Title: METHOD AND DEVICE FOR MULTIPLYING TISSUE PARTS

Abstract: Method and device for multiplying plan parts. An air jet is directed onto a plant to be multiplied. For this purpose a sealing screen is arranged around the plant, which screen also serves as extractor (32) for the removed parts and provides sealing with respect to the substrate in which the plants have been planted. The direction of the jet of air directed onto the plant can be continually changed in order to optimise multiplication. The separated parts can then be detected with the aid of a vision system (13) and placed individually with the aid of a grab (15) in a subsequent substrate, for example contained in a tray, or first subjected to a further mechanical dividing operation.
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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.
Method and device for multiplying tissue parts

The present invention relates to a method for removing parts of plants, comprising directing a stream of fluid onto each plant.

A method of this type is disclosed in EP 0 238 430 A1. This publication describes a method for removing leaves from certain large plants, such as cabbage varieties, lettuce and the like. In this context the outermost leaves are often of poorer quality and these are removed with the aid of a blowing device before the product concerned is marketed. For this purpose air is blown onto the plant with the aid of a number of air jets some height above the cabbage or other plant concerned, the outer leaves being blown away. These leaves are collected as waste beneath the device.

When multiplying tissue, very small plants, which in general are supplied in large numbers in trays, are treated in such a way that specific leaf parts thereof are separated off, which leaf parts are then introduced into a new substrate. One example of such multiplication of tissue parts is the multiplication of lilies. However, it must be understood that other plants can also be multiplied in this way. Such multiplication takes place under optimised conditions which approximate to or even are clean room conditions. The multiplication of tissue parts is highly accurate and labour-intensive work. High concentration is necessary at all times.

The aim of the present invention is as far as possible to mechanise this action for the multiplication of tissue parts, it being ensured that there is no or negligible loss of the parts freed. Moreover, the number of plant parts produced must be comparable with what was achievable in the state of the art, that is to say by dividing by hand.

The aim is achieved with a method as described above in that an extractor that guides the fluid stream and the parts to be removed is fitted around said plant, which extractor substantially seals against the substrate in which the plants have been planted.

The method described above disclosed in EP 0 238 430 A1 is not suitable for multiplying tissue parts. After all, if the blowing construction according to this European Patent Application were to be fitted on a tray containing plant parts, the most that could be achieved would be that all plant parts are blown away.

According to the invention it is proposed to deal with each plant or group of plants individually and to close off said plant or group of plants from the surroundings as far as possible. That is to say, if air is used as fluid, this air is not able to escape or is barely able
to escape in the direction of the substrate in which the plants have been planted. This sealing ensures that all parts that are obtained by the method according to the invention are actually also extracted with the aid of the extractor. These parts are the product to be obtained. The extractor can be an extractor tube. Surprisingly, it has been found that it is possible to divide a plant into small parts using an air jet, which parts are, in turn, suitable as the basis for a subsequent plant.

Division of the plant is possible by directing a fluid jet onto the plant for a short time. According to an advantageous embodiment of the invention, a fluid jet is brought into different positions with respect to the plant, so that optimum division of the plant is always ensured.

According to an advantageous embodiment of the invention, after the plant has been divided the parts transported by the extractor (tube) are placed on a movable plate. The latter can be moved by a robot or other transport device. In this context it is possible to register the position of the various plant parts that have just been obtained and to record this with a vision system. Such a system, that consists of a camera and a control, makes it possible, for example, to control a grab. This grab can grasp each of the plant parts obtained and place this in a separate space in a subsequent tray. According to an advantageous embodiment of the invention it is also possible to subject such parts to a further dividing operation before they are placed in a tray. This dividing operation can, for example, be a mechanical dividing operation.

According to an advantageous embodiment, an operation in which undesired parts of the plant, such as leaves and other parts, can be removed can take place before the dividing operation.

The invention also relates to a device for removing parts of plants. This device is provided with means for closing off each of said plants from the surroundings as far as possible and more particularly to ensure that the effect of the fluid jet, such as an air jet, is exclusively to blow away parts of the plant concerned.

The further measures described above can, of course, be translated into suitable devices. The grab means are preferably so constructed that a plant part is grasped with the aid of two jaws. The plant part is taken up between these two jaws, but these jaws are of such construction that after separating the plant parts, for example with the aid of a cutting device which passes between the two jaws, the resulting two parts are still each held in the respective jaw. Each of the jaws then positions the plant parts in the relevant compartment.
of the next tray.

