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**(54) EQUIPMENT FOR HEMP FIBER PROCESSING**

VORRICHTUNG ZUR VERARBEITUNG VON HANFFASERN

ÉQUIPEMENT DE TRAITEMENT DE FIBRES DE CHANVRE

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## Description

**[0001]** The invention relates to a mobile equipment with electromechanical drive intended for processing hemp stalks, from experimental plots, for fibre.

In the state of the art, it is known technical solution in the patent document CN 106811804 (A) Cannabis saliva fresh stem peeling machine, comprising inter alia, four pairs of rollers that fragments cannabis/hemp stalks, a pair with two rollers and a carder with two movable plates for cleaning the fibber of the rest of the stalks.

The equipment does not contain elements that can separate the hemp leaves from the stalks and does not ensure the correlation of the relative speed of the working surfaces of the ten rollers so that the hemp fibber to be pulled towards the exhaust end of the machine. Patent document EP2018447A1 (**A4, B1**), Apparatus and method for processing of plant material presents an apparatus for processing at least one plant stalk, having a fibrous outer part (fibre) and an inner section (hurds), the apparatus comprising: one or more toothed rollers and a bending element, in which the toothed roller has one or more teeth on the outside, each tooth comprising a guide part and a transport part, wherein the guide part extends over a smaller portion than the transport one so that on contact of the stalk with the bending element, the fibrous part is divided and the woody inner part is substantially separated from the fibrous outer part.

**[0002]** Patent document US 2018103591 A1 Systems for unbaling, separating and decortifying fibrous crops is also known, which relates to systems for processing fibrous crops in bales, such as hemp, and especially to systems that extract the stalks from their initial baled state, separate the outer fibres from the core of the stalks and remove the core residues from separate fibres.

Said system includes a bale opening step, a hulling step and a separation step. The bale opener has a conveyor that moves the bales from the entrance to a toothed extractor, with a series of teeth driven on a revolution path moving upwards, passing the adjacent end of the conveyor to rake the bale and extract the material from it. The conveyor tilts upwards, reducing the working angle between the conveyor and the toothed extractor, to direct the bale of hemp towards the moving teeth. A separating stage has several sets of vertically mounted rollers, with different characteristics from one set to another. A huller has an outer housing, an inner rotating drum, supported in the casing and a series of teeth on the drum. The driven rotation of the inner drum rotates the fibrous stalks around the inner drum and leads the fibrous stalks to the inner surfaces of the outer housing walls.

**[0003]** Disadvantages of the known solutions consist in the following:

- the equipment presented has a complex construction which is not justified as investment for the processing of hemp stalks from experimental plots;
- low degree of manoeuvrability and adjustments for

small batches of products;

- high energy consumption for driving the equipment;
- the equipment does not allow the processing of freshly harvested hemp stalks with leaves.

**[0004]** **Technical problem** solved by the invention consists in the realization of a mobile equipment with electromechanical drive that allows the flexible processing of freshly harvested hemp fibres with leaves by defoliating (breaking off) the leaves from the stalks before they enter the technological process of fibre processing.

**[0005]** The equipment, **according to the invention**, consists of a mobile support on four wheels that can be locked by means of two adjustable systems that are attached to the floor. On this mobile support is mounted a housing with two rollers for driving the hemp stalks and two profiled blade rollers that will defoliate the stalks introduced into the inlet only with the upper part of the stalk. Simultaneous drive of this set of rollers is done by an electric motor controlled by means of a frequency converter and a V-belt drive. On the same support and in the immediate vicinity of the support with rollers for defoliation is mounted a housing with 4 or 6 rollers that hulls the hemp stalks to obtain fibre. These rollers are simultaneously driven by a coaxial gear motor and a Galle chain drive. In this processing block, the woody part of the stalks is fragmented and the hemp fibre is partially separated. For the final cleaning of the fibre, the processed material reaches the surface of a rotating drum with wooden rods that drive the stalks and they come into contact with the top cover on which is mounted another set of wooden rods for cleaning woody pieces also from the upper surface of fibres. This cleaning drum is driven by an electric motor controlled by a frequency converter.

**[0006]** The equipment for hemp fiber processing, according to the invention, has the following advantages:

- the main advantage is the increase of the degree of manoeuvrability and adjustments depending on the variety and size of the hemp stalks;
- has an autonomous operating system and allows the separate adjustment of the three technological sections with specific equipment for each technological operation;
- allows the use for small batches of products with different technical characteristics;
- allows easy access to working rollers but is also protected by guards in areas with rotating kinematic parts;
- easy transport of the equipment in the work area.

