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INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(51) International Patent Classification 4 : A01F 29/10 — A1

(11) International Publication Number: WO 87/ 05186

(43) International Publication Date: 11 September 1987 (11.09.87)

(21) International Application Number: PCT/AU87/00065

(22) International Filing Date: 6 March 1987 (06.03.87)

(31) Priority Application Number: PH 4902

(32) Priority Date: 6 March 1986 (06.03.86)

(33) Priority Country: AU

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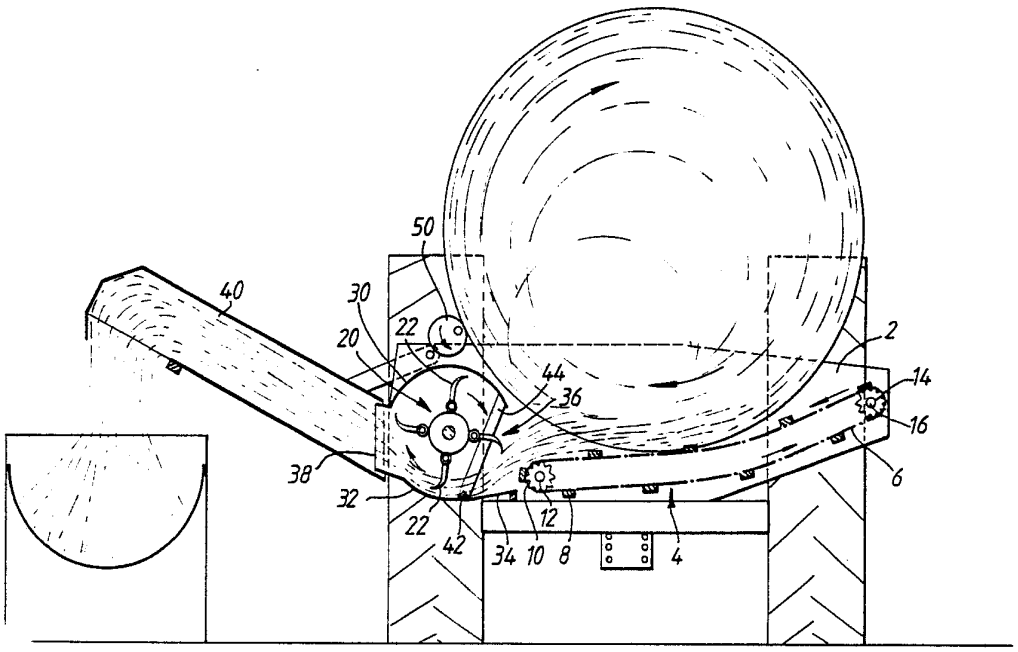
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(81) Designated States: AT (European patent), BE (European patent), CH (European patent), DE (European patent), DK, FR (European patent), GB (European patent), IT (European patent), JP, LU (European patent), NL (European patent), NO, SE (European patent), US.

Published
With international search report.

(54) Title: DEVICE FOR PEELING AND CHOPPING BALES



(57) Abstract

A device for chopping bales includes a rotary cutter device (20) mounted for rotation about a substantially horizontal axis. A tumble mechanism (4) supports a bale with its lower part adjacent the cutter device (20) and tumbles or rotates the bale such that an outer layer is removed from the bale and is fed to the cutter device to be comminuted thereby and discharged by the rotation of the cutter device (20). Means (50) is provided to move the bale periodically further away from the cutter device (20).

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DEVICE FOR PEELING AND CHOPPING BALES

The present invention relates to a device for chopping bales, especially round bales.

Conventionally, hay or other fodder in a round bale is removed by peeling the outer layer from the bale and discharging the fodder directly for use. Fodder in this form consists of relatively long stems which is not satisfactory for all uses. It has been proposed to comminute the fodder directly after removal from the bale by feeding the fodder through a rotary cutter assembly. However, previous attempts to achieve comminution directly after removal from the bale have been unsatisfactory in that substantial power input is required to drive the cutter assembly. There is also a tendency for the fodder to remain in contact with the cutter assembly for such a period that it is comminuted into particles of too small a size.

