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(54) **EQUIPMENT FOR DECORTICATION OF HEMP STALK**

(57) The equipment is composed of frame **1**, feed table **2**, cover **3**, and a number of guide rollers: a pair of rollers for guiding the stalks **4**, stationary, fixed on the bearings **14**, the upper shaft being driven by means of the chain pulley **13** and being provided with discs **15** and rubber sleeves **16** and the separation discs **17**, a pair of flattening rollers **5**, a pair of splitting rollers **6**, a pair of

crushing rollers **7**, provided with spotfaces and with the U5 profiles **20** mounted using the screws **21**, respectively with T3 profiles **18** mounted using the screws **19**, a pair of detachment rollers **8**, the second pair of crushing rollers **9**, the second pair of detachment rollers **10**, the third pair of crushing rollers **11** and the vibrating conveyor with bars for chaff removing **12**.

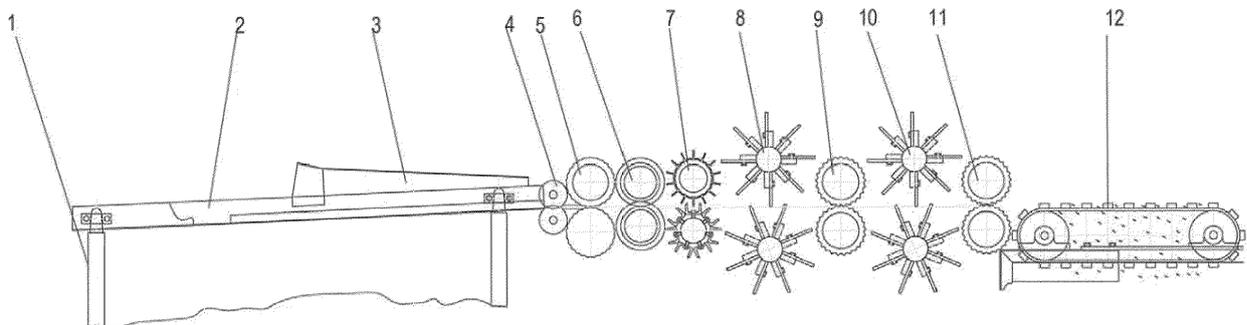


Fig. 1

Description

[0001] The invention relates to the equipment for hemp stalks decortication for fibre intended for industrialization in order to obtain textile fibres.

[0002] Hemp is a textile plant in the Cannabaceae family, *Cannabis sativa* and comprises two species: *Cannabis sativa culta*, grown primarily for fibre, and *Cannabis indica*, used to produce narcotic products. The fibres are very strong and that is why the stalk is difficult to cut, as it gets tangled in the knives of the harvester - which means that powerful cutting machines must be used, otherwise harvesting will be difficult.

[0003] The stalks should be cut as long as possible - long fibres are better and more useful than short ones.

[0004] The resistance, elasticity, flexibility, hygroscopicity and other features allow obtaining from the long hemp fibre numerous products: ropes, bags, hoses, power transmission belts, tents, sailcloths, furniture fabrics, summer clothes, etc.

[0005] Tow (40-50% of fibre) is used in the furniture industry and as insulating material.

[0006] The hemp stalk from which the fibres are extracted is straight and has branches at the bottom. Its length is between 1 and 3 m, and the thickness varies from 4 to 8 mm. Hemp stalks, for textile fibres, are assessed by: the predominant colour, which is usually greenish yellow or yellow, the length at a certain percentage of plants, the thickness and the moisture.

[0007] Mechanical breakage of the stalks is known as decortication and results in the separation of free fibres from the less valuable woody core (namely waste).

[0008] The fibre content in the stalks is influenced by the variety, the technological and pedoclimatic conditions. Fibres have a number of properties that are particularly valuable for strength (tensile, torsion, friction, rot), extensibility (elastic and plastic), spinning capacity, length greater than the sisal, jute, Manila or cotton fibres, which make them usable in a number of areas: in the textile industry, in the manufacturing industry, in the automotive industry (in the manufacture of car door panels and dashboards for numerous well-known companies).

