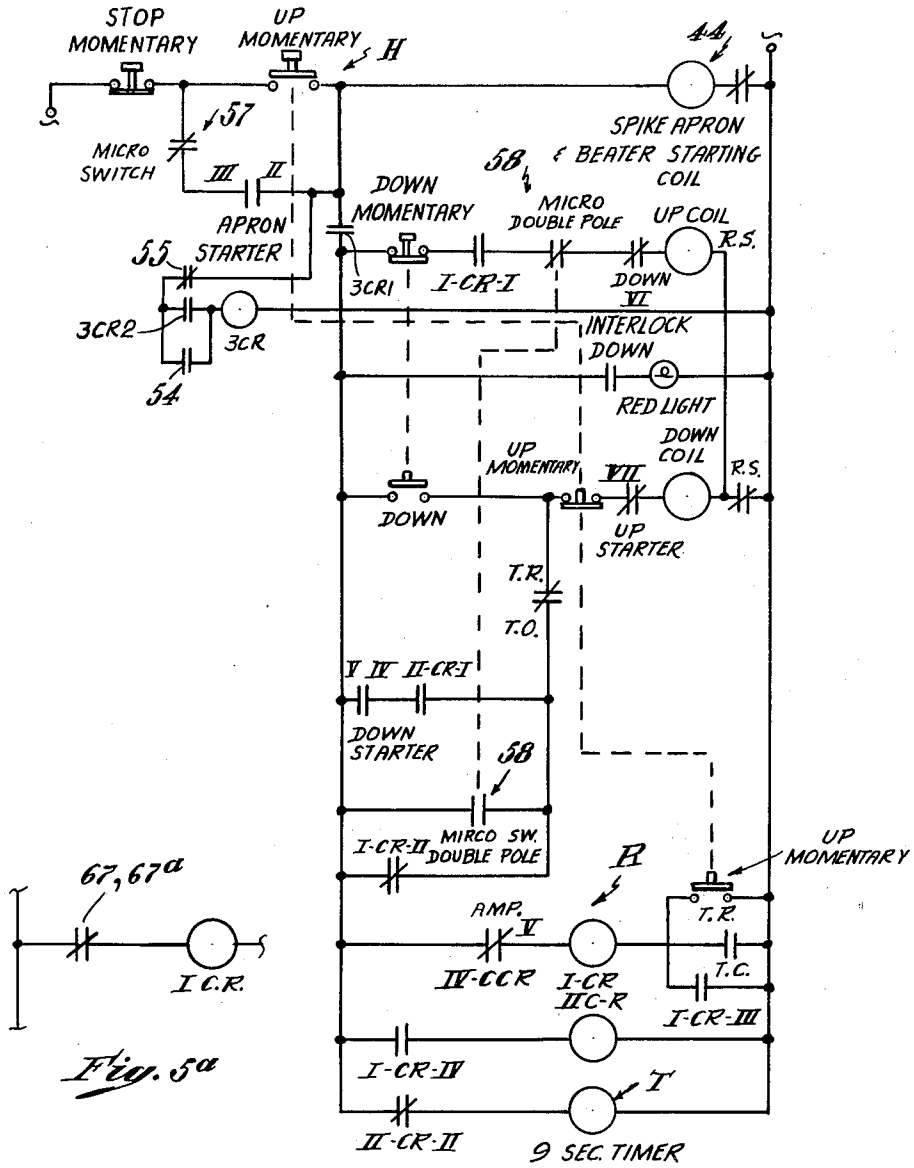


Fig. 5a

Fig. 5

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APPARATUS FOR DISINTEGRATING A DENSE MASS OF FIBERS

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Filed July 5, 1960, Ser. No. 40,713
15 Claims. (Cl. 19—81)

This invention pertains to textile manufacture, and more especially to apparatus for disintegrating a closely compacted dense mass of fiber, for example a cheese or bale, as a preliminary step in the processing of the fiber into yarn.