According to the present invention, there is provided a device for chopping bales, comprising rotary cutter means mounted for rotation about a substantially horizontal axis, means for supporting a bale with the lower part of the bale adjacent the cutter means and for tumbling or rotating the bale such that an outer layer is removed from the bale and is fed to the cutter means to be comminuted by the cutter means and discharged by the rotation of the cutter means, and means operative

to move the bale periodically further away from the cutter means.

Preferably, the supporting means is adapted to support a round bale with its axis substantially horizontal and to rotate the bale about said axis.

Further according to the present invention, there is provided a device for chopping round bales comprising rotary cutter means having cutting elements spaced in the direction of its axis of rotation, means for supporting and rotating a bale about an axis substantially parallel to that of the cutter means and to bias the bale towards the cutter means whereby to separate an outer layer from the bale and feed it to the cutter means, said cutter means when rotating inducing an air flow to draw matter removed from the bale into a zone of action of the cutter means for comminution and for subsequent discharge, and means for periodically moving the bale away from the cutter means to enhance the airflow.

An embodiment of the invention will now be described by way of example only with reference to the accompanying drawings in which:-

Figure 1 is a perspective view of a bale peeling and chopping device in accordance with a preferred embodiment of the invention;

Figure 2 is a schematic end elevation in the direction of arrow "A" in Figure 1'

Figure 3 is a schematic transverse section along line B-B of Figure 1;

Figure 4 is a schematic end elevation of a cutter drum; and

Figures 5A and 5B are schematic plan views of different forms of blade for the drum.

As shown in the drawings, a device for peeling and chopping round bales comprises an elevated bale supporting structure comprising opposed side walls 2 and a bale support surface 4 extending between the side walls and inclined downwardly from one end to an opposing end. The inclined bale support surface is defined by an endless conveyor comprising conveyor chains 6 having flights 8 of bar-like form and which extend between the side walls 2. The conveyor chains are entrained around driving sprockets 10 on a driving shaft 12 and sprockets 14 on an idle shaft 16.

Immediately downstream of the lower end of the conveyor 4 is a cutter drum 20 which extends the width of the conveyor. The cutter drum 20 is mounted for rotation about a horizontal axis parallel with that of the driving and idle shafts 12, 16 and carries flail blades 22 arranged at intervals along the length of the drum. Adjacent blades are equi-angularly spaced around the axis of the drum. As shown, the drum has four such blades arranged along its length, adjacent blades being angularly spaced by 90°. Each blade 22 is pivotally mounted on the drum about an shaft 24 parallel to that of the drum and rotation of the drum causes the blades to swing outwardly, as shown in Figure 3.

The cutter drum 20 is enclosed within a housing comprising a part-cylindrical upper wall 30 which

surrounds the upper portion of the drum and a part-cylindrical lower wall 32 which merges with a rectilinear inlet ramp 34 adjacent the lower end of the conveyor 4 (see Figure 3). The front side of the housing is open to provide an inlet 36 which extends the length of the drum and which is defined from above by the lower edge of the part-cylindrical upper wall 30 and from below by the inlet ramp 34. The rear side of the housing is open in its lower portion to define an outlet 38 which extends the length of the drum and faces towards the inlet 36. The outlet 38 communicates with a removable discharge chute 40.

Each blade 22 is of approximately right-angled configuration as viewed in cross-section. This configuration enables each blade to generate a substantial air flow during rotation of the cutter drum. As shown in Figures 5A and 5B, each blade 22 is sharpened at its tip portion 22a and also along its lateral edges 22b. A fixed anvil bar 42 preferably of triangular section extends along the lower edge of the inlet 36 to the housing to co-operate with the tips of the rotating blades 22 to produce a shearing action on matter fed to the drum 20, the length of each blade 22 and the depth of the anvil bar 42 being such that there is a small clearance between the blade tips and the angle bar during rotation.

The device may be set up to provide a relatively fine cut, or a coarser cut with particles of mixed length. To provide the fine cut a grill is mounted over the inlet 36 to the housing, the grill comprising a series of grill bars 44 each located between

respective groups of blades 22; in this configuration, the blades used are the narrower blades as shown in Figure 5A. To provide the coarser cut, the grill is removed and the wider blades shown in Figure 5B are used.

A bale support member 50 is located above the housing to support the lower side of a bale. In the embodiment shown, the bale support member extends the length of the housing and is in the form of a roller mounted for rotation about an eccentric axis. The eccentric support roller 50 is driven in synchronism with the conveyor 4.