[0009] Due to the increased need for hemp industrialization, the demand for specialized equipment for processing it has exceeded the supply.

[0010] But considering that the stalk of this plant is fibrous and hard, making machines equipped to handle and process this stalk is not a simple task.

[0011] Hemp being a plant with woody stalks is almost impossible to decompose with traditional equipment used for common agricultural products (such as cereals).

[0012] This characteristic makes the products obtained from hemp have applicability for a practically unlimited number of commercial and industrial products.

[0013] The first step to obtain any high value hemp product is decortication. Depending on the decortication equipment, the stalks may be wet or dry.

[0014] By hemp decortication process, the hard interior

of the wood (bark) is removed and the fibrous tissue of the stalk is separated.

[0015] Decortication generates both barks and glued materials, which are cellulose fibres, found in the composition of the stalk. Each fraction obtained is useful, but with different applications.

[0016] The proposed equipment will be able to be used by all economic agents whose basic activity is the processing of hemp stalks to obtain textile fibres, the use of which has gained a great development lately, all in the stalk being used following processing: fibre as a primary product and chaff as a secondary product.

[0017] Companies producing machines for hemp stalks decortication are known in the state of the art: Power Zone Agriculture, USA, (mobile machines with platform, self-driven), Canadian Greenfield Technologies Corp, Canada, (industrial type machines), Zhanjiang Weida Machinery Industrial CO. -LTD, China (stationary and mobile machines) and several patents such as: US 1308376/1919, US 24809602/1949, US 5465464/1995, US 5720083/1998.

[0018] The disadvantages of the constructive solutions adopted by these manufacturing companies and found in the studied patents are that:

- the feeding is not done uniformly and the stalks may overlap;
- some of the working rollers need quite complicated implementation;
- some constructive solutions do not provide a high degree of decortication;

[0019] The technical problem solved by the invention consists in the production of equipment that provides, through guide rollers, uniform feeding with hemp stalks and their efficient crushing by crushing rollers made with a significant labour saving and using profiles as interchangeable grooves, whenever necessary.

[0020] The technical solution according to the invention, uses within the decortication equipment a pair of guide rollers of which, the upper roller is driven by chain pulleys transmission and the lower one is supported by two bearing housings. The hemp stalks caught between the two rollers due to the friction force that appears between the upper roller groove and plants are moved over the lower roller grooves.

[0021] The equipment according to the invention also includes a first pair of rollers intended for crushing, of a special construction which consists in the fact that the lower roller is made of a pipe with several spotfaces on which U-shape laminated profiles of 5 mm are removably mounted and the upper roller is made of a pipe on which a double number of spotfaces was made relative to the lower drum. On each spotface made, a T-profile is removably mounted. When mounting for placing in service, it will be adjusted so that a T-profile from the upper roller falls in the middle of the U-profile from the lower roller. In this way, rollers are made with a high labour-efficiency

and with profiles as interchangeable grooves, whenever necessary.

[0022] The equipment for hemp stalks decortication has as novelty elements the following: - compact construction, with the realization of all the specific phases of decortication: plant guidance, flattening, splitting, crushing and chaff removal;

- in the case of the pair of guide rollers, the upper roller ensures the entraining and guiding of the plants and the lower one only guides the plants;
- simplicity in making the first pair of crushing rollers.

[0023] The following advantages are obtained by applying the invention:

- it covers all the phases of decortication;
- constructive simplicity;
- high degree of chaff removal;
- low cost price;
- low energy consumption;

[0024] The following is an example of embodiment of the invention in relation to Figures 1, 2 and 3 which represent:

- Fig. 1 - Equipment for hemp stalks decortication for fibre - general arrangement drawing
- Fig. 2 - Equipment for hemp stalks decortication for fibre - pair of guide rollers;
- Fig. 3 - Equipment for hemp stalks decortication for fibre - pair of crushing rollers.