Undesired material that is around the plant, such as leaves, can be removed prior to the actual division of the tissue with the aid of the device described above for removing parts of plants. According to an advantageous embodiment, removal takes place using a device consisting of a hollow pipe that is to be placed over the central part of the plant and at least the bottom section of which can be driven such that it rotates. This rotating bottom section is provided with cutting means by means of which the undesired parts concerned can be cut off. A reduced pressure can be generated in the cavity, as a result of which material cut off can be extracted. If mineral wool or similar material is used as substrate, the rotary blade can extend (a few millimetres) into the substrate. By this means, the hollow pipe is closed off at the bottom and it is possible to generate reduced pressure, by means of which parts that have been cut off can be extracted.

The device described above is, of course, constructed with means which as far as possible counteract contamination. Sterilisation means are fitted and these can consist of simple heating means. If, for example, the various parts of the transport mechanism are treated with hot air (for example 600 °C) for a short time, sterility can be ensured. Moreover, contamination is prevented to a large extent by working with a succession of plates.

With the aid of the invention it is possible to work at a very high capacity. At least 1,000 tissue parts per hour can be placed in the extractor tray. By means of the invention it is possible to make use not only of the leaf parts but also of the central, harder bulbous part. This is, of course, dependent on the plant used.

The invention will be explained in more detail below with reference to an illustrative embodiment shown in the drawing.

In the drawing:

Fig. 1 shows, diagrammatically, a view of an installation according to the invention;

Fig. 2 shows, in cross-section, in detail the device for multiplying plants according to the invention; and

Fig. 3 shows a detail of the cutting device for leaf.

Fig. 1 shows, diagrammatically, an installation in which the device according to the present invention is incorporated. This installation consists of a multiplying device 1, a dividing device 2 adjoining the latter and a removal device 3 where the multiplied parts are placed in a new tray. The multiplying device 1 consists of a dividing device 5, which is
shown in more detail in Fig. 2. This dividing device 5 is positioned with the aid of a robot arm 4. A tray 7 can be placed on a positioning table 6, which is not shown in full. Dividing device 5 is mounted on a subframe 39 together with the cutting device 40 to be discussed with reference to Fig. 3.

Material coming from the dividing device 5 is transferred to a plate 9. This plate 9 originates from rotary conveyor 37 on the central unit 11. This conveyor 37 rotates in the direction of arrow 38. There is a stationary barrier 39, so that the plates 9 are pushed into a fixed position in contact with this stationary barrier 39. The plate can be picked up from this position by the dividing device 5 and provided with material. After placing material on plate 9, the latter is then placed on the other side of barrier 39 and continues in rotary movement to conveyor 40, which is constructed such that it is rotatable in the same direction and which accepts the plates in recesses 41 provided for this purpose. The plate with the plant parts placed thereon is then detected and registered with the aid of a vision device 13. The camera of the vision system 13 is indicated by 14. At this point in time the plate concerned is moved from the central unit 11, that serves as a store, to the removal unit 3. Vision system 13 is provided with a control by means of which it is possible, inter alia, to control robot arm 15 provided with a grab. By means of the robot arm, individual parts can be grasped and picked up from the plate with the aid of the grab. These individual parts are then moved to a cutting device, indicated highly diagrammatically by 17, where division takes place. The grab is so constructed that it consists of two jaws between which the part concerned is positioned. During division in cutting device 17, a blade or the like is passed between the jaws. The two halves of the part concerned then remain attached to the grab and are moved into individual receptacles in tray 19. This tray 19 is placed on a positioning table 18. When the tray is full, it is transferred to exit conveyor 20.

A sterilisation device is shown diagrammatically by 21. Before they are returned to the multiplying device 1, empty plates are subjected to brief heating at high temperature in order to kill any microorganisms that may still be present.

The mode of operation of dividing device 5 is illustrated in more detail with reference to Figure 2. This dividing device 5 is placed above the relevant plant 22 with the aid of robot arm 4 (Fig. 1). A closed chamber 23 is then formed around this plant by a convex diaphragm-like construction consisting of a number of convex parts 24. These are controlled with the aid of a transfer mechanism 25 that, in turn, is controlled with the aid of an actuating cylinder 26 such as a compressed air cylinder. After closing has taken place
(during which the plant 22 is not damaged), air is supplied via line 31 by means of a blowpipe 28 arranged in chamber 27. This blowpipe 28 is mounted with the aid of a ball joint 35 and blows directly or indirectly onto the plant 22. During blowing, motor 29 is operated and, via transmission 30, the free end of the blowpipe 28 describes a specific path over the cross-sectional surface of the chamber 23.