A bale to be peeled is loaded onto the device so that it is supported on the conveyor 4 with its axis horizontal and transverse to the conveyor, and with the lower end of the bale resting against the eccentric support roller 50. The conveyor 4 is driven in the direction indicated by the arrows to peel the outer layer from the bale and to direct the peeled matter towards the inlet 36 of the cutter housing, this action of the conveyor 4 also causing rotation of the bale. The cutter drum 20 rotates at high speed in the direction indicated to generate an intense air flow which draws the peeled matter into the lower part of the housing in which it is sheared and chopped by the action of the rotating blades 22 and anvil bar 42. Any long particles which become wrapped around the blades will be cut by the sharpened lateral edges 22b of the blades. The cut particles are discharged through the outlet 38 by the combined effects of the forces imparted by the rotating blades 22 and the

airflow generated by the blades 22. The airflow carries the particles along the discharge chute 40 for discharge into a bin or other receptacle.

During this action, the bale is resting against the eccentric roller 50. The eccentric rotation of this roller 50 causes the bale to move repeatedly from a position in which it lies closely adjacent to, or against, the cutter housing, and a position further from the cutter housing. This oscillating movement of the bale is of importance to the operation of the device as it periodically creates a substantial gap between the lower part of the bale and the cutter housing to facilitate the ingress of a large volume of air which is drawn into the inlet 36 of the housing by the rotating cutter drum. The oscillation also acts to briefly interrupt, or at least to substantially reduce, the flow of peeled matter to the cutter drum when the bale is furthest from the housing. These two effects prevent blockage of the cutter drum during operation and act to permit a regular, strong, discharge of comminuted matter. The eccentric roller 50 also acts to loosen the outer layer of the bale for subsequent peeling.

The direction of drive of the conveyor 4 and eccentric roller 50 may be reversed so that the bale is peeled, with discharge being from the top end of the conveyor without comminution by the cutter drum. In this mode, the device thus acts like a conventional bale peeler.

The device may be mounted in a frame for free-standing operation, for example in a barn. In

this form, the device may include an electric drive motor with appropriate transmission to the cutter drum, conveyor belt and eccentric support roller.

However, in the preferred embodiment as illustrated, the device is mounted on a wheeled chassis 60 to be towed behind a tractor, the device being arranged laterally of the chassis whereby discharge occurs to one side via the discharge chute. Preferably, the chassis 60 also mounts a bale lifter 62, the lifter extending to the rear of the chassis so as to pick-up a bale and then load it into the device for peeling or for peeling and comminution. Alternatively, the device may be mounted as an attachment to the bale handler described in Australian patent application 40308/85 to which reference should be made for full details.

In the preferred embodiment, the device is powered from the PTO of the tractor. The cutter drum 20 is preferably directly driven via a mechanical drive transmission so as to rotate at a constant speed, for example up to 2000 r.p.m. The conveyor 4 and eccentric support roller 50 are driven in synchronism by a hydraulic motor which facilitates variation in their drive speed and also reversal of their directions of drive as discussed earlier. The discharge chute 40 is movable to an upright position (as shown at 40a in dotted lines in Figure 2) for transport of the device on the open road. In the vertical position, the outlet 38 from the housing is directly exposed and the device can be operated to discharge comminuted matter substantially horizontally

through the outlet whereby to form a layer for bedding purposes. The chute 40 may be provided with suitable extension pieces 70, if required.

A retaining roller 72 (Figure 2) may optionally be mounted on a suitable support above the upper end of the conveyor 4 to retain the bale in position even if the device is operating in a steeply sloping environment.

The device described herein operates to efficiently deliver large volumes of comminuted hay or other fodder peeled from a bale. The fodder is in contact with the cutter drum only over a relatively small proportion of its rotation (typically over an arc of about 60°) during movement of the fodder through the bottom part of the housing. This has the effect of reducing the overall power requirements and also obviates the comminution into very small particles which would have no value.

The embodiment has been described by way of example only and modifications may be made within the scope of the invention. For example, a further set of simple rectangular blades may be disposed one between each adjacent co-planar pair of flail blades 22. In another modification, provision may be made to bolt a screen across the interior of outlet 38. This screen may be arcuately contiguous and co-cylindrical with walls 30, 32 for trapping matter in the path of the blades until it is small enough to pass the screen.

