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(54) **EPICYCLOIDAL WRAPPING MACHINE FOR PALLETS**

EPIZYCLOIDALE EINWICKELMASCHINE FÜR PALETTEN

FARDELEUSE DE PALETTES EPICYCLOIDALE

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Description

[0001] The present invention relates to a wrapping machine for pallets. In particular it relates to a wrapping machine for pallets in which the product to be wrapped is in a fixed position and packaging is performed by means of spiral winding of an extendable film onto the product.

[0002] In the packaging or stabilization of palletized products, i.e. products piled on pallets, or for the production of multiple packs of products of various kinds (for example, little packets of coffee) grouped together in bundles, widespread use is made of pallet-wrapping machines in which a film of extendable plastic material (for example low-density linear polyethylene) is wound around the product. This type of extendable film is characterized by a notable ability for elongation and elasticity retention such that it is able to exert a retaining action on the products around which it is wound.

[0003] On the market there exist different types of pallet-wrapping machines which are affected, to a greater or lesser extent, by various drawbacks. In order to understand the innovative and revolutionary significance of the present invention, it is necessary to consider in detail the two main features of these machines: the pre-stretching capacity and the moving efficiency.

[0004] Firstly, it is necessary to consider the pre-stretching device associated with the bobbin of extendable film.

[0005] The tension of the film is approximately constant for an elongation variable from about 80% to about 300% and therefore it is preferred to stretch the film prior to winding thereof around the product, not only to provide it with the desired technical retaining characteristics, but also so as to use less material while achieving the same results. This elongation, also referred to as pre-stretching, is generally performed at the same time as unwinding of the film, by causing the latter to pass between a pair of rubberized rollers, shortly spaced apart and having different rotational speeds: the downstream roller rotates faster than the upstream roller, causing elongation of the film. The short distance between the two rollers has the purpose of preventing transverse contraction of the extendable film, a contraction which would not allow the desired pre-stretching in the longitudinal direction.

[0006] The pre-stretching unit, over time, has assumed different forms and characteristics with a view to constantly improving its performance and overcoming the intrinsic problems associated with operation thereof.

[0007] In fact, the pre-stretching unit must not only simply release the stretched film, causing it to unwind from the bobbin, but must be able to ensure that the operating parameters, such as the feed speed and the tension imparted to the film, remain as constant as possible despite the fact that the winding conditions vary with a certain regularity. The point where the film is released, from the pre-stretching device, for example, follows tra-

jectory which is substantially circular - by means of moving systems which will be discussed further below - whereas the product does not necessarily have a cylindrical shape with an axis coinciding with the axis of the circular trajectory; on the contrary, in most cases, it has a parallelepiped or in any case irregular shape. This means that the distance between the point where the film is released and the point where it adheres to the product varies with a certain regularity, which gives rise to fluctuations in the tension and feed speed of the film. Moreover, it should be possible to regulate the release tension, as well as the tension imparted to the film during pre-stretching, in accordance with the specific requirements.

[0008] According to the known art, various solutions have been proposed both in order to regulate the speed and the feed tension according to the surrounding conditions, and so as to be able to regulate the degree of pre-stretching.

[0009] The most simple and economical solution adopted generally consists in connecting the two rubberized idle rollers by means of a pair of fixed gears of different diameter. In this way the speed ratio between the two rollers - and hence the pre-stretching tension - remains constant and the film is unwound from the bobbin, causing rotation also of the rubberized rollers, owing to the tension imputed to the film and which is generated as a result of the relative movement between bobbin of reel and product. This solution may be acceptable in those cases where a relatively high degree of tensioning of the film is tolerated - it is suitable, therefore, where the product to be packaged is stable, as in the case of a pile of bricks, but not so when the products are deformable, as in the case of cardboard boxes, since the latter would be irremediably crushed at their edges - and, above all, when operation is performed with low tension of the film, which film is thus not affected by variations due to the irregular shape of the product.

[0010] In order to overcome these drawbacks, the most advanced wrapping machines for pallets use a motorized pre-stretching unit in which at least one of the two rollers is motor-driven and the speed of rotation of the pre-stretching unit, and indirectly the feed speed of the film, are regulated on the basis of the tension detected on the film downstream of the pre-stretching unit. Normally the tension of the film is detected by means of a so-called "jockey roller" consisting of a roller which is mounted on the end of an oscillating arm and over which the film travels: the tension of the film causes the arm of the jockey roller to oscillate, activating electric systems which emit a regulating signal for driving the pre-stretching unit. This system, in addition to being somewhat complex, suffers from a notable intrinsic response inertia which necessarily limits the working speed of the pallet wrapping machine. In fact, when operating at high speeds, there is the risk of a delay in the response of the system compared to that required, resulting in counter-productive effects. To avoid adversely affecting the

reliability of the machine, the operating tension must be necessarily kept low, otherwise sudden variations in tension may cause breakage of the film.

[0011] In the cases where, moreover, the degree of pre-stretching must also be regulated, the rubberized rollers may be driven independently, or use may be made of a motor-driven roller coupled with a braked one, and so on.

[0012] All these systems, as has been seen, are complex and, for one reason or another, are never entirely satisfactory.

[0013] Secondly, it is necessary to consider the system for the relative movement between the palletized product and the bobbin with its pre-stretching unit.

[0014] The wrapping machines for pallets used hitherto in the art consist substantially of two constructional types: one type where the bobbin of extendable material and the pre-stretching unit are mounted so as to slide vertically on a column and the product is made to rotate on a rotating platform, and another type where the product is fixed and the bobbin with the pre-stretching unit are made to rotate in a spiral path around the product to be packaged. The second type is specially designed for high productivity and is the one to which the invention refers.