**[0007]** An embodiment of the invention is shown in connection with Fig. 1-7 which represent:

- Fig.1 - Equipment for hemp fiber processing - main view;
- Fig.2 - Equipment for hemp fiber processing - rear

view;

- Fig.3 - Stalk processing module- main view;
- Fig.4 - Stalk processing module - rear view;
- Fig.5 - Module for removing leaves from hemp stalks - main view;
- Fig.6 - Module for removing leaves from hemp stalks - rear view;
- Fig.7 - Construction of the roller for removing hemp leaves.

**[0008]** The equipment for hemp fiber processing , according to the invention, consists of the support (1) constructed of assembled parts and having four wheels for movement (2), a handle (3) and two adjustable legs (4) for its positioning during work.

**[0009]** On the support (1) is mounted a stalk processing module (5) comprising a first housing (6) with a first pair of rollers (7) and (8) for driving hemp stalks and a second pair of profiled blade rollers (9) and (10) that will defoliate the stalks introduced into the inlet only with the upper part of the stalk. Simultaneous drive of the first and second pair of rollers is done by an electric motor (11) and a V-belt drive (12), the electric motor is controlled by means of a frequency converter mounted in the electrical control panel (13). The first pair of rollers (7) and (8) have on the outer surface a jacket (14) which will drive the hemp stalks and are positioned by means of fixed bearings (15) and two adjustable bearings (16) which are actuated by two adjustable springs (17) and two threaded rods (18).

**[0010]** The first pair of rollers (7) and (8) is driven together by two cylindrical pulley wheels (19) and (20) and the second pair of rollers (9) and (10) is driven together by two cylindrical pulley wheels (21) and (22) and between the two pairs of rollers a first Galle chain drive (23) is used. The blade rollers (9) and (10) which are used to remove the leaves from the stalks are constructed of a single body (24) provided with special grooves (25) in which the profiled blades (26) are positioned by means of wedges (27) and screws (28).

**[0011]** On the same support and in the immediate vicinity of the defoliation roller housing (6) is mounted a second housing (29) with six rollers (30), defining three additional roller pairs which hull the hemp stalks to obtain fibre. These rollers are simultaneously driven by a coaxial gear motor (31) and a second Galle chain drive (32). In this processing block, the woody part of the stalks is fragmented and the hemp fibre is partially separated. It was found experimentally that a number of six rollers with different numbers of profiles and different heights, allow to obtain an optimal fragmentation of the hemp stalks and to increase the efficiency of the fibre hulling technology.

**[0012]** Each pair of two rollers is mounted by means of two fixed bearings (33) and (34) and two adjustable bearings (35) and (36) which are adjusted by means of threaded rods (37) and helical springs (38). A pair of cylindrical pulley wheels (39) is mounted on the ends of

each additional pair of rollers (30) to synchronize the rotational movement between the rollers and to transmit the rotational movement from one set of rollers to another using a V-belt drive (40). An adjustable roller tensioner (41) is used to tension the belts. The angular velocities of the three sets of rollers are correlated by the appropriate sizing of the pulley wheels for V-belts so that the angular velocity increases by a predetermined value from one set of rollers to the next. The coaxial gear motor is also controlled by the electrical panel (13) which ensures the simultaneous control of the three electric motors that serve this equipment. Hulling rollers are made either monobloc with the active working part made by milling the teeth, with teeth welded in grooves or with removable teeth.

**[0013]** A specific module ensures the final cleaning of the fibre, so that the processed material reaches the surface of a rotating drum (42) with wooden rods (43) that drive the stalks and they come into contact with the top cover (44) on which is mounted another set of wooden rods (45) for cleaning woody pieces also from the upper surface of fibres. This cleaning drum is driven by an electric motor (46) controlled by a frequency converter located in the control panel (13). The processed fibre is collected on the adjustable support (47).

