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(71) Applicant and

(72) Inventor: **GUROV, George, Stefanov** [BG/BG]; z.k.
Strelbishte, bl.87, entr.A, apt.4, 1404 Sofia (BG).

(74) Agent: **LEKOVA, Tatyana, Boyanova**; 136, Hristo Botev
Blvd., 1202 Sofia (BG).

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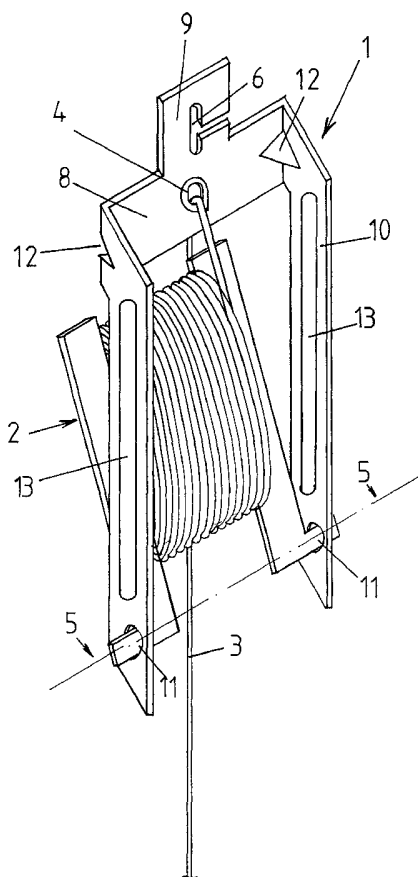
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(54) Title: SUSPENSION MECHANISM FOR GREENHOUSE PLANTS



(57) Abstract: A suspension mechanism for greenhouse plants, comprising a pulley with thread for suspending the plant and a catching part, characterized by that a hole is shaped in the catching part (1) for the thread (3) to pass through, the axis of rotation (5) of the pulley being replaced with respect to the straight line (P) as defined by the point of suspension of the catching part to the bearing wire (7) and the hole (4) for the thread (3) to pass through, the axis of rotation (5) of the pulley being replaced with respect to the turn axis and disposed outside the maximum wound thread (3) area.



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SUSPENSION MECHANISM FOR GREENHOUSE PLANTS

5 Field of Invention

The present invention relates to a suspension mechanism for greenhouse plants finding application in all known kinds of greenhouse constructions.

10

Prior Art

At present, basically two constructions of plant suspension mechanisms are used in the cultivation of greenhouse plants, such as tomatoes and cucumbers.

One of the known mechanisms represents a plastic pulley with a thread wound around it, the thread serving for the greenhouse plant to be attached thereto, so that the plant does not bend beneath its own weight during the process of growing up. A bearer is shaped at one of the pulley flanges, the top end of said bearer being curved so as to form a hook catching the bearing wire, the latter being disposed parallel and above the respective line of the greenhouse field of plants. This known mechanism is used as follows: when the plant grows up to a certain height (e.g. 1.5 to 3 m), the mechanism is manually taken down, the thread is unwound up to a certain length, whereupon the mechanism is hooked again to the bearing wire. In order to perform these operations, the attendants have to climb a

ladder for each single plant and work with two hands, this being a slow and labour-consuming process.

The other known mechanism, widely used in greenhouses, also consists of a pulley with a thread wound around it, on both sides of the pulley side flanges and along its rotation axis there being shaped bulges with a specifically bent steel wire joined thereto, so that an end section is shaped as a hook catching the bearing wire. This catching part of the known mechanism includes also a springy arm which, when in a loose state, catches a finger shaped on one of the pulley side flanges. When exerting pressure on the springy arm, the latter releases the finger so that the pulley could turn. After the thread gets unwound up to a certain length, the springy arm gets loose and the pulley stops rotating. The described known mechanism also requires climbing a ladder for each separate plant, both hands of the attendant being occupied because the plant has to be held when releasing the pulley in order to avoid unwinding of thread longer than is necessary. If the plant or the thread are not held, on release of the pulley the thread will get unwound under the influence of the plant weight until the springy arm of the mechanism gets loose.