[0015] In order to provide the spiral path around the product, the bobbin and the pre-stretching unit are mounted on a support bracket which describes a circular trajectory as it moves along the axis of the spiral. This movement is obtained substantially by two methods: by means of a rotating arm, hinged on a vertical axis at the top of the product, or by means of a rotating ring, surrounding the product, both moving vertically on suitable guides formed, normally, on a bridge frame which embraces the transportation line on which the palletized products travel.

[0016] Both these solutions have serious drawbacks.

[0017] Firstly, the bobbin and the pre-stretching unit mounted on the support bracket constitute a not insignificant mass, of the order of 70-80 kg, which shall be made to rotate along a circular trajectory with a wide radius (for palletized products, a minimum diameter of about 2 m is required) and with an angular speed of about one revolution per second, thus generating considerable centrifugal forces. These considerations are particularly important in the case of machines with a rotating arm where the arm must be provided with an additional balancing mass.

[0018] All this results in weighing down of the support structure, which must be dimensioned so as to withstand mainly the centrifugal forces (compared to these letters, the forces due to the wrapping tension become negligible), and in serious complications in view of the accident prevention measures which are to be adopted. In fact, a mass of 70-80 kg which moves at a speed of about 6 m/sec. possesses a considerable amount of kinetic energy, which is fairly dangerous should it accidentally come into contact with an object or a person or,

even worse, should the support structure collapse. It is in particular for this reason that the winding speed, and hence the productivity of conventional wrapping machines for pallets, normally does not exceed the values mentioned above.

[0019] Secondly, in the case of use of a motorized pre-stretching unit, the motor for the driving system must be necessarily mounted together with the pre-stretching unit on the support bracket. This involves the transfer of power, an electric power for the most part of the cases of electric power, from a fixed installation to the motor in movement along a circular trajectory. The power supply line will therefore make use of sliding contacts or other known systems, but will nevertheless be complex and costly.

[0020] Finally, the replacement of the bobbin always involves stoppage of the machine with access by the operator inside the working zone of the pallet wrapping machine. This operation, in addition to involving a not small amount of dead time and requiring suitable safety measures, also results in other indirect disadvantages.

[0021] In particular, the bobbin may run out at a time when the operator is involved in other operations and therefore the machine downtime will also be determined by the time necessary for the operator to realize that replacement is required and to interrupt the operation which he was already performing. Moreover, on some occasions, the bobbin runs out without having completely enveloped a product: in this case the operator is obliged to eliminate the portion of film already wound on the product and recommence the packaging of that product so as to avoid the same remaining slack or incomplete.

[0022] It has become generally widespread practice for an expert operator, as a way of overcoming these drawbacks, to interrupt operation of the machine of his own initiative, at a moment when he has some free time available, in particular when the bobbin is not yet entirely used up, but there is no longer a sufficient quantity of film to package entirely a new product; this operation enables excessive dead time owing to machine stoppage to be eliminated, but results in wastage of material which is no longer recovered.

[0023] US-5,027,581 discloses a wrapping machine comprising a ring structure embracing the work to be wrapped and rotatable in a vertical plane, said ring being equipped with guiding rollers, dispensing roller and a bobbin of stretchable plastic film. A drive means is provided to cause rotation of the ring through direct engagement with a driven belt; accordingly, the rotation of the ring structure is determined solely by the speed of the belt and, hence, tension in the film is affected by the shape and position of the work to be wrapped; further, a portion of the film, which is not enough to complete the wrapping operation of the work, is eliminated when the bobbin reaches its almost completely unwound status; finally the pre-stretching unit is not self-sensitive to the tension of the film and must be properly controlled.

[0024] The object of the present Invention is therefore that of eliminating entirely all the drawbacks mentioned above and, in particular, of providing a machine which is able to wrap a product, resting on the pallet in a fixed position, with an extendable film, by stretching the film itself, during feeding thereof, in a constant and uniform manner and without making use of complicated mechanisms for adjusting the tension; preferred embodiment, this machine must also allow elimination of the dead time resulting from machine stoppage and facilitate maintenance work by the operator; a final object is that of achieving the aforementioned features with a machine which is both streamlined and lightweight and which thus allows a reduction in the manufacturing and rigging costs.

[0025] These objects are achieved with a wrapping machine for pallets of the type defined in claim 1 comprising a fixed frame on which there is mounted an annular structure surrounding a product to be wrapped and translatable with respect thereto, wherein a film of plastic material is distributed around said product by the annular structure, wherein said annular structure has a configuration in the form of an epicycloidal gearing in which the spider, the planetary gears and the driving gear consist, respectively, of an annular support, a set of rollers rotatably mounted on parallel axes mounted on said annular support along a circular line, and a driving element operated by motor means and acting on said rollers, and wherein said film is supplied from the outside of said annular structure and, crossing said annular structure between two of its adjacent rollers, is distributed internally by the rotation of said annular structure, so as to be applied in turns on said product.