One specific utility of such apparatus is in the handling of cheeses of dyed stock, such as are produced as the product of some modern dyeing and moisture-extracting procedures—such cheeses being extremely hard-packed and coherent and requiring very laborious, rough, and fiber-damaging methods to break them apart by manual means, in preparation for further processing.

It is contemplated that a plurality of machines, such as that herein disclosed, may be arranged in a battery with provision for driving several machines at relatively different speeds so that the battery may be employed in forming blends of fibers—the fiber, which, for instance, may be in the form of a cheese or bale, being loaded into each respective machine—the removal of the fiber in a horizontal direction as is done in accordance with the present invention, being superior, with respect to the prevention of sorting of the long and short fibers, to the customary procedure of removing fibers from a mass by an upwardly moving spike apron. Obviously the product of the machine herein disclosed, whether from a single machine or from the machines of a battery, may be delivered to a blower, garnett feeder, picker, picker-feeder or other apparatus as desired.

Another specific utility of the apparatus is for disintegrating a dense, hard compact mass of fibrous material preparatory to delivering the constituent fibers to a card feeder, such as is used in a woolen mill. Within very recent years the woolen (including carpet) industry has increasingly adopted the practice of baling stocks of different kinds and/or colors immediately upon completion of the picking and blending process, and of manually transferring stock directly from the resultant bales, as required, into the hoppers of the card feeders.

Each such bale contains only a relatively small part of the total flow of stock comprising a given lot, so that it fails to contain fibers which emerged from the picking and blending process either earlier or later during the processing of the total lot. This situation is aggravated by the fact that even the fibers which become compressed to form a layer of a single bale rarely or never get into contact with those in any other layers of the same bale, except perhaps with fibers in immediately adjoining layers. Thus, an irregularity or imperfection in the mixing of fibers during the picking and blending process will result in layers or laminations in any given bale having different compositions. For example, in a lot composed equally of black stock and white stock, any layer of the bale can (and frequently does) contain an excessive concentration of either black or white stock, which aggravates the problem created by one whole bale containing an overall excess of black, whereas another bale contains an overall excess of white.

It is virtually impossible, physically, for stock to be removed manually form the customary compact dense bale except by peeling it off layer-by-layer. This results in stock going into the hopper of a card feeder layer-by-layer as it comes from the bale, so that the feeder will deliver perfectly or imperfectly blended batches of stock

in essentially the same sequence as its hopper receives them; and the roving produced by the carding machine will inevitably vary accordingly, as to contents, within spools or from spool to spool. Since nothing in the woolen manufacturing process can compensate for such variation, streaky and imperfect cloth must result. Thus, the advantages in efficiency gained by baling stock in the blending and picking department is, in actual practice, frequently offset by the off-blend results created by the blending process itself and from manual methods of transferring stock from bales to the hoppers of the card feeders. Even when the card room worker transfers stock from two or three bales at a time, a real problem is found to remain as regards uniformity of blends in roving or sliver and therefore in yarn and cloth, because it lies only with chance if layers used simultaneously happen to offset one another's divergence from an accurate blend.

Therefore, a machine which consistently delivers representative portions of all layers of a bale, or of more than one bale, to a card feeder would vastly improve the chances of the carding machine consistently receiving and producing perfectly blended roving or sliver.

One object of the present invention is to provide apparatus capable automatically of disintegrating such a compact mass of textile fiber as a hard-packed cheese (such as results from certain dyeing or moisture-extracting processes) so as to reduce the constituent material to well separated tufts or flocks without damage to the fibers themselves.

A further object is to provide apparatus which will so remove fibers from all of the constituent layers of such a dense compact mass of fiber as a multi-layer bale, as to deliver the fibers individually or in small tufts to form a consistently uniform blend of all of the fibers comprised in the bale.

A further object is to provide apparatus operative automatically to disintegrate a hard cheese or dense bale without substantial damage to individual fibers and to deliver the material in well-blended condition, thereby minimizing labor costs and producting a more perfect blend than results from usual manually performed methods of reducing such hard, compact or multi-layer fibrous masses to usable condition.

