

(19) World Intellectual Property Organization
International Bureau



(43) International Publication Date
8 August 2002 (08.08.2002)

PCT

(10) International Publication Number
WO 02/060237 A2

(51) International Patent Classification⁷: **A01H**

(21) International Application Number: PCT/DK02/00062

(22) International Filing Date: 28 January 2002 (28.01.2002)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:
PA 2001 00147 29 January 2001 (29.01.2001) DK

(71) Applicant and

(72) Inventor: MADSEN, Kristian [DK/DK]; Slettensvej
207-215, DK-5270 Odense (DK).

(74) Agent: BUDDE, SCHOU & OSTENFELD A/S; Vester
Søgade 10, DK-1601 København V (DK).

(81) Designated States (national): AE, AG, AL, AM, AT (utility model), AU, AZ, BA, BB, BG, BR, BY, BZ, CA, CH,

CN, CO, CR, CU, CZ (utility model), DE (utility model), DK (utility model), DM, DZ, EC, EE (utility model), ES, FI (utility model), GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, MZ, NO, NZ, OM, PH, PL, PT, RO, RU, SD, SE, SG, SI, SK (utility model), SL, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VN, YU, ZA, ZM, ZW.

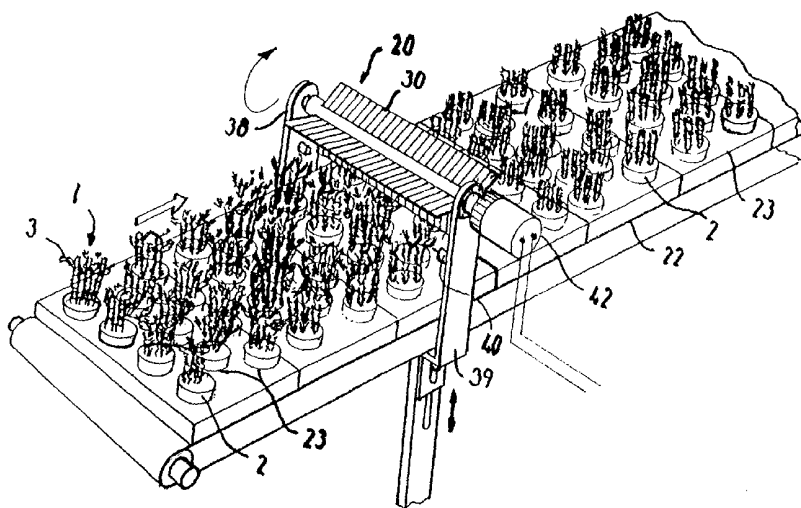
(84) Designated States (regional): ARIPO patent (GH, GM, KE, LS, MW, MZ, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE, TR), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).

Published:

— without international search report and to be republished upon receipt of that report

For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.

(54) Title: METHOD OF REMOVING PHYLLOCLADES FROM PHYLLOCACTI



(57) Abstract: The present invention relates to a method and apparatus for removing upper stem segments (3), from Phyllocacti (1) in order to produce flowering butts. Thereto the segments (3) have to be torn off from the stem segment (3) below. The level above which the segments are to be removed is established in accordance with the development stage of the Phyllocacti (1), the desired stability of the Phyllocacti for transport reasons etc. Mechanical impact is applied to the segments (3) above the determined level, by means such as brushes (30) or fluid jets (50). The Phyllocacti (1) may be subjected to mechanical impact several times by resubmitting them to the impact means (30,50) or by placing several impact means (30,50) in series. Transport means (22) for creating a relative movement between the impact means (30,50) and the Phyllocacti (1) are provided. According to one embodiment of the invention Phyllocacti (1) are furthermore exposed to ethylene or an ethylene releasing compound which will facilitate removal of upper stem segments from Phyllocacti (1).

METHOD OF REMOVING PHYLLOCLADES FROM PHYLLOCACTI

TECHNICAL FIELD

5

The present invention relates to a method of removing the upper phylloclades from Phyllocacti of the kind set forth in the preamble of claim 1 and to an apparatus for removing the upper phylloclades from Phyllocacti of the kind set forth in the preamble of claim 16.

10

BACKGROUND ART

15 Phyllocacti are epiphytic plants native to a small region in the Organ Mountains north of Rio de Janeiro, Brazil in South America. Under natural conditions, Phyllocacti or *Schlumbergera truncata* will flower in mid to late November and *Schlumbergera bridgesii* in December thus the common names given are Thanksgiving and Christmas Cacti, respectively.