CLAIMS:

1. A device for chopping bales, comprising rotary cutter means mounted for rotation about a substantially horizontal axis, means for supporting a bale with the lower part of the bale adjacent the cutter means and for tumbling or rotating the bale such that an outer layer is removed from the bale and is fed to the cutter means to be comminuted by the cutter means and discharged by the rotation of the cutter means, and means operative to move the bale periodically further away from the cutter means.

2. A device according to claim 1, wherein said supporting means is adapted to support a round bale with its axis substantially horizontal and to rotate the bale about said axis.

3. A device according to claim 1 or 2, wherein the means for supporting and rotating the bale comprises an endless conveyor on which the bale rests.

4. A device according to claim 1, 2 or 3, wherein the means for periodically moving the bale comprises an eccentric roller being rotatable to effect oscillating movement of the bale.

5. A device according to claim 4, wherein the means for supporting and rotating the bale comprises an endless conveyor on which the bale rests, the device further comprising means for driving the roller and conveyor in synchronism.

6. A device according to claim 5, comprising means for reversing the direction of the conveyor.

7. A device according to any one of the preceding claims, wherein the cutter means is within a housing having an inlet positioned to receive matter removed from the bale, and an outlet through which matter comminuted by the cutter means is discharged, said cutter means comprising means for generating an airflow to draw matter into the inlet end to discharge the comminuted matter through the outlet.

8. A device according to claim 7, wherein the means for supporting and rotating the bale comprises an endless conveyor on which the bale rests, the inlet is located at a discharge end of the conveyor and extends the width of the conveyor, and the rotating cutter means is co-extensive with the inlet and includes pivotal blades spaced in the direction of the axis of rotation of the cutter means, the blades being shaped to create the airflow.

9. A device for chopping bales comprising rotary cutter means having cutting elements spaced in the direction of its axis of rotation, means for supporting and rotating a bale about an axis substantially parallel to that of the cutter means and to bias the bale towards the cutter means whereby to separate an outer layer from the bale and feed it to the cutter means, said cutter means when rotating inducing an air flow to draw matter removed from the bale into a zone of action of the cutter means for comminution and for subsequent discharge, and means for periodically moving the bale away from the cutter means to enhance the airflow.

10. A device according to claim 9, wherein the means for supporting and rotating the bale comprises a downwardly inclined endless conveyor, and the cutter means is mounted for rotation about a substantially horizontally axis adjacent a lower end of the conveyor, said cutter means substantially extending the width of the conveyor.

11. A device according to claim 10, comprising means for reversing the direction of movement of the conveyor whereby to cause matter separated from the bale to be fed away from the cutter means for discharge at the upper end of the conveyor without comminution.

12. A device according to claim 10 or 11, wherein the cutter means is mounted within a housing having an inlet adjacent the downstream end of the conveyor and an outlet which faces the inlet.

13. A device according to claim 12, wherein the outlet communicates with a discharge chute, said chute being movable to expose the outlet for direct discharge.

14. A device according to claim 11, wherein the housing inlet includes a grill defined by a grill bar between adjacent cutting elements.

15. A device according to any one of claims 9 to 14, wherein the cutting elements comprise blades shaped to generate the airflow.

16. A device according to claim 15, wherein the blades are pivotal about axes parallel to the axis of rotation

of the cutter means and co-operate with a fixed anvil during rotation.

17. A device according to claim 16, wherein the blades each have a sharpened tip and sharpened lateral edge directed transversely to the axis of rotation of the cutter means.

18. A device according to any one of claims 9 to 17, wherein the means for periodically moving the bale comprises a roller adapted to engage a peripheral side of the bale, and means for displacing the roller to cause such movement of the bale.

19. A device according to claim 18, wherein the roller is eccentrically mounted whereby rotation of the roller causes such movement of the bale.