[0026] Further characteristic features and advantages of the machine according to the invention will be apparent, however, more clearly from the detailed description which follows of a preferred embodiment thereof, provided by way of example and illustrated in the accompanying drawings in which:

Fig. 1 is a side elevation view, with parts removed, of a wrapping machine for pallets according to the invention;

Fig. 2 is a top plan view of the wrapping machine for pallets according to the invention;

Fig. 3 is a view, on a larger scale, of a partial section along the line III-III of Fig. 2;

Fig. 4 is a view, on a larger scale, of the details shown enclosed by the circle B in Fig. 1;

Fig. 5 is a plan view, on a larger scale, of the driving system and the pre-stretching unit according to a preferred embodiment of the invention;

Fig. 6 is a view, similar to that of Fig. 2, of another embodiment of the invention; and

Fig. 7 is a view, similar to that of Fig. 4, of the embodiment shown in Fig. 6.

[0027] As can be seen in Fig. 1, a bridge frame P, of

a known type, is located across a transportation line T, at the position for packaging towards which a product C, resting on a pallet, moves. According to the invention, the machine which actually performs wrapping with the extendable film consists of a ring structure N (which can be seen in Fig. 1 in the raised position) mounted so as to slide vertically on the bridge frame P and raised and lowered by means of a raising system operated by a motor M.

[0028] The annular structure N consists of a pair of annular rims - a lower one 1 and upper one 2 - which are fixed together by a set of pins arranged along an ideal circular line, on which there rotate rollers 3 mounted idle between said rims 1 and 2 which thus form an annular support for said rollers. The two rims 1 and 2 are guided on a guiding frame 4 so that they are free to rotate in their plane. Preferably, the guiding frame 4 comprises a set of wheels 5, in particular eight wheels 5 (Fig. 3), which are arranged uniformly along the perimeter of the rims 1 and 2 and on which the annular structure N is supported, being free to rotate.

[0029] An endless belt 6 extends over the rollers 3, on the outside thereof, embracing the entire set of rollers 3 as shown in Fig. 3, and also traveling over a driving pulley 7 of a power motor 8 (Figs. 4 and 5) arranged on the outside of the annular structure N. The movement of the belt 6 operated by the motor 8, being transferred to the periphery of the rollers, causes rotation of the rollers 3 about themselves and/or the rims 1 and 2, which form a single body with the rollers, around the centre of the circular structure N, depending on which of the two offers least resistance. If, in fact, rotation of the rims supported on the wheels 5 offers a greater resistance, the belt 6 will preferably cause rotation of the rollers 3 and vice versa.

[0030] In other words, an epicycloidal transmission system is provided, in which the planetary gears are the rollers 3, the spider consists of the combined arrangement of the two rims 1 and 2, and the belt 6 forms the driving gear; the movement of the belt 6 is transmitted to the rollers 3 and to the rims 1 and 2 by suitably adjusting the resistance to the movement offered by them: should, for example, the two rims 1 and 2 be stopped, the movement of the belt would be converted totally into a rotation of the rollers 3 about their axes and, vice versa, if rotation of the rollers 3 were blocked, the movement of the belt 6 would produce rotational driving of the two rims 1 and 2 together with the rollers fixed thereto.

[0031] Normally the internal friction is such that rotation of the entire annular structure N is privileged over rotation of the individual rollers. Therefore, by suitably adjusting a braking system (not shown) operating over the rims 1 and 2, it is possible to obtain an intermediate movement, i.e. a partial rotation of the rims and partial rotation of the rollers about themselves.

[0032] One of the rollers 3 - the roller 3a - is rubberized and is coupled with a corresponding rubberized roller 3b, arranged at a short distance from the roller 3a and

further internally with respect to the ideal circular line described by the set of rollers (Fig. 5). These two rollers 3a and 3b form a pre-stretching unit, which was discussed in detail above, having a well known configuration. Preferably, for the sake of greater simplicity and economy, they are connected by means of a gear-type coupling arrangement which provides a transmission ratio such that the roller 3b rotates at a greater speed than the roller 3a.

[0033] A bobbin 9 of extendable plastic film is mounted, externally with respect to the ring structure N, on a suitable support (not shown) which allows free rotation thereof.

[0034] Operation of the wrapping machine for pallets according to the invention will now be described so as to clarify even further additional characteristic features and details of the machine.

[0035] Initially an end of the film 10 is passed onto the roller 3a and then, in the opposite direction of rotation, onto the roller 3b as well, and, by means of a transmission roller 11, is guided finally, with automatic gripper systems of the known type, which we shall not consider here, onto the product to be wrapped. The film 10 does not interfere with the belt 6 since the latter adheres to a upper portion of the rollers 3 (as can be clearly seen in Fig. 4), whereas the film adheres to the remaining portion thereof.

[0036] When the motor 8 is started up, the belt 6 causes rotation of the annular structure N which, in turn, causes rotation, about the product C, of the point where the extendable film 10 is released - which corresponds to the position of the transmission roller 11 - performing the desired winding action. The spiral path of the point where the film adheres onto the product C, is obtained by combining the rotary movement of the annular structure N with vertical translation thereof on the bridge frame P.

[0037] Actually, what happens is somewhat more complex: let us analyse the situation.

[0038] First of all, as the film is gradually distributed onto the product C, passing across the pre-stretching unit consisting of the two rollers 3a and 3b, it undergoes the desired elongation.

