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(54) **APPARATUS FOR THE OPENING OF SPOOLS OF WOUND MATERIAL**

(57) An apparatus for the opening of spools of wound material is disclosed, comprising at least a support frame (4, 5, 19) whereon an operating unit (7, 20) is mounted, provided with opening means of said spool comprising at least one circular blade (9, 28) longitudinally translatable to said spool, wherein
said circular blade (9, 28) has a smooth perimeter cutting edge with triangular cross-section and is driven into rotation by a motor assembly (8, 27) mounted on said support frame (4, 5, B) so as to determine a first (X) and a second (Z) axis of translation relating to a support base (2, 24) of said spool,
said axes of translation (X, Z) being mutually orthogonal and said first axis of translation (X) being parallel to a longitudinal axis of said spool and to said circular blade (9, 28), and
said movable operating unit (7) is mounted translatable according to said first axis of translation (X) horizontally on said frame (4, 5) in a higher position with respect to said support base in the shape of a fixed holding seat (2) having a V-section.

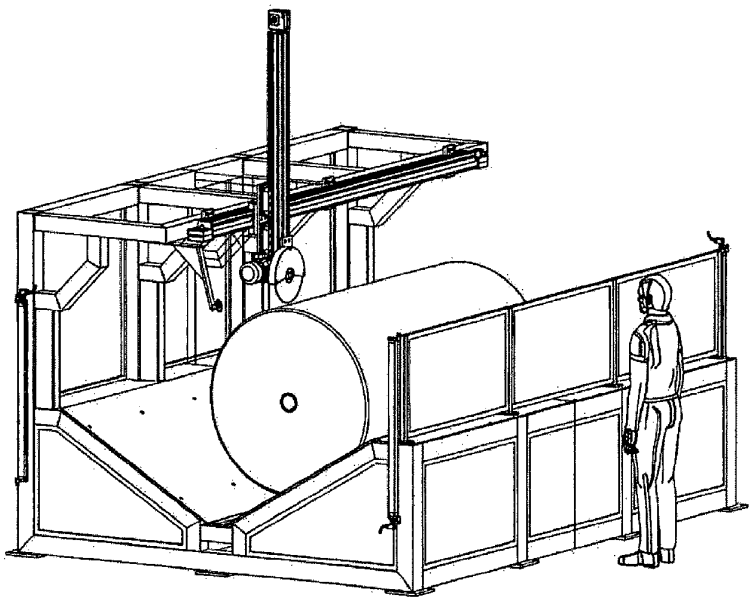

Fig. 7

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Description

FIELD OF THE INVENTION

[0001] The present invention refers to an apparatus for the opening of spools of wound material. In particular, an apparatus for the opening of waste spools in the field of plastic material regeneration.

BACKGROUND ART

[0002] In the last few decades the plastic sector has known a steep technological growth due to the increasing affirmation in more and more sophisticated and unimaginable applications, due to the development of technopolymers, provided with superior physical-mechanical and heat-resistance characteristics.

[0003] Great success has been enjoyed by extruded thermoplastic materials, characterised by a high ultimate tensile strength and by good heat and wear resistance. For example, polypropylene (PP) on its own or bonded in compounds, gives the opportunity to be used in the most diverse applications, both in a rough form (powder, granules, ground matter, ...) and in the form of semi-finished products (typically films, yarns, non-woven fabric and the like). It must furthermore be noted that polypropylene, like various other thermoplastic materials, is ideally suited to be recycled or in any case processed again, for example in all those cases in which it comes out of the production line in a defective state.

[0004] A manufacturing area in which a certain incidence of waste occurs is precisely that of the manufacturing of semi-finished products of thermoplastic material, typically in the form of films or yarns or non-woven fabrics.

[0005] As known, semi-finished products in the form of films, yarns and non-woven fabrics are manufactured with suitable continuous matrixes and wound on spools, which are then sold to final users. The spools hence consist of a hollow supporting core, of various materials (cardboard, plastic, metal, ...), whereon hundreds of metres of film or yarn or non-woven fabric are wound.

[0006] The industry which deals with the manufacturing of these semi-finished products is often confronted with the problem of managing waste spools. As a matter of fact, the management and the control of the tension of the material (particularly of film) to be wound is not devoid of difficulties.

[0007] The semi-finished products which are wound are usually materials which have a much greater length and width compared to the thickness thereof and are hence sensitive to longitudinal tension variations, thus determining manufacturing faults if they are not suitably controlled. As a result spool quality is strongly determined by the winding process and by the disturbances which occur on the production line. Misalignment problems further exist of the material winding which, beyond a certain tolerance limit, represent faults to be rejected.

[0008] In the field of non-woven fabric other typical faults furthermore occur, which then determine spool rejection, for example material density or colour which are uneven or non-compliant.

[0009] Finally, during the winding, radial forces may occur within the spool (for example tensioning mistakes during winding) such as to cause the inner core to collapse and buckle whereon the material is wound, which then makes the spool non-usable on the machines of the subsequent processing.

[0010] All these faults result in the spool being unable to be marketed.

[0011] This leads to have a certain number of faulty spools in production environments, so that the need exists to process them to recover the plastic material which can be regenerated.

[0012] In order to recover the plastic material, the spool must be disassembled to recover, on the one hand, the plastic material in manageable batches and, on the other, the inner core which is incompatible with the recycling process.

[0013] For such purpose, it would be too burdensome to unwind the material from the core thereof. According to the art, spool-cutting machines are hence employed, which have the double task of reducing the size of the material on the spool, in order to ease the subsequent work by grinders or other machinery with different processing purposes, as well as of separating the inner tubular core.

[0014] The use of guillotine-like spool-cutting machines has by now become common practice for years, that is machines generally consisting of a support arc whereon a suitable hydraulic guillotine is vertically slidably mounted.

[0015] However, this type of machine is prone to some drawbacks.

[0016] Firstly, the way of operating of the guillotine releases the tensions in the material across the entire spool length, which may cause a sudden release of high energy, with the risk of projecting pieces of plastic material sideways to the machine, with the imaginable consequences on workplace safety.

[0017] Moreover, the high pressure of the guillotine applied to the spool produces stresses which end up deforming or breaking the core, which can no longer be reused.

[0018] In addition, in order to be able to process spools of thermoplastic material, a sturdy structure is needed which, moreover, must be sized to the maximum diameter of the spools to be treated, both in terms of resistance and of power. Such machines are therefore often oversized and operate with high energy consumption.

[0019] Moreover, the movement speed of the guillotine is very low and the entire process is characterised by long times (for example, about ten spools per hour). Process automation is also very low because, due to the high pressure imparted by the guillotine, the spool rests on a fixed, solid abutment plane and it is not conceivable to

obtain automatic transport lines.

[0020] Other cutting systems of the spool material have proven unfeasible so far due to other drawbacks.

[0021] For example, the option of using a classical miter saw with rotary cutting blade has proven not to be effective in cutting thermoplastic materials, especially if they are films or yarns or bobbin-wound, non-woven fabric, because the blade overheats and the saw teeth quickly tend to be clogged with the melted thermoplastic material, thereby making the cut fully ineffective. Moreover, a toothed saws inevitably leads to the formation of shavings and powders.

[0022] In the timber field use has already been made of longitudinal cutting systems, but the existing configurations, with the conventional toothed saws, have proved useless for plastic film spools.

[0023] GB2046147 discloses a cutting system of spool tying bands, which makes use of a rotary blade.