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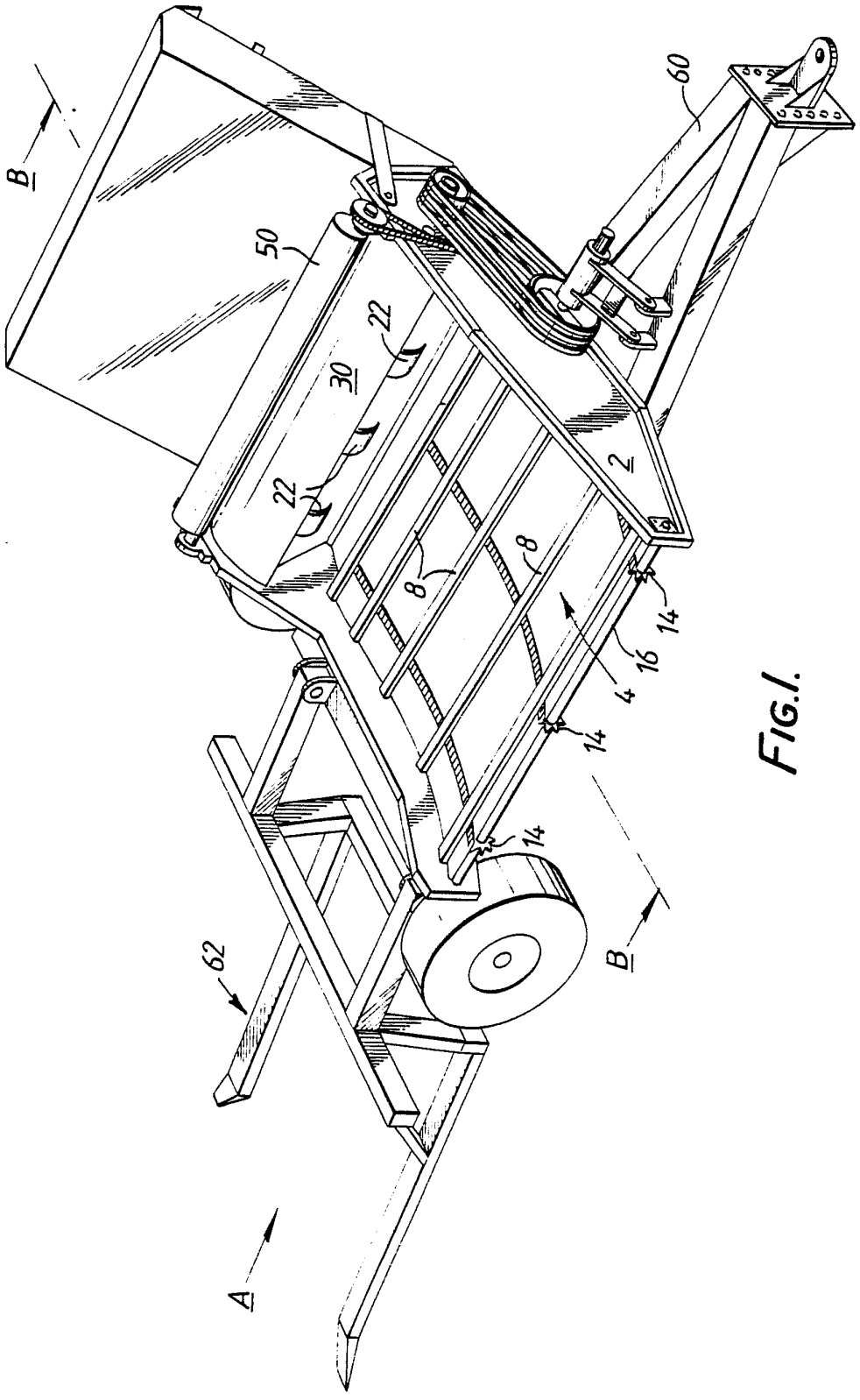


FIG. 1.