20 The Phyllocacti grow vegetatively by producing flat, leaf-like stem segments, so-called phylloclades connected at the mid-veins. The Phyllocacti have two to four saw-toothed serrates along the phylloclade margins. Holiday cactus can be propagated from seed, however, propagation by cuttings of 2 to 3 phylloclades produce saleable plants faster. Cuttings are usually stuck in the final container as

25 either 3 or 4 cuttings in a Ø 10 cm pot or 5 or 6 cuttings in a Ø 15 cm pot. In order to ensure that the Phyllocacti will flower in late November to early December for the typical use as a Christmas Cactus, it is necessary that by mid-June the plants are pinched back, i.e. the top of one or two phylloclades of each stem are removed. The segments removed can be rooted to establish stock plants for the following year.

30 The removal of segments is a labour intensive and therefore costly process, which makes up for a considerable part of the total production cost. Up to now, such pinching or taking cuttings has been carried out manually. The top 1 or 2 segments are grasped with the fingers and with a twisting movement separated from the stem. This manual process is slow, expensive, repetitive tedious work and damaging to

35 the arm, in particular wrist injuries are common. Several attempts have been made

to mechanise this process, however, none of them has been commercially successful.

Another reason to cut back the top 1 or 2 segments of the stems is to secure a plant
5 with stems comprising no more than four flat leaf-like stem segments (phylloclades)
for reasons of stability. Stems made up of more segments will be unstable and likely
damaged during transport.

The segments are connected at the mid-veins. In order to ensure that butts that will
10 flower will be produced, it is necessary that the segments are torn off at the mid-
veins. A segment that is cut off by means of a knife or scissors will not produce any
butts that can flower.

15 DISCLOSURE OF THE INVENTION

It is the object of the invention to provide a method of the kind referred to above,
which allows mechanical removal of the top segments (phylloclades) of a
Phyllocactus. This object is achieved by the characterising features of claim 1. By
20 providing a means creating a mechanical impact to the top leaves, the top leaves
can be removed without manual labour. It is another object of the present invention
to provide an apparatus for removing the upper segments of a Phyllocactus of the
kind referred to above which mechanises the segment-removing process. This
object is achieved by the characterising features of claim 16. By providing a means
25 applying a mechanical impact to the upper segments of the Phyllocacti, said upper
segments can be removed without the use of manual labour.

According to an embodiment of the invention, the method and the apparatus
comprise a stage in which the pots are tilted to ensure that the removed segments
30 of the Phyllocacti or in the sales pot are disposed of.

According to another embodiment of the invention, the means for creating an impact
is a rotary brush with bristles of flexible strip material attached to a rotating brush
body.

According to another embodiment of the invention, the means for creating a mechanical impact is a brush with relatively stiff bristles and the Phyllocacti are held into place by retaining means.

- 5 According to another embodiment of the invention, the means for creating a mechanical impact to the Phyllocacti is a fluid jet.

According to another embodiment means are provided for clamping the Phyllocacti below the segments to be removed.

10

- A further advantageous embodiment of the invention is based on the fact known per se that certain chemical agents have an effect on growth and ageing of plants. Thus Phyllocacti such as Rhipsalidopsis and are sensitive to ethylene. Exposing Phyllocacti to low concentrations of ethylene, i.e. concentrations below approximately 0.1 ppm, thus leads to a loss of buds and flowers, whereas higher concentrations facilitates separation of segments. High concentrations may also lead to intoxication impeding the further growth of the plant.

- 20 According to said advantageous embodiment of the invention the method is thus characterised by furthermore comprising the step of prior to the exertion of said mechanical impact to said segments exposing the Phyllocacti to a predetermined concentration of a gaseous agent for facilitating the mechanical removal of the segments of Phyllocacti.

- 25 Specifically said gaseous agent is ethylene or an ethylene releasing compound, such as Ethrel, Ethaphon or the like, and such chemical agents can be applied by either placing the plants in an atmosphere with a predetermined concentration of such agents or alternatively by spraying the plants with ethylene releasing compounds.

