United States Patent [19]

Werner

[11] **3,870,167**

[45] **Mar. 11, 1975**

[54] **SHEET PULP SEPARATOR AND FEEDER FOR BALED PULP**

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[73] Assignee: **Kimberly-Clark Corporation,** Neenah, Wis.

[22] Filed: **Oct. 3, 1973**

[21] Appl. No.: **403,062**

[52] **U.S. Cl.** ..... **214/8.5 SS,** 271/128

[51] **Int. Cl.** **B65g 59/02**

[58] **Field of Search** ..... 214/8.5 A, 8.5 F, 8.5 SS; 271/42, 128, 129, 130; 221/270, 273

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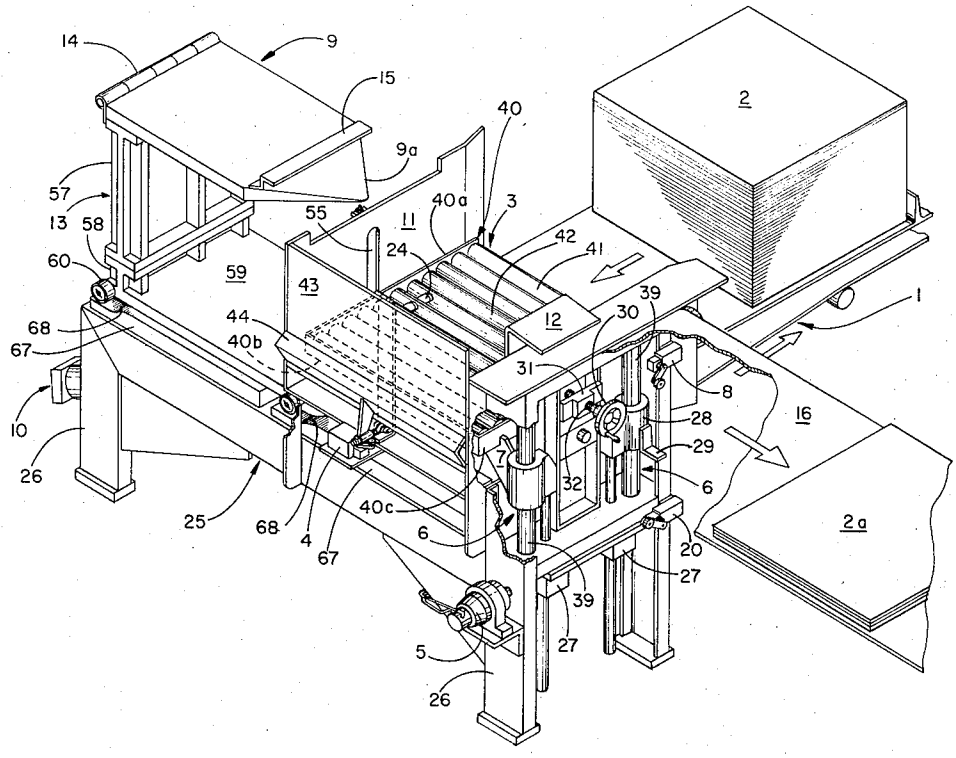
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Primary Examiner—Drayton E. Hoffman
Assistant Examiner—Larry Martin
Attorney, Agent, or Firm—Kimberly-Clark Corporation

[57] **ABSTRACT**

The separation of a small multiplicity of sheets from a bale of pulp is carried out by shearing the sheets from the body of the bale and feeding the separated sheets from the equipment. The separating equipment in a preferred embodiment includes a pulp sheet separator in the general form of a blade which penetrates the bale in a zone adjacent an upper side of the bale while the bale itself is moving upwardly. The separator is hingedly mounted to protect it against breakage and to permit jogging of the blade. The separator blade is, in operation, capable of being jogged in a plane perpendicular to its own plane while inserted in the bale to aid in breaking pulp sheets from the body of the bale. The action of the separator and bale moving mechanism may be substantially continuous until the last sheets of the bale have been severed and moved from the separator equipment.

