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(71) Applicant: **PERMX B.V.**
Wildekamp 1b
NL-6704 AT Wageningen(NL)

(72) Inventor: **Van Oeveren, Jacobus Johannes**
Chemin de la Croix de Chôdes 12
B-4890 Malmedy(BE)

(74) Representative: **Boelsma, Gerben Harm, Ir. et al**
Octrooibureau Polak & Charlouis Laan
Copes van Cattenburch 80
NL-2585 GD Den Haag(NL)

(54) **A device for filling and subsequent sealing of a capsule chain supplied in a flat-folded state from a supply coil.**

(57) A device for filling and subsequent sealing of a capsule chain, (2) in a flat-folded state from a supply coil (1) comprising a pair of cooperating drawing rollers (8) which are mounted for rotation about vertical axes, a travelling space connected to the outlet side of said rollers and confined by the opposite runs of a pair of upright positioned endless conveyor belts (13) filling means being provided above said space and a welding station (25) being connected to the outlet end of said travelling space, equipped with a pair of welding beams (25) positioned one opposite the other and extending in the travelling direction, perforations being provided in the outer surfaces of the drawing rollers, through which said surfaces are connected to a source of sub-atmospheric pressure at the outlet side of the roller pair, said opposite belt runs being also subjected to a source of sub-atmospheric pressure through perfora-

tions provided in supporting walls for said belt runs. According to the invention two endless belts (6) are provided between the supply coil (1) and the drawing roller pair (8) adjacent the upper edge of the capsule chain (2) said belts being positioned in a horizontal plane and mating with grooves in the circumferential surface of the respective, driven drawing rollers, the adjacent runs of said belts being adapted to clamp the upper edge of the capsule chain between them, while at the outlet end of the travelling space there is also at least one pair of endless belts positioned on either side of the path of the capsule chain in a substantially horizontal plane adjacent the upper edge of the capsule chain, said belts being guided about pulleys adapted to be driven at a speed corresponding to the drawing off speed.

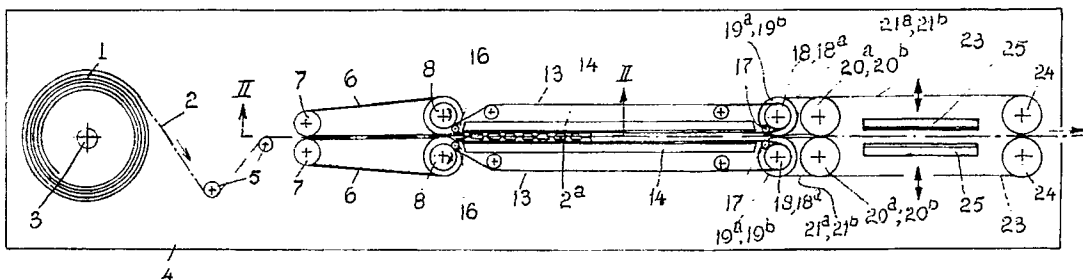


FIG.1

The invention relates to a device for filling and subsequent sealing of a capsule chain which is unrolled in a flat-folded state from a supply coil, comprising a pair of cooperating drawing rollers, which are mounted for rotation about vertical axes, a travelling space connected to the outlet side of said rollers and confined by the opposite runs of a pair of upright positioned endless conveyor belts, filling means being provided above said space and a welding station being connected to the outlet end of said travelling space, equipped with a pair of welding beams positioned one opposite the other and extending in the travelling direction, perforations being provided in the outer surfaces of the drawing rollers, through which said surfaces are connected to a source of sub-atmospheric pressure at the outlet side of the roller pair, said opposite belt runs being also subjected to a source of sub-atmospheric pressure through perforations provided in supporting walls for said belt runs.

A capsule chain is to be understood as a double-walled band of a suitable plastics material, which is divided - by providing seals at right angles to the longitudinal direction of the band - into a plurality of juxtaposed compartments or "capsules". Such a capsule chain may e.g. be obtained by starting from an extruded tube, which is cut - in a flat folded state - into two halves along its longitudinal axis, so that two double-walled bands are produced, which are then each divided into capsules.

A device of the type indicated hereinabove, is described in Dutch patent application 8902032, said device being more particularly suitable for carrying out a method for the vegetative propagation of plantlets, whereby in a sterile environment starting material is placed in individual membrane capsules, into which an amount of nutrient medium for the material to be propagated or to be rooted is introduced in an earlier stage.