30

- The optimal effect of the application of ethylene requires the proper combination of concentration of ethylene, temperature and duration of exposure. It has experimentally been established that the best overall effect is achieved by application of relatively high concentrations of ethylene over short periods of time.
- 35 This leads to a good distribution of plant material with a minimal risk of damage to

the plants. Thus ethylene concentrations in the range 10 to 1000 ppm have been found to be applicable, although a range of 50 to 500 has been found to yield more optimal results, particularly a good distribution within the plant material. The effect furthermore depends on temperature and duration of exposure. Good choices of duration of exposure have been found to be in the order of 12 hours for unripe segments, whereas a longer duration of exposure would be optimal for ripe segments, where a good choice has been found to be in the order of 24 hours. For the relatively high concentrations of ethylene as mentioned above serious damages of the plants have been observed after 72 hours duration of exposure.

10

According to the invention there is furthermore provided an apparatus comprising means for application of ethylene or an ethylene releasing compound to said Phyllocacti (1).

15 Said means for application of ethylene comprises according to one embodiment a sealed enclosure capable of accommodating said Phyllocacti (1) and containing an inlet valve for ethylene for obtaining an atmosphere with a given concentration of ethylene. The enclosure is furthermore provided with means for controlling the temperature of the atmosphere. Furthermore the apparatus is provided with means
20 for controlling the duration of exposure of the plants.

According to an alternative embodiment of said apparatus according to the invention the apparatus comprises means for application of an ethylene releasing compound provided with spray members for spraying said Phyllocacti (1) with said ethylene
25 releasing compound.

Although specific values of concentration of ethylene and duration of exposure have been mentioned above it is understood that these values should merely serve to indicate the order of magnitude of these parameters, and that these and other
30 parameters may be further optimised by routine experimentation.

BRIEF DESCRIPTION OF THE DRAWINGS

35 In the following detailed part of the description of the present invention, the invention

will be explained in more detail with reference to the exemplary embodiments of the apparatus and Phyllocacti shown in the drawings, in which

Figure 1 is a side view of the apparatus according to the invention with Phyllocactus in a sales pot,

5 Figure 2 is a perspective view of a first embodiment of the apparatus according to the invention, and

Figure 3 is a perspective view of a second embodiment of the invention.

10 DETAILED DESCRIPTION OF THE INVENTION

Figure 1 shows a Phyllocactus 1 which in a final container 2 (sales pot) has matured to a size that is suitable for sale on the conveyor of the apparatus for removing phylloclades. The stems 5 of the Phyllocacti comprise 5 to 6 segments 3 including
15 the root segment. The desirable number of segments 3 for transport and sales is 4. An imaginary line 10 has been drawn which corresponds to the average height of the upper edge of the fourth segment 3, i.e. the average height of the joint 6 (mid-vein) between the fourth and the fifth segment 3. The segments above 3 this height are to be removed for reasons of stability and creating flowering butts. Figure 2
20 shows a perspective view of the apparatus 20 for removing upper segments 3 from Phyllocacti 1. The apparatus 20 comprises a conveyor 22 provided with a plurality of cavities 23 for securely supporting the pots 2. An electrical motor 25 powers the conveyor 22. Due to the mechanical impact forces applied to the Phyllocacti 1 it is necessary to secure the pots 2 against tilting. The cavities 23 may simply be circular
25 openings in the top surface of the conveyor possibly supplied with a smaller sized circular opening in a lower support plate. The diameter of the two circular openings corresponds to the conical frustum shape of the pots 2 so that they are secured well against tilting. Any other cavity 23 suitable for holding a typical sales pot 2 could be used. A rotary brush 30 comprising radially extending strips 32 is placed above the
30 conveyor 22. The rotary brush 30 comprises an elongated cylindrical body 34 rotatable about its longitudinal axis 35. The strips 32 are made of flexible material such as (synthetic) rubber or foam-rubber, wash-leather, (non-woven) cloth or the like and are attached to the elongated brush body 34. The strips 32 are radially and axially equally spaced and arranged with their flat side parallel with the longitudinal
35 axis 35 of the brush body 34.

The longitudinal axis 35 of the brush body 35 extends substantially parallel with the upper surface of the conveyor 22 and extends at an angle in the range of 45 to 90° with the transport direction of the conveyor 20. The brush body 34 is supported between arms 38,39 which allow for height adjustment of the rotary brush 30 relative to the conveyor 22. The height-adjustment can be manual or automatic in response to a plant height sensor 40. A variable speed electric motor 42 is mounted on pivot arm 38 and coupled in a conventional and well known fashion to rotate the brush 30 about its longitudinal axis 35.

10 In another embodiment of the invention the rotary brush comprises 30 relatively stiff conventional plastic bristles (not shown). In this embodiment the Phyllocacti 1 are clamped between two flexible clamping members (not shown) during the brushing operation to prevent the stems from breaking below the fourth segment. Hereto the flexible members support the stems 5 of the Phyllocacti 1 just below the fifth segment 3.