5 Claims, 10 Drawing Figures



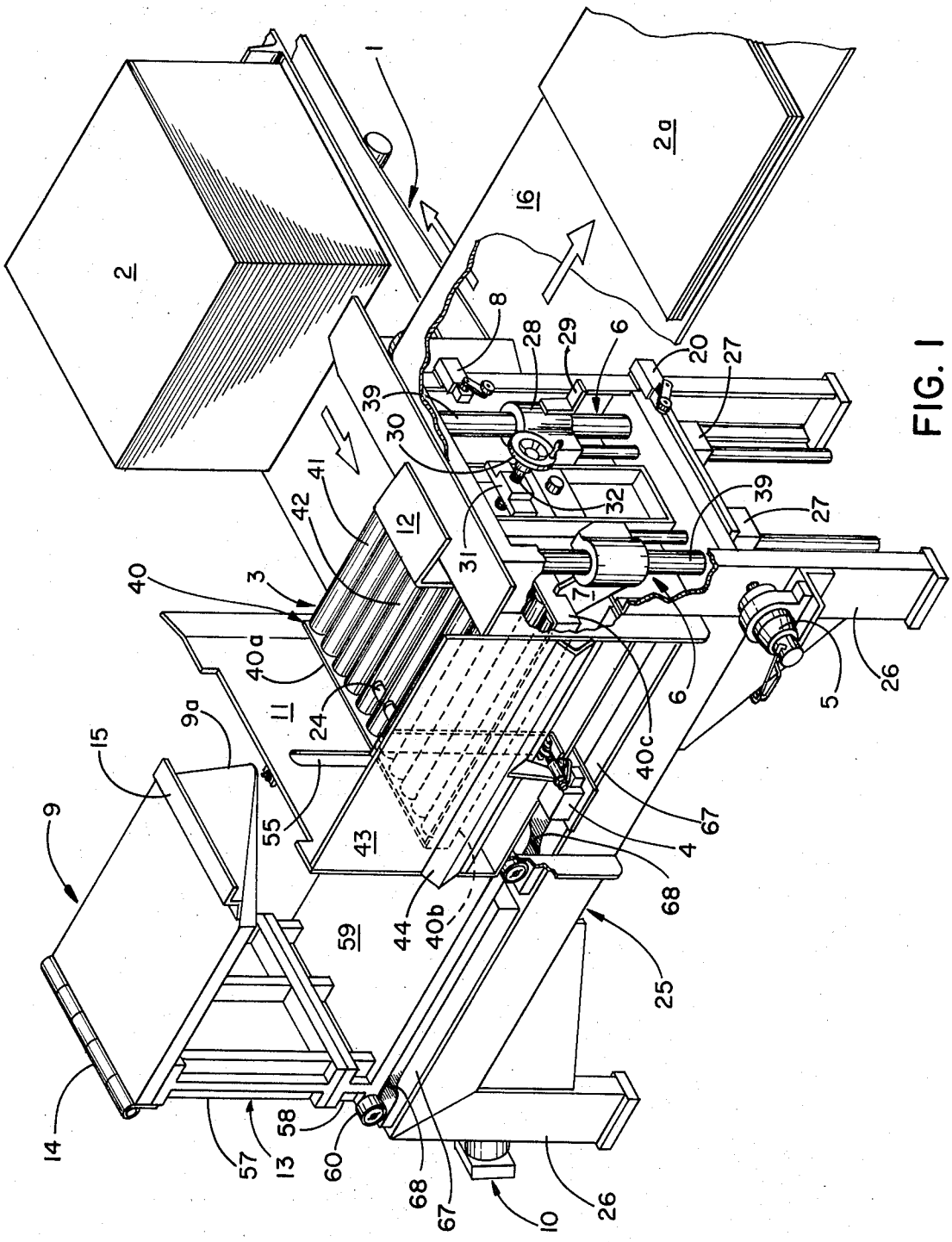

1
2
2a
16
8
28
29
6
20
27
39
30
41
42
12
31
32
40
3
40a
11
24
9a
15
9
55
43
59
44
40b
40c
67
4
68
25
5
26
7
14
57
13
58
60
10

FIG. 1

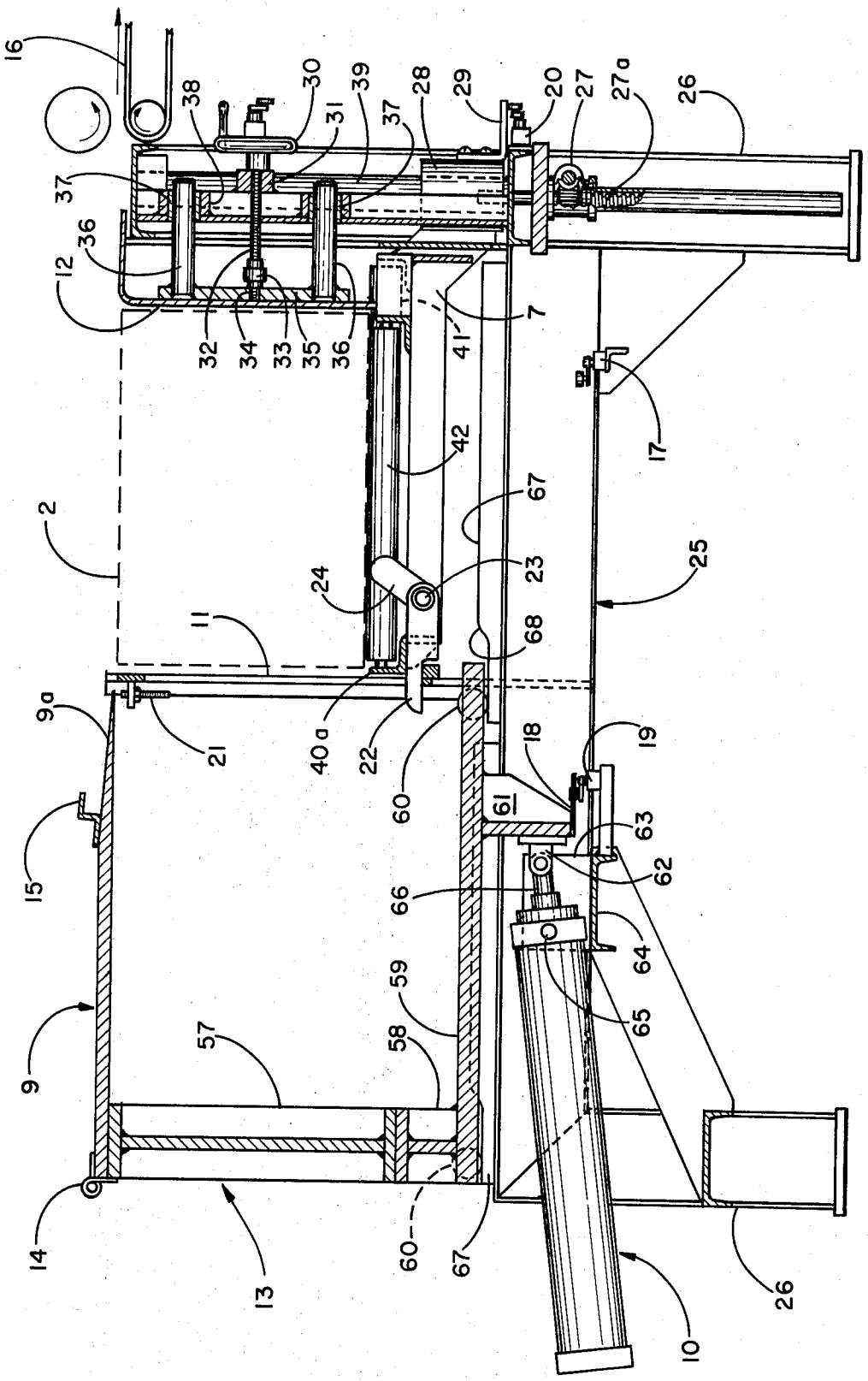

16
38
30
31
39
37
28
29
20
27
27a
26
37
36
12
32
34
33
35
36
41
7
17
42
67
2
24
23
25
11
68
9a
21
40a
22
60
18
19
61
63
62
15
66
64
59
65
9
57
58
14
13
60
67
10
26