In use of this device the capsule chain, which is drawn in a flat folded state from a supply package (e.g. a supply roll mounted for unrolling about a vertical axis) has to be opened at the outlet side of the drawing roller pair and has to remain open on its way through the travelling space in order to be filled. This means that the capsule chain will - at the transition towards the travelling space - undergo a certain decrease in length in comparison with the flat-folded state and the travelling speed through the travelling space will be correspondingly lower than the unrolling speed. At the transition from the travelling space to the welding station this decrease in length has to be compensated again so as to permit the filled capsule chain to be sealed in a stretched condition along its upper edge.

With the device according to the above men-

tioned patent application the stretching of the filled capsule chain required to allow the latter to be sealed, is effected by means of two pair of clamping jaws, one pair of which - viz. that pair which is located adjacent the outlet side of the travelling space - is positioned stationary as seen in the travelling direction, whereas the second pair of clamping jaws - which is provided at a downstream location - is mounted to be reciprocated in the travelling direction. These clamping jaws are periodically operated during the filling stage, when the capsule chain is stationary.

The present invention aims at improving the device according to the above mentioned patent application, such, that the introduction of the leading end of a capsule supply into the nib between the cooperating drawing off rollers may take place under sterile conditions and without human assistance, while the stretching of the filled capsule chain may be effected in a simpler manner i.e. without the use of clamping jaws which require an intermittent displacement of the capsule chain.

In accordance with the invention this aim is achieved in that two endless belts are provided between the supply coil and the drawing roller pair, adjacent the upper edge of the capsule chain, said belts being positioned in a horizontal plane and mating with grooves in the circumferential surface of the respective, driven drawing rollers, the adjacent runs of said belts being adapted to clamp the upper edge of the capsule chain between them, while at the outlet end of the travelling space there is also at least one pair of endless belts positioned on either side of the travelling path of the capsule chain in a substantially horizontal plane adjacent the upper edge of the capsule chain, said belts being guided about pulleys adapted to be driven at a speed corresponding to the unrolling speed.

The pair of belts at the inlet side may be provided, like the device itself, within a sterile space, so that the capsule chain will arrive at the drawing off rollers in a sterile condition, which is an absolute requirement when using the device for the propagation of cells and tissue, e.g. for the vegetative propagation of plant material. The use of a similar pair of belts (or a plurality of such pairs positioned in vertically spaced relationship) results in a uniform stretching of the filled capsule chain, when the latter is leaving the travelling space under the filling means. Due to this a continuous displacement of the capsule chain under the filling means (which in that case will have to move along with the capsule chain and then be returned) may take place, if desired.

The invention will be hereinafter, by way of example, further explained with reference to the drawing.

Fig. 1 is a diagrammatic view of the device of

the invention;

fig. 2 is an enlarged diagrammatic view, as seen from the plane II-II in fig. 1, of a portion of the device at the transition between the drawing off rollers and the travelling space and

fig. 3 is a diagrammatic view of a portion of the device, located at the transition between the travelling space and the welding station.

The device shown in fig. 1-3 is an improvement of the device shown in fig. 1 of EP-A-0412621 and serving for the same purpose.

Like in EP-A-0412621, a plurality of such devices may be disposed one parallel to the other, in which case one device constitutes e.g. a production line for plantlets to be propagated and a second device is serving as a production line for plantlets to be rooted. Such production lines may be disposed longitudinally offset to an extent corresponding to the length of a processing station, while the drive means of the devices may be interconnected.

In the drawing 1 designates a supply roll coiled from a capsule chain 2. The capsule chain 2 consists of a double-walled membrane foil of plastics material, which is divided into a plurality of juxtaposed compartments ("capsules") which are separated by individual seals extending perpendicular to the longitudinal direction of the foil.

The supply roll 1 is mounted on a base 4 for rotation about a vertical axis 3.

The capsule chain 2 is guided in an upright position, via guide rollers 5, towards the inlet area between two cooperating endless belts 6, which are disposed in a common horizontal plane. The belts 6 are guided about upstream rollers 7 and about downstream drawing off rollers 8, the latter rollers being driven in the arrow direction by drive means (not shown) provided under the base 4. The belts 6 are received in circumferential grooves in the peripheral surface of the drawing off rollers 8. The capsule chain 2, unrolled from the supply roll 1 in a flat-folded state, is guided, while clamped between the adjacent runs of the belts 6, towards the nib between the cooperating drawing off rollers 8.