#### Claims

1. Equipment for hemp fiber processing , consisting of a mobile support (1) on four wheels for movement (2), a handle (3) and two adjustable legs (4) for its positioning during work, **characterized by the fact that**, it is made of a stalk processing module (5) which performs in a first stage hemp stalk driving through a first housing (6) with a first pair of rollers (7) and (8) driven together by two cylindrical pulley wheels (19) and (20), having on the outer surface a jacket (14), in a second stage leaf removing from the stalks in a specific module provided with a second pair of rollers (9) and (10), simultaneous drive of the first and second pair of rollers being done by an electric motor (11) and a V-belt drive (12), a first Galle chain drive (23) being used between the two pairs of rollers, in a third stage hemp stalk hulling to obtain fibre, made by a second housing (29) with six rollers (30) defining three additional roller pairs, simultaneously driven by a coaxial gear motor (31) and a second Galle chain drive (32), at the end of each pair of rollers (30) being mounted a pair of cylindrical pulley wheels (39), to synchronize the rotational movement between the rollers and to transmit the rotational movement from one set of rollers to another using a V-belt drive (40), the woody part of the stalks being thus fragmented and the hemp fibre being partially separated, while the angular velocities of the three additional sets of rollers are correlated by the appropriate sizing of the pulley wheels (39) for V-belts so

that the angular velocity increases by a predetermined value from one set of rollers to the next, the equipment comprising a specific module for the final cleaning of the processed material.

2. Equipment for hemp fiber processing, according to claim 1, **characterized by the fact that**, the second pair of rollers (9) and (10) is formed by profiled blade rollers, driven together by two cylindrical pulley wheels (21) and (22), which will defoliate the stalks introduced into the inlet only with the upper part of the stalk, the electric motor (11) being controlled by means of a frequency converter mounted in an electrical control panel (13).
3. Equipment for hemp fiber processing, according to claim 1 and 2, **characterized by the fact that**, the set of blade rollers (9) and (10) is made of a single body (24) provided with special grooves (25) in which the profiled blades (26) are positioned by means of wedges (27) and screws (28).
4. Equipment for hemp fiber processing, according to claim 1, **characterized by the fact that**, in the module for the final cleaning of the fibre, the processed material reaches the surface of a rotating drum (42) with wooden rods (43) that drive the stalks and they come into contact with a top cover (44) on which another set of wooden rods (45) is mounted for cleaning woody pieces also from the upper surface of fibres, the rotating drum (42) being driven by an electric motor (46) controlled by a frequency converter located in the control panel (13).

#### Patentansprüche

1. Vorrichtung zur Verarbeitung von Hanffasern, bestehend aus einem beweglichen Träger (1) auf vier Rädern zum Bewegen (2), einem Griff (3) und zwei verstellbaren Beinen (4) zum Positionieren während der Arbeit, **dadurch gekennzeichnet, dass** sie aus einem Stängelverarbeitungsmodul (5) besteht, das in einer ersten Phase den Antrieb des Hanfstängels durch ein erstes Gehäuse (6) mit ein erstes Walzenpaar (7) und (8) durchführt, die gemeinsam durch zwei zylindrische Riemenscheiben (19) und (20) angetrieben werden, die an der Außenfläche eine Ummantelung (14) aufweisen, in einer zweiten Phase die Entfernung der Blätter von den Stängeln in einem speziellen Modul, das mit einem zweiten Walzenpaar (9) und (10) versehen ist, wobei der gleichzeitige Antrieb des ersten und zweiten Walzenpaares durch einen Elektromotor (11) und einen Keilriemenantrieb (12) erfolgt, wobei ein erster Gallekettenantrieb (23) zwischen den beiden Walzenpaaren verwendet wird, in einer dritten Phase das Schälen des Hanfstängels zur Gewinnung von Fasern, beste-

hend aus einem Gehäuse (29) mit sechs Walzen (30) die drei zusätzliche Rollenteile definieren, die gleichzeitig durch einen koaxialen Getriebemotor (31) und ein zweites Gallekettenantrieb (32), am Ende jedes Rollenpaars (30) wird ein Paar zylindrischer Riemenscheiben (39) montiert, um die Drehbewegung zwischen den Rollen zu synchronisieren und die Drehbewegung mithilfe eines Keilriemenantriebs (40) von einem Paar auf einen anderen zu übertragen, wobei der holzige Teil der Stängel zerkleinert und die Hanffasern teilweise abgetrennt werden, wobei die Winkelgeschwindigkeiten der drei zusätzlichen Walzensätze durch die entsprechende Dimensionierung der Riemenscheiben (39) für Keilriemen so korreliert werden, dass die Winkelgeschwindigkeit von einem Walzensatz zum nächsten um einen vorbestimmten Wert zunimmt, die Vorrichtung umfasst auch ein spezifisches Modul für die Endreinigung des verarbeiteten Materials..