FIG. 2

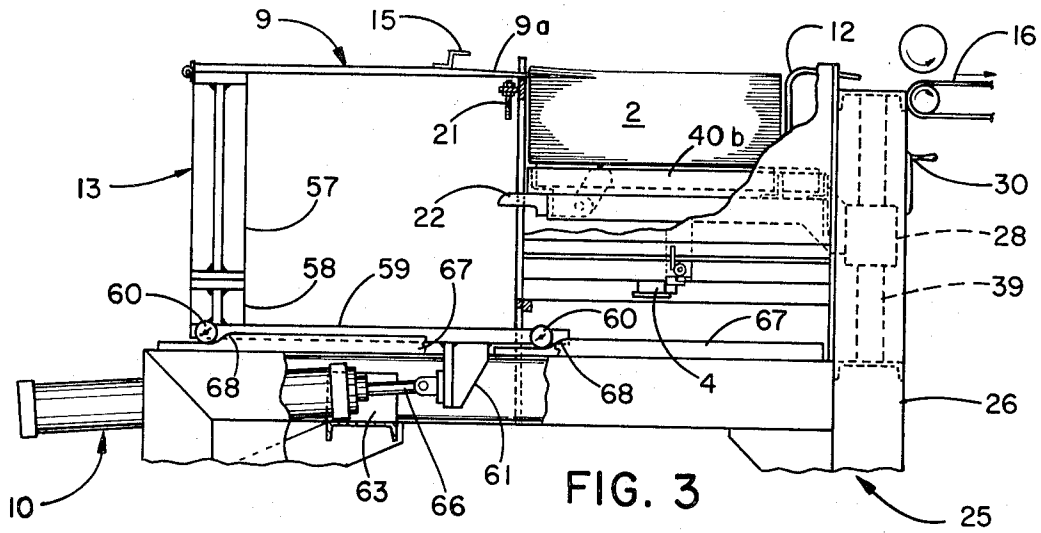


FIG. 3

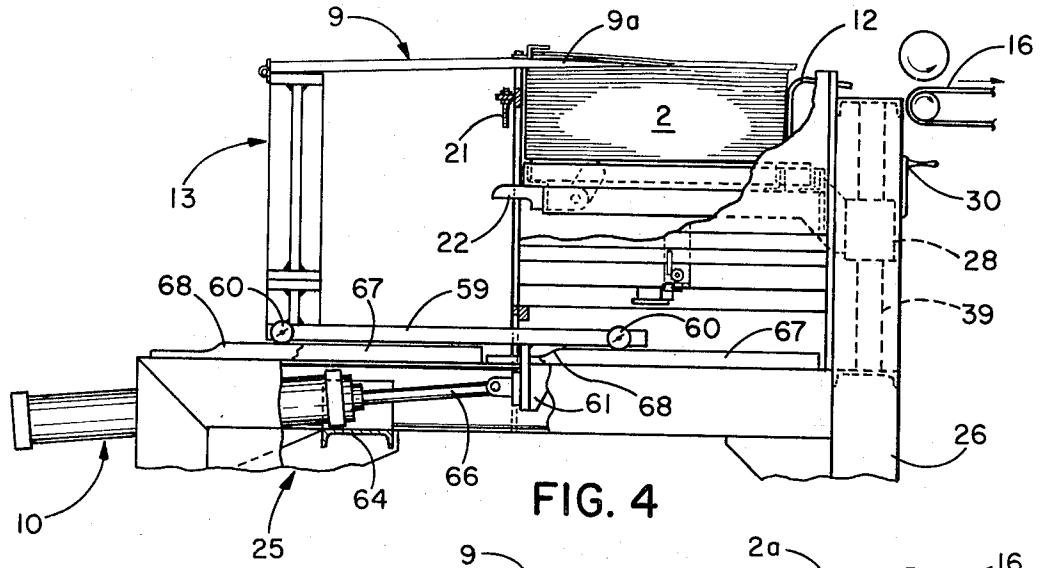


FIG. 4

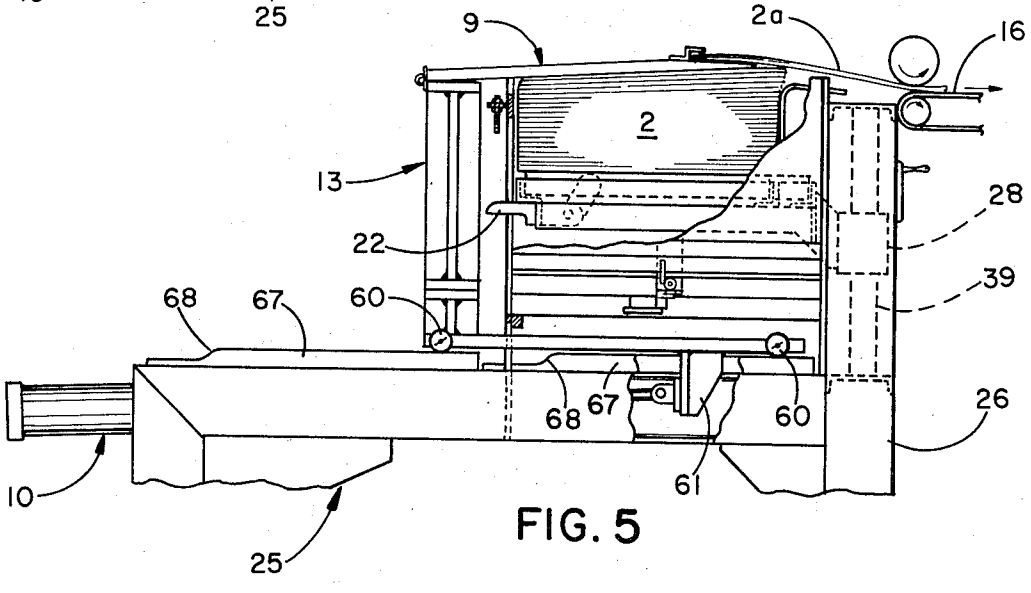


FIG. 5

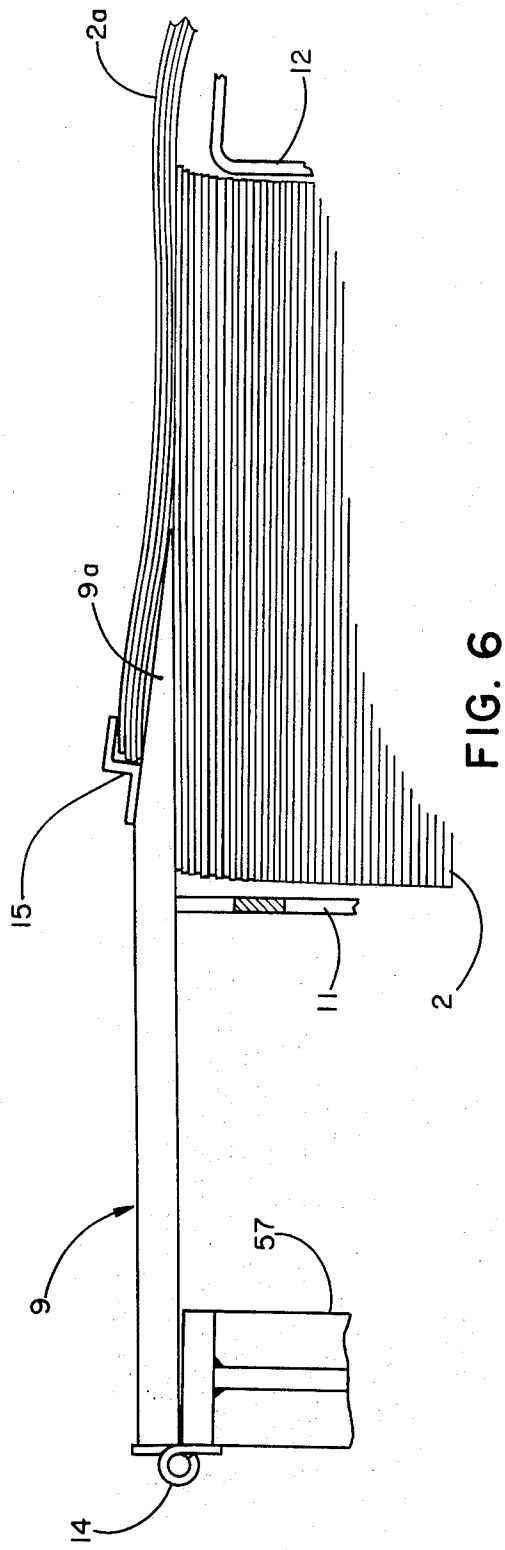


FIG. 6

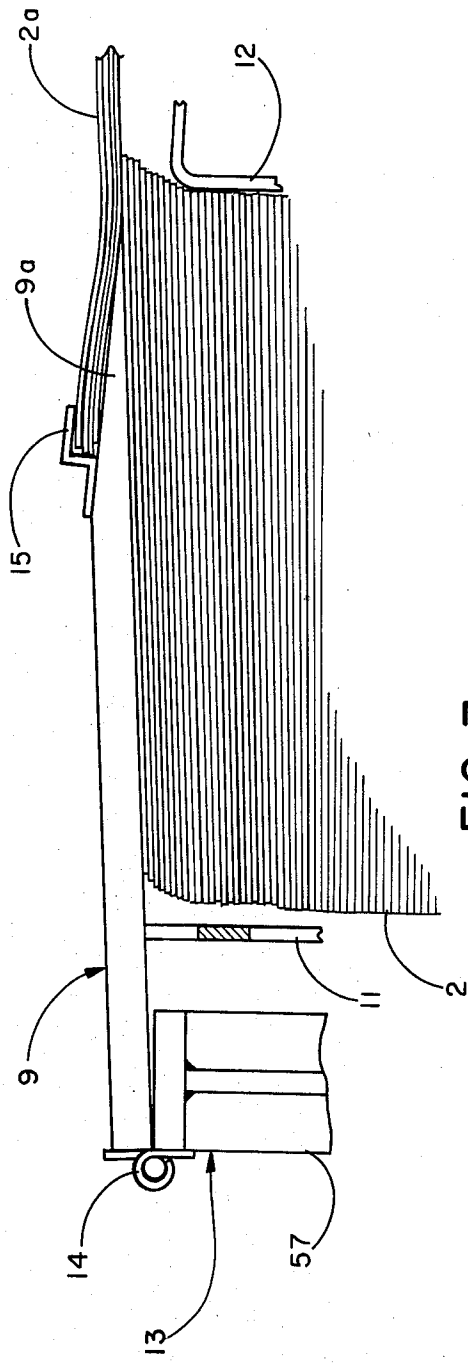


FIG. 7

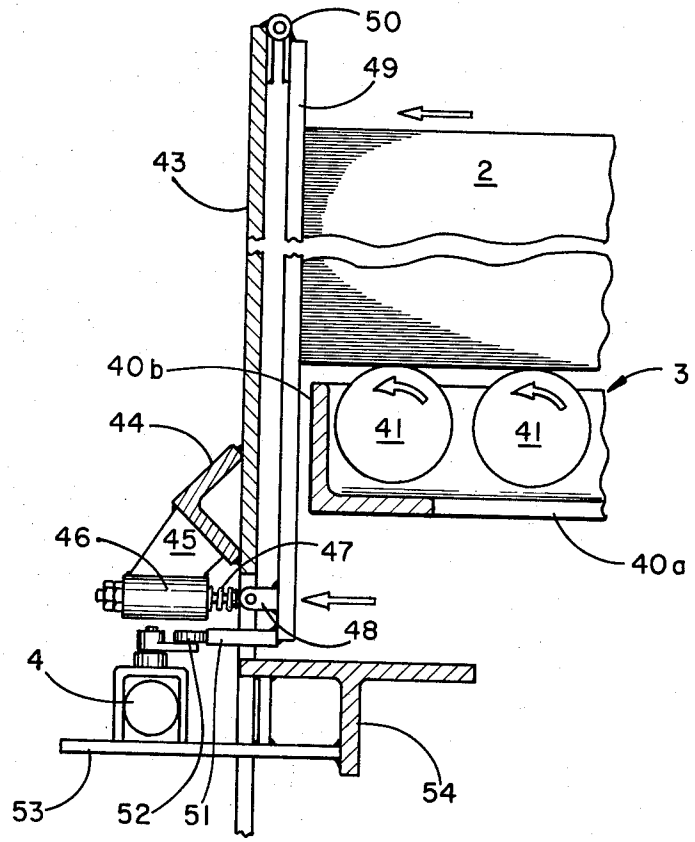

50
49
43
2
40b
3
44
41
41
46
45
47
40a
48
4
54
53
52
51

FIG. 8

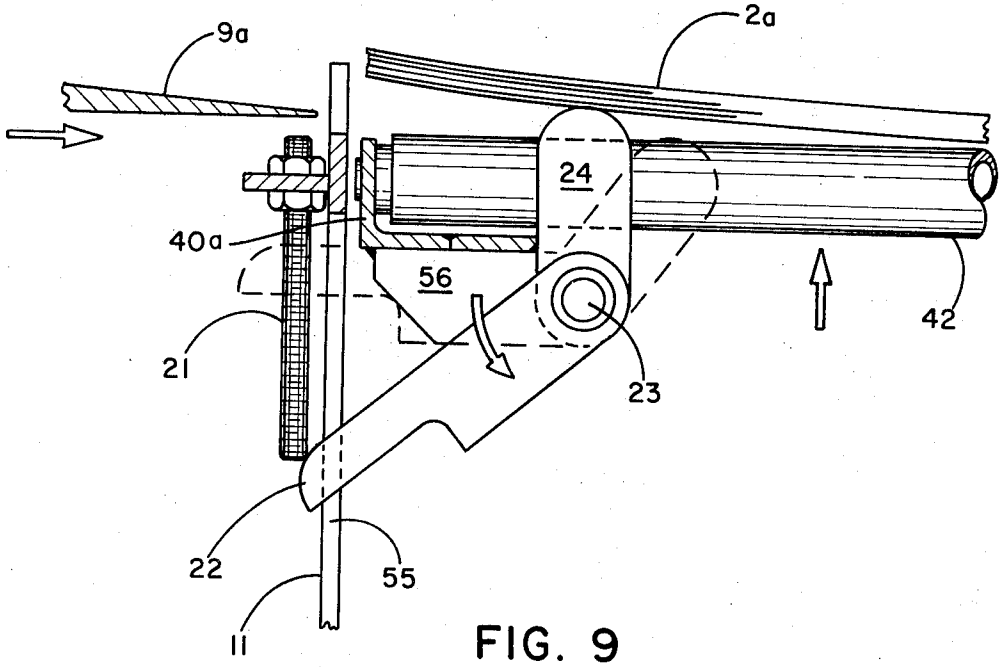

9a
2a
24
40a
56
42
21
23
22
55
11

FIG. 9

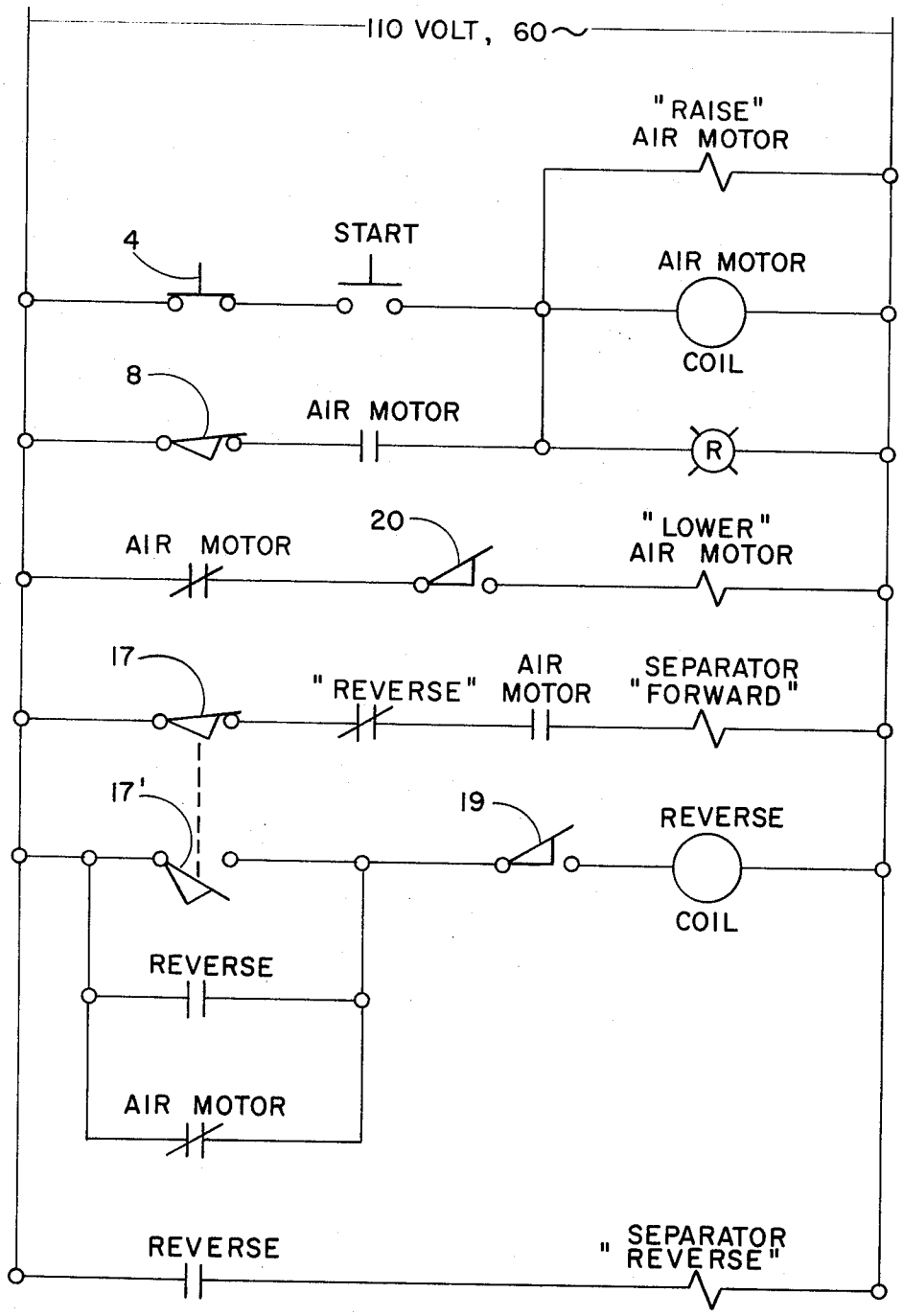

110 VOLT, 60~
"RAISE" AIR MOTOR
4
START
AIR MOTOR
COIL
8
AIR MOTOR
R
AIR MOTOR
20
"LOWER" AIR MOTOR
17
"REVERSE"
AIR MOTOR
SEPARATOR "FORWARD"
17'
19
REVERSE
COIL
REVERSE
AIR MOTOR
REVERSE
" SEPARATOR REVERSE"

FIG. 10

SHEET PULP SEPARATOR AND FEEDER FOR BALED PULP

This invention relates to a sheet pulp feeder and particularly to equipment which is capable of separating sheet pulp in minor thicknesses of the pulp, such as a plurality of sheets, from bales of the sheeted pulp.

Pulp in bale form is commonly quite compact so that separation or removal of one or more sheets of pulp from the bale requires the expenditure of considerable energy. The prior history of the bale is a factor influencing the difficulties which may be encountered in sheet removal. Such factors relate to whether or not the bale has been subjected to moisture, very low temperatures and/or high compression or whether or not the pulp itself is solf and easily disrupted when sheet removal is attempted.

An important object of the present invention is to provide a device in which a pulp sheet separator is driven substantially horizontally into the pulp bale to initiate sheet separation.

A primary object of the present invention is to provide a device for removing pulp sheets from a bale of pulp in which a blade is employed as the pulp sheet separator and which separator may be jogged in a direction generally perpendicular to itself while within the body of the bale to accomplish breaking of the pulp from itself.

Another object of the invention is to provide apparatus for separting sheets of pulp from a pulp bale in which the apparatus is so arranged that separation in minor thicknesses of pulp may take place over substantially the complete height of the bale.