As already indicated, during this operation a jet of fluid, such as air, can impinge directly or indirectly on the plant. Air can be steered towards the plant via the sloping walls 36.

During this short, vigorous blowing operation, which lasts approximately 1 second, the parts that are separated off are moved from chamber 23 to extractor tube 32. Extractor tube 32 terminates in a funnel-shaped part 34 that is arranged above plate 9 and is clamped by a spring construction. The funnel-shaped part 34 is provided with openings through which it is possible for air, but not parts, to pass to the outside. The plate is provided with plant parts in this way. Surprisingly, it has been found that a particularly high yield can be obtained by this means. Closing off from the surroundings prevents parts other than plant parts from being extracted. The entire device 5 is then, as indicated above, moved with the aid of robot arm 4 to the central unit in order to release clamping of plate 9 there, that is to say plate 9 is deposited on the central device 1. The robot then continues to rotate a little further and an empty plate can be picked up from the other side of the central unit 11.

As already indicated, there is also a cutting device 40 on the subframe 39. This cutting device can be used if leaf has to be removed before the dividing operation, that is to say before device 5 comes into operation. The various features are indicated in more detail in Fig. 3. The leaf to be removed is indicated by 41. A rotary cylindrical cutting blade 42 is placed above the plant 22. This cutting blade is mounted on bearings in housing 43 and is driven with the aid of a belt 44 or in some other way by motor 45. The cylindrical blade 42 is of hollow construction and is connected to a suction hose 46.

Although the invention has been described above with reference to a preferred embodiment, it will be understood that numerous modifications can be made thereto. For instance, the moving jet of fluid or air can be generated in another way. Theoretically it is even possible to work with a single stationary jet. Moreover, it is possible to activate various blowing positions successively or simultaneously by means of a number of nozzles. These and further modifications fall within the scope of the present invention for which rights are requested in the appended claims. The same applies in respect of further
embodiments for the further treatment of the plant parts thus obtained.
Claims

1. Method for removing parts of plants, comprising directing a stream of fluid onto each plant, characterised in that an extractor that guides the fluid stream and the parts to be removed is fitted around each of said plants, which extractor substantially seals against the substrate in which the plants have been planted.

2. Method according to Claim 1, wherein said fluid jet is moved relative to said plant while removing said parts.

3. Method according to one of the preceding claims, wherein said removed parts are collected on a movable plate downstream of said extractor.

4. Method according to Claim 3, wherein said removed parts are submitted individually and placed in a nutrient medium.

5. Method according to Claim 3 or 4, wherein said removed parts are divided after they have been grasped individually and before they are placed in the nutrient medium.

6. Method according to one of the preceding claims, wherein said plants are lilies.

7. Method according to one of the preceding claims, wherein said fluid is air.

8. Method according to one of the preceding claims, wherein material (leaves) present around the plant is detached by a rotary cutting movement before the plant is divided.

9. Device (5) for removing parts of plants, comprising positioning means (6) for said plants, blowing means (28) for directing a jet of fluid towards each of said plants and extractor means for said removed parts, characterised in that said extractor means comprise an extractor (23, 32) extending around said plant.

10. Device according to Claim 9 comprising operating means (26) for bringing said extractor into a sealing position with respect to the substrate of said plant.

11. Device according to Claim 9 or 10, wherein a support (10) for a plate receptacle (9) for said plant parts is arranged at the downstream end of said extractor.

12. Device according to one of Claims 9 - 11, comprising vision means (13) for detecting and registering plant parts placed on a plate.

13. Device according to Claim 12, comprising grab means (16) for said plant controlled by said vision means.

14. Device according to one of Claims 9 - 13, comprising mechanical dividing means (17) for said plant.

15. Device according to one of the preceding claims, comprising cutting means for
removing parts present around said plant.
**INTERNATIONAL SEARCH REPORT**

**A. CLASSIFICATION OF SUBJECT MATTER**

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According to international Patent Classification (IPC) or to both national classification and IPC

**B. FIELDS SEARCHED**

Minimum documentation searched (classification system followed by classification symbols)

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Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

EPO-Internal, WPI Data

**C. DOCUMENTS CONSIDERED TO BE RELEVANT**

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**Authorized officer**

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