Hence, a common disadvantage of the two widely used suspension mechanisms for greenhouse plants is the relatively difficult operation therewith and the long time needed to manipulate each single plant the way it is necessary to do when growing greenhouse plants.

Technical Essence of the Invention

So, the task of the present invention is to create a suspension
5 mechanism for greenhouse plants, which allows easy and fast
manipulation of each separate plant.

The task was performed by creating a suspension mechanism
for greenhouse plants, which consists of a pulley with a thread for
suspending the plant and a catching part. It is characteristic of the
10 mechanism that a hole is shaped in the catching part for the thread to
pass through, the axis of rotation of the pulley being displaced with
respect to the line as defined by the point of hooking of the catching
part to the bearing wire and the thread passing hole. The axis of
rotation of the pulley is displaced with respect to the turn axis and is
15 disposed outside the area of the maximum wound thread.

In an embodiment of the mechanism, the pulley represents an
H-shaped part with bulges at the bottom ends of the two side walls
thereof, the bulges being connected to the catching part with a
possibility to rotate. The transverse part of the pulley is disposed
20 asymmetrically, so that the bulges are outside the area of the
maximum wound thread.

It is suitable in this embodiment that partition elements
covering the wound thread area be shaped on both side walls of the
pulley.

25 In a further embodiment, the pulley represents a roller with
bulges shaped on its side flanges, said bulges being disposed
eccentrically towards the roller rotation axis and outside the area of
the maximum wound thread.

In still another embodiment, the catching part comprises a profile body consisting of an essentially flat top wall, the uppermost end of which is shaped as a hook to catch the bearing wire. A through hole is shaped in the center of the top wall for the thread to pass.

5 There are two side walls shaped on both side ends of the top wall, said two walls being essentially perpendicular to the flat top wall and running downwards from it. There are coaxial through holes at the bottom end of the two side walls, said holes being replaced in a direction opposite to the direction of unwinding of the pulley in

10 relation to the top wall, the pulley bulges being situated in the through holes.

It is advisable that the hole for the thread in the top wall be rounded.

It is advisable also that hollows be shaped at the places of

15 connection of the top wall to the side walls.

In another embodiment, each side wall is ribbed by a longitudinal groove with a bottom that is a part of the outside surface of the wall.

The advantages of the suspension mechanism for greenhouse

20 plants according to the invention consist in the effect of self-locking of the mechanism owing to the replacement of the pulley rotation axis with respect to the straight line as defined by the point of hooking of the catching part to the wire and the thread passing hole, as well as to the displacement of the pulley rotation axis with respect

25 to the turn axis and the disposition of the pulley rotation axis outside the area of the maximum wound thread. This effect allows a very fast and easy operation of the mechanism, the thread release needing just slight lifting (by one hand only) of the plant top or of the thread, as a

result of which the pulley gets free and performs one revolution, whereupon it gets self-locked again. The invention applied for is used without it being necessary for the attendant to climb a ladder, this helping cut down the time needed to manipulate a plant and, respectively, raise the efficiency of work in greenhouses.

Brief explanation of the drawings

Figure 1 represents a perspective view of the suspension mechanism for greenhouse plants according to the invention;

Figure 2 represents a side view of the mechanism in a locked and an unlocked position;

Figure 3 illustrates an embodiment of the pulley of the mechanism according to the invention;

Figure 4 illustrates another embodiment of the pulley of the mechanism according to the invention.

Embodiments of the invention

The suspension mechanism for greenhouse plants (Figs. 1 and 2) comprises a catching part 1 and a pulley 2 with a thread 3 wound thereon. There is a hole shaped in the catching part 1 for the thread 3 to pass through. The axis of rotation 5 of the pulley 2 is replaced (best seen in Fig. 2) with respect to the straight line P as defined by the point of hooking of the catching part 1 to the bearing wire 7 and the hole 4 for the thread 3 to pass through. The catching part 1 may be shaped as a profile body consisting of an essentially flat top wall

8, the uppermost end of which is shaped as a hook 9 to catch the bearing wire 7. The hole 4 is shaped in the center of the top wall 8 for the thread to pass through. There are two side walls 10 shaped on both side ends of the top wall 8, said two walls 10 being essentially perpendicular to the flat top wall 8 and running downwards from it. There are coaxial through holes 11 at the bottom end of the two side walls 10 so that their axis is replaced with respect to the straight line P at a distance d.