A particular object of the invention is to provide apparatus for separating sheets of pulp from a bale of the sheeted pulp in which the separating equipment is continuously cycled to and from the bale as the bale itself is fed relative to the separating equipment.

A further object of the invention is to provide a device for separating sheets of pulp from a pulp bale in which the separator equipment feeds the separated sheets from the equipment and is capable of feeding the whole bale from the euipment without manual attention.

A still further object of the invention is to provide a novel method of separating a bale of sheeted pulp into smaller thicknesses of the pulp while still in sheet form.

These and other objects of the invention will be more fully understood by reference to the following detailed description and accompanying drawings wherein:

FIG. 1 is a perspective view schematically illustrating the equipment in accordance with one embodiment of the invention, the drawing indicating the manner of feeding the pulp bale to the equipment;

FIG. 2 is a view partially in section illustrating primary components of the equipment, a pulp bale being illustrated in phantom outline in position for the separating action;

FIGS. 3, 4 and 5 are views to a smaller scale than that of FIG. 2 but illustrating various positions of the pulp sheet separator in its penetration of a pulp bale;

FIGS. 6 and 7 are much enlarged (relative to FIGS. 3, 4 and 5) views schematically illustrating in more detail the function of the pulp sheet separator;

FIGS. 8 and 9 are fragmentary views partially in section illustrating mechanical details of the equipment; and

FIG. 10 is a schematic illustrating one embodiment of control mechanism for regulating the major functions of the device of FIG. 1.

Initially, a general description of equipment operation will be set out as primary novelty is considered to reside in the broad approach to separation of pulp sheets rather than only in details of equipment arrangement.

Referring now to the drawings more in detail, the numeral 1 designates a belt conveyor for pulp bales 2, fragments of the upper and lower strands of the conveyor belt being shown and the direction of travel being indicated by arrows. The pulp bale 2 is moved to the elevator 3 by the conveyor and the positioning of the bale causes actuation of a switch 4.

Switch 4 (FIGS. 1, 8 and 10) is operatively associated with an air motor 5 by conventional means, and the air motor (FIG. 1) is itself in driving relation to elevator 3 through drive mechanism indicated generally at 6. Frame portions 7 to be discussed more particularly hereinafter connect the mechanism 6 with the elevator 3 to cause its elevation from the position shown in FIG. 1 to that shown in FIG. 5, for example, when power is supplied to the mechanism illustrated.

A switch 8 is positioned to be contacted in operation of the drive mechanism 6 as the elevator 3 approaches its uppermost position, the switch being in communication with the air motor by conventional means to cause reversal of the air motor rotation and descent of the elevator in a manner to be more particularly described hereinafter.

The pulp sheet separator is indicated generally at 9 and is adapted to penetrate a pulp bale positioned on the elevator 3. The pulp sheet separator includes a blade portion 9a and is supported for movement transversely across and above the elevator by carrier means 13. The actuating device for attaining this movement is the air cylinder indicated generally at 10. The blade 9a tapers (increases) in thickness and width (increases) rearwardly from a forward leading extremity shown in FIG. 1. The fullness in width, nearly that of the bale, aids the pulp separation and the full width aspect is particulary beneficial when the pulp is soft.

In operaion, the pulp sheet separator penetrates the bale of pulp which is itself held between lateral support means 11 and 12 in the form of walls, the latter wall being adjustably positionable as will be noted more particularly hereinafter.

Immediately after penetration of the bale by the pulp sheet separator, the separator is caused to move somewhat abruptly upwardly to jog and break loose the upper plies of the bale away from the lower body portions of the bale. In specific aspect as shown in the drawings, the jogging action is caused by a cammed upward movement at 68 of the carrier means 13 which supports the pulp sheet separator 9, as the carrier means moves under the influence of the air cylinder mechanism 10. The pulp sheet separator, for the purpose of attaining the jogging action and preventing breakage of the separator in its penetration of a bale during upward bale movement is hingedly connected at 14 to the carrier means. The weight of the separator blade tends in the specific embodiment to maintain it in a horizontal position as it enters the bale although some jogging movement may tend to occur with pulp that is hard to penetrate. The jogging action may be induced by means other than the camming structure indi-

cated at **68**, it being only important that the pulp separator **9** be moved sharply upwardly to attain pulp sheet breaking action.

The pulp sheet separator carries on its upper surface a grip **15** which engages sheets cut from the bale and serves to abut the sheets urging them toward the removal conveyor **16**. As each portion of pulp is cut and removed during upward movement of the bale, switch **17** at the end of carrier traverse is engaged by a switch contactor **18** in the movement of the piston of the air cylinder-piston combination designated at **10**, and the effect of switching is to reverse the actuation of cylinder **10** in known manner. Retraction of the piston from the bale to starting position causes the contactor **18** to engage switch **19**, providing for the next penetration movement of the pulp sheet separator **9** into the upwardly moving bale.

An abutment **21** is engageable by lever **22** in the upward traverse of the elevator as the elevator approaches its upper limit position. The lever **22** is mounted on pivot shaft **23**, which pivot shaft also carries a plurality of finger lifts **24**. These lifts project between the roller (FIG. **1**) of the table and, as illustrated particularly in FIG. **9**, urge the last sheets of a bale upwardly from the table so that the separator blade **9a** may move under these last sheets, effecting their transfer to removal conveyor **16**.

Following removal of the last sheets, the limit switch **8** (FIG. **1**) is contacted and reversal of the elevator movement is initiated, so that a new bale made be received on the elevator when the elevator has fully descended. The switch position and operation are discussed in connection with the schematic illustration of the control circuit set out in FIG. **10**.

Referring now more particulary to the details of construction, the numeral **25** designates a main frame having a plurality of supporting legs **26**. A pair of jack screw housings **27** are supported in spaced relation on screw shafts **27***a* of the frame and by the frame at the rightward end (FIG. **1**), a portion of one of the screws only being shown. Collars **28** which are slidable vertically upon guides **39** are secured to shafts **27***a*. The collars are secured also to the frame portions **7** already mentioned hereinbefore and, accordingly, the movement of the jack screws through the shafts **27***a*, collars **28** and frame portions **7** provide for raising of the elevator table **3**. The numeral **29** indicated the abutment contact of switch **8** carried on the right hand (FIG. **1**) collar **28**.

A hand wheel **30** secured to a crew shaft **32** through cross head **31** and union **33** (FIG. **2**) has a threaded extremity **34** received in a backing plate **35**. The backing plate is supported on a plurality of upper and lower horizontally extending slide rods **36** which are themselves mounted at one end in bearings **37** supported by housings **38**. The backing plate carries the wall **12**, which is relatively narrow (FIG. **1**) but of sufficient width to press against and firmly retain between itself and wall **11** a bale **2** on the elevator **3**.

