

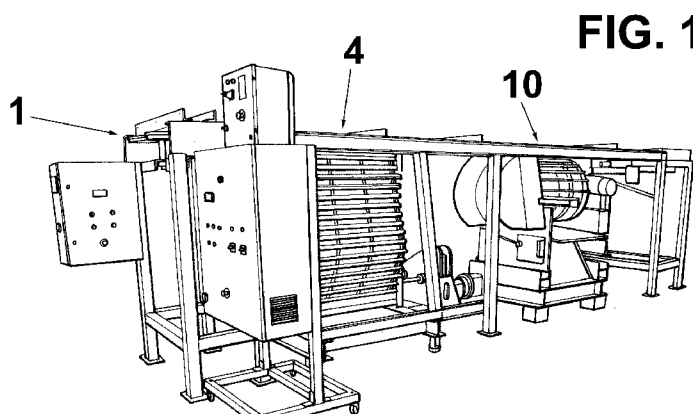


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- (54) Title: METHOD AND MACHINE FOR OBTAINING FIBER FROM LEAVES



(57) Abstract: The present invention relates to a method and a machine for obtaining fiber from leaves. The method comprises the steps of conveying the leaves (20) by conveying means (1); holding said leaves (20) in said holding means (2); linearly scraping said leaves (20) to leave them flat in a first scraping module (4); rotationally scraping said leaves (20) for removing residues from said leaves (20) in a second scraping module (10); separating fiber from the rest of the leaves (20); and depositing said fiber and the leaves (20) for collection. The machine comprises conveying means (1) and holding means (2) for conveying and holding the leaves (20); a first scraping module (4); a second scraping module (10); cutting means (14); and driving means (15) for driving the fibers out of the machine. The invention allows obtaining fiber in an automated manner with the subsequent economic gain with respect to productivity.





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METHOD AND MACHINE FOR OBTAINING FIBER FROM LEAVES

The present invention relates to a method and to a machine for obtaining fiber from leaves, particularly from the leaves of plant species belonging to the Musaceae, Agavaceae and Bromeliaceae families.

Background of the Invention

Fibers from the leaves of plant species belonging to the Musaceae, Agavaceae and Bromeliaceae families, for example, banana tree fibers, are a completely natural organic material that is very useful today. For example, it has been found that blending organic material with polymers is a viable alternative for increasing plastic degradation capacity and reducing the environmental impact, being able to further improve the mechanical characteristics of the product.

An example of said organic material that can be used as reinforcement is banana tree fiber.

A drawback of using banana tree fiber for industrial purposes is the cost for obtaining same since the machinery used today for extracting banana tree fiber is semi-automated, which leads to low productivity affecting the costs of obtaining the fiber.

Therefore, there is a need for a machine and a method which allows obtaining fiber from the leaves of plant species belonging to the Musaceae, Agavaceae and Bromeliaceae families in a manner that is as automated as possible, such that the productivity thereof is suitable for industrial application.

Description of the Invention

The method and the machine of the invention solve the mentioned drawbacks, presenting other advantages that will be described below.

According to a first aspect, the present invention relates to a method

for obtaining fiber from leaves, characterized in that it comprises the steps of:

- conveying the leaves by conveying means;
- holding said leaves in said conveying means;
- 5 - linearly scraping said leaves to leave them flat;
- rotationally scraping said leaves for removing residues from said leaves;
- separating the fiber from the rest of the leaves; and
- depositing said fiber and the leaves for collection.

10 Separating fiber from the rest of the leaf that remains as it is being held is advantageously performed by means of cutting.

15 Furthermore, to facilitate the entry of the leaves to a rotational scraping module, said leaves are preferably curled, and the entry to the first and second scraping modules is performed laterally or transversely with respect to the scraping direction in a continuous manner.

20 According to a second aspect, the present invention relates to a machine for obtaining fiber from leaves, characterized in that it comprises:

- conveying means and holding means for conveying and holding the leaves;
- a first scraping module where linear scraping of the leaves is performed;
- a second scraping module where rotational scraping of the leaves is performed; and
- 25 - cutting means where the separation of the fiber from said conveying means and holding means is performed; and
- driving means for driving the fibers out of the machine.