2. Vorrichtung zur Verarbeitung von Hanffasern gemäß Anspruch 1, **dadurch gekennzeichnet, dass** das zweite Rollenpaar (9) und (10) umfasst, die gemeinsam durch zwei zylindrische Riemenscheiben (21) und (22) angetrieben werden und die in den Einlass eingeführten Stängel nur mit dem oberen Teil des Stängels entblättern, wobei der gleichzeitige Antrieb dieses Walzensatzes durch einen Elektromotor (11) und einen Keilriemenantrieb (12) erfolgt und der Elektromotor mittels eines Frequenzumrichters gesteuert wird, der in der elektrischen Schalttafel (13) montiert ist.
3. Vorrichtung zur Verarbeitung von Hanffasern gemäß Anspruch 1 und 2, **dadurch gekennzeichnet, dass** der Satz von Klingenwalzen (9) und (10) aus einem einzigen Körper (24) besteht, der mit speziellen Rillen (25) versehen ist, in denen die profilierten Klingen (26) mittels Keilen (27) und Schrauben (28) positioniert sind.
4. Vorrichtung zur Verarbeitung von Hanffasern gemäß Anspruch 1, **dadurch gekennzeichnet, dass** im Modul zur Endreinigung der Fasern das verarbeitete Material die Oberfläche einer rotierenden Trommel (42) mit Holzstäben (43) erreicht, die die Stängel antreiben, und diese kommen mit einer oberen Abdeckung (44) in Kontakt, auf der ein weiterer Satz Holzstäbe (45) angebracht ist, um Holzstücke auch von der oberen Oberfläche der Fasern zu entfernen, die rotierende Reinigungstrommel von einem Elektromotor (46) angetrieben wird, der von einem Frequenzumrichter gesteuert wird, der sich in der Schalttafel (13) befindet.

## Revendications

1. Equipement pour le traitement de la fibre de chanvre, constitué d'un support mobile (1) sur quatre roues pour déplacement (2), d'une poignée (3) et de deux pieds réglables (4) pour son positionnement pendant le travail, **caractérisé en ce qu'il** est constitué d'un module de traitement de tiges (5) qui effectue dans une première étape l'entraînement de la tige de chanvre à travers d'un premier boîtier (6) avec une première paire de rouleaux (7) et (8) entraînés ensemble par deux poulies cylindriques (19) et (20), ayant sur la surface extérieure une chemise (14), dans une deuxième étape l'effeuillage des tiges dans un module spécifique pourvu avec une deuxième paire de rouleaux (9) et (10), l'entraînement simultané de la première et de la deuxième paire de rouleaux étant effectué par un moteur électrique (11) et une transmission par courroie trapézoïdale (12), une première transmission par chaîne Galle (23) étant utilisée entre les deux paires de rouleaux (23), dans une troisième étape le décorticage de la tige de chanvre pour obtenir de la fibre, réalisé par une deuxième boîtier (29) avec six rouleaux (30) qui définissent trois parties supplémentaires de rouleau, entraînés simultanément par un motoréducteur coaxial (31) et une deuxième transmission par chaîne Galle (32), à l'extrémité de chaque paire de rouleaux (30) étant montée une paire de roues de poulies cylindriques (39), pour synchroniser le mouvement de rotation entre les rouleaux et transmettre le mouvement de rotation d'un ensemble à l'autre à l'aide d'un entraînement par courroie trapézoïdale (40) la partie ligneuse des tiges étant ainsi fragmentée et la fibre de chanvre étant partiellement séparée, tandis que les vitesses angulaires des trois paires des rouleaux supplémentaires sont corrélées par le dimensionnement approprié des roues de poulies (39) pour courroies trapézoïdales de sorte que la vitesse angulaire augmente d'une valeur prédéterminée d'un jeu de rouleaux à l'autre, l'équipement comprenant un module spécifique pour le nettoyage final du matériau traité..
 

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2. Equipement pour le traitement de la fibre de chanvre, selon la revendication 1, **caractérisé en ce que**, une deuxième paire de rouleaux (9) et (10) est formé de rouleaux à lames profilés, entraînés ensemble par deux poulies cylindriques (21) et (22), qui défolieront les tiges introduites dans l'entrée uniquement avec la partie supérieure de la tige, le moteur électrique (11) étant commandé au moyen d'un convertisseur de fréquence monté dans le panneau de commande électrique (13).
 