[0039] Secondly, the epicycloidal system described has a fairly important characteristic feature, namely it constitutes a superb self-adjusting mechanism for the feeding tension of the film 10. In fact, let us suppose that, on account of the irregularity of the shape of the product C, at a certain time the feeding of a greater quantity of film is required, resulting in an increase in the tension exerted thereon. The increase in tension immediately produces an equal and opposite reaction on the transmission roller 11 and on the pre-stretching unit, resulting in a braking action on the annular structure N. This leads to a slowing down in the rotation of the annular structure N (spider) and in a corresponding increase in the speed of rotation of the rollers 3 (planetary gears), in particular the roller 3a which determines the

feed speed of the film 10 and which, therefore, we shall also call feed roller 3a. The combined action of acceleration of the pre-stretching unit and slowing down of rotation of the annular structure, and hence also of the point where the film is released, corresponding to the roller 11, favours a reduction in the tension of the film and therefore reestablishes instantaneously, owing to the lack of delays in the system, a new equilibrium condition. This equilibrium condition is typical of the particular working condition of the epicycloidal system, in particular the internal friction of the system and speed of the belt 6, and therefore may be regulated, for example, by suitably adjusting the braking system mentioned above. The ideal braking condition is the one where, with practically zero tension, i.e. where no film is required, there is also no feeding of the film, namely rotation of the annular structure occurs exclusively without rotation of the rollers.

[0040] The rapid succession of these equilibrium conditions allows operation to be carried out always with a substantially constant tension of the film 10, without having to adopt complicated automatic adjusting systems, such as the jockey roller of the known art.

[0041] Another fairly interesting aspect of the wrapping machine for pallets according to the invention consists in the fact that, since the bobbin is mounted externally of the annular structure, it unwinds the film both onto the product C and onto the perimeter of the annular structure itself.

[0042] In fact, during a complete revolution of the annular structure N, one turn of film is envelopped on the product C and, at the same time, is distributed also onto the annular structure N, thus unwinding a quantity of film far greater than that strictly necessary for packaging of the product C.

[0043] Ideally, if the film were not extendable and the perimeter of the product C were equal to the circumference of the annular structure N, at each turn a quantity of film exactly double that required would be unwound. In reality, the intense pre-stretching which the film undergoes before being wound onto the product and the size of the latter, which never is as great as that of the perimeter of the annular structure N, is such that the film fed to the product is only a small amount of that actually unwound from the bobbin 9.

[0044] This excess of film unwound from the bobbin 9, accumulates, ringwise, in the form of a strip 10a adhering to the outside of the rollers 3. During operation, the feed roller 3a draws the film from the innermost ring of the strip 10a, while the bobbin supplies the outermost ring of the strip 10a. It is obvious that the strip 10a, resting on the rollers 3 and having to unwind an amount of film equal to that required for packaging will have a peripheral speed, relative to the rims 1 and 2, equal to the peripheral speed of the rollers 3, i.e. equal to the feed speed of the film.

[0045] Using a bobbin of extendable film, commonly used in this sector, the maximum thickness which the

strip 10a may assume is 10 mm, which, for a diameter of 2 m typical of the annular structure N, means a variation in length of 1 % between the innermost ring and the outermost ring. This variation is entirely negligible, in terms of the behaviour of the strip 10a, for a material which is able to undergo elongation of up to 300%.

[0046] Finally, in order to ensure uniform and homogeneous transfer of the movement from the belt 6 to the rollers 3, the latter are preferably connected together, for example either by means of a series of short belts 12 which connect each roller 3 to the next one, or via a single peripheral belt when the perimeter to be embraced is small. These short belts 12 are preferably arranged on the upper portion of the rollers 3, underneath the drive belt 6. This arrangement also allows the movement to be transferred to the feed roller 3a, and hence to the pre-stretching unit, when the feed roller is located in the position illustrated in Fig. 5, i.e. at a position where it is not affected by the direct action of the belt 6.

[0047] To conclude, the wrapping machine for pallets as described fully achieves the objects of the invention, obtaining moreover a series of further advantages:

- the pulsating request of film, due to the irregular shape of the product, is compensated immediately by the epicycloidal system which is not affected by delays of any kind and does not require the use of complicated and costly compensation mechanisms such as the aforementioned jockey roller;
- the ability to keep the tension of the film constant, thus drastically reducing the possibility of accidental breakage, allows operation with a decidedly higher degree of pre-stretching compared to that commonly used in conventional pallet wrapping machines, allowing savings in material;
- the winding tension can be regulated from the outside by adjusting the braking system of the annular structure, also during operation of the pallet wrapping machine;
- the absence of concentrated rotating masses and the excellent compensation of the tension allow operation at higher rotational speeds, increasing the productivity;
- the absence of large rotating masses allows the entire machine to be designed with more streamlined dimensions, without affecting the safety, resulting in greater economy and easy assembly and maintenance;
- the accumulation of film on the perimeter of the annular structure results in the availability of film even after the bobbin has run out; this gives the operator a period of time, between running out of the bobbin and running out also of the strip of accumulated film, during which the pallet wrapping machine may continue operation normally, to intervene and replace the bobbin;
- the accumulated strip provides an excellent support onto which the terminal end of the used-up bobbin

may be joined to the initial end of the new bobbin, the joining operation being able to be performed simply by affixing of one end onto the other taking advantage of the adhesive properties of the extendable plastic material; in this way continuity is ensured between one bobbin and another one, completely eliminating the wastage of material following running out of the bobbin, both due to precautionary stoppage of the pallet wrapping machine and due to that portion of film wrapped only partially on the product;

- the arrangement of the bobbin externally of the annular structure allows replacement thereof even when the pallet wrapping machine is in operation, since the operator does not have to enter into the working zone: machine stoppage time is thus reduced to a minimum, coinciding substantially with the time necessary for joining together the two ends of film in the manner described above;
- the optimum arrangement of the bobbin also simplifies the design of an automatic bobbin-changing machine;
- the use of single motor for achieving both movement of the annular structure and driving of the pre-stretching unit without doubt constitutes an advantage in terms of cost;
- the constructional simplicity of the entire machine, due also to the fact that the electric motor is located outside the annular structure, i.e. fixed with respect to the bridge frame, and does not require complex power supply systems, reduces the manufacturing costs, improves the operational reliability and results in less complex maintenance.