The drawing off rollers 8 (vide fig. 2) each comprise an outer drum 9 which is mounted for rotation about a vertical axis around a fixed drum 10, that is connected to a vacuum conduit not shown. The outer drum is provided with perforations which are disposed in two vertically spaced annular zones 11. The perforations of the outer drum are inwardly covered by the fixed drum 10 along the greater part of its circumferential surface. It is only in the outlet nib between the drawing off rollers that the perforations of the outer drum are in free connection with the drum 10 so that a vacuum generated within the latter, is allowed to act upon

the outcoming capsule chain and cause the capsule entering into said outlet nib to open (compare also fig. 2 of EP-A-0412621).

The capsule chain 2 with its thus opened capsules 2a is then guided from said outlet nib into the travelling space between two pair of cooperating endless conveyor belts 13. The parallel opposite runs of these pairs of conveyor belts are guided along the opposite walls of two vacuum chambers 14 disposed on either sides of the travelling path of the capsule chain. The opposite walls of the vacuum chambers 14 are perforated in the region of the adjacent runs of the air pervious conveyor belts. The relatively narrow belts 13 are guided, at the upstream ends of the vacuum chamber 14, around guiding members 16 which are disposed in annular recesses 15 provided in the outer surfaces of the drawing off rollers between the two perforated annular zones and under the lower perforated annular zone respectively.

By having the belts 13 extend until into the annular recesses 15 of the drawing off rollers 8 the risk for an excessive bulging out in the transitional area between the drawing off rollers 8 and the travelling space between the belts 13, is avoided.

At the downstream end of the vacuum chambers 4 the belts 13 are guided, via similar guiding members 17, about the portions 18a of a pair of drive rollers 18, which are driven with the same annular speed as the drawing off rollers 8. Due to the smaller diameter of the drive roller portions 18a the belts 13 will be driven at a speed which is correspondingly lower than the speed at which the capsule chain is supplied from the drawing off rollers 8.

Vertically spaced upper and lower pulleys 19a and 19b are mounted for free rotation about each roller 18. The roller portions 18a guiding the belts 13 are located between said pulleys and under the lower pulley 19b respectively. Said pulleys have a diameter corresponding to that of the belt-groove comprising portions of the drawing off rollers 8. Each pair of pulleys 19a, 19b located at the same side of the travelling path of the capsule chain is cooperating with a downstream disposed second pair of pulleys 20a, 20b on a shaft 20c which is driven at the same nominal annular speed as the drawing off rollers 8. The upper pulleys 19a and 20a on each side of the travelling path are interconnected by a belt 21a, whereas the lower pulleys 19b and 20b are interconnected by a belt 21b.

The chambers 14 are connected to a vacuum source not further shown. The underpressure created within the chambers 14 causes the walls of the opened capsule chain to be sucked against the cooperating runs of the conveyor belts 11. The capsule chain 2 will thus be frictionally engaged by the conveyor belts 13 and taken along in the travel-

ling direction. The travelling speed through the travelling space is reduced relative to the unrolling speed of the still flat-folded capsule chain to an extent corresponding to the decrease in length caused by the opening of the capsules in the capsule chain. The capsule chain may be supported at its lower edge - which is formed by the bottoms of the individual capsules - on a vertically adjustable support, in a manner as described in the above cited reference.

Over the trajectory of the capsule chain 2 determined by the conveyor belts 13, there are provided means for filling the opened capsules from above. These means do not make part of the present invention and therefore will not be further shown.