30 According to a preferred embodiment, said conveying means and holding means are chains provided with a plurality of complementary clamps, the separation between two complementary clamps being adjustable.

35 Said clamps preferably comprise notching and are divided into sections in said chains, the ends of said sections being curved and complementary with the adjacent sections.

According to a preferred embodiment, said first scraping module comprises two sets of movable blades placed beside one another, and the distance and/or angle between said sets of blades is advantageously variable.

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According to a preferred embodiment, said second scraping module comprises a curved surface, a thrust element pushing the leaves against said curved surface and a rotor provided with a plurality of blades, which blades scrape the leaves placed between the rotor and the curved surface, the separation between the rotor and the curved surface being advantageously variable.

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According to a preferred embodiment, said cutting means comprise two polygonal rotating blades, cutting the fibers as they intersect one another; for example, said rotating blades can be hexagonal.

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Furthermore, said driving means preferably comprise moving belts, although they may comprise any means suitable for driving the clean fibers out of the machine.

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The main advantage of being able to obtain fiber in an automated manner, with the subsequent economic gain with respect to productivity, is achieved with the method and the machine according to the present invention.

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Brief Description of the Drawings

To better understand what has been described above, several drawings schematically depicting a practical embodiment only by way of non-limiting example are attached.

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Figure 1 is a perspective view of the machine according to the present invention;

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Figure 2 is a schematic front view of one of the clamps of the machine according to the present invention, where the adjustable separation between

two complementary clamps can be seen;

Figure 3 is a schematic side view of two sections of clamps of the machine according to the present invention, where the curved ends of said sections can be seen;

Figure 4 is a perspective view of the first scraping module of the machine according to the present invention;

Figure 5 is a side elevational view of the second scraping module of the machine according to the present invention;

Figure 6 is a schematic elevational view of the cutting means of the machine according to the present invention; and

Figure 7 is a plan view of the driving means of the machine according to the present invention.

Description of a Preferred Embodiment

It must first be indicated that the leaves from which the fiber is obtained are leaves from plant species belonging to the Musaceae, Agavaceae and Bromeliaceae families, for example, banana (*Musa paradisiaca*), abaca (*Musa textilis*), sisal (*Agave sisalana*), pineapple (*Ananas comosus*), curauá (*Ananas erectifolius*), etc.

Figure 1 depicts a perspective view of the machine of the present invention comprising a pair of chains 1 provided with a plurality of complementary clamps 2. Said chains 1 convey the clamps 2 along the entire machine, and said clamps 2 hold the leaves 20 for passing them throughout the components of the machine that will be described below.

Said clamps 2 are divided into sections and their separation with respect to the other complementary section is variable in order to adapt to the dimensions of the leaves 20, as can be seen in Figure 2. Furthermore, the sections forming said clamps have curved ends 3, such that their ends 3

are complementary with the ends of the adjacent sections, as can be seen in Figure 3.

Once the leaves 20 are held by means of the clamps 2, they are conveyed to a first scraping module, generally indicated by means of reference number 4, where linear scraping is performed for the purpose of eliminating the curling of the leaves 20 by means of removing the concave layer, such that a flat leaf 20 is obtained.

Said linear scraping is performed by means of two sets of moving blades 5, the leaves 20 being placed between said two sets of blades 5, such that linear scraping will be performed when said blades 5 move (by means of a motor 9). It must be indicated that the distance and/or angle between said sets of blades 5 are variable in order to adjust to the dimensions of the leaves 20.

The entry to the first and second scraping modules 4, 10 is preferably performed laterally or transversely with respect to the scraping direction in a continuous manner.

The distance and/or angle between said sets of blades 5 can be changed by means of three shafts 6, 7, 8.

Once said linear scraping has been performed, the leaves 20 are conveyed to a second scraping module, generally indicated by means of reference number 10, where rotational scraping is performed to remove residues and obtain clean fiber.