[0048] Finally, the absence of components inside the annular structure N, which exist instead in the known art in the form of the bobbin support bracket with the associated pre-stretching unit, allows machine size to be reduced considerably.

[0049] This advantage may be readily demonstrated. For ordinary pallets with dimensions of 1200 x 1000, the internal diameter of the annular structure N shall be greater than about 1900 mm and its maximum dimension may be easily contained within 2300 mm, compared to the 2500 - 2600 mm of pallet wrapping machines constructed in accordance with the known art: this means that the entire machine may be loaded into the storage container of a lorry (width 2400 mm) without having to disassemble and reassemble the machine at its destination.

[0050] According to another embodiment of the invention, a pallet wrapping machine which is simplified compared to the one described above, i.e. in which the bobbin is mounted fixed to the annular support defined by the two circular rims 1 and 2 (Figs. 6 and 7), is provided. In this case, there is no longer a relative movement between the bobbin 9 and the rims which results in the film being wound gradually onto the external perimeter of the

rollers 3. Therefore, in the absence of the accumulating function of these rollers 3, it is no longer necessary for them to have a length at least equivalent to the height of the film, but it is sufficient for them to have an adequate length for engagement with the short belts 12. Only the rollers 3a and 3b, forming part of the pre-stretching unit, and where applicable the transmission roller 11, have an extension such that they are able to guide the entire height of the film.

[0051] Preferably, as can be seen in Fig. 7, the bobbin is mounted entirely in cantilever fashion, projecting perpendicularly from one of the two annular rims, and likewise the rollers of the pre-stretching unit also project from the same side.

[0052] This solution involves an advantageous constructional simplification, which consists in a greater lightness of the annular structure and in a reduction in costs, even though it means having to dispense with some of the advantages described above, including the possibility of creating an accumulation of film, so as to allow more efficient changing of the bobbin, and the elimination of eccentric masses, so as to lighten the supporting structure.

[0053] In any case the effect of balancing and compensating the tension of the film owing to use of the epicycloidal structure, remains unaffected, thus fulfilling the objects described in the preamble. Therefore, the manufacturer will retain the option of offering the purchaser the embodiment which is most suited to his requirements also in terms of a performance-versus-cost comparison.

[0054] It is understood, however, that the invention is not limited to the particular configurations illustrated above, which are merely non-limiting examples of the invention, but that numerous variants are possible, all within the capacity of a person skilled in the art, without thereby departing from the protective scope of the invention itself.

[0055] It should be pointed out that the scope of the invention may be extended also to other possible embodiments of the epicycloidal gearing developed for this specific application. For example, the driving belt 6 could be replaced by a crown gear which engages, internally, with the rollers provided with pinions and, externally, with a driving pinion made to rotate by the motor 8.

[0056] Finally, although a vertically extending pallet wrapping machine has been described, i.e. one in which the translation of the annular structure is performed vertically, the same principle may be applied to a pallet wrapping machine which winds the film turns along a horizontal axis. This latter solution is particularly suitable for those cases where it is intended to wrap small packs so as to obtain multiple-pack bundles.

Claims

1. Wrapping machine for pallets of the type comprising a fixed frame (P) on which there is mounted an annular structure (N), surrounding a product (C) to be wrapped with a film (10) of plastic material unwound from a bobbin, and comprising:

an annular support (1, 2), rotating in its plane by way of a driving element (6), and a set of rollers (3) rotatably mounted on parallel axes and carried by said annular support (1, 2) along a circular line, onto which said film is guided, one of the rollers (3a) being a feed roller apt to dispense said film inwardly of said annular structure (N), characterized in that the annular structure (N) is translatable with respect to the product (C) and in that said driving element (6) at least partly embraces the rollers (3), bearing on their periphery, and is apt to cause spinning of the rollers (3) and rotation thereof about the central axis of the annular structure (N), said annular support (1, 2), set of rollers (3) and driving element (6) constituting, respectively, the spider, the planetary gears and the driving gear of an epicycloidal gearing.

2. Wrapping machine for pallets as claimed in claim 1), wherein said driving element is an endless belt (6) operated by motor means in the form of a pulley (7).
3. Wrapping machine for pallets as claimed in claims 1), 2), wherein a pre-stretching unit (3a, 3b) is also provided on the annular support (1, 2) to dispense stretched film toward said product (C).
4. Wrapping machine for pallets as claimed in claim 3, wherein said pre-stretching unit comprises a primary roller (3a), coinciding with said feed roller (3a) of said set of rollers (3), and at least another secondary roller (3b), which are located at short distance from one another and are connected mechanically with a transmission ratio such that the secondary roller (3b) rotates at a faster speed than the primary roller (3a), said extendable film (10) undergoing elongation as it passes from the primary roller (3a) to the secondary roller (3b).
5. Wrapping machine for pallets as claimed in any one of claims 1 to 3 further comprising a braking system acting either on the annular support (1, 2) or on the rollers (3).
6. Wrapping machine as claimed in any one of the preceding claims, wherein the annular support comprises a pair of parallel annular rims (1, 2) between which the rollers (3) are rotatably mounted.