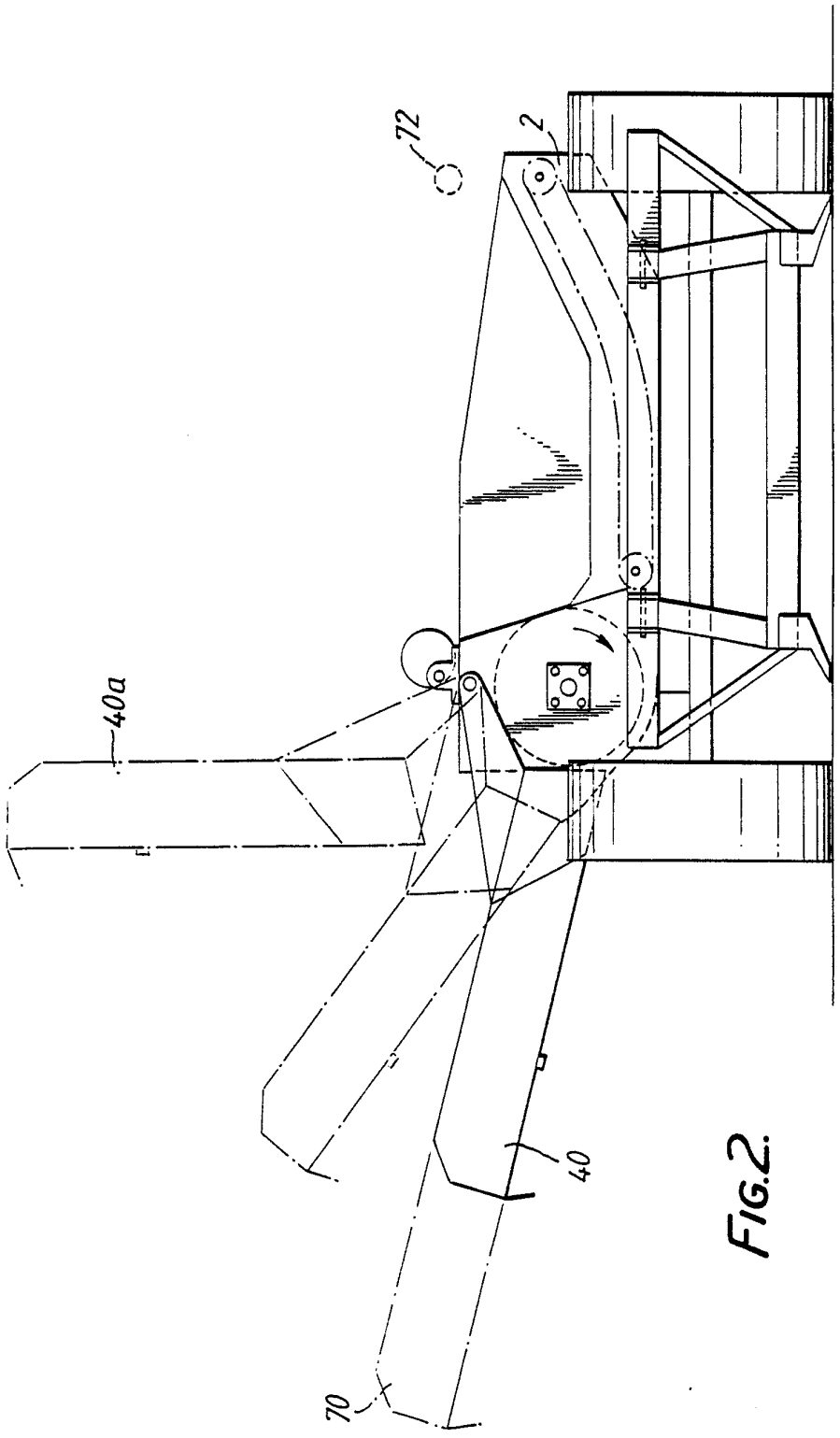


FIG.2.