Said rotational scraping module comprises a rotor 11 provided with a plurality of blades in its periphery. Said rotational scraping is performed against a curved surface 12 by means of the rotor 11, the leaf 20 being placed between the rotor 11 and the curved surface 12. The leaf 20 is curled by means of a thrust element 13, pushing the leaf 20 against said curved surface 12.

To achieve suitable rotational scraping, the rotor 11 is movable with

respect to said curved surface 12, as depicted in Figure 5 by means of arrows, the distance between the rotor 11 and the curved surface 12 being able to be adjusted.

5 Once rotational scraping has been performed, the leaves 20 are moved to cutting means formed by polygonal, for example hexagonal, blades 14. The purpose of these hexagonal blades 14 is to separate clean fibers from the residue of the leaf 20 held by means of said clamps 2.

10 Finally, driving means formed by belts 15 drive the clean fibers out of the machine, separating the clean fibers from the residues of the leaves 20.

15 Despite the fact that reference has been made to a specific embodiment of the invention, it is obvious for a person skilled in the art that the described method and machine are susceptible to a number of variations and modifications, and that all the mentioned details can be replaced with other technically equivalent details without departing from the scope of protection defined by the attached claims.

CLAIMS

1.- Method for obtaining fiber from leaves, characterized in that it comprises the steps of:

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- conveying the leaves (20) by conveying means (1);
- holding said leaves (20) in said holding means (2);
- linearly scraping said leaves (20) to leave them flat in a first scraping module (4);
- 10 - rotationally scraping said leaves (20) for removing residues from said leaves (20) in a second scraping module (10);
- separating the fiber from the rest of the leaves (20); and
- depositing said fiber and the leaves (20) for collection.

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2.- Method for obtaining fiber from leaves according to claim 1, wherein said separating fiber from the rest of the leaves (20) is performed by means of cutting.

20

3.- Method for obtaining fiber from leaves according to claim 1, wherein said leaves (20) are curled before said rotational scraping.

25

4.- Method for obtaining fiber from leaves according to claim 1, wherein the entry to the first and second scraping modules (4, 10) is performed laterally or transversely with respect to the scraping direction in a continuous manner.

5.- Machine for obtaining fiber from leaves, characterized in that it comprises:

30

- conveying means (1) and holding means (2) for conveying and holding the leaves (20);
- a first scraping module (4) where linear scraping of the leaves (20) is performed;
- a second scraping module (10) where rotational scraping of the leaves (20) is performed;
- 35 - cutting means (14) where the separation of the fiber from said conveying

means (1) and holding means (2) is performed; and
- driving means (15) for driving the fibers out of the machine.

5 6.- Machine for obtaining fiber from leaves according to claim 5,
wherein said conveying means and holding means are chains (1) provided
with a plurality of clamps (2) complementary to one another.

10 7.- Machine for obtaining fiber from leaves according to claim 6,
wherein the separation between two complementary clamps (2) is adjustable.

15 8.- Machine for obtaining fiber from leaves according to claim 6,
wherein said clamps (2) are divided into sections in said chains (1), the ends
(3) of said sections being curved and complementary with the adjacent
sections.

20 9.- Machine for obtaining fiber from leaves according to claim 5,
wherein said first scraping module (4) comprises two sets of movable blades
(5) placed beside one another.

25 10.- Machine for obtaining fiber from leaves according to claim 9,
wherein the distance and/or angle between said sets of blades (5) is variable.

30 11.- Machine for obtaining fiber from leaves according to claim 5,
wherein said second scraping module (10) comprises a curved surface (12),
a thrust element (13) pushing the leaves (20) against said curved surface
(12) and a rotor (11) provided with a plurality of blades, which blades scrape
the leaves (20) placed between the rotor (11) and the curved surface (12).