7. Wrapping machine for pallets as claimed in claim 6, wherein the braking system acts on at least one of said rims.
8. Wrapping machine for pallets as claimed in any one of the preceding claims, wherein said rollers (3) are rotationally synchronized by reciprocal connection means. 5
9. Wrapping machine for pallets as claimed in claim 8, wherein said reciprocal connection means are short belts (12) which connect each other the rollers (3). 10
10. Wrapping machine for pallets as claimed in claim 9, wherein said endless driving belt (6) embraces said rollers (3) bearing on said short belts (12). 15
11. Wrapping machine for pallets as claimed in any one of the preceding claims, wherein said annular structure (N) is guided by a plurality of supporting wheels (5) distributed along its periphery and rotatably mounted on a translatable guiding frame (4). 20
12. Wrapping machine for pallets as claimed in claim 11, wherein the motor means (7) which operate the driving element (6) and a bobbin (9) supplying the film (10) are mounted externally with respect to the annular structure (N), on said guiding frame (4). 25
13. Wrapping machine for pallets as claimed in claim 12, wherein said rollers (3) have a length at least equal to the height of the film (10). 30
14. Wrapping machine for pallets as claimed in any one of claims 1 to 11, wherein the motor means (7), which operate the driving element (6), are mounted externally with respect to the annular structure (N), and said bobbin (9) supplying the film is mounted on said annular support (1, 2). 35
15. Wrapping machine for pallets as claimed in claim 14 wherein the bobbin (9) is cantilevered mounted projecting from the side of said annular support (1,2) and only said rollers (3a,3b) forming the pre-stretching unit extend over a length at least equal to the height of the extendable film (10). 40 45

Patentansprüche

1. Einwickelmaschine für Paletten der Bauart, die einen feststehenden Rahmen (P) umfaßt, auf dem eine ringförmige Struktur (N) angebracht ist, die ein Produkt (C) umgibt, das mit einem Film (10) aus Kunststoffmaterial zu umwickeln ist, das von einer Spule abgewickelt wird, mit: 50 55

einem ringförmigen Träger (1, 2), der in seiner

Ebene mittels eines Antriebselements (6) rotiert, und

einem Satz von Rollen (3), die drehbar auf parallelen Achsen angebracht und durch den ringförmigen Träger (1, 2) entlang einer kreisförmigen Linie getragen sind, auf die der Film geführt wird, wobei eine der Rollen (3a) eine Zuführungsrolle ist, die dazu bestimmt ist, den Film nach innen bezüglich der ringförmigen Struktur (N) abzugeben, dadurch gekennzeichnet, daß die ringförmige Struktur (N) in Bezug auf das Produkt (C) verlagerbar ist und daß das Antriebselement (6) die Rollen (3) zumindest teilweise umgreift, wobei es gegen deren Umfang anliegt, und dazu bestimmt ist, eine Drehung der Rollen (3) und deren Rotation um die Mittelachse der ringförmigen Struktur (N) zu bewirken, wobei der ringförmige Träger (1, 2), der Satz von Rollen (3) und das Antriebselement (6) das Radialarmteil, die Planetenzahnräder und das Antriebszahnrad eines epizykloidschen Getriebes bilden.

2. Einwickelmaschine für Paletten nach Anspruch 1, dadurch gekennzeichnet, daß das Antriebselement ein endloser Gurt (6) ist, der durch eine Antriebseinrichtung in Form einer Riemenscheibe (7) angetrieben ist.
3. Einwickelmaschine für Paletten nach Anspruch 1 oder 2, dadurch gekennzeichnet, daß eine Vorstreckeinheit (3a, 3b) auf dem ringförmigen Träger (1, 2) angeordnet ist, um gestreckten Film zu dem Produkt (C) zuzuführen.
4. Einwickelmaschine für Paletten nach Anspruch 3, dadurch gekennzeichnet, daß die Vorstreckeinheit eine erste Rolle (3a) aufweist, die mit der Zuführungsrolle (3a) des genannten Satzes von Rollen (3) zusammenfällt, und zumindest eine weitere zweite Rolle (3b) aufweist, die in einem geringen Abstand voneinander angeordnet und mechanisch mit einem Übertragungsverhältnis verbunden sind, so daß sich die zweite Rolle (3b) mit einer größeren Drehzahl als die erste Rolle (3a) dreht, wobei der streckbare Film (10) eine Verlängerung erfährt, wenn er von der ersten Rolle (3a) zu der zweiten Rolle (3b) gelangt.
5. Einwickelmaschine für Paletten nach einem der Ansprüche 1 bis 3, weiter gekennzeichnet durch ein Bremssystem, das entweder auf den ringförmigen Träger (1, 2) oder auf die Rollen (3) wirkt.
6. Einwickelmaschine nach einem der vorangehenden Ansprüche, dadurch gekennzeichnet, daß der ringförmige Träger ein Paar paralleler, ringförmiger

Reifen (1, 2) aufweist, zwischen denen die Rollen (3) drehbar gehalten sind.