The numeral **40** designates generally an essentially three-sided frame in which rollers of the elevator are supported, the rollers extending parallel to the open end of the frame and forming the platform of the elevator. Rollers **41** are relatively long and border a plurality of shorter rollers **42** intermediate the longer rollers. Rollers **42** are shortened to accommodate the frame, that is, to avoid contact with the adjustable side wall **12** which, as is most clearly shown in FIG. **2**, is movable inwardly to engage a bale on the elevator. The three-sided frame includes sides **40***a*, **40***b* and **40***c*.

The rear wall **43** bordering the elevator has an appendage **44** of generally triangular shape as shown in FIG. **8** and it carries a web **45** which is secured to housing **46** carrying spring **47** the exterior end of which is mounted in clevis **48**. A downwardly depending relatively narrow bar **49** (FIG. **1**) is hinged at **50** to the wall **43** and has welded to it at its lower end clevis **48** as well as a contact arm **51** for the switch **4**. The contact arm engages (FIG. **8**) a roller **52** for actuation of switch **4**. The switch **4** is itself mounted on a shelf **53** projecting from the downwardly extending web **54** of the frame. Switch **4** is normally open but is maintained closed against the action of spring **47** by the presence of a bale on elevator **3**. The live rollers **41,42** provide that a bale received on the elevator will move against bar **49**.

Referring now more particularly to the structure shown in FIG. **9**, it is to be noted that the lever **22**, when carried upwardly by the elevator **3** to the abutment **21**, moves in a slot **55** (FIG. **1** also) in the wall **11**. The plate support **56** of the roller frame is shown as supporting the pivot shaft **23**. The abutment **21** is a screw threaded rod and its effective length as an abutment for lever **22** may be adjusted to regulate the height at which finger lfits **24** are actuated.

Referring now to the carrier which mounts the pulp sheet separator **9**, the numeral **57** (FIG. **1**) indicates the carrier framework. The framework includes the pedestal **58** which, in cross section, is similar to that of an I beam. The carrier roller base is indicated at **59** and has a plurality of depending rollers, four in number, and two of which are shown, **60**. The rollers, two on each side of the carrier, support the carrier and, accordingly, the pulp sheet separator **9** for movement. The base **59** also has a depending bracket **61** (FIG. **2**) depending centrally of the frame **25** and which carries cylinder clevis **62** so that the air cylinder **10** is pivotally supported relative to the trunnion bracket **63**, itself carried by support **64**. The numeral **65** designates the trunnion pivot and **66** indicates the cylinder piston rod. Actuation of the air cylinder to drive the piston rod **66** rightwardly (FIG. **2**) causes the carrier also to move rightwardly (FIG. **2**).

The frame **25** provides a mount **67** in the general form of spaced ways on which the rollers **60** ride. The mount **67** includes cam surfaces **68** providing for the jogging movement of the separator, when the wheels **60** move rightwardly (FIG. **2**) up the cam surfaces.

The control circuit of FIG. **10** is shown in the inactive position of the euipment. In specific application, with reference to the control circuit, actuation of the start button with a bale in position on the elevator closing switch **4** places the coil designated "air motor" across the power line and closes the normally open air motor relay contacts which are in series with normally closed limit switch **8** and signal light R. This provides continuous power ot the solenoid "Raise" of the air motor **5**, initiating upward movement of the elevator **3**. The contacts of the start button open after removal of the actuating means which may be manual.

The normally open contacts of the air motor relay in series connection with the normally closed limit switch **17** are also closed providing for energizing of the "Forward" solenoid of the carrier **13** and movement of the pulp sheet separator **9** into the bale. Thus, as the eleva-

tor initiates its slow rise, the separator penetrates the upper layers of the bale as already noted. In conventional practice, the bale may have a height of 18 inches and a plurality of plies, about ½ – 6 inches in thickness may be removed in each pass of the separator.

The normally closed contacts of the air motor relay are opened by the energizing of the coil designated "air motor."Thus, the contacts in series with switch **20,** itself held open in the down position of the elevator by contactor **29,** are opened preventing energizing of the solenoid designated "lower air moter" when the contactor moves upwardly with the elevator and switch **20** is biased to the closed position. Also, the normally closed contacts of the air motor relay connected in series with limit switch **19** are opened preventing energizing of the coil designated "Reverse". The limit switch **19** moves to the closed position as the separator moves forward from the switch.

The movement of the carrier **13** through the bale to cut the upper layers from the bale causes contactor **18** (FIG. 2) to engage and open limit switch **17,** thus deenergizing the forward coil and stopping movement of the separator **9** into the bale. Simultaneously, however, the normally open contacts are made as at **17'** (FIG. **10**) to place the reverse relay coil in circuit through now closed limit switch **19.** This closes the normally open contacts of the reverse relay in series with switch **19,** maintaining the reverse coil energized when switch **17'** contact opens ans switch **17** contact closes. The normally open reverse contacts in series with the separator reverse coil are also closed, providing for the separator **13** to move outwardly of the bale as the elevator continues to rise. The normally closed contacts of the reverse relay in series with switch **17** contacts are opened when the reverse relay coil is energized preventing energizing of the forward coil of the separator. The separator withdraws from the bale, opens switch **19,** deenergizing the reverse coil, opening the normally open reverse relay contacts, stopping the reverse action of the separator and closing the normally closed contacts of the reverse relay so the forward coil is energized through limit switch **17** permitting the separator **9** to repeat its inward and outward actions. These actions continue until the bale is completely moved from the elevator, opening switch **4** but the air motor continues to run as switch **8** is closed. The switch **19** is maintained in open position by the separator in its fully withdrawn position relative to the elevator and bale and, hence, is shown in open position in FIG. **10.**

The limit switch **8** is positioned sufficiently far up on the frame so that it is not opened until the pulp sheets have been transferred from the elevator. When opened, the limit switch **8** opens the line to both the air motor "rise" solenoid and the coil of the air motor relay, thus opening the normally open contacts in series with limit switch **8** and with limit switch **17** but closing the normally closed contacts in series with limit switch **20** and limit switch **19.** The reverse coil of the carrier **13** is thus energized causing the separator to retract; when the limit switch **19** is now opened by the carrier retraction, the forward solenoid is no longer. automatically energized as the air motor contacts in series with it are open. The elevator, however, is now lowered as the "lower"solenoid is in circuit through the normally closed contacts and limit switch **20.** When limit switch **20** is opened by contact of the contactor **29** with the switch mechanism, the air motor action is terminated.