[0024] WO00/62981 discloses an apparatus for the opening of paper spools, wherein a rotary blade is caused to run longitudinally for cutting the material wound on a spool. This machine is conceptually applicable to any spool, but it has proven unsuited to the cutting of plastic film. It furthermore provides to handle the spools using gripping arms at the two ends, which act on the spool core, which makes the support frame complex and bulky, because it requires sturdy movement rails for raising and transferring the spool.

[0025] The need is hence felt to have a spool-cutting machine which overcomes the drawbacks existing in the prior art.

SUMMARY OF THE INVENTION

[0026] The object of the present invention is therefore to supply a system which solves the above-cited problems, providing a simple and lightweight machine, easily automatable within a working process.

[0027] Such a result, according to the invention, is achieved with an apparatus having the characteristics defined in essential terms in claim 1. Other preferred characteristics of the invention are defined in the dependent claims.

BRIEF DESCRIPTION OF THE DRAWINGS

[0028] Further features and advantages of the invention are in any case more evident from the following detailed description of preferred embodiments, given purely as a non-limiting example and illustrated in the attached drawings, wherein:

fig. 1 is a perspective view of a first embodiment of the apparatus according to the invention;
fig. 2 is an elevation front view of the apparatus of fig. 1 according to the invention;
figs. 3A and 3B are perspective and elevation front views, respectively, of the apparatus of fig. 1 in a first engraving step on a large-diameter spool (for example 1200 mm);
figs. 3B-3F are similar views to those of figs. 3A-B in subsequent spool cutting steps;
figs. 4A-4D are views similar to figs. 3A-B which illustrate two engraving steps of a reduced-diameter spool (for example of 600 mm);
fig. 5 is a perspective view of the apparatus of fig. 1, provided with a movable wedge accessory;
fig. 6 is an enlarged view of a detail of the apparatus of fig. 5 according to the invention;
fig. 7 is a perspective view of a variant of the apparatus of fig. 1, provided with a sharpening accessory;
fig. 7A is an enlarged view of a detail of the apparatus of fig. 7 according to the invention;
fig. 8 is a perspective view of a different embodiment of the invention for small-sized, lightweight spools;
fig. 9A is an elevation side view of the apparatus of fig. 7;
fig. 9B is a top plan view of the apparatus of fig. 7;
fig. 10A is a perspective view of the apparatus of fig. 8 which illustrates a first starting step of the machine;
fig. 10B is an elevation side view of the apparatus of fig. 10A; and
figs. 10C-10F are views similar to those of figs. 10A-B, which illustrate two subsequent engraving steps on a small-sized spool.

DETAILED DESCRIPTZION OF THE PREFERRED EMBODIMENTS

[0029] A spool-cutting apparatus 1, as clearly shown in fig. 1, comprises a very simple support frame, for example consisting of two parallel arc-shaped elements 4, 5 or a semi-arc shaped elelements(as illustrated in fig. 7) which support a central beam 6 arranged according to a longitudinal axis in the upper part of the apparatus.

[0030] Central beam 6 is provided with a linear guide, or with a toothed rack, for the horizontal translation of a moving operating unit 7. Said moving operating unit 7 comprises a translatable trolley 14 whereon an electric motor 8 is installed, which brings a circular blade 9 in rotation, resting on a respective frame, consisting for example of two brackets 10, 11. The rotation motion between motor 8 and circular blade 9 is transferred through a suitable transmission assembly, for example a gear reducer.

[0031] According to a peculiar feature of the invention, circular blade 9 has a smooth, cutting perimeter edge, that is devoid of teeth, preferably with a substantially triangular cross section.

[0032] Different sections of the blade edge are possible, for example right-triangle or isoceles-triangle as well as sections with a rounded edge.

[0033] The triangular-section cutting edge of the blade has a vertex angle which is large with respect to the lying plane of the blade, typically exceeding 60°. With a blade thickness ranging between 2 mm and 3 mm, preferably

2.5 mm, the height of the bevelled profile which defines the cutting edge ranges between 10 mm and 20 mm, preferably 15 mm.

[0034] Preferably, the cutting edge at the vertex of the blade is further bevelled with a smaller angle with respect to the remaining portion of the cutting edge closest to the rotation axis of the blade.

[0035] Moreover, as illustrated in figs. 7 and 7A, according to a preferred feature a blade sharpening device 19 is provided - equipped with an abrasive element known per se to a blade technician - arranged so that there may be a mutual coming closer between sharpener 19 and blade cutting edge when necessary and required. In particular, advantageously sharpening device 19 is mounted in a fixed position at a front end of the machine (as visible in fig. 7): when the need to proceed to sharpening is detected, the blade is brought into contact with the sharpener (19), in a way described further on, and is sharpened with a relative rotary movement.

[0036] Trolley 14 is mounted translatable according to a horizontal movement axis, by means of a suitable actuator controlled by an operator control unit (not shown). Moreover, at least circular blade 9, with the relative transmission assembly and motor 8, are mounted translatable along a second vertical axis with respect to trolley 14, for example driven by means of a vertical movement actuator 12.

[0037] For the partial protection of the actuating members and of the supply and control cables, a bellow cuff 15 is preferably provided 15.

[0038] Central beam 6, onto which trolley 14 is meant to translate, is of such a size that the length thereof is greater than the length of any type of spool meant to be processed by the apparatus.

[0039] Operating unit 7 is hence conceived to drive into rotation a circular blade with smooth cutting edge 9, furthermore causing it to slide along the two axes X (longitudinal horizontal axis) and Z (vertical axis). The horizontal translation and the vertical translation of circular blade 9 are achieved with a suitable system of pneumatic or hydraulic actuators or of electric motors, which are not described in detail because they are within the reach of a person skilled in the field of movement axes.

[0040] Below longitudinal support beam 6 the stationing base 2 of a spool 3 to be engraved and opened is arranged. Preferably, stationing base 2 is in the form of a V-shaped holding seat, for example integral with frame arches 4 and 5, provided with a series of conveying rollers or with a pair of conveyor belts (not shown), known per se, connected to a similar adduction transport line, along which waste spools arrive which travel according to the longitudinal axis thereof and are hence automatically conveyed to the opening station. Following the opening, spools 3 can be moved away from the processing station either unloading them laterally, for example by means of a forklift, or conveying them longitudinally with another removal conveying line.

[0041] For safety reasons, preferably the assembly comprising motor and blade is kept inoperative for the entire step of moving spool 3 in the proximity of the processing station.

[0042] In the following the operation of spool-cutting system 1 is briefly described for greater clarity.

[0043] In a first step, spool-cutting machine 1 is kept in an idle condition with operating unit 7 kept at the highest allowed height.

[0044] A spool 3, for example of thermoplastic film such as polypropylene, is transferred by means of a roller conveyor as far as V-shaped holding seat 2, so that the centre of priority of said spool 3 is aligned to the centre of the operating area of spool-cutting machine 1. The sloped-wall structure of said holding seat 2, which restingly supports the spool, favours both an alignment of the centre of gravity of said spool 3 with the longitudinal axis of spool-cutting machine 1, and an adequate retaining of spool 3 during the entire engraving operation. Thereby spool 3, under its own weight, remains fixed, stable and insensitive to the vibrations originating from the engraving operation, without the need to provide other gripping or halting elements.

[0045] In a second step, spool-cutting machine 1 is started and operating unit 7, through the system of motors and actuators, is caused to descend to an established height at a travel end of the sliding guide located below central beam 6. At this point, said rotary blade 9 is ready to perform the engraving on spool 3.

[0046] In a third step, once ascertained (through conventional accident-preventing safety devices and systems) that the operation area is free from personnel or from any accidental object, electric motor 8 is switched on and through a suitable gear reducer, transmits the rotation to blade 9. Operating unit 7 is hence caused to translate, at a preset speed, towards the opposite travel end. Blade 9, in its horizontal translation path, thus performs an engraving on spool 3, at an established cutting depth.