7. Einwickelmaschine für Paletten nach Anspruch 6, dadurch gekennzeichnet, daß das Bremssystem auf zumindest einen der genannten Reifen wirkt. 5
8. Einwickelmaschine für Paletten nach einem der vorangehenden Ansprüche, dadurch gekennzeichnet, daß die Rollen (3) durch wechselweise Verbindungseinrichtungen drehsynchronisiert sind. 10
9. Einwickelmaschine für Paletten nach Anspruch 8, dadurch gekennzeichnet, daß die wechselweisen Verbindungseinrichtungen kurze Gurte (12) sind, die die Rollen (3) untereinander verbinden. 15
10. Einwickelmaschine für Paletten nach Anspruch 9, dadurch gekennzeichnet, daß der endlose Antriebsgurt (6) die Rollen (3) umgreift, die gegen die kurzen Gurte (12) anliegen. 20
11. Einwickelmaschine für Paletten nach einem der vorangehenden Ansprüche, dadurch gekennzeichnet, daß die ringförmige Struktur (N) durch eine Anzahl von Stützrädern (5) geführt ist, die entlang ihres Umfangs verteilt und auf einem verlagerbaren Führungsrahmen (4) drehbar gehalten sind. 25
12. Einwickelmaschine für Paletten nach Anspruch 11, dadurch gekennzeichnet, daß die Antriebseinrichtung (7), die das Antriebselement (6) antreibt, und eine Spule (9), die den Film (10) liefert, außerhalb der ringförmigen Struktur (N) auf dem Führungsrahmen (4) angeordnet sind. 30 35
13. Einwickelmaschine für Paletten nach Anspruch 12, dadurch gekennzeichnet, daß die Rollen (3) eine Länge aufweisen, die zumindest gleich der Höhe des Films (10) ist. 40
14. Einwickelmaschine für Paletten nach einem der Ansprüche 1 bis 11, dadurch gekennzeichnet, daß die Antriebseinrichtung (7), die das Antriebselement (6) antreibt, außerhalb der ringförmigen Struktur (N) angebracht ist, und die Spule (9), die den Film liefert, auf dem ringförmigen Träger (1, 2) angebracht ist. 45
15. Einwickelmaschine für Paletten nach Anspruch 14, dadurch gekennzeichnet, daß die Spule (9) fliegend gelagert ist und von einer Seite des ringförmigen Trägers (1, 2) vorsteht, wobei lediglich die Rollen (3a, 3b), die die Vorstreckeinheit bilden, sich über eine Länge erstrecken, die zumindest gleich der Höhe des streckbaren Films (10) ist. 50 55

Revendications

1. Machine d'enveloppement pour palettes du type comprenant un châssis fixe (P) sur lequel est montée une structure annulaire (N), entourant un produit (C) devant être enveloppé d'un film (10) de matière plastique dévidé d'une bobine, et comprenant :

un support annulaire (1, 2), tournant dans son plan au moyen d'un élément d'entraînement (6), et
un jeu de rouleaux (3) montés en rotation sur des axes parallèles et supportés par ledit support annulaire (1, 2) le long d'une ligne circulaire, sur lesquels ledit film est guidé, un des rouleaux (3a) étant un rouleau d'alimentation adapté à distribuer ledit film vers l'intérieur de ladite structure annulaire (N), caractérisée en ce que la structure annulaire (N) est adaptée à un déplacement en translation par rapport au produit (C) et en ce que ledit élément d'entraînement (6) englobe au moins partiellement les rouleaux (3), portant sur leur périphérie, et est adapté à produire une rotation des rouleaux (3) sur eux-mêmes et une rotation de ceux-ci autour de l'axe central de la structure annulaire (N), ledit support annulaire (1, 2), jeu de rouleaux (3) et élément d'entraînement (6) constituant, respectivement, le satellite, les planétaires et la roue menante d'un engrenage épicycloïdal.
2. Machine d'enveloppement pour palettes selon la revendication 1, dans laquelle ledit élément d'entraînement est une courroie sans fin (6) actionnée par un moyen de moteur sous la forme d'une poulie (7).
3. Machine d'enveloppement pour palettes selon les revendications 1 et 2, dans laquelle une unité d'étrépage préalable (3a, 3b) est également prévue sur le support annulaire (1, 2) pour distribuer un film étiré vers ledit produit (C).
4. Machine d'enveloppement pour palettes selon la revendication 3, dans laquelle ladite unité d'étrépage préalable comprend un rouleau principal (3a) coïncidant avec ledit rouleau d'alimentation (3a) dudit jeu de rouleaux (3), et au moins un autre rouleau secondaire (3b), qui sont situés à une courte distance l'un de l'autre et sont reliés mécaniquement avec un rapport de transmission de manière que le rouleau secondaire (3b) tourne plus rapidement que le rouleau principal (3a), ledit film pouvant être étiré (10) subissant un allongement lorsqu'il passe du rouleau principal (3a) au rouleau secondaire (3b).
5. Machine d'enveloppement pour palettes selon l'une

quelconque des revendications 1 à 3, comprenant également un système de freinage agissant soit sur le support annulaire (1, 2), soit sur les rouleaux (3).