A further object is to provide apparatus capable of so thoroughly blending the fibers constituting a single multi-layer bale as to make it practical to produce a blend of sufficient uniformity to make it unnecessary to employ multiple baling such as is customarily practiced in the attempted attainment of desirable uniformity.

Some textile mills at the present time purchase baled synthetic staple fibers directly from the manufacturers of such fibers and put them into process without any preliminary steps other than the manual de-baling which, as above noted, is slow and expensive, and which does not result in any improvement of the blend.

A further object of the present invention is to provide apparatus capable of automatically disintegrating a dense, hard bale of synthetic staple fiber as received from the manufacturer, thereby eliminating the slow, expensive and usual manual de-baling operation, while also providing for a blending of the fibers such as does not result from the manual de-baling operation.

Other and further objects and advantages of the invention will be pointed out in the following more detailed description and by reference to the accompanying drawings, wherein:

FIG. 1 is a more or less diagrammatic side elevation, with parts broken away, illustrating one desirable apparatus in accordance with the present invention and useful in the practice of the method herein described;

FIG. 2 is a horizontal section, to somewhat smaller scale, substantially on the line 2—2 of FIG. 1;

FIG. 3 is a diagrammatic rear elevation of the elevator housing of the apparatus of FIG. 1, showing a multi-layer bale of fibrous material as having been placed on the elevator as a first step in the operation;

FIG. 4 is a fragmentary diagrammatic side elevation illustrating a modification of the arrangement of FIG. 1, for so controlling the upward motion of the bale as to insure a substantially uniform rate of removal of fiber from the bale by the spike apron;

FIG. 5 is an electrical circuit diagram illustrative of one desirable automatic control for the apparatus; and

FIG. 5*a* is a fragmentary wiring diagram illustrative of a modification of that shown in FIG. 5.

Referring to the drawings, and particularly to FIGS. 1 and 2, the apparatus of the present invention is shown as comprising a frame including vertical channel bars **20**, **20***a*, **20***b* and **20***c*, defining the corners of an elevator well W closed by panels **21** and **21***a* at its right and left sides, and by a fixed panel **22** at its front, and having a removable panel or door **23** which normally closes its rear side.

This frame supports an upper structure **24** (FIG. 1) of any suitable design within which bearings for spaced horizontal shafts **25** and **26** are arranged. Preferably, though not necessarily, the axes of the shafts are in the same horizontal plane. These shafts carry sprocket wheels over which endless chains are entrained, these chains supporting a spike apron K having the lower run **27**, here shown as substantially horizontal. This spike apron may be of conventional construction, here shown as having fiber-entraining teeth which are inclined forwardly in the direction of movement of the apron. It may be understood that these teeth will be of such shape, length and degree of inclination as may be appropriate to the working of the particular fiber to be processed.

The structure **24** comprises a horizontal plate **28** upon which is mounted a variable speed motor **29**, whose shaft **29***a* carries a sprocket wheel which is embraced by a chain **29***b*, which also embraces a sprocket wheel **32** on the shaft **25**, thus providing for driving the spike apron at a constant predetermined speed in accordance with the adjustment of the speed of the motor **29**. As here shown, the lower horizontal run **27** of the spike apron moves in the direction of the arrow A.

Within the elevator well W defined by the frame and the panels **21**, **22**, etc., there is arranged bale-lifting means, here illustrated, by way of example, as a vertically movable elevator comprising the rigid platform **33**. To opposite sides of this platform, at points approximately midway between its front and rear edges, brackets are attached which extend outwardly through vertical slots in the side panels and each of which carries a pair of guide rolls **34** which are disposed between the flanges of corresponding vertical channel bars **35**, arranged at opposite sides of the elevator well and exterior to the panels **21** and **21***a*. To each of these brackets there is attached the lower end of a sprocket chain **36**, these chains extending upwardly and over sprocket wheels **37** (only one of which is shown) fixed to a shaft **38** extending transversely of the machine and turning in bearings in the structure **24**. The chains extend over the respective sprocket wheels and then downwardly, and to the depending end of each chain there is attached a weight **39** which keeps the chain properly engaged with the teeth of the corresponding sprocket wheel.