[0025] Figure 1 shows schematically the equipment for hemp stalks decortication for fibre which consists of: frame **1**, feed table **2**, cover **3** and 8 pairs of rollers: a pair of rollers for guiding the stalks **4**, a pair of flattening rollers **5**, a pair of splitting rollers **6**, a pair of crushing rollers **7**, a pair of detachment rollers **8**, the second pair of crushing rollers **9**, the second pair of detachment rollers **10**, the third pair of crushing rollers **11** as well as the vibrating conveyor with bars for chaff removing **12**.

[0026] Figure 2 shows the pair of guide rollers consisting of a pair of stationary shafts spaced apart from each other at an adjustable distance depending on the thickness of the plant stalks.

[0027] The upper shaft is provided with a number of discs made of a material with a high coefficient of friction (low hardness rubber) **15**, mounted at a distance given by rubber sleeves **16** of high hardness rubber or polyamide, mounted on the lower shaft and the separation discs **17**. These discs also have the role of detaching the leaves from the stalks.

[0028] These shafts are positioned so that the discs on the upper shaft are positioned at the middle of the distance between two separation discs on the lower shaft. Both shafts are supported at the ends by a bearing **14**. The upper shaft is driven by means of the chain pulley

13. Due to the force generated by the mass of the components on the upper shaft and following their driving in the rotation movement through the chain pulley **13**, in contact with the fed stalks are pulled and pushed toward the flattening rollers **5**.

[0029] The distance between the two shafts is automatically adjusted according to the diameter of the stalks in the material to be fed by using spring devices.

[0030] Figure 3 shows the pair of rollers that perform the first crushing. Both rollers have a special construction. The lower roller is made of a round pipe, chosen so that after the spotfaces are made, the U5 profiles could be mounted, position **20**. These are interchangeable and are mounted using the screws **21**.

[0031] The upper roller is made of a round pipe, chosen so that after a double number of spotfaces is made, the same number of T3 profiles, position **18**, could be mounted with small adjustments. The assembly of the profiles on the pipe will be done using the screws **19**, which are positioned in a staggering way on the sides of the T3 profile.

[0032] The hemp stalks prepared for decortication (without inflorescence and leaves) are placed on the feed table **2** and are inserted into the pair of guide rollers. In the guide rollers between the separation discs **17**, only one stalk can enter and pass through. The stems are driven by the discs **15** and are taken over by the flattening rollers **5**. The leaves left involuntarily on the stalks are retained by the separation discs **17** or detached at the contact between discs **15** and sleeves **16**.

[0033] When passing between the flattening discs **5**, the round shaped stalks flatten out and take an elongated shape depending on the diameter of the stalk, the thickness of the stalk wall and the distance between the rollers. The flattened stalks then pass between the splitting discs **6**, where each stalk is cut into strips.

[0034] The obtained strips get between the crushing rollers **7**, where, the woody part is subjected to a first crushing process. The overlap of the working depth of both rollers partially achieves the crushing of the woody part. The material passing through these rollers passes between the first pair of detachment rollers **8**, which results in the detachment of a good part of the crushed woody part, which is then evacuated. What is left is taken over by the second pair of crushing rollers **9**, continuing the process of crushing the woody part which is subjected to the detachment process through the second pair of detachment rollers **10**, where another part of the woody part (chaff) is removed. The remaining material is taken over by the third pair of crushing rollers **11** where another part of the remaining woody part is crushed. What resulted from the crushing process from the third pair of rollers is thrown on the vibrating conveyor with bars for chaff removing **12**. Due to its vibration system, given by the elastic supports on which the drum at the top end is mounted, during the movement of the bar belt a part of the woody part attached to the fibres detaches and is removed and collected separately.