[0047] In a fourth step, operating unit 7 if furthermore caused to descend to a second established height, before going back to the first travel end, thus applying a second engraving on the material of spool 3 with a cutting depth equal or different with respect to the engraving depth performed upon the first passage.

[0048] Preferably a spool height detector is provided for the spool located on stationing base 2: through the geometric configuration of base 2, it is thus possible to determine the diameter of the spool and hence establish the travel along vertical axis Z which the blade must overall accomplish. Thereby operating unit 7 is able to perform a clear cut separation of the plastic winding from the spool core.

[0049] These engraving steps are performed a number of times suited to engrave the material of the spool on the entire height thereof.

[0050] The engraving steps will be repeated up to the engraving reaching plastic or cardboard core 17 of spool 3, but it is not ruled out that blade 9, if desired, may en-

grave also core 17.

[0051] At each of the engraving steps, an entire band 16 of spool material is progressively released, which spool opens on the two sides of the cut which will fall extending to the respective sides of conveyer 2 (see figs. 3A-3F).

[0052] After a preset number of passages, for example four in a large-diameter spool (figs. 3A-3F) and two in a medium-diameter spool (figs. 4A-4D), a series of bands of material 16 is obtained to be laid upon each other and arranged at the two sides of the core. Operating unit 7, at this point, will go to the end of the linear guide and will be lifted into a home position, in order to free the area to allow the removal of the bands of polymer 16 from the holding seat of base 2. Once the open-spool material has then been removed, the conveyor will provide to correctly position another spool to be processed in a central position of the operating area of spool-cutting machine 1.

[0053] At the end of the opening of each spool, or at greater time intervals, operating unit 7 moves towards the front end of the machine, to bring the blade into engagement with sharpening device 19 and perform the sharpening of the blade.

[0054] The operation of spool transfer and opening is strongly automatable and extremely fast.

[0055] According to a preferred optional variant, as clearly shown in fig. 5, operating unit 7 furthermore comprises an additional equipment in the shape of an expansion wedge 18, mounted on a bracket installed integral with the support of circular blade 9.

[0056] As clearly illustrated in fig. 6, wedge element 18 is arranged with a vertex radially facing the spool centre. Although not shown, on the machine there are mounted two of said wedge elements 18, mutually opposite along the cutting plane of blade 9, so as to have a wedge element downstream of blade 9 in the cutting path regardless of the direction of the individual run: by doing so, the moving wedge enters the engraving and produces, if necessary, an expansion of the cutting surface, aiding and accelerating the net severing of the bands of material. The two opposite wedge elements 18 are movably mounted, so that they are apt to be lifted simultaneously or alternatively when they must not operate in the engraving of the material.

[0057] In figs. 8-10 a different embodiment of the apparatus according to the invention is shown, apt to be used for much smaller and lighter spools, for example yarn spools of thermoplastic material.

[0058] This apparatus, as clearly shown in fig. 7, comprises a basement B, for example obtained from a metal sheet, suitable to be rested onto any work bench 32, whereon a fixed operating unit 20 is installed, meant for the cutting of spools, for example spools with a diameter ranging between 100 and 200 mm. On the same base plate B a system of linear sliding rails 21, 22 is furthermore provided - arranged to the side of operating unit 20 and parallel to a cutting axis - whereon a carriage 23 is slidably mounted.

[0059] Said carriage 23 is provided with a small spool-carrying shaft 24 and with an ergonomic handle 25 to allow an operator to impart a manual translation action on carriage 23 along rails 21 and 22. Spool-carrying shaft 24 is apt to support a small spool BO, such as a spool of thermoplastic yarn, in correspondence of said cutting line.

[0060] Preferably spool-carrying shaft 24 is adjustable in position transversally to the cutting line, to determine the opening position of the spool with respect to the core axis thereof.

[0061] Operating unit 20 comprises a support frame whereon a motorisation assembly 27 of a circular blade 28 provided with a smooth cutting edge is translatably mounted according to a vertical axis, with the features seen above in connection with the first embodiment.

[0062] The plane of the circular blade 28 is arranged on said cutting line.

[0063] The support frame with the relative movement actuator of motorisation assembly 27 are included in a shielding casing 29.

[0064] Operating unit 20 is furthermore provided with a suitable blade shield 30, preferably provided with a fixed upper portion and a pivoting lower portion, which is displaced upon contact with the spool to be cut. Within blade shield 30 a blade sharpener is preferably also installed, which is apt to be moved relatively closer to the blade when desired.

[0065] The operating area next to blade 28 is also equipped with an accident prevention cover 31, for example a front protection shield made of Plexiglass for tool machines.

[0066] In this case, too, it is hence provided an operating unit provided with a circular blade with a smooth cutting edge, mounted so as to determine a relative movement with respect to the spool to be opened according to two translation axes, a first axis X of horizontal movement (carriage 23 which moves with respect to the fixed cutting assembly) and a second axis Z of vertical movement (the motor assembly which is mounted vertically adjustable with respect to base plate B). Since in this case the spools are small and lightweight, they can be manually loaded onto spool-carrier 24; moreover a configuration is preferable wherein spool BO is displaced onto carriage 23, while blade 28 is fixed and simply adjustable in a vertical direction, since it is meant to open the spool in a single run (even though that is not to be understood in a limiting manner).

[0067] This embodiment is conceived for manual operation by an operator, even though it is not ruled out that carriage 23 may be motorised to cause it to move automatically on the horizontal translation axis.

[0068] In general, after having installed basement plate B on a generic work bench, the operator inserts a yarn spool BO onto spool-carrying shaft 24, preferably locking it into position.

[0069] Operating unit 20 is adjusted at a suitable height based on the type of spool. Motor 27 is then switched on

to start the rotation of blade 28. Carriage 23 is pushed by the operator using handle 25, causing it to slide on rails 21,22 from left to right or vice versa (in the drawings of the attached figures), until bringing the spool into engagement with blade 28 (figs. 10C e 10D).

[0070] Through a suitable and limited thrust pressure by the operator, spool BO is engraved, by means of blade 28, with a single run. Hence, once the cut has been performed, the operator can remove from spool-carrying shaft 24 the side bands of plastic yarn obtained at the end of the cut (figs. 10E-10F). The spool core, of plastic or cardboard, remains on spool-carrier 24 and will be manually removed later.

[0071] As can be clearly understood from the above-reported description, as regards all embodiments described here according to the present invention, the devised system allows to perfectly achieve the objects set forth in the preambles.

[0072] The solution offered here implies a series of advantages over the prior art.

[0073] As a matter of fact, the use of a rotary circular blade with a smooth cutting edge allows to perform a more progressive engraving of the material, avoiding sudden reactions, projection of pieces of material and jamming of the blade with the plastic material.

[0074] Moreover, being able to accurately adjust blade cutting speed and depth, the stresses generated during the opening of the spool are determinable regardless of the spool size, so that the sizing (in terms of sturdiness and employed power) of the machine is not affected by the maximum size of the spool to be processed.

[0075] Furthermore, energy consumption and relative costs are markedly lower than the prior-art guillotine.

[0076] What is more, unlike conventional spool-cutting machines, there are no pressures applied to the spool such as to cause deformations or net breaking of the core. That way it is possible to advantageously save and reuse the cores of open spools.

[0077] Moreover, the spool opening speed is markedly higher than what occurs in conventional spool-cutting machines.