The hole 4 the thread 3 passes through may be rounded (e.g. by means of flaring). Such rounding prevents the thread 3 from fast wearing, and also helps avoid any undesirable arresting of the thread caused by the harder friction between the thread 3 and the wall of the hole 4 when there is no rounding.

In order to raise the strength of the construction, it is advisable that hollows 12 be shaped between the top wall 8 and the side walls 10, and ribs 13 be shaped along the side walls 10, the bottom of the ribs consisting of the outer surface of the walls 10.

Figure 3 illustrates an embodiment of the pulley 2. It may represent an H-shaped plate with the bulges 15 at the bottom end of the two side walls 14. The transverse part 16 is disposed asymmetrically, so that the bulges 15 be situated outside the area of the maximum wound thread 3. In this embodiment of the pulley, partition elements 17 may be shaped on the two side walls 14 for the purpose of preventing the thread from dropping out of the pulley area it is to be situated in. In order to facilitate the mechanical winding of the thread 3, it is advisable that a centring hole 20 be shaped in the side wall 14.

The embodiment of the pulley 2 as illustrated in Fig. 4 is of the roller type. The bulges 15 are connected to the side flanges 21 of the roller, and here again it is necessary that the bulges be disposed so as to be outside the wound thread area.

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Use of the invention

After the plant reaches a certain height, it is necessary to stabilize it vertically so as to prevent it from leaning to one side and possibly breaking. To this end, bearing wires 7 are disposed behind
10 the lines of plants usually at a height of 2 to 4 meters. The mechanism is suspended on the wires 7 by means of the hook 9. The free end of the thread 3 is dropped down to the ground and is attached to the plant stem. The plant is spirally wound around the thread 3.
15 The attachment operation is periodically effected until the plant top reaches the desired height (usually 1.5 to 3 m). In order to keep the plant top at that height, it is necessary that during the further growth of the plant it be periodically released downwards. In order to release the thread, it should be slightly lifted by one hand so that the pulley
20 could turn around the axis 5 beneath its own weight from the locked position (Fig. 2a) to the position as shown in Fig. 2b. On reaching this position, the plant, respectively the thread, gets loose and under the influence of the plant's weight the pulley turns to its stable locked position of Fig. 2a. This motion helps release a one-turn length of the
25 thread 3. If the plant is to be released more, the motion is repeated as many times as necessary.

The effect of self-locking of the mechanism according to the invention is achieved thanks to the replacement of the axis of rotation

of the whole pulley with respect to the winding axis and the disposition of the pulley rotation axis outside the area of disposition of the winding. The pulley turns beneath its own weight in the direction of unwinding of the thread 3 and returns back to its stable
5 locked position under the influence of the plant's weight thanks to the replacement of the axis of rotation 5 of the pulley 2 with respect to the straight line P in a direction opposite to the direction of unwinding of the pulley.

The members of the mechanism according to the invention
10 may be made of metal sheet materials, e.g. galvanized, aluminum or other corrosion-proof sheet iron, as well as of various plastic materials, wood, or suitable alloy castings.

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PATENT CLAIMS

1. A suspension mechanism for greenhouse plants, comprising a pulley with thread for suspending the plant and a catching part,
5 characterized by that a hole is shaped in the catching part (1) for the thread (3) to pass through, the axis of rotation (5) of the pulley being replaced with respect to the straight line (P) as defined by the point of suspension of the catching part to the bearing wire (7) and the hole
10 (4) for the thread (3) to pass through, the axis of rotation (5) of the pulley being replaced with respect to the turn axis and disposed outside the maximum wound thread (3) area.