By supporting the stems in this way it is secured that the stems are all oriented substantially upright so that the most of the phylloclades to be removed are placed above the imaginary line 10. If the stems are not supported and the stems are bend aside the line above which the leaves are to be removed will be arc shaped and it is more difficult to adjust the means for applying impact to the correct level.

According to a preferred embodiment the clamping means comprise at least one inflatable member (not shown). This member is preferably torus-shaped. The uninflated torus-shaped member is moved over the plant with the stems in the hole of the torus. The torus shaped member is then inflated and the diameter of the hole is reduced so that the inner surface of the torus shaped member supports the stems.

30 The brush member may also be a disk-shaped brush (not shown). This embodiment has the advantage the inclination of the brush with respect to the plants can be adjusted.

According to a preferred embodiment an optical recognition system (not shown) comprising a video camera and a signal processor is used to determine the area in

which the segments are to be removed. The height and position adjustment of the impact means is controlled automatically in response to a signal from the optical recognition system.

5 Figure 3 shows another embodiment in which the apparatus 20 comprises one or more water powered nozzles 50. The nozzle or nozzles 50 are arranged above and/or aside the conveyor 22 and directed towards the Phyllocacti 1 so as to hit the fifth and higher segments 3 in order to apply a mechanical impact that tears off the segments 3. In order to reduce the number of nozzles 50 required to cover the
10 complete width of the conveyor 22 it is possible to use a nozzle or nozzles 50 that carry out a reciprocating angular or absolute movement substantially perpendicular to the movement of transport of the conveyor 22.

According to an embodiment of the invention (not shown) the apparatus comprises a
15 stationary substrate receiving the Phyllocacti. The means for applying a mechanical impact, such as the rotary brush 30 and/or the nozzles 50 are provided with (castor) wheels or the like and possibly guiding rails to allow movement over Phyllocacti on the substrate.

20 According to an embodiment of the invention the apparatus 20 is provided with means for tilting the Phyllocacti (not shown) after the segment removing operation in order to dispose of loose segments 3 on the Phyllocacti 1 or in the pot 2. The apparatus 20 may also be arranged such that the Phyllocacti 1 are tilted during the segment removing operation.

25 The method of operation will now be described. The Phyllocacti 1 are placed on the conveyor 22 in the suitable cavities 23. The height above which the segments 3 are to be removed is determined and the brushes 30 and/or the water jets 50 are correspondingly adjusted. The conveyor 22 transports the Phyllocacti 1 to the
30 brush(es) 30 and/or water jets 50. Optionally the stems 5 of the Phyllocacti are clamped below the fifth segment by flexible clamping members 46,47. The brushes 30 and/or the water jets 50 apply impact to the Phyllocacti 1 and the upper segments 3 of the Phyllocacti 1 are removed. As an optional step the Phyllocacti 1 are then tilted so that loose segments 3 in the plant 1 or pot 2 are disposed of.

35

According to one embodiment of the invention there is furthermore provided an apparatus comprising means for application of ethylene or an ethylene releasing compound to said Phyllocacti (1).

- 5 Said means for application of ethylene comprises according to one embodiment a sealed enclosure (not shown in the figures) capable of accommodating said Phyllocacti (1) and containing an inlet valve for ethylene for obtaining an atmosphere with a given concentration of ethylene. The enclosure is furthermore provided with means for controlling the temperature of the atmosphere. Furthermore
10 the apparatus is provided with means for controlling the duration of exposure of the plants.

- According to an alternative embodiment of said apparatus according to the invention the apparatus comprises means for application of an ethylene releasing compound
15 (not shown in the figures) provided with spray members for spraying said Phyllocacti (1) with said ethylene releasing compound.

- Although specific values of concentration of ethylene and duration of exposure have been mentioned above it is understood that these values should merely serve to
20 indicate the order of magnitude of these parameters, and that these and other parameters may be further optimised by routine experimentation.