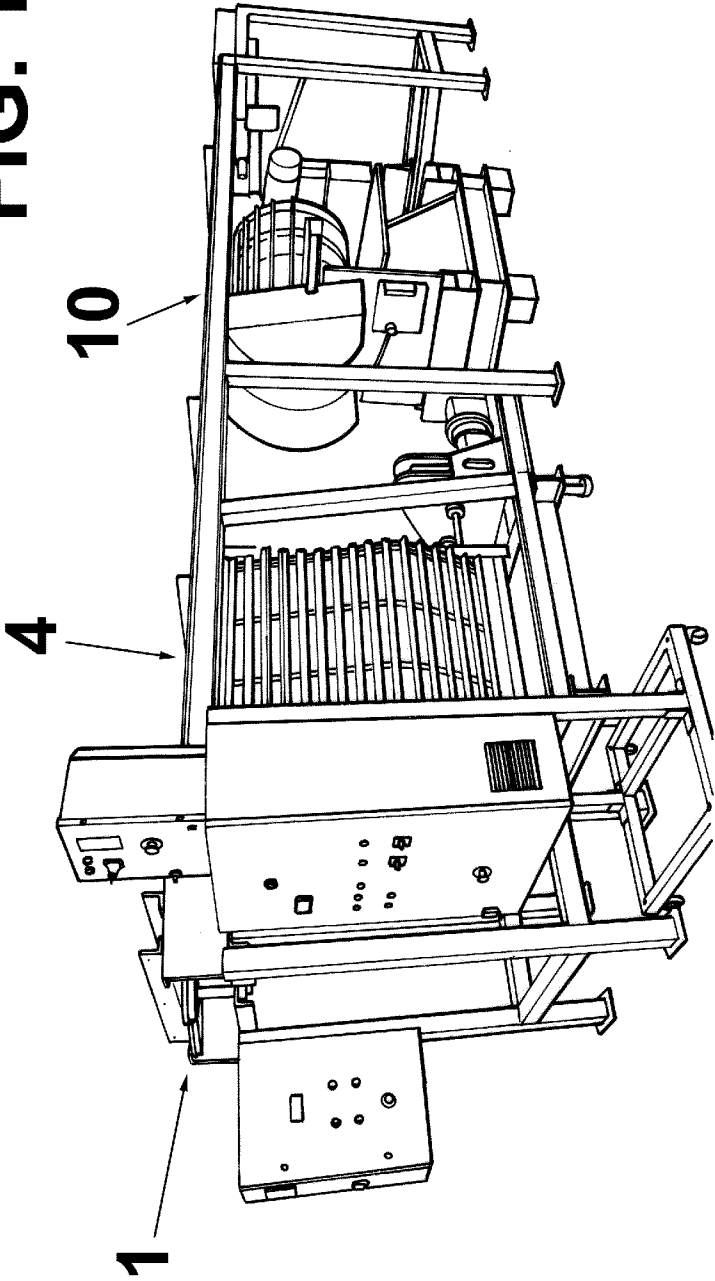
35 12.- Machine for obtaining fiber from leaves according to claim 11,
wherein the separation between the rotor (11) and the curved surface (12) is
variable.

 13.- Machine for obtaining fiber from leaves according to claim 5,
wherein said cutting means comprise two polygonal rotating blades (14),
cutting the fibers as they intersect one another.