[0078] Finally, the very reduced pressure imparted vertically (neglectable with respect to the weight typical of spools), allows to use a roller conveyor or a tape conveyor in correspondence of the spool stationing base; therefore, providing also the sharpening device onboard the machine, it is possible to obtain a greater automation which results into a synergistic acceleration of the spool handling operations.

[0079] However, it is understood that the invention must not be considered limited to the specific arrangements illustrated above, which make up only exemplifying embodiments thereof, but that different variants are possible, all within the reach of a person skilled in the field, without departing from the scope of protection of the invention, as defined by the following claims.

[0080] For example, although the description refers exclusively to spools of thermoplastic material, it is not ruled out that the same system of the invention may subsequently be used also with spools of a different nature.

Claims

1. Apparatus for the opening of spools of wound material, comprising at least one support frame (4, 5, 19) whereon an operating unit (7, 20) is mounted, provided with opening means of said spool, comprising at least one circular blade (9, 28) longitudinally translatable to said spool, **characterised in that**
said circular blade (9, 28) has a smooth perimeter cutting edge with a triangular cross-section and is driven into rotation by a motor assembly (8, 27) mounted on said support frame (4, 5, B) so as to determine a first (X) and a second (Z) axis of translation with respect to a support base (2, 24) of said spool,
said axes of translation (X, Z) being mutually orthogonal and said first axis of translation (X) being parallel to a longitudinal axis of said spool and to said circular blade (9, 28) and
said movable operating unit (7) is mounted translatable according to said first axis of translation (X) horizontally onto said frame (4, 5) in a position above said support base in the shape of a fixed holding seat (2) having a V-section.

2. Apparatus as in 1), wherein said motor assembly (8) and said circular blade (9) are mounted translatable along said second axis of translation (Z) being vertical on a carriage (14) translatable along said first axis of translation (X).

3. Apparatus as in 1) or 2), wherein said holding seat (2) has a V-shaped section and is apt to host a roller conveyor or a V-shaped belt conveyor.

4. Apparatus as in 1), 2), or 3), wherein said operating unit (7) comprises at least a movable expansion wedge-shaped device (18) mounted integral in translation with said circular blade (9) .

5. Apparatus as in any one of the preceding claims, wherein it is provided a spool height detecting device, for determining the size of the diameter thereof and for defining a maximum travel of said blade (9) along said second axis of translation (Z) .

6. Apparatus as in any one of the preceding claims, wherein a sharpening device is provided (19) in a fixed position at a front side of said apparatus.

7. Apparatus as in 1, wherein said opening means comprising a circular blade (28) with smooth perimeter cutting edge, driven into rotation by said motor assembly (27) are mounted translatable along said

second axis of translation (Z) with respect to said support frame (B) and said support base (24) of the spool is mounted on a carriage (23) translatable along said first axis of translation (X).

8. Apparatus as in 7, wherein said carriage (23) is manually translatable on guides (21, 22) integral with said support frame in the shape of a basement (B).

9. Apparatus as in 7 or 8, wherein said circular blade (28) is provided with a partly pivoting protection cover (31).

10. Apparatus as in 6, 7 or 8, wherein said support base (24) comprises a small shaft for the insertion of a spool core, aligned substantially parallel to said first axis of translation (X) .