To the shaft **38** there is fixed a sprocket wheel **41**, which is embraced by a sprocket chain **42**, which also embraces a sprocket wheel **43** on the shaft of an electric motor **44**. This motor may be of a type or so connected into its supply circuit that the direction of rotation of its shaft may be reversed at will. Such an arrangement is herein referred to for convenience as a "reversible motor," although the motor herein diagrammatically indicated in FIG. 5 is a motor having a reversing switch by means of which the direction of the current may be changed. A double-wound motor which provides for double speed of the elevator in the downward direction, as compared with its upward speed, is preferred. With this latter arrangement, rotation of the shaft of motor **44** in one direction raises the elevator platform **33**, at a relatively slow speed while rotation of the motor shaft in the reverse direction moves the elevator platform downwardly at double its upgoing speed.

Another horizontal shaft **45** is mounted to turn in bearings in the structure **24**, and this shaft has fixed thereto a pinion (not shown) which meshes with a gear **45***a* fixed to the above-named shaft **26** which carries supporting sprockets for the spike apron K. Thus, as the spike apron is driven by the motor **29**, the shaft **45** is likewise driven. The shaft **45** has fixed thereto a sprocket wheel **45***a* about which a sprocket chain **47** is entrained, this chain also embracing a sprocket wheel on a shaft **48** mounted in bearings carried by the structure **24**. As here illustrated, these bearings are carried by adjustable brackets whereby the chain **47** may be properly tensioned and, if desired, the sprocket wheel **48** exchanged for another of a different diameter. Fixed to the shaft **48** there is a doffer cylinder D (shown in dotted lines), for example, a bristle brush, which is operative to sweep fibrous material, carried by the teeth of the spike apron, from off the latter so that the fibrous material may drop, for example into a suitable container indicated in broken lines at **50**.

In accordance with one desirable arrangement, a detector device is arranged within the receptacle **50** so as to respond to the filling of the latter and thereby temporarily stop the operation of the elevator motors. Such arrangement being particularly desirable when the machine of the present invention delivers its product directly to a succeeding piece of apparatus. As here illustrated the detector device comprises a plate **51** depending from a horizontal shaft **52** and so arranged that the lower portion of the plate **51** is within the upper part of the receptacle **50**. To this shaft **52** there is also fixed a contact arm **53**, which, unless the receptacle **50** is filled with the fibrous material, contacts the actuating button of a microswitch **54** which thereby closes a circuit controlling the supply of current to the elevator motor **44**. Assuming that this circuit is closed at all other points, the motors **29** and **44** will function in the normal manner to actuate the spike apron and elevator. However, when the receptacle **50** has been filled to a predetermined level with fiber doffed from the spike apron by the brush D, the pressure of the fiber against the detector plate **51** will swing the latter in a clockwise direction thus separating the arm **53** from the button of the switch **54** and contacting it with the actuating button of a switch **55**, thereby opening the circuit of the elevator motor **44** so that the elevator stops.

It is extremely important for the proper functioning of this apparatus that the mass of material which is to be disintegrated be held against the lower run **27** of the spike apron with sufficient pressure to insure removal of fiber from the mass by the spike apron at a rate sufficiently high to be practical, and, on the other hand, to prevent the pressure from becoming excessive such as to cause the spike apron to remove the fibrous material in unduly large masses rather than in small tufts or flocks appropriate to be presented to the next processing apparatus to which it is to be subjected. In accordance with one embodiment of the present invention provision is made for stopping the upward motion of the elevator if the pressure becomes abnormal, and preferably reversing the elevator motion temporarily so as very quickly to reduce the pressure to normal.