Claims

1. The equipment for hemp stalks decortication for fibre, **characterized by the fact that**, it is composed of frame **1**, feed table **2**, cover **3**, a pair of rollers for guiding the stalks **4**, actuated by a pair of flattening rollers **5**, a pair of splitting rollers **6**, a pair of crushing rollers of special construction **7**, a pair of detachment rollers **8**, the second pair of crushing rollers **9**, the second pair of detachment rollers **10**, the third pair of crushing rollers **11** and the vibrating conveyor with bars for chaff removing **12**.

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2. The equipment for hemp stalks decortication for fibre, according to claim 1, is **characterized by** the fact that the pair of guide rollers **4** consists of two stationary shafts fixed on the bearings **14**, only the upper shaft being driven by means of the chain pulley **13**, spaced apart from each other at an adjustable distance depending on the thickness of the plant stalks, the upper shaft being provided with a number of discs **15** made of a material with a high coefficient of friction, mounted at a distance given by rubber sleeves **16** of high hardness rubber or polyamide and the separation discs **17**, mounted on the lower shaft, these discs also having the role of detaching the leaves from the stalks.

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3. The equipment for hemp stalks decortication for fibre, according to claim 1, is **characterized by** the fact that in the case of the pair of crushing rollers **7** of special construction, the lower roller is made of a round pipe, chosen so that after the 7 equidistant spotfaces are made, the U5 profiles **20** (7 of them) could be mounted, interchangeable and mounted using the screws **21**, while the upper roller is made of a round pipe, chosen so that after a number of 14 spotfaces is made, the T3 profiles **18** (14 of them), could be mounted with small adjustments using the screws **19**, which are positioned in a staggering way on the sides of the profile **18**.

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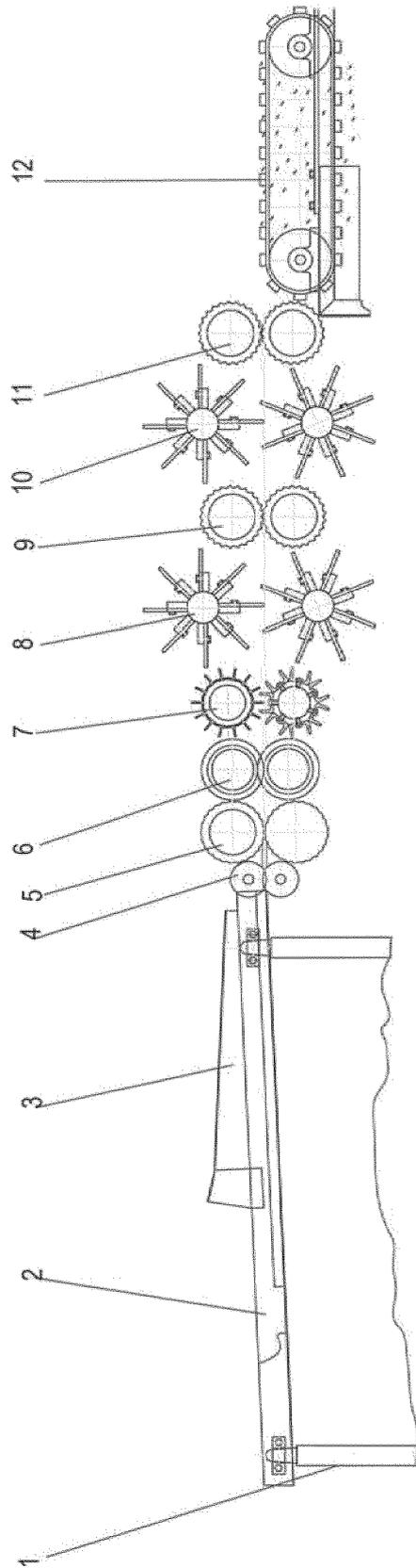