LIST OF REFERENCE NUMERALS

	1	Phyllocactus
	2	Pot
5	3	Segment
	5	Stem
	6	Joint
	10	Imaginary line
	20	Apparatus
10	22	Conveyor
	23	Cavity
	30	Rotary Brush
	32	Strips
	34	Brush Body
15	35	Axis
	38	Pivot Arm
	39	Pivot Arm
	40	Sensor
	42	Motor
20	44	Gear Box
	50	Nozzle

CLAIMS:

1. Method of removing upper stem segments (3) from Phyllocacti (1) comprising the following steps:

5

- providing a supply of Phyllocacti (1);
- determining a zone of the Phyllocacti (1) in which segments (3) are to be removed;
- providing means for applying a mechanical impact to said segments (3) in said determined zone;
- causing relative movement between the Phyllocacti and said means for applying mechanical impact, whereby said zone of the Phyllocacti (1) in which segments (3) are to be removed is exposed to mechanical impact from said means for applying mechanical impact.

10

15

2. Method according to claim 1, c h a r a c t e r i s e d by furthermore prior to the exertion of said mechanical impact to said segments (3) comprising the step of subjecting said Phyllocacti (1) to a predetermined exposure of a gaseous agent for facilitating said removal of said segments (3) of Phyllocacti (1).

20

3. Method according to claim 2, c h a r a c t e r i s e d in that said gaseous agent being ethylene or an ethylene releasing compound.

4. Method according to claim 3, c h a r a c t e r i s e d in that the concentration of said ethylene being in the range 10 to 1000 ppm.

25

5. Method according to claim 3 or 4, c h a r a c t e r i s e d in that said exposing of Phyllocacti (1) takes place for a period of time in the range 10 to 30 hours.

30

6. Method according to any of the preceding claims 2 to 5 where said Phyllocacti (1) are subjected to said predetermined exposure of a gaseous agent by placement of the Phyllocacti (1) in an atmosphere with a predetermined concentration of said gaseous agent.

7. Method according to any of the preceding claims 2 to 5 wherein said Phyllocacti (1) are exposed to said predetermined concentration of a gaseous agent by spraying the Phyllocacti (1) with said ethylene releasing compound.
- 5 8. Method according to any preceding claims, c h a r a c t e r i s e d by furthermore comprising the step of providing means for clamping the stems (5) of the Phyllocacti (1), preferably below the segments (3) to be removed for supporting the stems (5) and ensuring that only the upper segments are removed.
- 10 9. Method according to claim 8, c h a r a c t e r i s e d by furthermore comprising the step of clamping the Phyllocacti (1) at least during the phase in which mechanical impact is applied to the segments (3) to be removed.
- 15 10. Method according to any of the claims 1 to 9, c h a r a c t e r i s e d in that the means for applying mechanical impact comprise at least one rotary brush (30) with strips (32) of flexible material attached to a brush body (34).
- 20 11. Method according to any of the claims 1 to 10, c h a r a c t e r i s e d in that the means for applying mechanical impact comprise at least one rotary brush (30) with relatively stiff bristles.
12. Method according to any of claims 1 to 11, c h a r a c t e r i s e d in that the means for applying mechanical impact comprise at least one fluid jet (50).
- 25 13. Method according to any of claims 1 to 12, c h a r a c t e r i s e d by providing two or more impact applying means in series.
14. Method according to any of claims 1 to 13, c h a r a c t e r i s e d by re-subjecting the Phyllocacti (1) to mechanical impact.
- 30 15. Method according to any of claims 1 to 14, c h a r a c t e r i s e d by the step of tilting the Phyllocacti (1) after the applying of the mechanical impact in order to dispose of loose segments (3).

16. Apparatus for carrying out the method according to any of the claims 1 to 15 of removing stem segments (3) from Phyllocacti comprising:

- a substrate (22) for carrying the Phyllocacti
- 5 - means (30,50) for applying a mechanical impact,
- means (22,25) for creating a relative movement between the Phyllocacti (1) and the means for applying a mechanical impact (30,50).

17. Apparatus according to claim 16, c h a r a c t e r i s e d by comprising means (38,39,40) for controlling the zone of the Phyllocacti (1) in which mechanical impact is applied to the segments (3).

18. Apparatus according to any of the claims 16 to 17, c h a r a c t e r i s e d in that the substrate is a conveyor that is preferably provided with pockets (23) for receiving the Phyllocacti.

19. Apparatus according to any of claims 16 to 18, c h a r a c t e r i s e d by comprising means (46,47) for clamping stems (5) of the Phyllocacti (1) below the segments (3) to be removed.

20. Apparatus according any of claims 16 to 19, c h a r a c t e r i s e d in that the means for applying mechanical impact comprise at least one rotary brush (30) with strips of flexible material (32) attached to a rotating brush body (34).

21. Apparatus according to any of claims 16 to 20, c h a r a c t e r i s e d in that the means for applying mechanical impact comprise at least one rotary brush (30) with relatively stiff bristles.