As one specific way of controlling the rate of removal of fiber from the mass, there is provided, as here shown (FIG. 1), a shaft **59**, journaled in brackets carried by the channel bars **20** and **20***c* which is provided at opposite ends with upwardly directed lever arms **59***a* (only one

being shown), which extend upwardly and preferably to a point above the level of the shaft **25**, and which carry a rake member **60** which extends transversely across the machine for the full width of the spike apron so as to be contacted by the fibrous material moving upwardly with the spike apron as the latter passes about the sprocket wheel **32**. This rake member has as its principal function the combing and smoothing of the fibrous material carried by the upwardly moving spike apron, but as a secondary function, it acts as a detector, responsive to an abnormal thickness of fiber clinging to the spike apron. For the latter purpose the shaft **59** has fixed to it the horizontal arm **61**, desirably provided with an adjustable weight Z and which carries an actuating member **61***a* arranged between the switches **62** and **62***a* in the circuit of motor **44**, and which, when the arm **61** is raised, engages the actuating pin of the switch **62**. The arrangement is such that so long as the spike apron is moving fibrous material at approximately the desired uniform rate as it passes over the sprocket wheel **32**, the contact member **61***a* will remain spaced from the button of the switch **62** while contacting that of switch **62***a* and thus the circuit of the motor will remain closed. However, if an excessive amount of fibrous material be removed per unit of time from the mass being disintegrated, the detector **60** and the arm **59***a* will swing in a counterclockwise direction and the motor circuit will be broken at switch **62***a*, thus stopping the motor **44** and then temporarily reversing it—thereby causing the elevator platform **33** to stop and then temporarily to move down thus quickly reducing the rate of fiber removal. When the pressure is reduced substantially to normal the elevator platform will resume its upward motion.

As a modification of the means just described for insuring a substantially uniform rate of removal of fiber from the mass by the spike apron, or in addition thereto, the arrangement illustrated in FIG. 4 may be employed. In this arrangement a horizontal shaft **63**, supported in bearings in the structure **24**, carries arms **64** (located at the outer sides of panels **22** and **23**), which support a horizontal shaft just above the lower horizontal run **27** of the spike apron, the ends of the shaft passing through slots in the panels. Rolls **65** carried by this shaft rest upon the upper surface of the lower run **27** of the spike apron so that if said run **27** be raised, as by abnormal upward pressure of the mass of material against it, the arm **64** will be turned clockwise. A switch actuating member **66** is fixed to the shaft **63**. This member **66** is arranged between two snap switches **67** and **67***a*. It is normally spaced from the actuating button of the switch **67**, but in response to abnormal elevation of the run **27** of the spike apron, by excess upward pressure of the bale, the member **66** leaves switch **67***a* and engages the button of switch **67**, thus stopping and reversing the elevator motor **44**, thus reducing the pressure between the mass of material and the spike apron so that the normal rate of removal of fiber from the bale is quickly restored.

It is to be understood, that reversal of the elevator motor is not essential, since the continued action of the spike apron, while the elevator is stopped, will gradually restore the rate of fiber removal to normal, but momentary reversal of the motor more quickly restores conditions to normal and thus helps in maintaining the desired uniformity of action.

In accordance with a preferred method of maintaining a substantially constant rate of removal of fiber from the mass of material, and which may be used in addition to either or both of the foregoing arrangements, the circuit of the motor **29** which drives the spike apron includes an overload relay R (FIG. 5) which responds to an increase in amperage in the circuit of said spike apron motor resultant from excessive resistance experienced by the spike apron because of abnormal upward pressure of the mass of material against the spike apron, or because for some reason the spike apron has torn off excessively large lumps of material from the mass. This relay is so devised and so connected into the circuit of the motor **44**, which drives the elevator, that the motor **44** will be stopped and, desirably, reversed for a predetermined period of time, thus quickly reducing the pressure between the mass of material and the spike apron. This arrangement is diagrammatically illustrated in the circuit diagram of FIG. 5.