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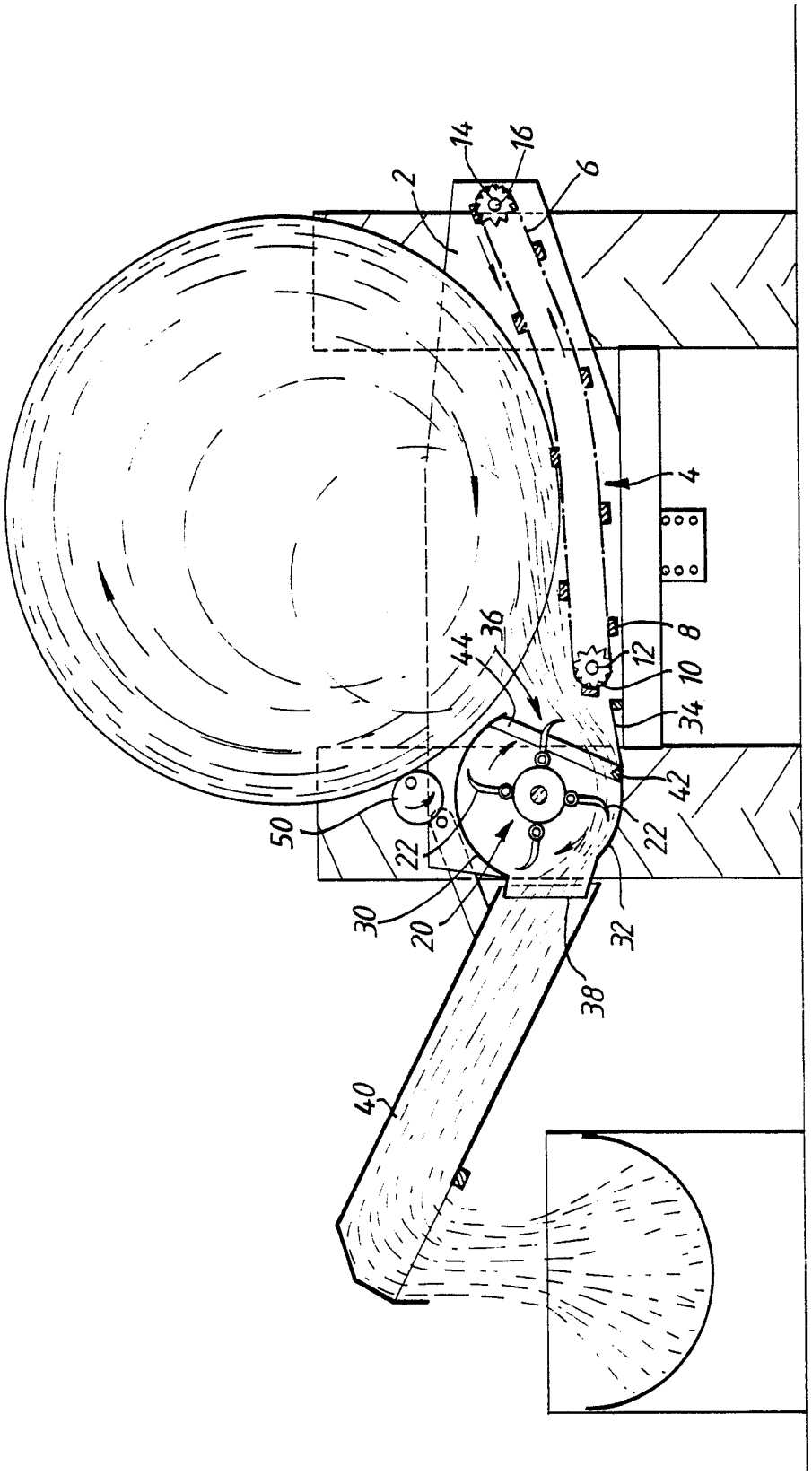


FIG. 3.