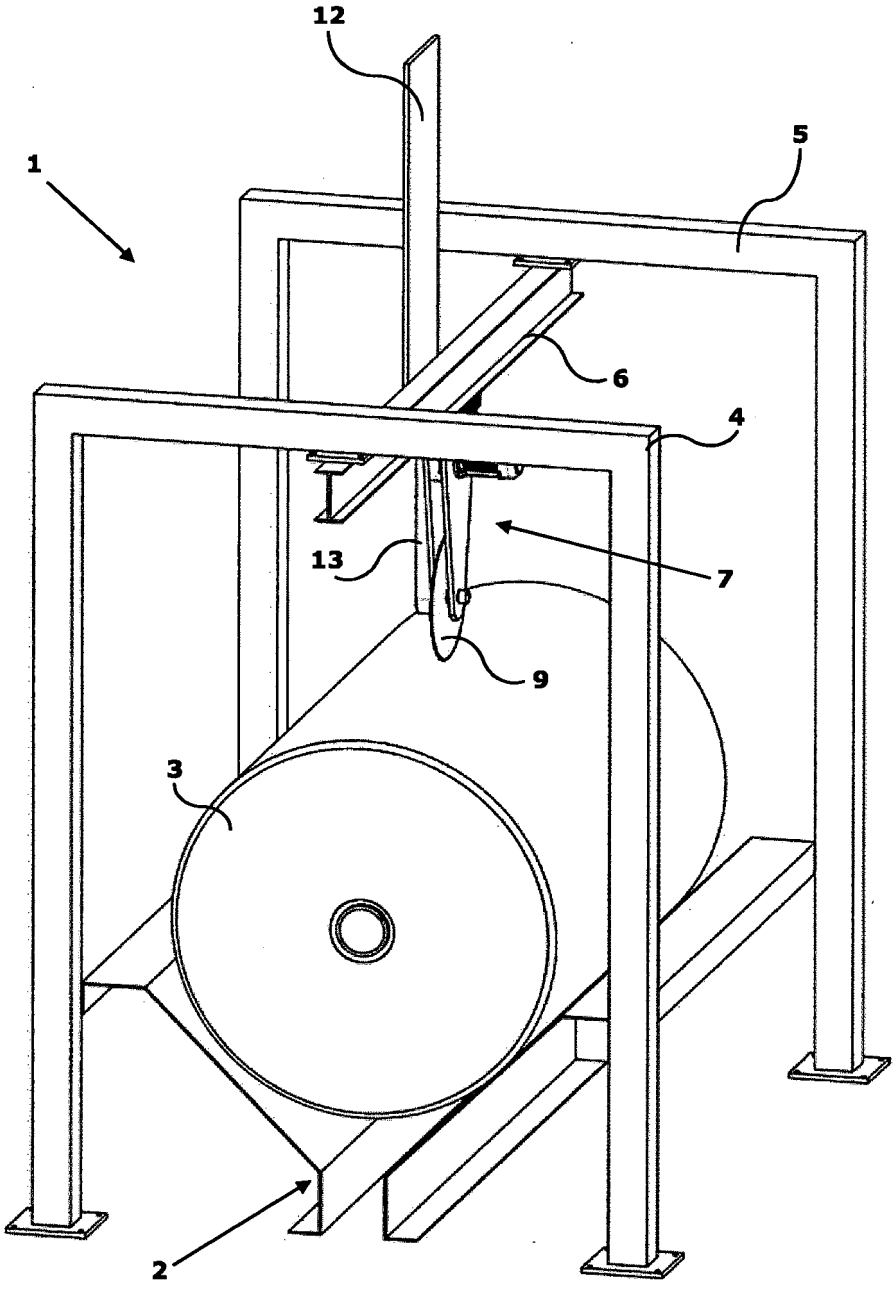

Fig. 1

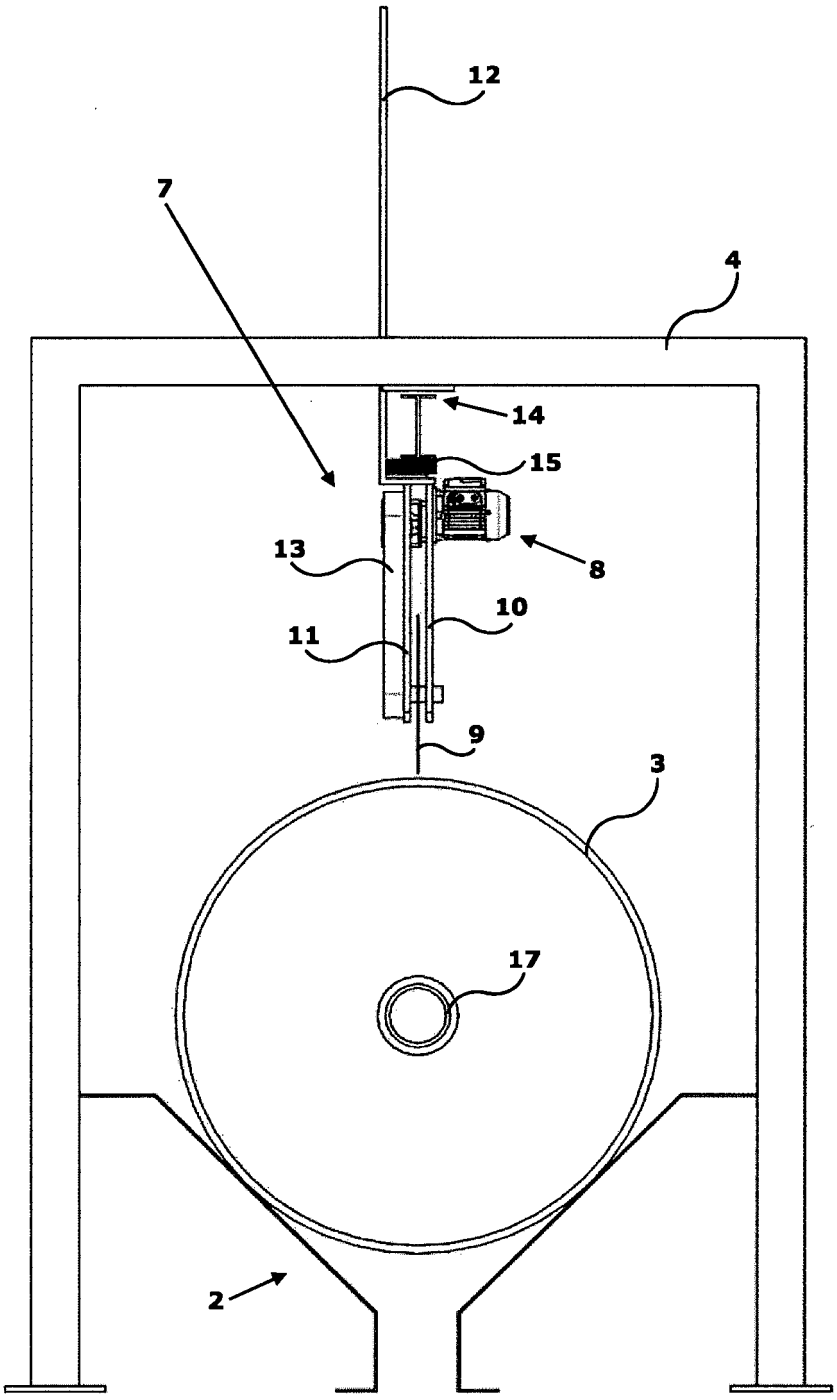

Fig. 2

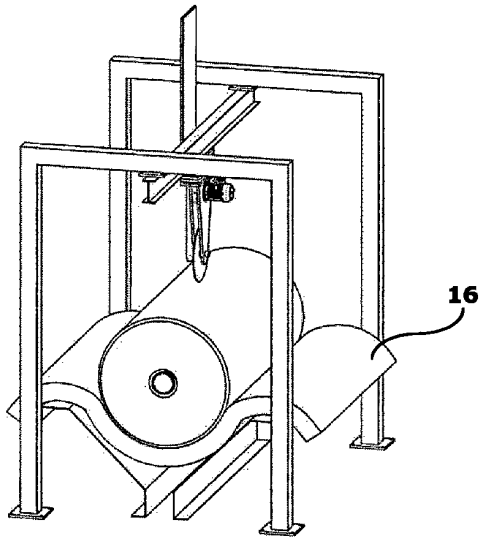

Fig. 3A

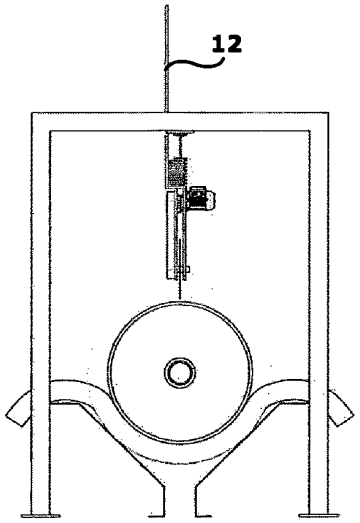

Fig. 3B

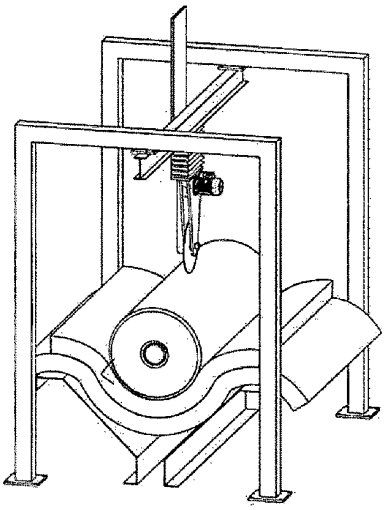

Fig. 3C

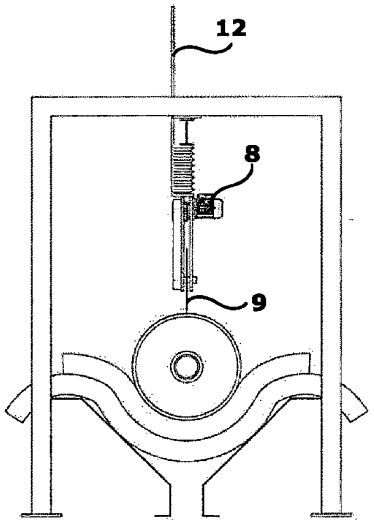

Fig. 3D

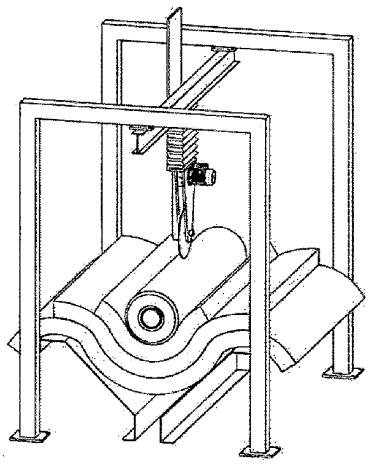

Fig. 3E

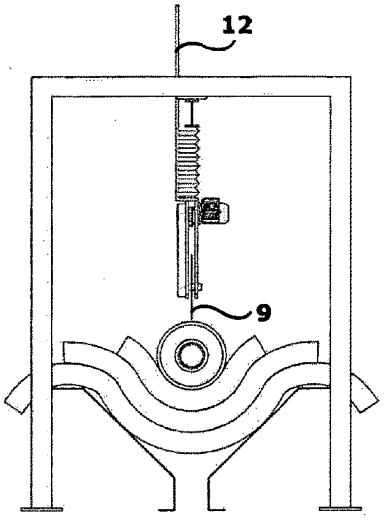

Fig. 3F

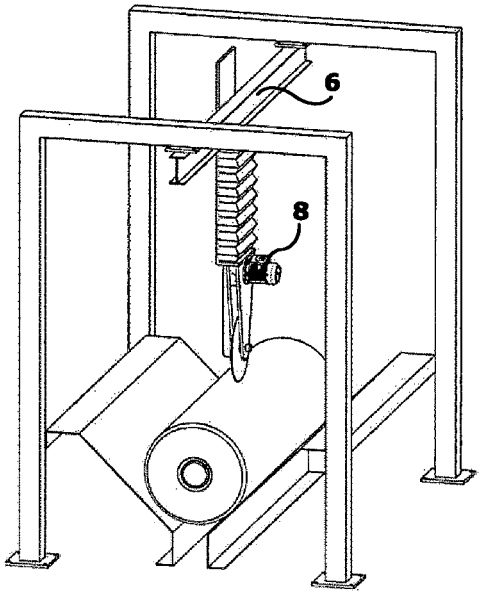

Fig. 4A

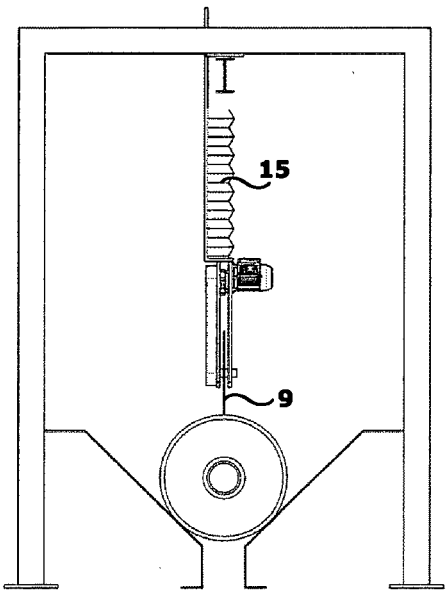

Fig. 4B