2. A mechanism according to claim 1, characterized by that the pulley represents an H-shaped part with bulges (15) at the bottom end of its two side walls (14), said bulges (15) being connected to the
15 catching part (1) with a possibility to rotate, while the transverse part (16) of the pulley is asymmetrically disposed so that the bulges (15) are situated outside the area of the maximum wound thread (3).

3. A mechanism according to claim 2, characterized by that partition elements (17) are shaped on the two side walls (14) of the
20 pulley, said partition elements (17) covering the area of disposition of the wound thread (3).

4. A mechanism according to claim 1, characterized by that the pulley (2) represents a roller with bulges (15) shaped on the side flanges (21) thereof, said bulges being disposed eccentrically with
25 respect to the axis of rotation of the roller and outside the area of the maximum wound thread (3).

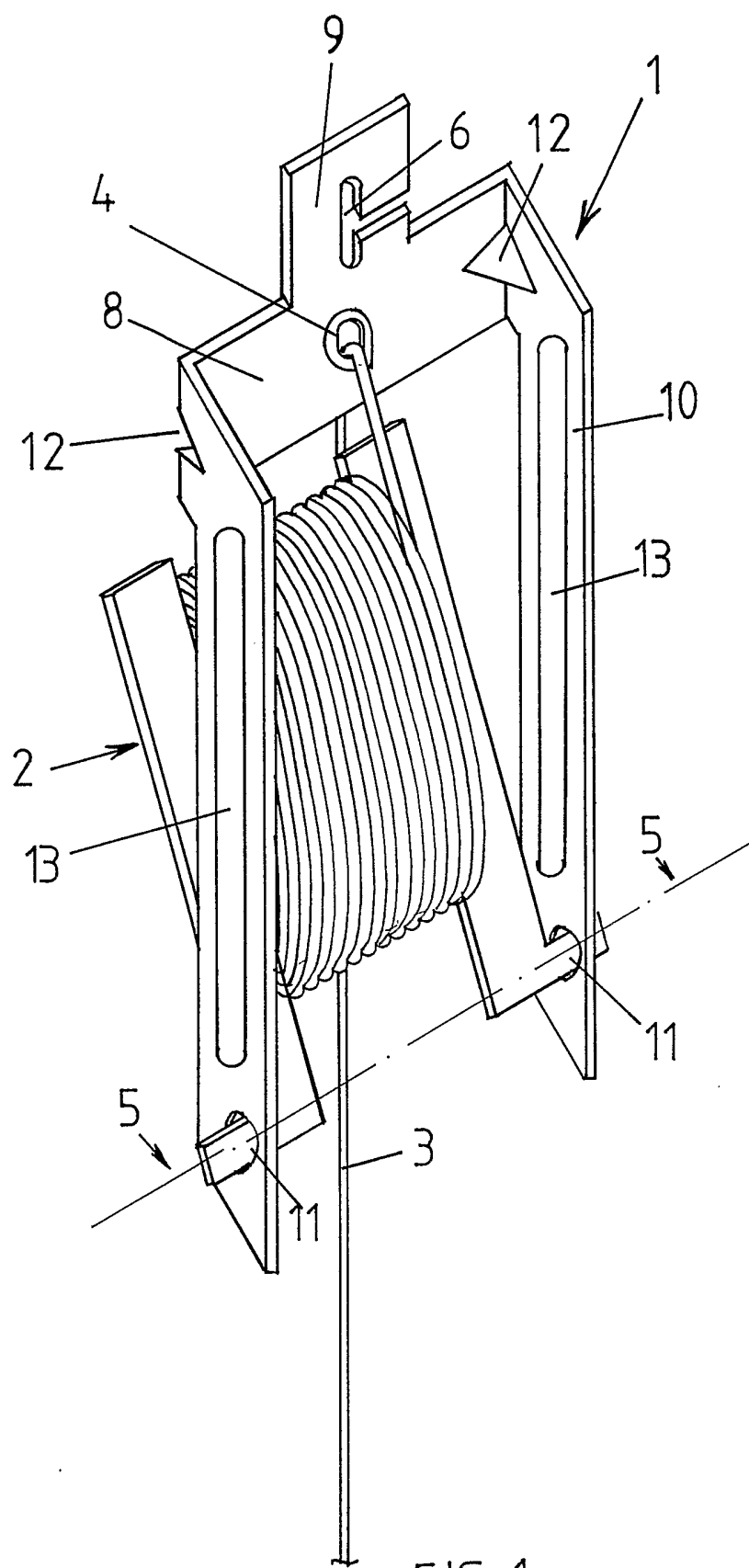
5. A mechanism according to claim 1, characterized by that the catching part (1) comprises a profile body consisting of an