Upon leaving the travelling space the filled capsule chain 2 is gripped - along two horizontal lines in the upper marginal area - by the cooperating runs of the two pairs of belts 21a, 21a and 21b, 21b and stretched thereby to its original length. The two lower pulleys 20b are provided with an additional circumferential groove for guiding an additional pair of belts 23, the cooperating runs of which are engaging the stretched and filled capsule chain 2 at a slight distance under the upper edge of said chain and which are guided about downstream guide rollers 24. These belts 23, which are driven at a speed corresponding to the unrolling speed, pass the filled and stretched capsule chain through the welding station between the roller pairs 20 and 24, which station comprises two welding beams 25 which are movable one relative to the other in a transverse direction. By means of these welding beams the upper marginal areas 26 of the two walls of the capsule chain 2 may be heat-sealed. The two welding beams 25 are periodically - i.e. each time after a series of e.g. eight capsules has been filled - mutually displaced into the closed position. In case the travel of the capsule chain through the device is continuous, the welding beam pair will have to be simultaneously displaced in the travelling direction and this will require adequate space between the downstream end of the welding beam pair and the roller pair 24. Instead of welding beams use could also be made of a so-called roll-welding device.

The sealed capsule chain 2 leaving the outlet nib between the rollers 24 may be collected in the form of a zig-zag folded package and deposited in a supply container, in a manner as shown in the above reference.

In practical use the above device is completely surrounded by a so-called "sterile cloud", which may be generated as a vertical sterile stream of air between a panel (not shown) covering the upper-side of the device and the base 4 which serves as a support for the various parts of the device.

Claims

1. A device for filling and subsequent sealing of a capsule chain in a flat-folded state from a supply coil, comprising a pair of cooperating drawing rollers, which are mounted for rotation about vertical axes, a travelling space connected to the outlet side of said rollers and confined by the opposite runs of a pair of upright positioned endless conveyor belts, filling means being provided above said space and a welding station being connected to the outlet end of said travelling space, equipped with a pair of welding beams positioned one opposite the other and extending in the travelling direction, perforations being provided in the outer surfaces of the drawing rollers, through which said surfaces are connected to a source of sub-atmospheric pressure at the outlet side of the roller pair, said opposite belt runs being also subjected to a source of sub-atmospheric pressure through perforations provided in supporting walls for said belt runs, characterized in that two endless belts are provided between the supply coil and the drawing roller pair, adjacent the upper edge of the capsule chain, said belts being positioned in a horizontal plane and mating with grooves in the circumferential surface of the respective, driven drawing rollers, the adjacent runs of said belts being adapted to clamp the upper edge of the capsule chain between them, while at the outlet end of the travelling space there is also at least one pair of endless belts positioned on either side of the path of the capsule chain in a substantially horizontal plane adjacent the upper edge of the capsule chain, said belts being guided about pulleys adapted to be driven at a speed corresponding to the drawing off speed.
2. A device according to claim 1, characterized in that at the upstream end of the travelling space each of the conveyor belts are extending, in the upstream direction, until into a circumferential recess in the outer surface of the respective drawing off roller and is guided about a guide roller or guide pin provided within said recess.
3. A device according to claim 2, characterized in that the annular recesses in the outer surface of the drawing off rollers are located between non-recessed annular portions, in which the perforations are provided.
4. A device according to claims 1-3, characterized in that the welding beams are positioned

in a plane just over a substantially horizontal plane through two cooperating endless drive belts, which are guided about pairs of pulleys, which are adapted to be driven at a speed corresponding to the unrolling speed and are positioned at the beginning and the end respectively of the welding station.

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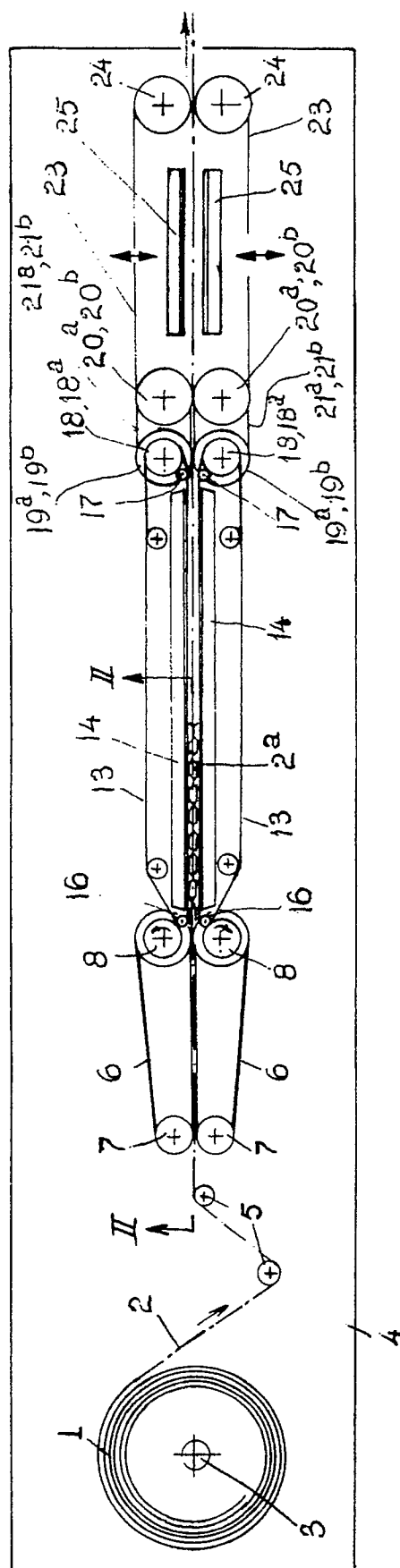