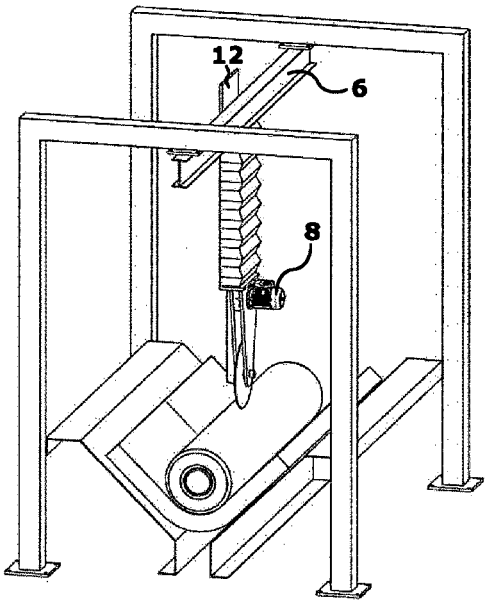

Fig. 4C

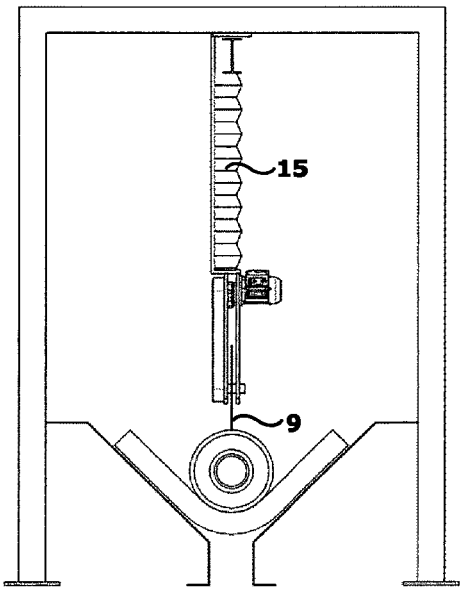

Fig. 4D

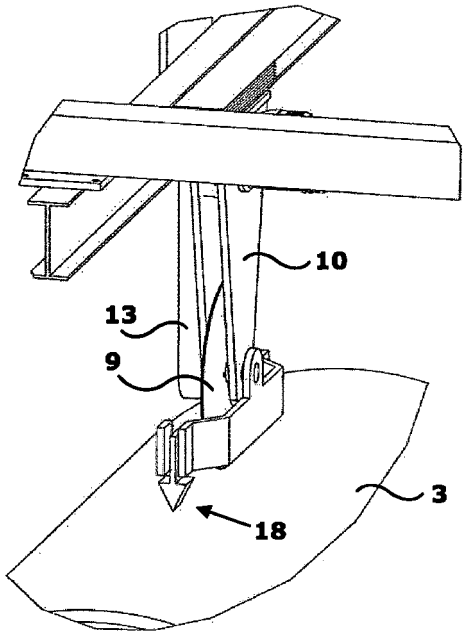

Fig. 6

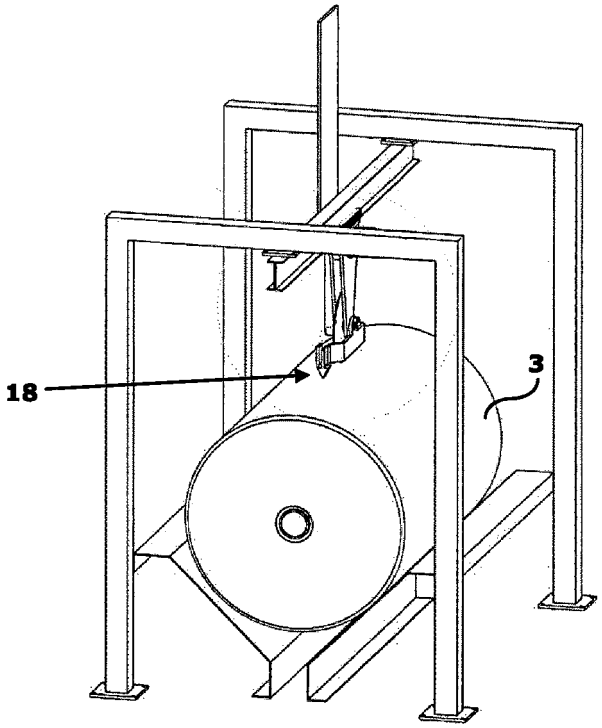

Fig. 5

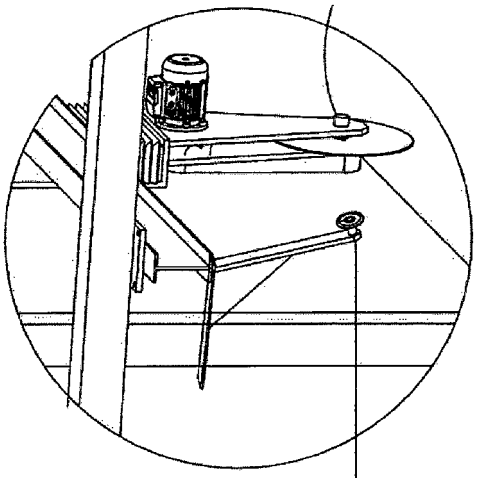

Fig. 7A

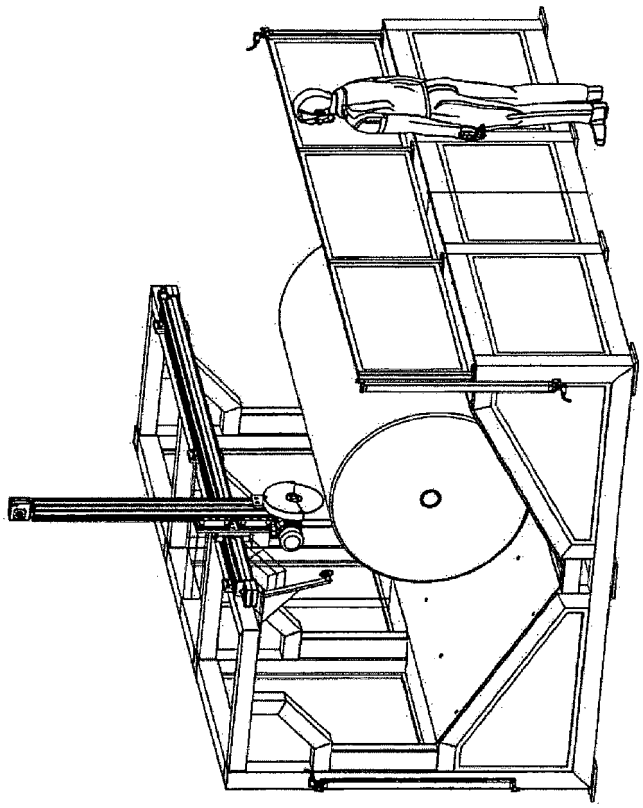

Fig. 7

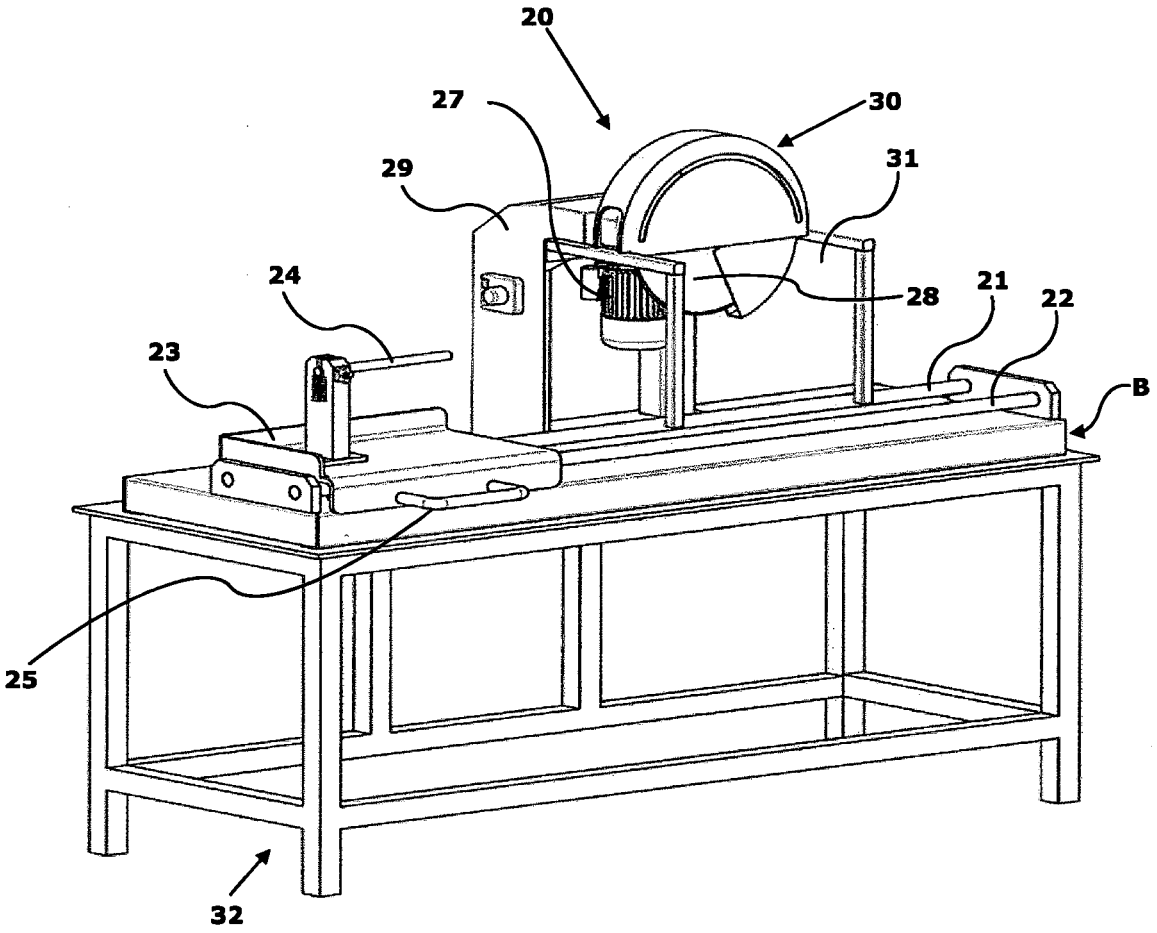

Fig. 8

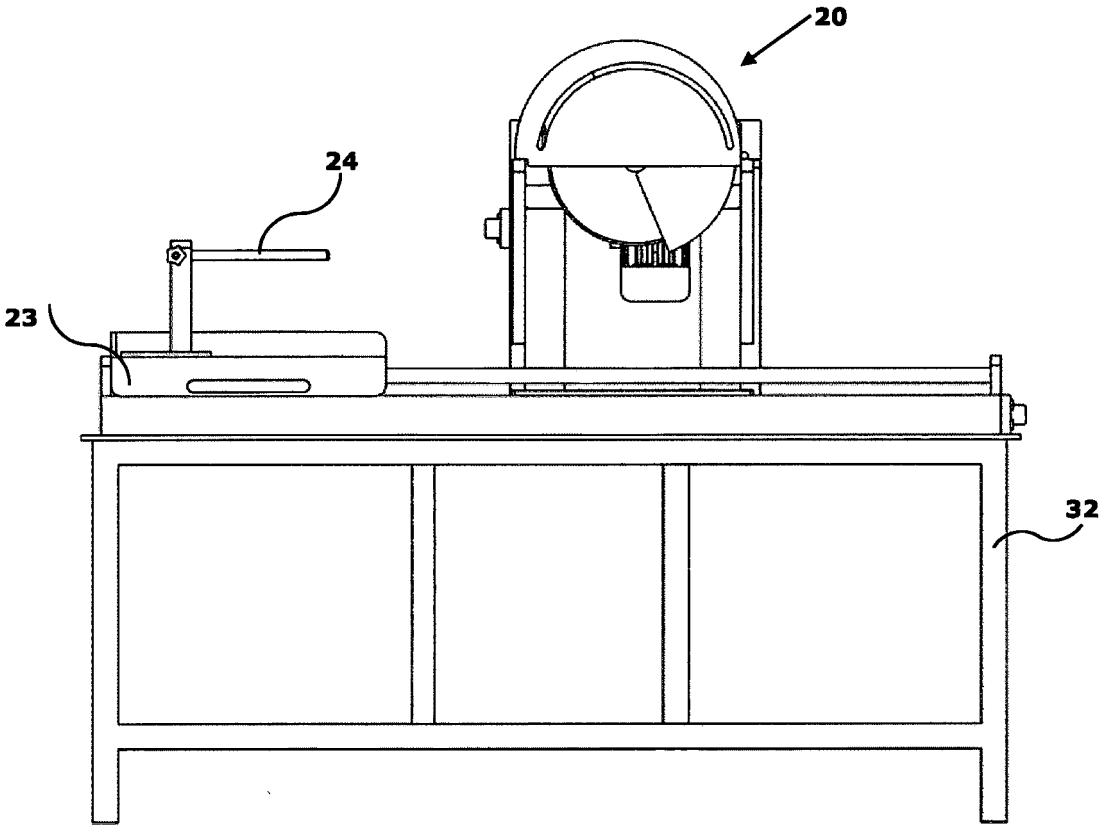

Fig. 9A

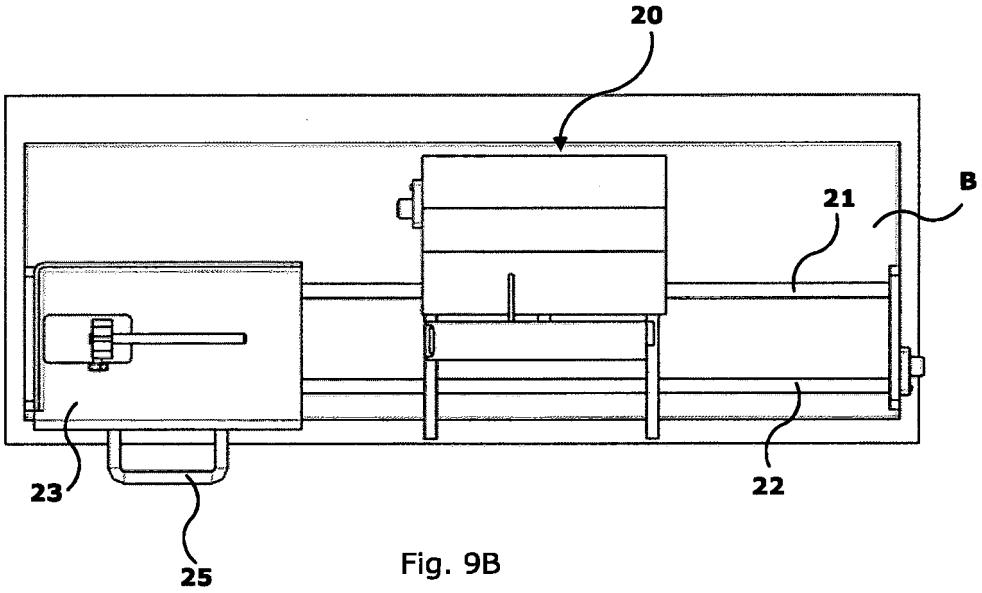

Fig. 9B

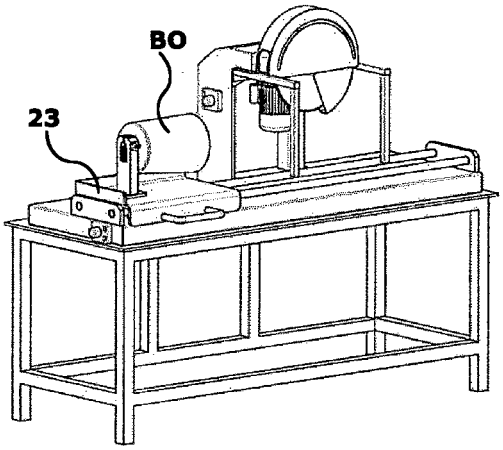

Fig. 10A

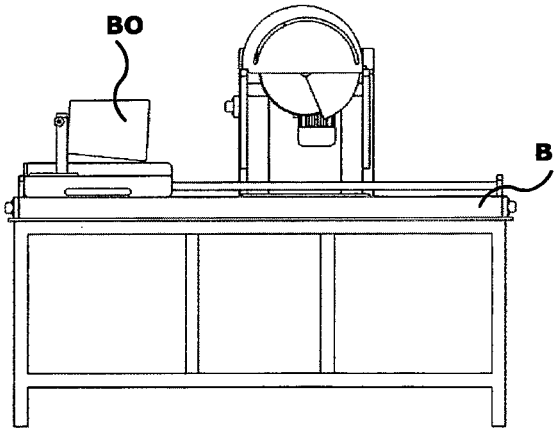