FIG. 5*a* diagrammatically illustrates a modification of the circuit of FIG. 5, such as may be controlled by the switches **62**, **62***a* and/or **67**, **67***a* of FIGS. 1 and 4, respectively. Since the circuits have been provided with designating legends, it appears unnecessary to describe them in detail.

In the operation of the apparatus, and assuming that the elevator motor is stopped, but that the spike apron is being driven by the motor **29** at the normal rate, and that the elevator platform **33** is at the bottom of the elevator well, as illustrated in FIGS. 1 and 3, and that the door **23** has been opened or removed, the mass M (FIG. 3) of material which is to be disintegrated and which is shown in FIG. 3 as a multi-layer bale having its constituent layers arranged vertically, is first placed upon the platform **33** and the bale bands are removed, thus permitting the bale to expand transversely as limited by the panels **21** and **21***a*. The door is then closed and the elevator motor **44** is started by the manual operation of the starting switch H (FIG. 5). The elevator platform **33** now rises and impels the bale upwardly until it brings the upper face of the bale M (FIG. 3) into contact with the fiber-entraining teeth of the moving lower run **27** of the spike apron. As will be apparent from inspection of FIG. 3, the exposed upper edges or faces of the several layers of the multilayer bale there illustrated, are simultaneously contacted with the moving spike apron, and the downwardly directed teeth of the latter pull off material simultaneously from all of the several layers and carry it along until it is doffed by the cylinder D. As illustrated in FIG. 3, the longer dimension of the exposed upper face of each of the layers is parallel to the direction of motion of the lower run **27** of the spike apron, but preferably the bale should be disposed at right angles to the position illustrated in FIG. 3, so that the longer dimension of the upper edge face of each of the several layers will extend at right angles to the direction of motion of the lower run **27** of the spike apron. Such an arrangement provides a maximum blending effect as the bale is disintegrated.

If, in the normal operation, the pressure of the upper surface of the bale against the spike apron becomes excessive, and if the detector arrangement of FIG. 4 be employed, the lower run **27** of the spike apron will be abnormally elevated and the button of the switch **67***a* will be released, and the button of switch **67** actuated so as to stop and reverse the motor **44**, thus preventing further increase in pressure. Under normal circumstances the pressure will then gradually decrease as fiber is pulled off from the upper face of the bale (the motor **29** continuing to operate) until the rate of fiber removal is restored to normal, whereupon the run **27** drops to normal position and the elevator resumes its upward motion. If the detector device of FIG. 1 be employed and the pressure of the bale against the lower run **27** of the spike apron becomes excessive so that an abnormal quantity of fibrous material is carried away, per unit of time, by the spike apron, the detector device **60** will be pushed away from the spike apron abnormally and the switches **62***a* and **62** actuated to stop and reverse motor **44**, thus again providing for the gradual reduction in the contact pressure.

If, the electrically actuated control, above described, be provided, and because of excessive pressure or otherwise, the circuit of motor **29** becomes overloaded, the elevator motor **44** will be stopped and temporarily reversed by the action of the overload relay, thus again relieving the pressure. Since the circuit of FIG. 5 includes a timing device T, the reversal of the motor will be for a predetermined period only, and upon the expiration of this

period, the elevator will again resume its upward motion.

When the bale has been completely depleted by the action of the spike apron, a contact member 56 (FIG. 1) carried by the chain 36, contacts the actuating button of a switch 58 in the circuit of the motor 44, thus reversing the motor and moving the elevator platform 33 downwardly to the bottom of the elevator wall. When the contact member 56 actuates the switch 57, the entire machine is stopped until the motor circuit is again closed by the manually actuated switch H, as above described.