FIG. 1

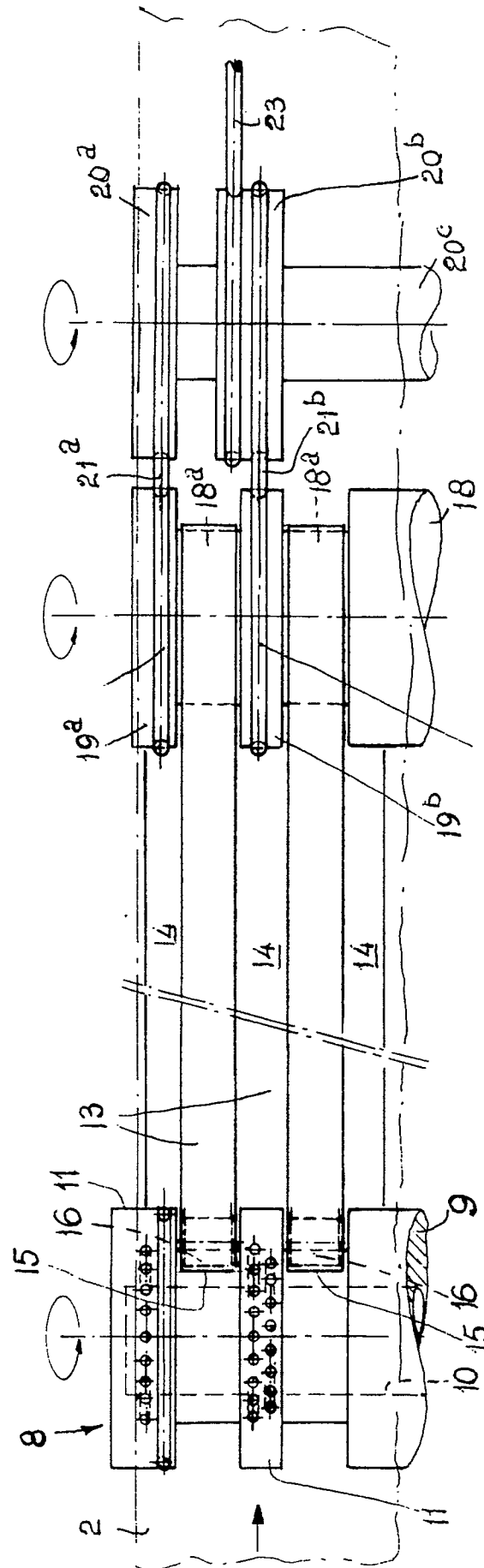


FIG. 2

FIG. 3



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EUROPEAN SEARCH REPORT

Application Number

EP 91 20 0648

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int. Cl.5)
X,Y	US-A-3 699 746 (O. TITCHENAL) * column 4, line 29 - column 6, line 62; figures 7,8 * - - -	1,2,4,3	B 65 B 43/12
Y	EP-A-0 071 736 (FÖCKE) * page 6, line 21 - page 7, line 28; figures 1,2 * - - -	3	
A	US-A-3 817 017 (O. TITCHENAL) * column 6, line 34 - column 7, line 48; figures 5,6 * - - -	1,2,4	
A	US-A-3 583 127 (J. MARCHAND) - - - - -		
			TECHNICAL FIELDS SEARCHED (Int. Cl.5)
			B 65 B
The present search report has been drawn up for all claims			
Place of search The Hague		Date of completion of search 07 June 91	Examiner JAGUSIAK A.H.G.
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