22. Apparatus according to any of claims 16 to 21, c h a r a c t e r i s e d in that the means for applying mechanical impact comprise at least one fluid jet (50).

23. Apparatus according to any of claims 16 to 22, c h a r a c t e r i s e d by comprising two or more impact applying means in series.

24. Apparatus according to any of claims 16 to 23, characterised by comprising means for tilting the Phyllocacti (1) after the applying of the mechanical impact in order to dispose removed segments (3).
- 5 25. Apparatus according to any of claims 16 to 24, characterised by comprising means (38,39,40) for adjusting the position and angle of attack of the means for applying a mechanical impact relative to the Phyllocacti (1) on the substrate (22).
- 10 26. Apparatus according to any of claims 16 to 25, characterised by comprising means for creating reciprocative movement of the means for applying a mechanical impact.
- 15 27. Apparatus according to any preceding claim 16 to 26, characterised by furthermore comprising means for application of ethylene or an ethylene releasing compound to said Phyllocacti (1).
- 20 28. Apparatus according to claim 27, characterised in that said means for application of ethylene comprises an enclosure capable of accommodating said Phyllocacti (1) and containing an atmosphere with a given concentration of ethylene.
- 25 29. Apparatus according to any preceding claim 27, characterised by furthermore comprising means for application of an ethylene releasing compound comprises spray members for spraying said Phyllocacti (1) with said ethylene releasing compound.