While the mass M of material, as illustrated, by way of example, in FIG. 3, is a multi-layer bale, it will be understood that this mass may be a hard, dense cheese (which may or may not be of multi-layer construction), such as results from the practice of certain dyeing operations and which, in that event, will usually be circular in horizontal section, but that such a mass will be upwardly impelled by the elevator until its upper surface contacts the spike apron run, and that the apparatus may then function in the same way as above described, to disintegrate this hard, dense mass by the gradual removal of fiber from its upper surface. Under such conditions, the speed of the spike apron will be adjusted and the teeth of the spike apron will be so shaped and arranged as to remove the material from this very hard and dense mass at the proper rate to prevent injury to the individual fibers and to avoid the removal of masses of undue size, but will perform its intended function at a much higher speed than is possible of accomplishment by the use of the hand tools and manual methods heretofore customarily employed for the purpose. Obviously, the apparatus may be employed for removing fiber from a hard compact mass of any description, carried by the elevator platform.

While, as here specifically described and illustrated, the fiber-entraining means is a flexible, endless spike apron, it is contemplated, as within the scope of the invention to employ equivalent means for tearing fiber or tufts of fiber from the mass or bale, and that, although certain desirable embodiments of the invention have herein been illustrated and described by way of example, it is to be understood that the invention is broadly inclusive of any and all modifications falling within the terms of the appended claims.

I claim:

1. Apparatus useful for disintegrating a hard compact fibrous mass without substantial injury to individual fibers, said apparatus including bale-lifting means comprising an elevator platform for moving such a mass in an upward direction, means guiding the elevator platform to move along a predetermined path, fiber-entraining means movable transversely across said path, means for constantly moving said fiber-entraining means, a motor and means actuatable by said motor to move the elevator platform thereby to contact the upper surface of the fibrous mass with the moving fiber-entraining means, and automatically acting means operative, so to control motion of the elevator, as to maintain a substantially constant rate of removal of fiber from the mass by the fiber-entraining means as the mass is gradually depleted by removal of fiber therefrom by the fiber-entraining means.

2. Apparatus according to claim 1, wherein the means for maintaining a substantially constant rate of removal of fiber from the mass comprises a detector which is responsive to an abnormal upward pressure of the mass against the fiber-entraining means, and means controlled by said detector for temporarily stopping the upward advance of the elevator platform.

3. Apparatus according to claim 1, wherein the means for controlling the motion of the elevator comprises a detector which is sensitively responsive to the delivery, by the fiber-entraining means, of an abnormal quantity of fiber per unit of time, and means controlled by the detector for stopping upward advance of the elevator platform.

4. Apparatus according to claim 1, wherein the means for controlling the motion of the elevator includes an electric motor, comprised in the means for constantly moving the fiber-entraining means, and means responsive to excess amperage drawn by said last-named motor, temporarily to stop the upward advance of the elevator platform.

5. Apparatus according to claim 4, wherein the motor for moving the elevator platform is of reversible type, and the circuit of said motor is such, that in response to excess amperage in the motor circuit which drives the spike apron, the motor which actuates the elevator platform is temporarily reversed.

6. Apparatus according to claim 1, wherein the motor for moving the elevator is of reversible type and wherein the fiber entraining means comprises an endless spike apron, having a substantially horizontal run which extends across the path of the fibrous mass as the latter is advanced upwardly by the elevator platform, a detector responsive to upward displacement of said run of the spike apron because of abnormal pressure of the mass thereagainst, and means controlled by the detector for reversing the motor which moves the elevator platform.

7. Apparatus according to claim 1, wherein the motor for moving the elevator is a reversible multi-speed electric motor so arranged that, when raising the elevator platform, it runs at low speed thereby to press the fibrous mass against the fiber-entraining means, the fiber-entraining means comprises an endless spike apron, having a substantially horizontal run which extends transversely across the path of the fibrous mass as the latter is slowly raised by the upwardly moving elevator platform, and wherein a detector is responsive to the delivery, per unit of time, of an abnormal quantity of fibrous material by said run of the spike apron and by such response, actuates switch means, thereby temporarily to reverse the elevator motor and move the elevator platform down at high speed.