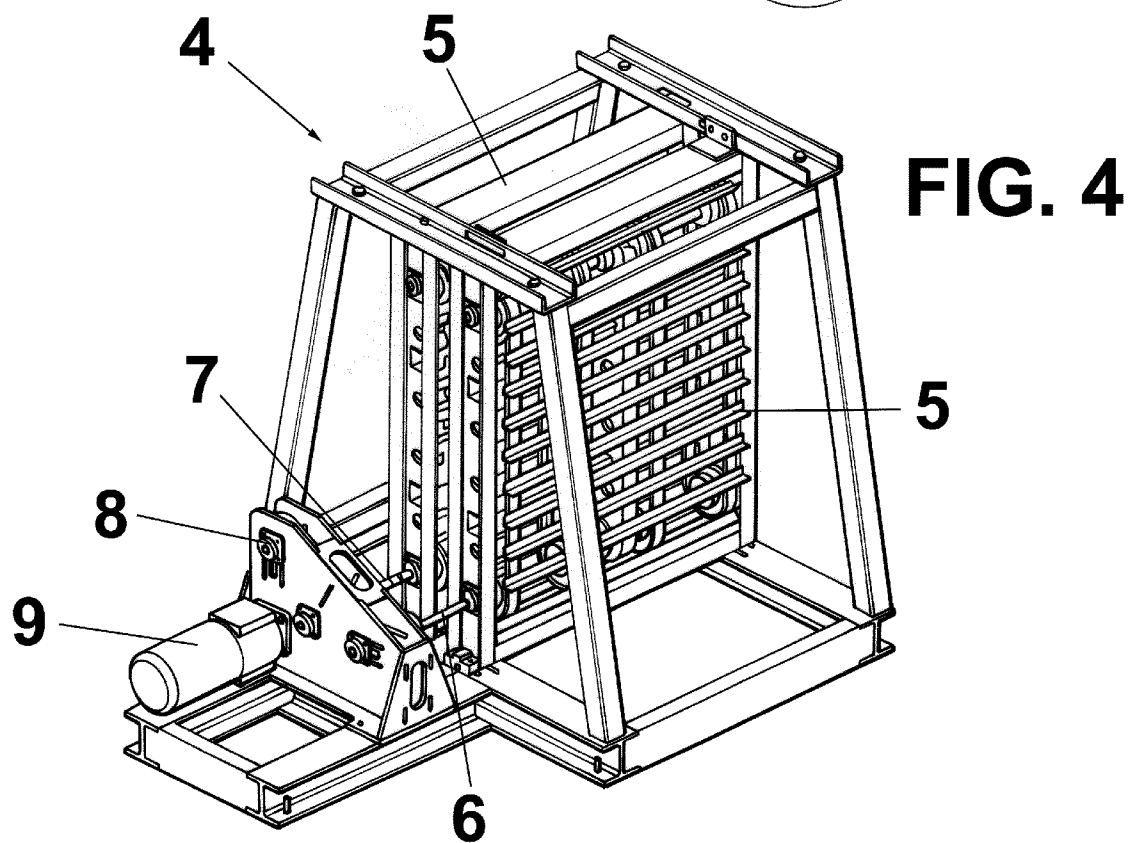
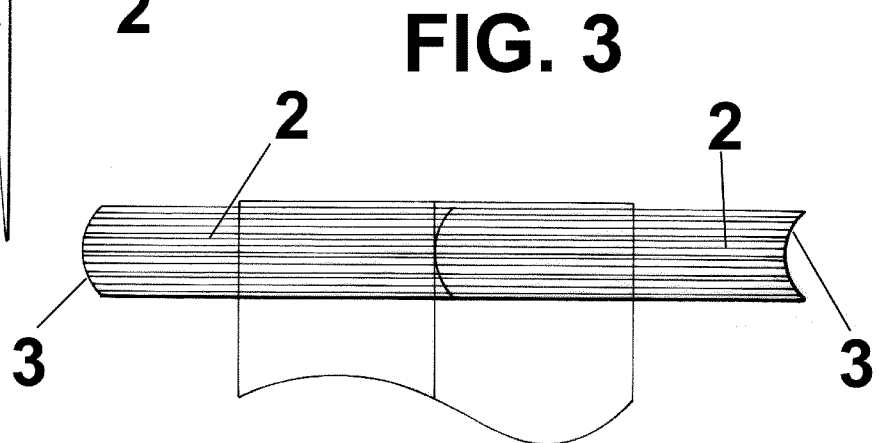
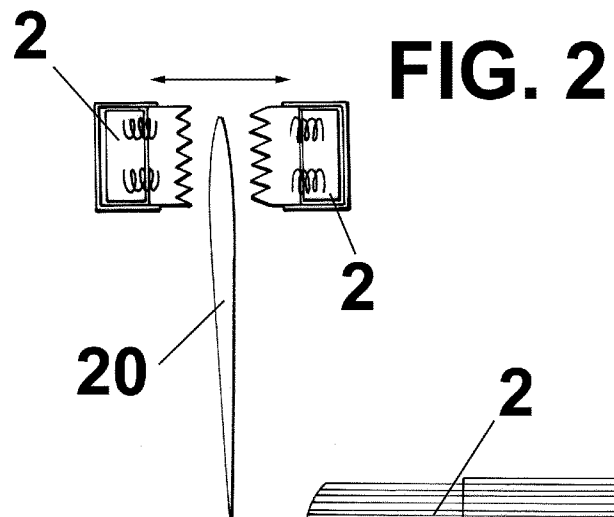
14.- Machine for obtaining fiber from leaves according to claim 13, wherein said rotating blades (14) are hexagonal.