1/3

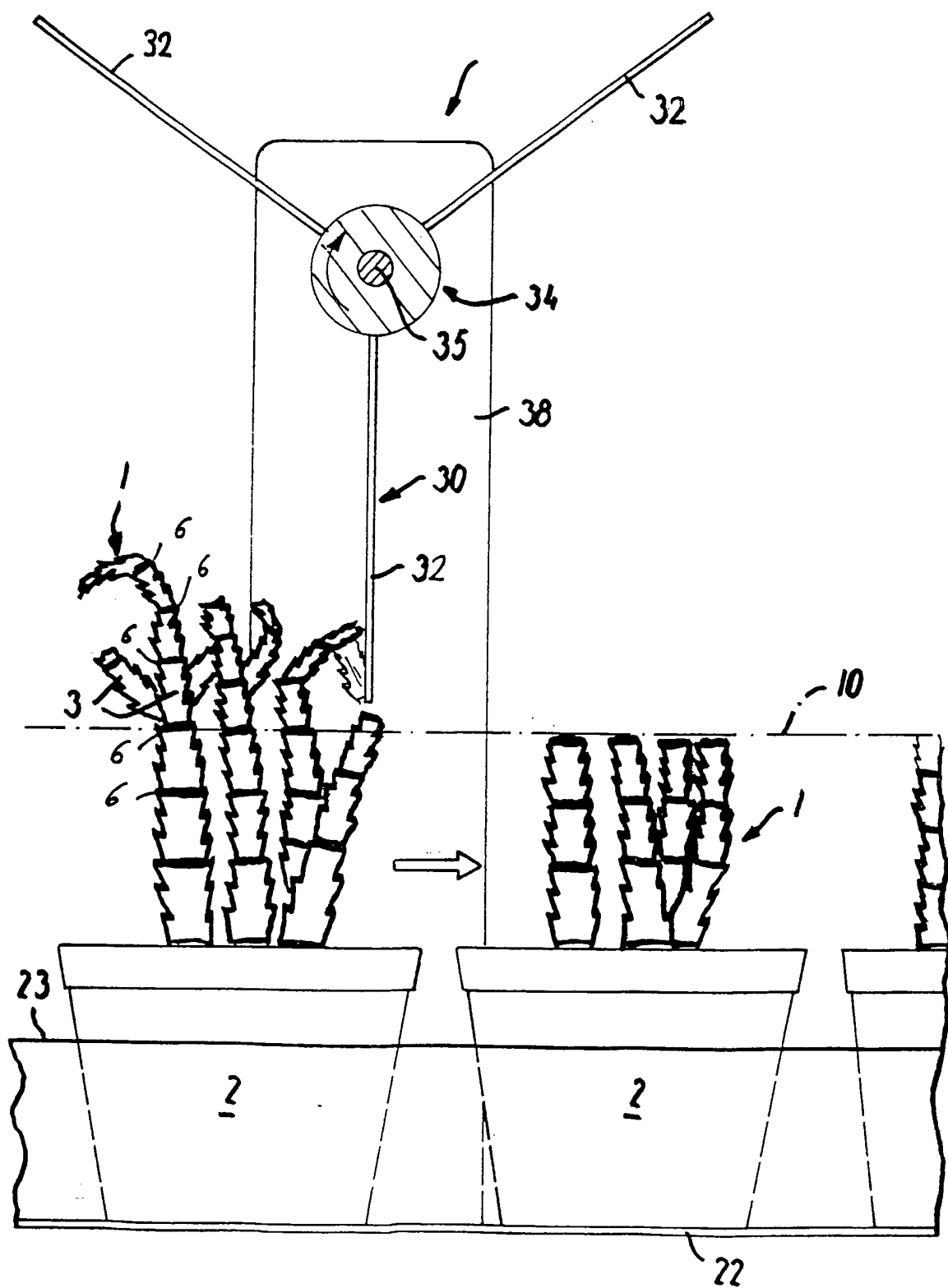


FIG. 1

2/3