8. Apparatus according to claim 1, wherein the motor for moving the elevator is a reversible electric motor operative, when turning in one direction, to raise the elevator platform so as to press the fibrous mass against the fiber-entraining means, said fiber-entraining means comprising an endless spike apron having a horizontal run which extends transversely across the path of the fibrous mass as the latter is raised by the moving elevator platform, and wherein the means for constantly moving said fiber-entraining means comprises an electric motor, and an overload relay in the circuit of said last-named motor which responds to abnormal amperage drawn by said last-named motor and thereby temporarily reverses the motor which moves the elevator platform, thus reducing the pressure between the fibrous mass and the spike apron.

9. In combination, in apparatus for disintegrating a hard compact multi-layer bale of fibrous material while concomitantly blending the fibers comprised therein, an endless spike apron having an elongate horizontal working run, means for driving the spike apron at a predetermined substantially constant speed, motor-driven bale-lifting means for advancing such a bale bodily upward toward said working run of the spike apron with the edge faces of its several layers always in a plane substantially parallel to that of said working run and with the longer dimension of each of said edge faces at right angles to the direction of motion of said working run, and means operative so to regulate the motor drive for the bale-lifting means as to insure a substantially constant rate of removal of fiber from the bale by said working run of the spike apron as the bale is gradually depleted by the removal of fibers therefrom by the spike apron.

10. In combination, in apparatus for disintegrating a dense multi-layer bale of fibrous material while concomitantly blending the fibers comprised in the several layers, a spike apron having an approximately horizontal working run, means for driving the spike apron, a ver-

tically movable support arranged directly below said run, said support being operative to receive the bale to be disintegrated, motor means for moving said support upwardly, thereby to contact the upper face of the bale with said horizontal working run, and means operative, so automatically to control said motor means, as to insure a substantially constant rate of removal of fiber from the bale by the spike apron as the bale is gradually depleted.

11. The combination, according to claim 10, wherein said motor means comprises a reversible electric motor, and the means for controlling the motor comprises a detector which is responsive to abnormal elevation of said horizontal run of the spike apron and thereby actuates switch means to reverse the motor.

12. The combination, according to claim 10, wherein the motor means comprises a reversible electric motor, and the means for controlling the motor comprises a detector which responds to the delivery of an abnormal amount of fiber per unit of time by the spike apron and thereby actuates switch means to reverse the motor.

13. The combination, according to claim 10, wherein said motor means comprises a reversible electric motor, and wherein a second electric motor drives the spike apron, an overload relay in the circuit of the last-named motor, and switch means actuable by said relay, in response to overload in the circuit of the motor which drives the spike apron, thereby to reverse the motor which normally moves the support upwardly.

14. The combination, according to claim 10, having means defining an elevator well, the spike apron having a working run which extends across the top of said well, means for driving the spike apron at a constant predetermined speed, an elevator comprising a vertically movable platform within said well, means including a reversible electric motor for raising the platform, switch means automatically operative to reverse said motor when the platform arrives at the top of the well, a second switch means operative automatically to stop the motor when the platform arrives at the bottom of the well, manual means for starting the motor, and automatic control means for the motor operative to insure a substantially constant rate of removal of fiber from the bale by the working run of the spike apron as the bale is gradually depleted as the result of removal of fiber therefrom by the spike apron.

15. Apparatus for use in disintegrating a hard compact fibrous mass without substantial injury to individual fibers, said apparatus comprising a movable part which, by contact with one face of said mass, is operative to advance the mass bodily along a predetermined path, fiber-entraining means movable transversely of said path and which is operable, by contact with the forward face of the advancing mass, to remove fibers from the latter, means normally operable to move the entraining means constantly and in the same direction, motor means for advancing said movable part thereby to bring the forward face of said mass into operative engagement with the entraining means, and means operative so automatically to control said motor means, as to insure a substantially constant rate of removal of fiber from the mass by the entraining means as the mass is gradually depleted.

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