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3. Equipement pour le traitement de la fibre de chanvre, selon la revendication 1 et 2, **caractérisé par le fait que** l'ensemble de rouleaux à lames (9) et (10) est constitué d'un seul corps (24) pourvu de rainures spéciales (25) dans lesquelles les lames profilées (26) sont positionnées au moyen de cales (27) et de vis (28).
 

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4. Equipement pour le traitement de fibres de chanvre, selon la revendication 1, **caractérisé par le fait que**, dans le module de nettoyage final de la fibre, le matériau traité atteint la surface d'un tambour rotatif (42) avec des tiges en bois (43) qui entraînent les tiges et celles-ci entrent en contact avec un couvercle supérieur (44) sur lequel est monté un autre ensemble de tiges en bois (45) pour nettoyer les morceaux de bois également de la surface supérieure des fibres, le tambour rotatif étant entraîné par un moteur électrique (46) commandé par un convertisseur de fréquence situé dans le panneau de commande (13).
 

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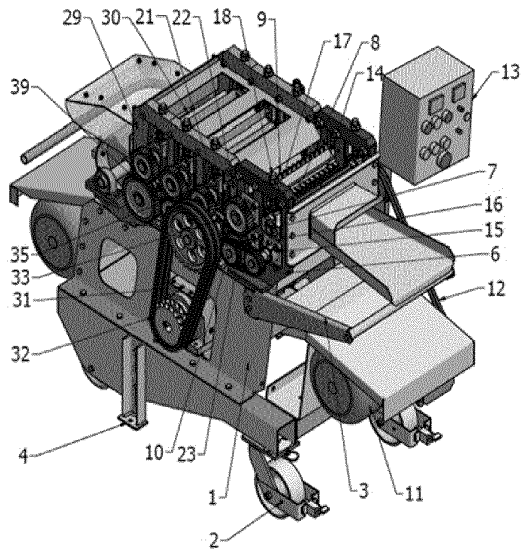