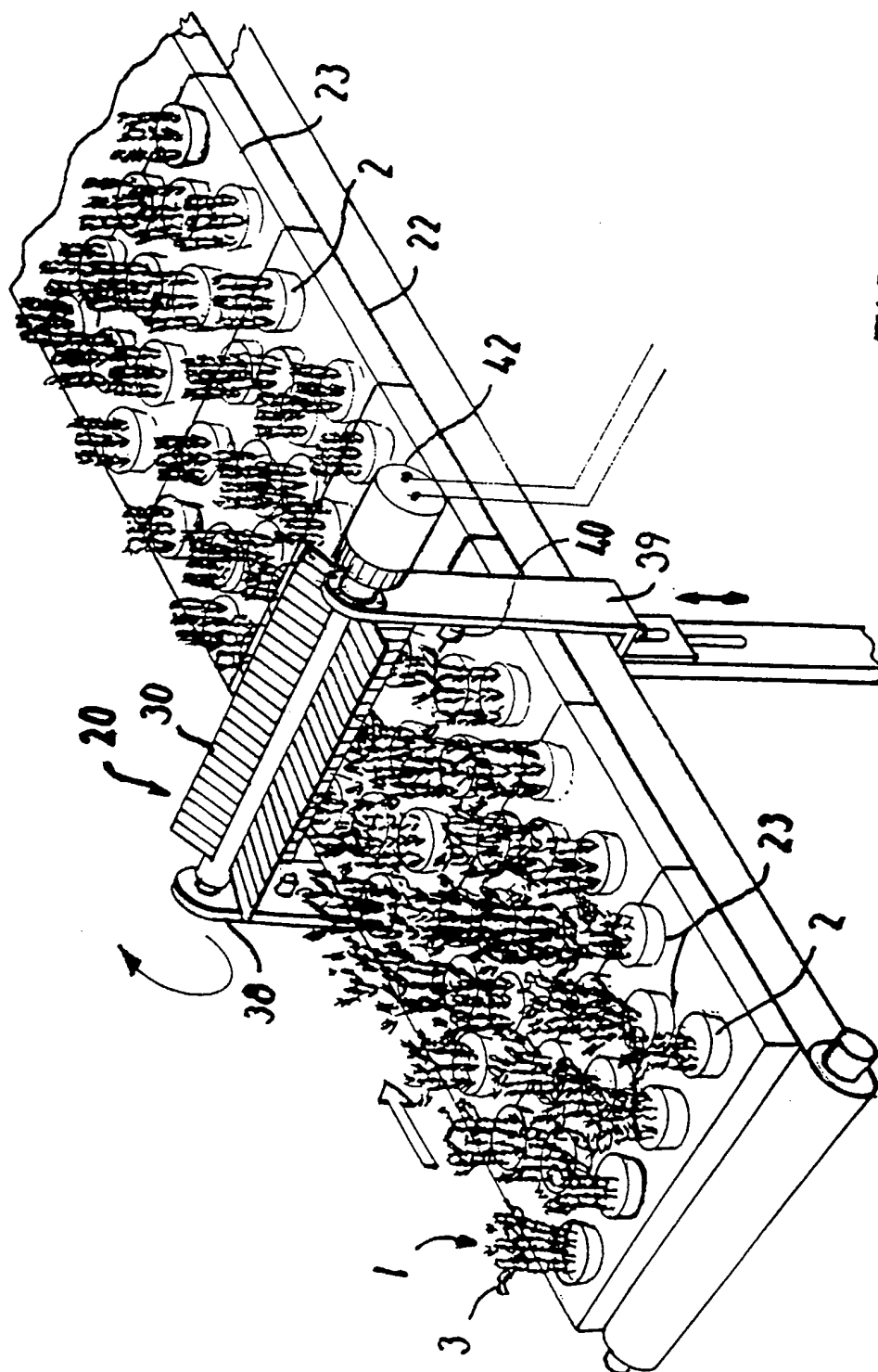


FIG. 2

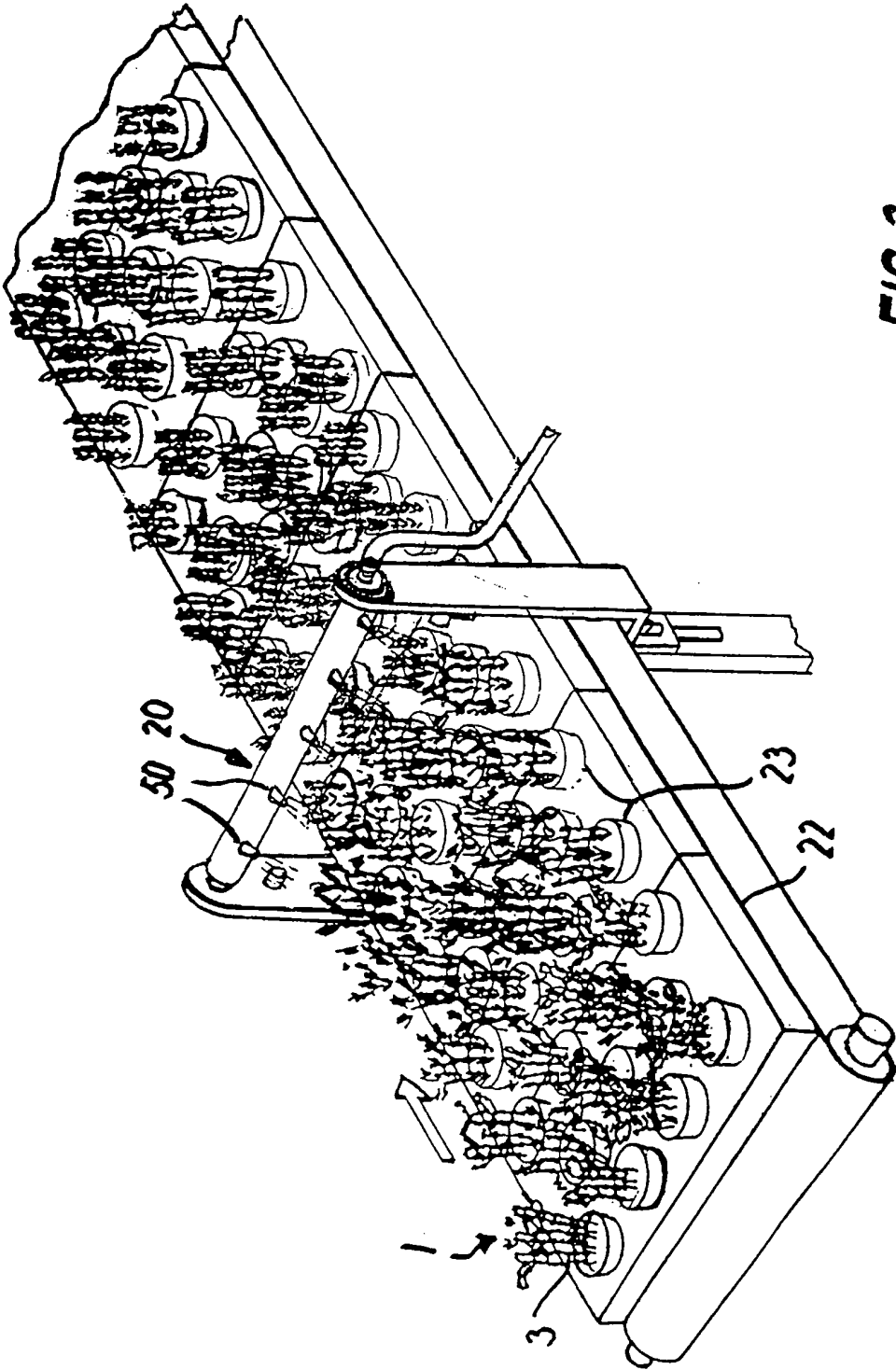


FIG. 3