essentially flat top wall (8), the uppermost end of which is shaped as a hook (9) to catch the bearing wire (7), while a through hole (4) is shaped in the center of the top wall (8) for the thread (3) to pass through, two side walls (10) being shaped on both side ends of the top wall (8), said two walls being essentially perpendicular to the flat top wall (8) and running downwards with respect to it, and coaxial through holes (11) are made at the bottom end of the two side walls (10), said holes (11) being replaced in a direction opposite to the direction of unwinding of the pulley (2) in relation to the top wall (8), the bulges (15) of the pulley (2) being situated in the through holes (11).

6. A mechanism according to claim 5, characterized by that the hole (4) in the top wall (8) is rounded.

7. A mechanism according to claim 5 or 6, characterized by that there are hollows (12) shaped at the places of connection of the top wall (8) to the side walls (10).

8. A mechanism according to one of claims 5 to 7, characterized by that each side wall (10) is ribbed by a longitudinal groove (13), whose bottom is a part of the outer surface of the wall (10).



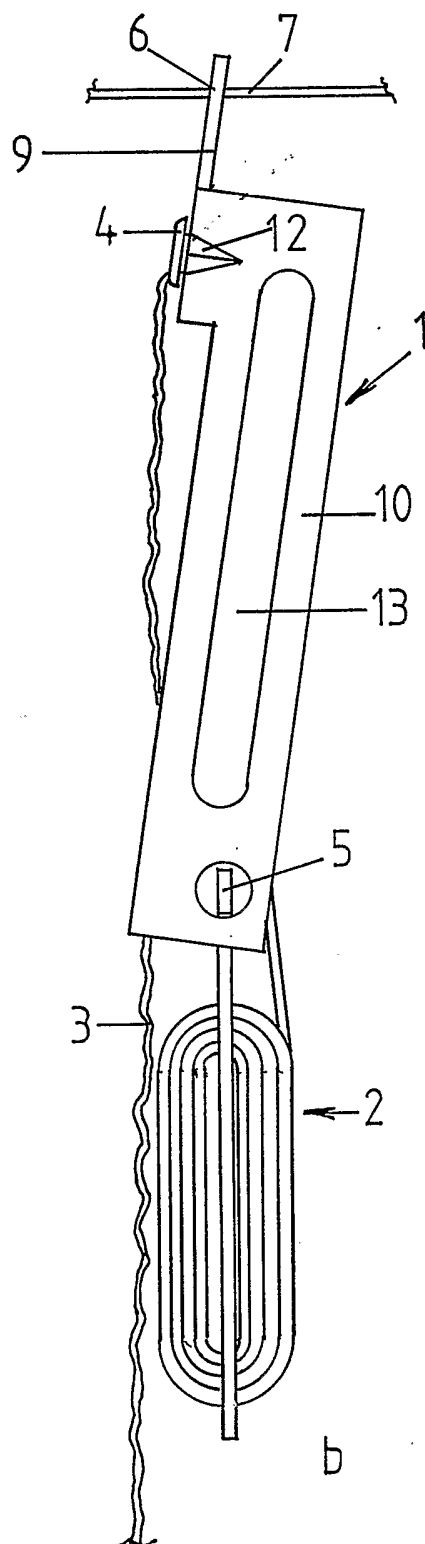
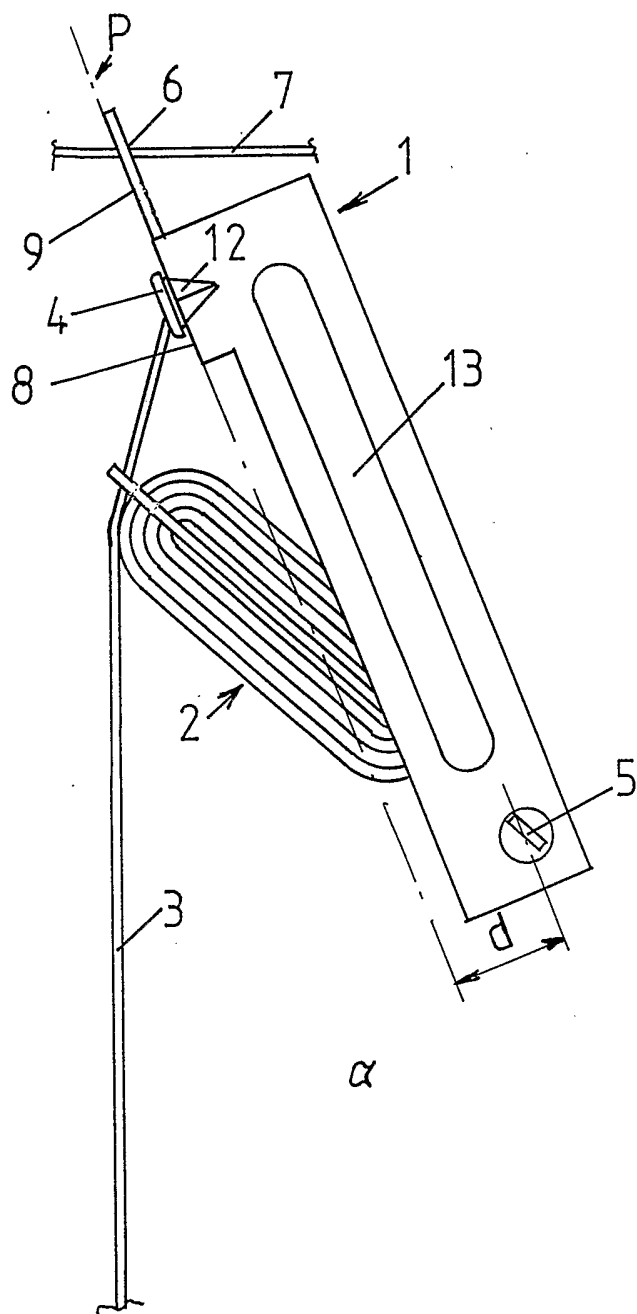