Fig. 1

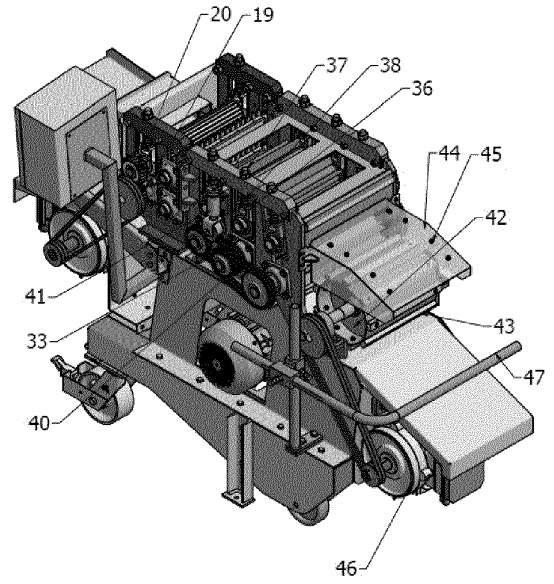


Fig. 2

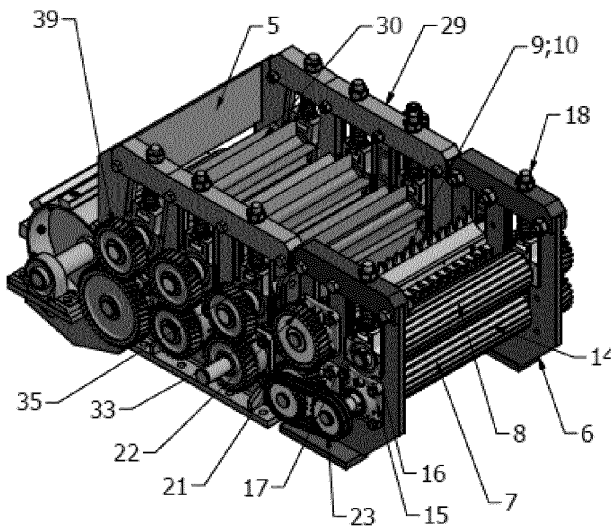


Fig. 3

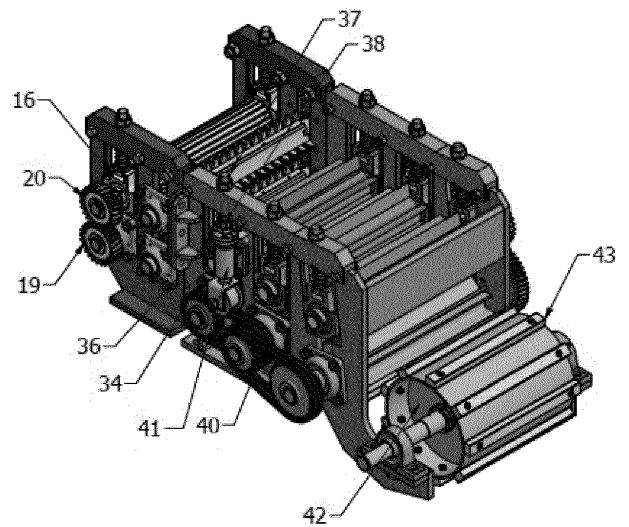


Fig. 4

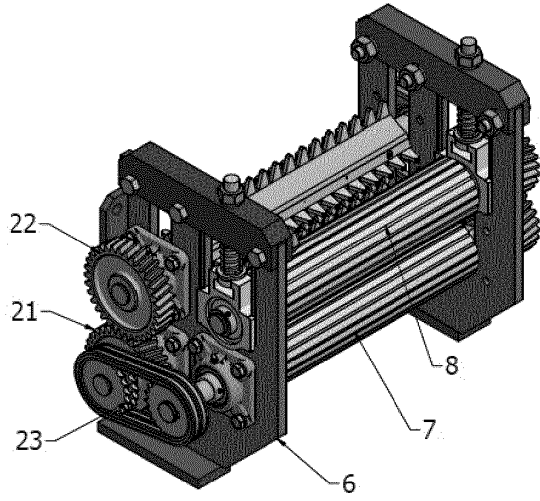


Fig.5

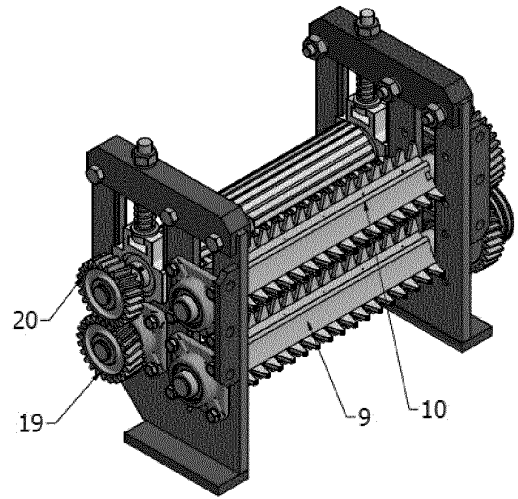


Fig.6

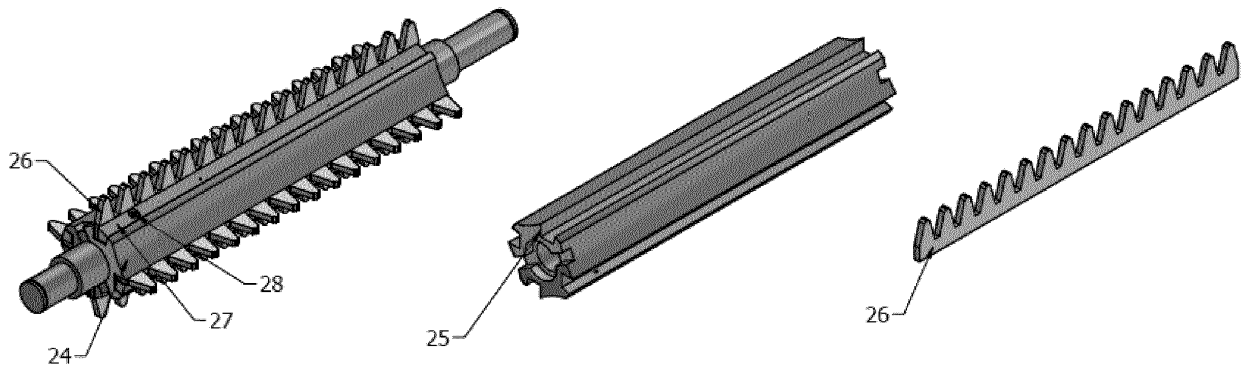


Fig.7

**REFERENCES CITED IN THE DESCRIPTION**

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