Fig. 1

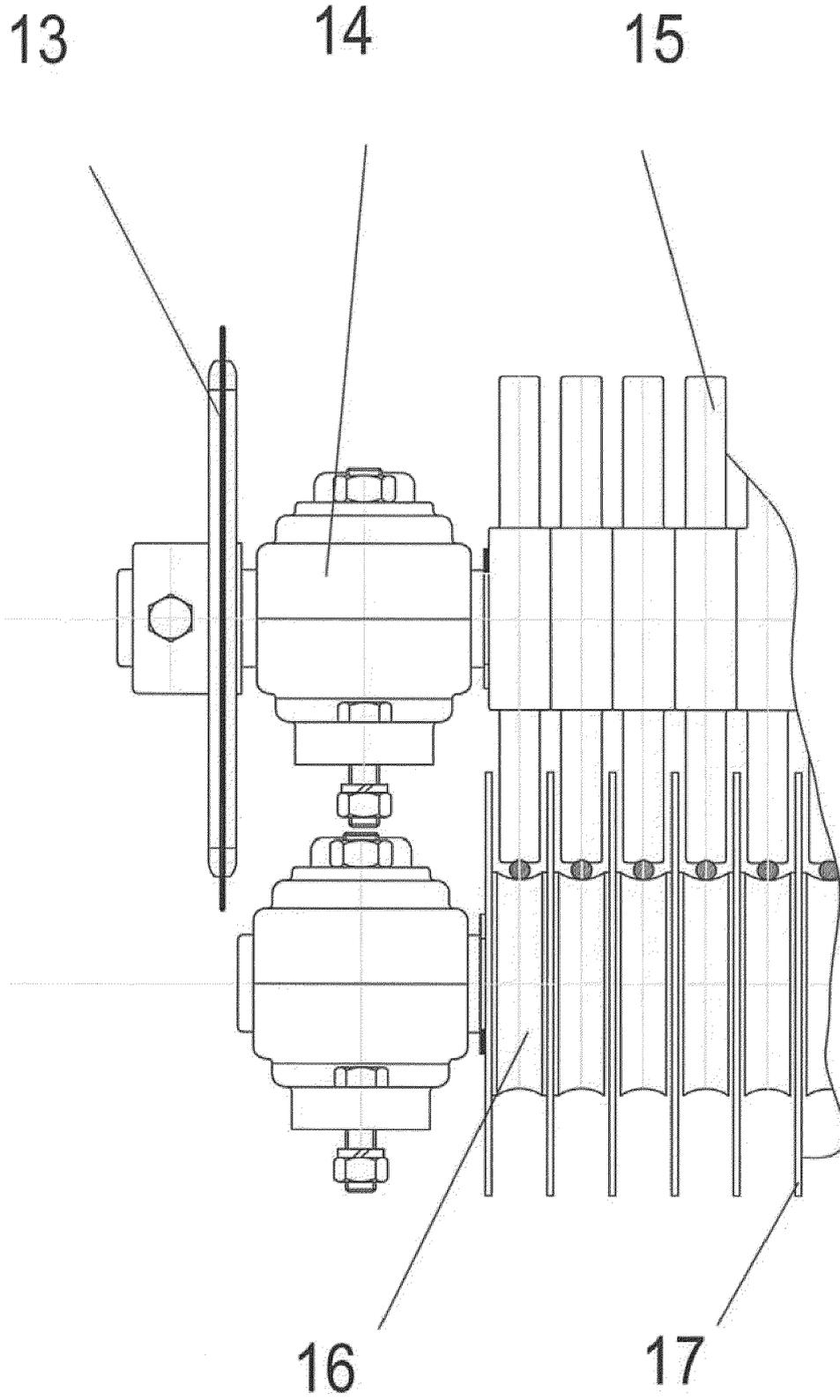


Fig.2

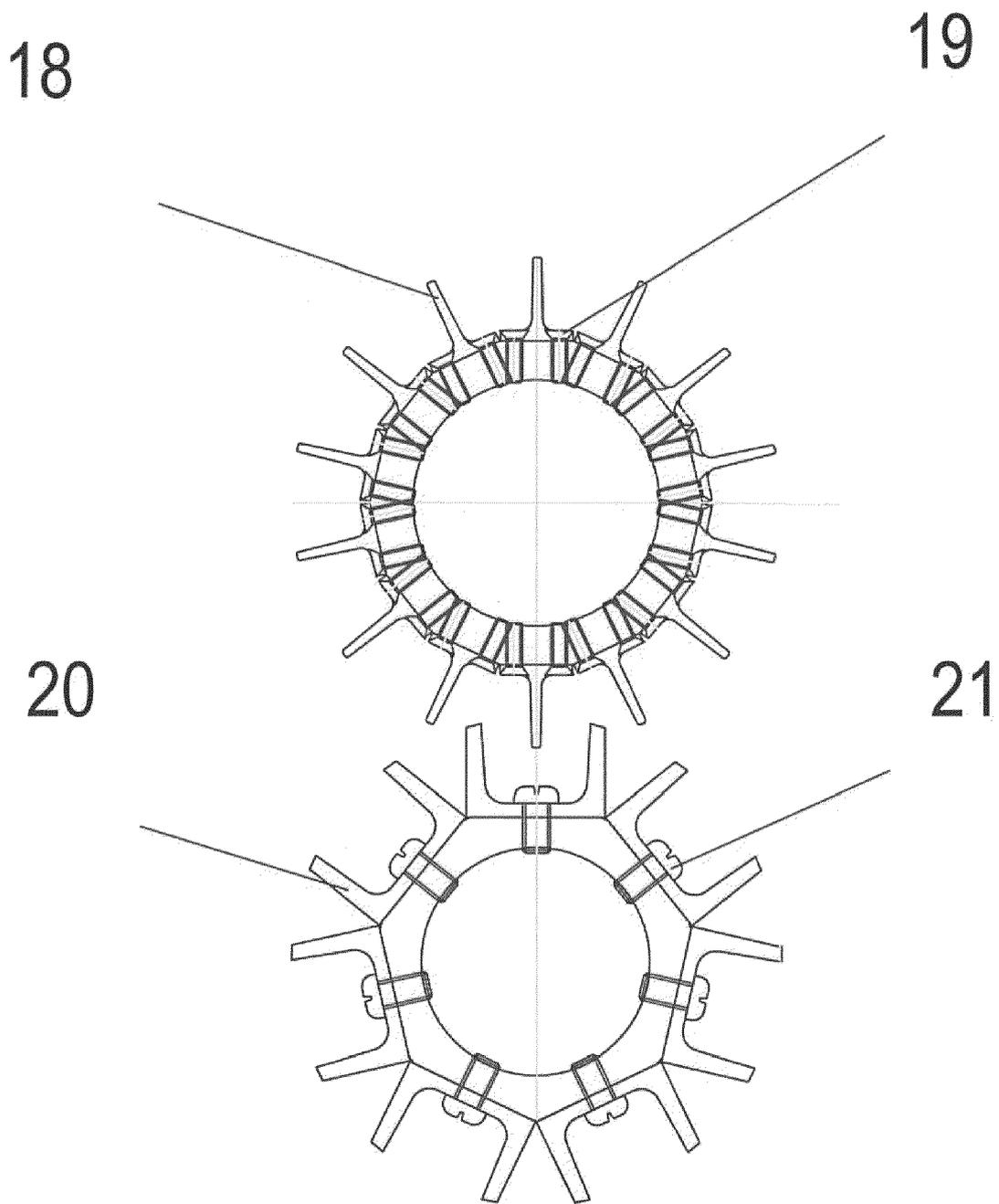


Fig. 3

**ANNEX TO THE EUROPEAN SEARCH REPORT
ON EUROPEAN PATENT APPLICATION NO.**

EP 19 02 0585

5 This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report.
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29-06-2020

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For more details about this annex : see Official Journal of the European Patent Office, No. 12/82

REFERENCES CITED IN THE DESCRIPTION

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