Fig. 10B

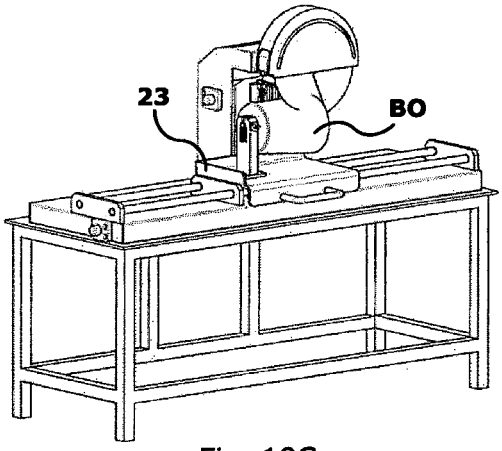

Fig. 10C

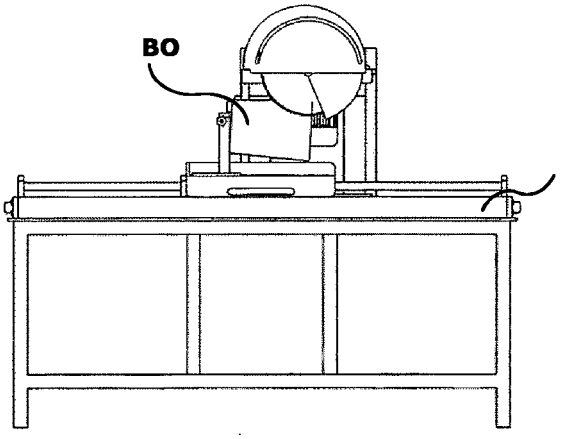

Fig. 10D

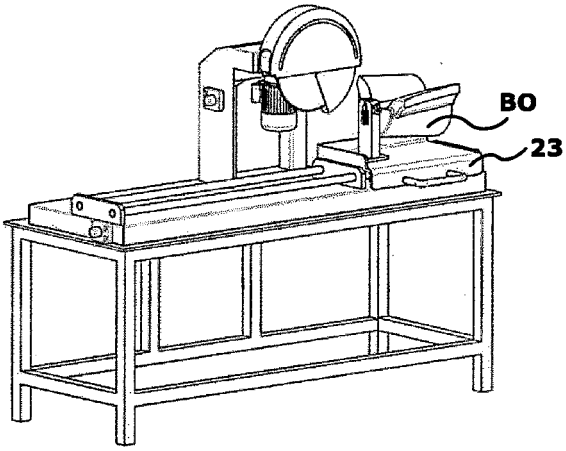

Fig. 10E

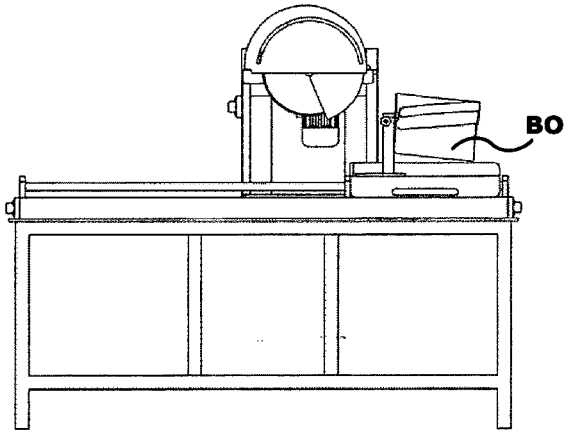

Fig. 10F

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EUROPEAN SEARCH REPORT

Application Number
EP 19 19 7403

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Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
A,D	GB 2 046 147 A (LOEWY ROBERTSON ENG CO LTD) 12 November 1980 (1980-11-12) * page 2, line 11 - line 115; figures 1,2 * -----	1-10	INV. B26D3/00 B26D1/16 B26D1/18 B26D5/06 B26D5/08 B26D1/00 B26D7/01 B65H19/10
A,D	WO 00/62981 A1 (CORE LINK AB [SE]; ESPING THOMAS [SE] ET AL.) 26 October 2000 (2000-10-26) * page 2, line 1 - page 4, line 22; figures 1-4 * -----	1	

TECHNICAL FIELDS SEARCHED (IPC)

B26D
B65H

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
Munich	27 March 2020	Maier, Michael

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27-03-2020

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