FIG. 2

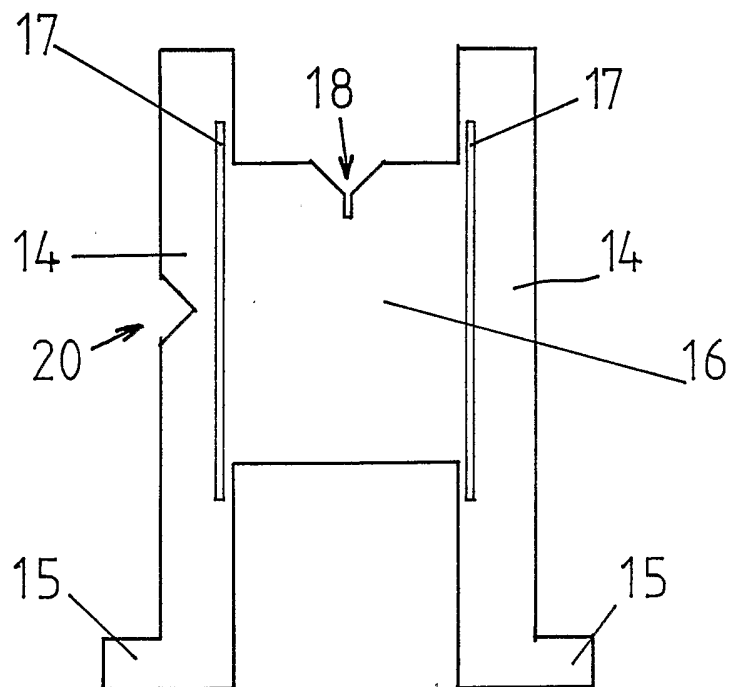


FIG. 3

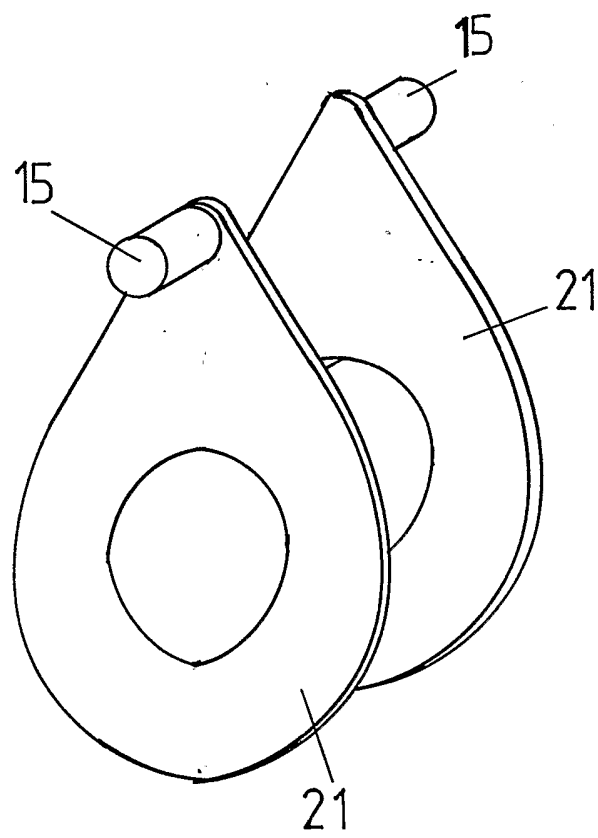


FIG. 4

INTERNATIONAL SEARCH REPORT

International Application No

PCT/BG 02/00009

A. CLASSIFICATION OF SUBJECT MATTER
IPC 7 A01G9/12

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)

IPC 7 A01G

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, PAJ, WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	WO 02 21904 A (SCHOENMAKER KAREL JAN ;CORSA BEHEER BV (NL); PRINS ADRIANUS (NL);) 21 March 2002 (2002-03-21) the whole document ----	1
A	GB 2 027 323 A (WAVIN BV) 20 February 1980 (1980-02-20) the whole document ----	1
A	FR 2 743 258 A (FILPACK) 11 July 1997 (1997-07-11) page 5, line 1 -page 6, line 14; figures ----	1
A	EP 0 273 491 B (DELISSE WILLEM JOZEF) 7 November 1990 (1990-11-07) claims; figures -----	1



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Patent family members are listed in annex.

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European Patent Office, P.B. 5818 Patentlaan 2
NL - 2280 HV Rijswijk
Tel. (+31-70) 340-2040, Tx. 31 651 epo nl,
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Merckx, A

INTERNATIONAL SEARCH REPORT

Information on patent family members

International Application No

PCT/BG 02/00009

Patent document cited in search report		Publication date	Patent family member(s)	Publication date
WO 0221904	A	21-03-2002	NL 1016210 C2	19-03-2002
			AU 1438402 A	26-03-2002
			WO 0221904 A1	21-03-2002
GB 2027323	A	20-02-1980	IE 781259 L	23-12-1979
			DK 264079 A	24-12-1979
			FR 2428969 A1	18-01-1980
FR 2743258	A	11-07-1997	IL 116722 A	06-12-2000
			BE 1012525 A3	05-12-2000
			ES 2147067 A1	16-08-2000
			FR 2743258 A1	11-07-1997
			NL 1004953 C2	30-09-1997
			NL 1004953 A1	10-07-1997
EP 0273491	B	06-07-1988	NL 8603039 A	16-06-1988
			AT 58042 T	15-11-1990
			DE 3766086 D1	13-12-1990
			EP 0273491 A1	06-07-1988