Contactor **20** maintains limit switch **20** open until the elevator again rises in the processing of another bale. The processing of the next bale is initiated by closing of the "start" button and with a bale in position to close switch **4.**

Summarizing, in operation a pulp bale **2** is fed by the conveyor **1** to the elevator table **3** composed of the plurality of rollers **41,42.** The pulp bale generally commercially available has a height of about **18** inches and a width and length of between about 28 to 33 inches. As the pulp bale engages the switch **4,** the start button may be closed so that air motor **5** is actuated to drive the jack screws at **27** and, consequently, the collars **28** mounted on guides **39** upwardly. The collars **28** through the supports **7** are secured to the table **3** and cause it to be raised slowly. As the table rises, it carries with it the pulp bale **2** which continues to bear against bar **49** holding switch **4** closed. Simultaneously with the rise of the table **3** the cylinder **10** also is energized and piston **66** causes the carrier means for the separator to be urged rightwardly in FIG. **2** so that the separator passes through the upper end of the pulp bale. The initial movement of the carrier means for the separator is in a horizontal direction. Shortly after the penetration of the bale, however, the carrier means are cammed upwardly by the action of rollers **60** on the cam surfaces **68** and this causes the separator to be jogged upwardly, tending to break the upper layers of pulp, already penetrated by the separator, from the main body.

As the separator continues its path through the pulp bale, it causes the upper layers to be separated and the removed material to be transferred to the conveyor **16,** the removed material being identified as *2a* in FIG. **1.** The table **3** and the pulp bale on it move continuously upwardly as the separator penetrates the bale. The separator is caused to retract by the engagement of the contactor **18** with limit switch **19,** reversing the action of the cylinder **10.** Upward movement of the bale continues as the cylinder retracts, and the separator is automatically reversed in its motion when the contactor **18** engages the switch **19** in its rearward movement. Thus, the separator is again caused to move directly and substantially horizontally into the upwardly moving bale penetrating the upper sheets and removing sheet in the manner already described.

When the bale has reached its full upward course, the contactor **29** engaging with the switch **8** causes the air motor **5** action to be reversed and the table to again descend. Also, air cylinder **10,** when it reaches the retracted position of the piston **66,** is de-energized. The descent of the table causes the contactor **29** to engage the switch **20,** setting the circuitry for receipt of a new bale. Thus, it is only necessary to correlate the speed of the air motor with the movement of the separator means for the separator to result in continuous action for the separation of one bale. The feeding of a second bale is, of course, accomplished by the conveyor **1** in any convenient manner. In specific application, removing 1 inch heights from an 18 inch high bale in each pass of the separator, **28** bales per hour may be readily separted. In such application the separator operates substantially continously while a bale is on the elevator, and feed of the bales to the elevator is made promptly as the elevator is in position to receive the bale. The operation, of course, may be on an intermittent basis but such is less economical of time.

Certain apparent modifications may be made to aid speed of operation. For example, the return of the elevator from an upper position to the lower start position may be at an increased speed relative to the raise speed by employing a higher air motor pressure on the return.

As many apparently widely different embodiments of this invention may be made without departing from the spirit and scope thereof, it is to be understood that I do not limit myself to the specific embodiments thereof except as defined in the appended claims.

I claim:

1. In apparatus for separating sheets of pulp from a pulp bale, an elevator for raising a bale of pulp, lateral support means for a bale of pulp carried on the elevator, a pulp sheet separator, carrier means supporting the pulp sheet separator for movement transversely across and above the elevator in the direction of the said lateral support means and through a bale on the elevator to remove sheets from the bale, a mounting for the said carrier means, other means pivotally supporting the pulp sheet separator with respect to said carrier means so that said pulp sheet separator may be jogged in a direction transverse to the plane of the pulp sheet separator to break pulp sheets loose from a pulp bale into which the separator has penetrated, and fourth means for jogging the pulp sheet separator when the pulp sheet separator is over the elevator, said fourth means being upwardly inclined cam means on the mounting positioned to be traversed by the carrier means in said movement of the carrier means.

2. In apparatus for separating sheets of pulp from a pulp bale, an elevator for raising a bale of pulp, lateral support means for a bale of pulp carried on the elevator, a pulp sheet separator, carrier means supporting the pulp sheet separator for movement transversely across and above the elevator in the direction of the said lateral support means and through a bale on the elevator to remove sheets from the bale, said elevator having a platform for the bale and a plurality of supports in spaced relation forming the platform, finger means between some of said supports and normally positioned below the platform level, and means for urging the finger means upwardly above the platform level to urge a pulp bale on the platform upwardly.

3. In apparatus for separating sheets of pulp from a pulp bale as claimed in claim 2 in which the supports are rollers.

4. In apparatus for separating sheets of pulp from a pulp bale as claimed in claim 2 wherein the means for urging the finger means upwardly include lever means operatively associated with the finger means for moving the finger means upwardly above the platform level, said lever means projecting laterally of the elevator, and a contactor abutment fixedly positioned in the path of the projecting lever means arranged to engage the lever means at the upper end of the elevator movement to raise the finger means upwardly and lift the lowermost sheets of a bale on the elevator platform for movement of the pulp sheet separator thereunder.

5. The method of separating a plurality of pulp sheets from a bale of pulp sheets comprising the steps of moving a bale of the pulp continuously upwardly, penetrating the bale with a relatively wide pulp separator by urging the separator substantially horizontally into the bale, and then when the separator is within the bale jogging the separator in a vertical direction to break the upper pulp sheets loose from the bale, and then removing the loosened sheets from the bale, the said method including that the lowermost sheets of the bale, following removal of the upper sheets, are raised on an edge facing the pulp separator to permit the pulp separator to pass beneath the lowermost sheets of the bale

* * * * *

UNITED STATES PATENT OFFICE

CERTIFICATE OF CORRECTION

PATENT NO. : 3,870,167

DATED : March 11, 1975

INVENTOR(S) : Edward E. Werner and Wayne S. Cheng

It is certified that error appears in the above-identified patent and that said Letters Patent are hereby corrected as shown below:

Inventor Wayne S. Cheng was omitted as one of inventors of patent. First page, after Inventors, should read:

Inventors: Edward E. Werner, Oshkosh, Wis.
Wayne S. Cheng, Neenah, Wis.

Signed and Sealed this

twenty-second Day of *July 1975*

[SEAL]

Attest:

RUTH C. MASON
Attesting Officer

C. MARSHALL DANN
Commissioner of Patents and Trademarks