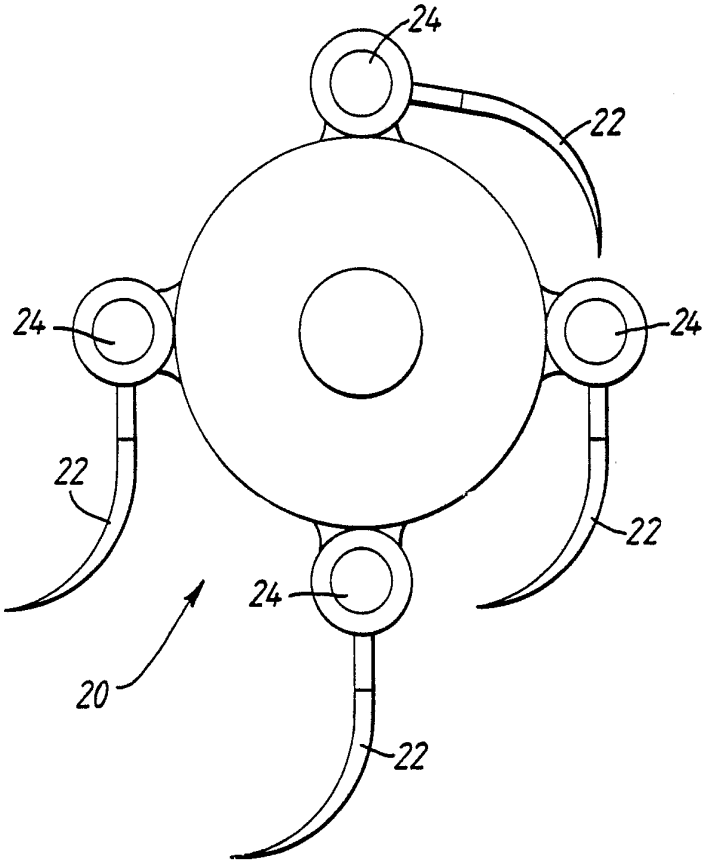


FIG. 4.

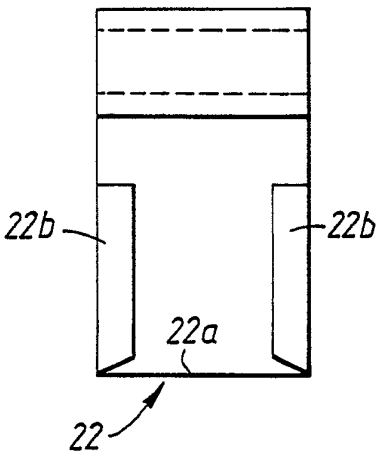


FIG. 5A.

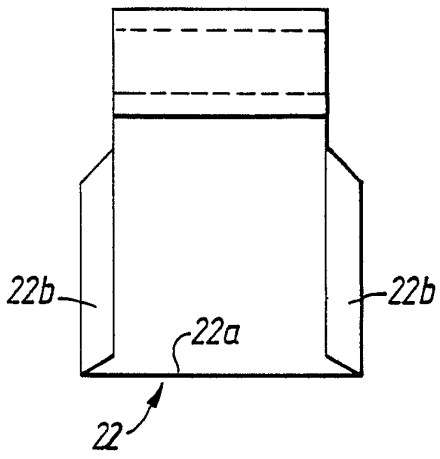


FIG. 5B.

SUBSTITUTE SHEET

INTERNATIONAL SEARCH REPORT

International Application No PCT/AU 87/00065

I. CLASSIFICATION OF SUBJECT MATTER (if several classification symbols apply, indicate all) [6]

According to International Patent Classification (IPC) or to both National Classification and IPC

Int. Cl.[4] A01F 29/10

II. FIELDS SEARCHED

Minimum Documentation Searched [7]

Classification System	Classification Symbols
IPC	A01F 29/00, 29/02, 29/04, 29/06, 29/10

Documentation Searched other than Minimum Documentation to the Extent that such Documents are Included in the Fields Searched [8]

AU : IPC A01F 29/00, 29/02, A01K 5/00

III. DOCUMENTS CONSIDERED TO BE RELEVANT [9]

Category *	Citation of Document, [11] with indication, where appropriate, of the relevant passages [12]	Relevant to Claim No. [13]
A	AU,B, 77913/75 (484509) (HESSTON CORPORATION) 5 August 1976 (05.08.76)	(1,9)
A	FR,A, 2522472 (ETABLISSEMENTS MAITRE SA) 9 September 1983 (09.09.83)	(1,9)
A	US,A, 3208491 (BLISS) 28 September 1965 (28.09.65)	(1,9)

* Special categories of cited documents: [10]

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IV. CERTIFICATION

Date of the Actual Completion of the International Search	Date of Mailing of this International Search Report
15 May 1987 (15.05.87)	(26.05.87) / 26 MAY 1987
International Searching Authority	**Signature of Authorized Officer**
Australian Patent Office	B.R. DASHWOOD

Form PCT/ISA/210 (second sheet) (January 1985)

ANNEX TO THE INTERNATIONAL SEARCH REPORT ON

INTERNATIONAL APPLICATION NO. PCT/AU 87/00065

This Annex lists the known "A" publication level patent family members relating to the patent documents cited in the above-mentioned international search report. The Australian Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

Patent Document Cited in Search Report	Patent Family Members
AU 77913/75	DE 2535204 FR 2287182

END OF ANNEX