5 15.- Machine for obtaining fiber from leaves according to claim 5, wherein said driving means comprise moving belts (15).

FIG. 1



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3/4

FIG. 5

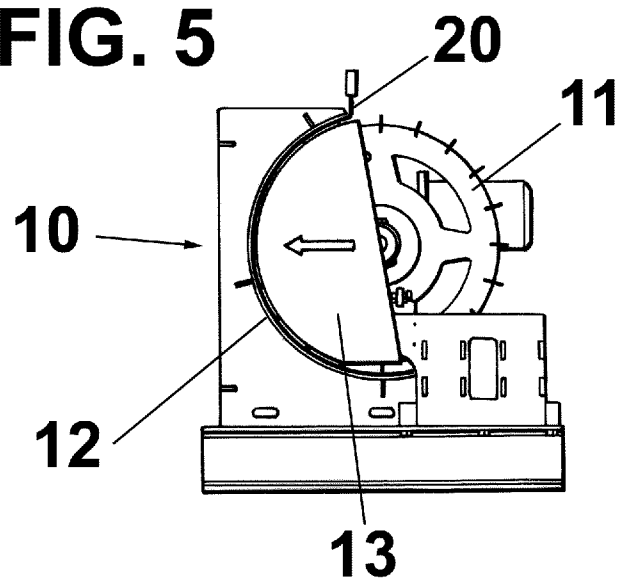


FIG. 6

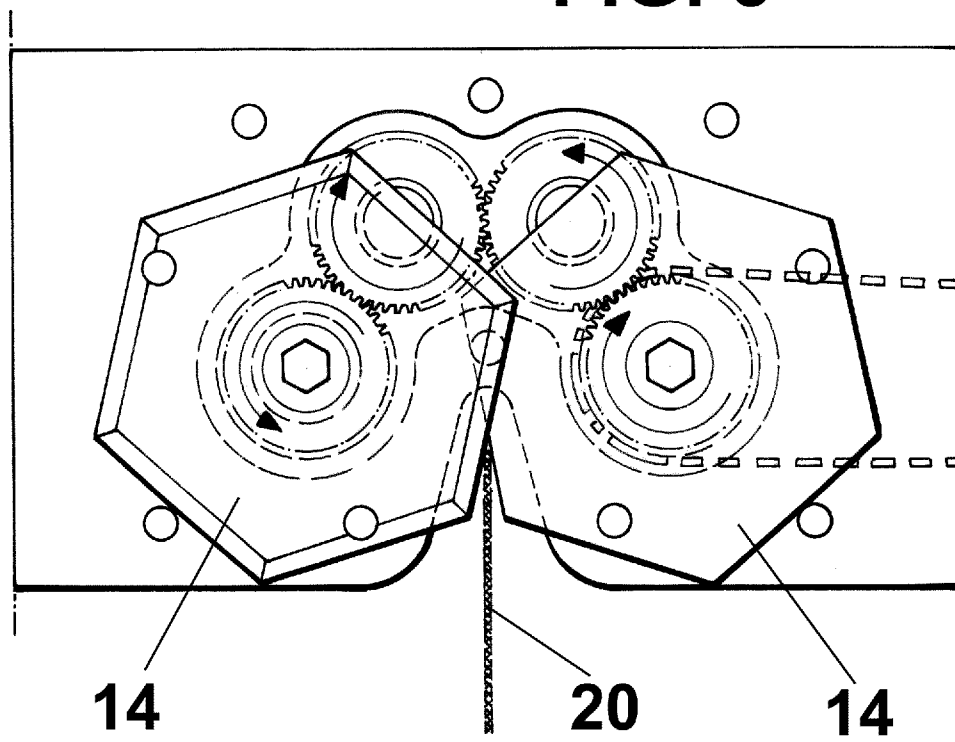
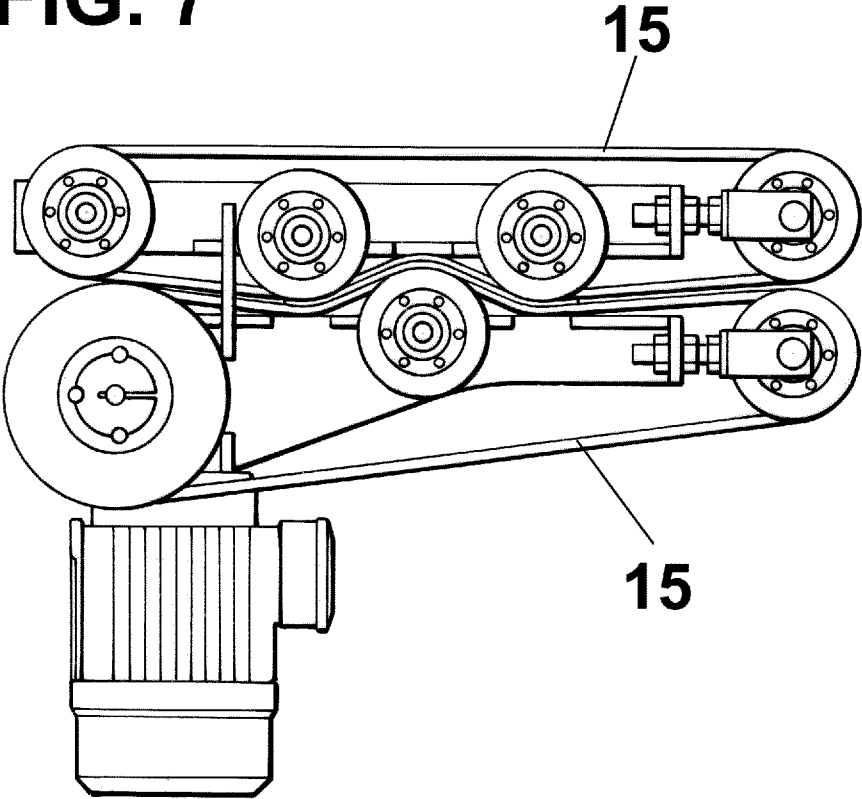


FIG. 7



INTERNATIONAL SEARCH REPORT

International application No
PCT/EP2014/058597

A. CLASSIFICATION OF SUBJECT MATTER
INV. D01B1/20 D01B1/36
ADD.

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)
D01B

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 practicable, search terms used)

EPO-Internal

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	US 2 759 224 A (SIMONS WALTER B) 21 August 1956 (1956-08-21) column 1, line 63 - column 2, line 64 column 3, line 67 - column 4, line 15 column 12, line 60 - column 13, line 9 figures 1,10	1-15
Y	GB 193 202 A (HERBERT FREDERICK FREULER; CHARLES LEWIS MORRILL) 22 February 1923 (1923-02-22) page 1, line 16 - line 46 page 3, line 45 - line 46 page 4, line 9 - line 10 page 4, line 76 - line 89 page 5, line 75 - line 122 figure 1	1-15
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Further documents are listed in the continuation of Box C.



See patent family annex.

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Date of the actual completion of the international search

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INTERNATIONAL SEARCH REPORT

International application No
PCT/EP2014/058597

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
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INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No

PCT/EP2014/058597

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