6. Machine d'enveloppement pour palettes selon l'une quelconque des revendications précédentes, dans laquelle le support annulaire comprend une paire de rebords annulaires parallèles (1, 2) entre lesquels les rouleaux (3) sont montés en rotation. 5
10
7. Machine d'enveloppement pour palettes selon la revendication 6, dans laquelle le système de freinage agit sur au moins l'un desdits rebords.
8. Machine d'enveloppement pour palettes selon l'une quelconque des revendications précédentes, dans laquelle lesdits rouleaux (3) sont synchronisés en rotation par des moyens de connexion réciproques. 15
9. Machine d'enveloppement pour palettes selon la revendication 8, dans laquelle lesdits moyens de connexion réciproques sont de courtes courroies (12) qui relient les rouleaux (3) les uns aux autres. 20
10. Machine d'enveloppement pour palettes selon la revendication 9, dans laquelle ladite courroie d'entraînement sans fin (6) englobe lesdits rouleaux (3) portant sur lesdites courtes courroies (12). 25
11. Machine d'enveloppement pour palettes selon l'une quelconque des revendications précédentes, dans laquelle ladite structure annulaire (N) est guidée par une pluralité de roues de support (5) réparties le long de sa périphérie et montées en rotation sur un châssis de guidage à translation (4). 30
35
12. Machine d'enveloppement pour palettes selon la revendication 11, dans laquelle le moyen de moteur (7) qui actionne l'élément d'entraînement (6) et une bobine (9) distribuant le film (10) sont montés extérieurement par rapport à la structure annulaire (N), sur ledit châssis de guidage (4). 40
13. Machine d'enveloppement pour palettes selon la revendication 12, dans laquelle lesdits rouleaux (3) ont une longueur au moins égale à la hauteur du film (10). 45
14. Machine d'enveloppement pour palettes selon l'une quelconque des revendications 1 à 11, dans laquelle le moyen de moteur (7), qui actionne l'élément d'entraînement (6) est monté extérieurement par rapport à la structure annulaire (N) et ladite bobine (9) distribuant le film est montée sur ledit support annulaire (1, 2). 50
55
15. Machine d'enveloppement pour palettes selon la revendication 14, dans laquelle la bobine (9) est mon-

tée en porte-à-faux, faisant saillie depuis un côté dudit support annulaire (1, 2) et uniquement lesdits rouleaux (3a, 3b) formant l'unité d'étirage préalable s'étendent sur une longueur au moins égale à la hauteur du film pouvant être étiré (10).

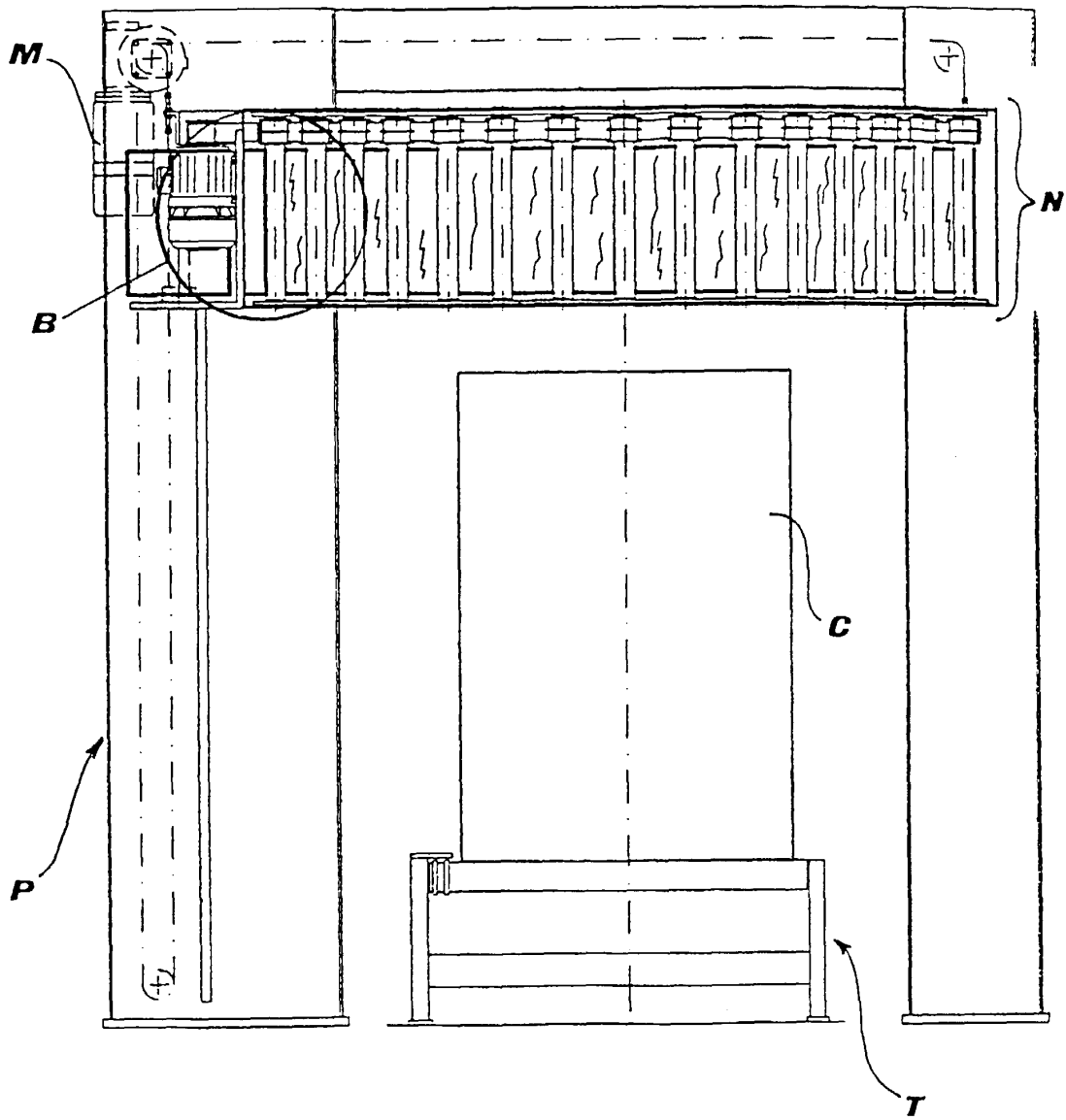


Fig. 1

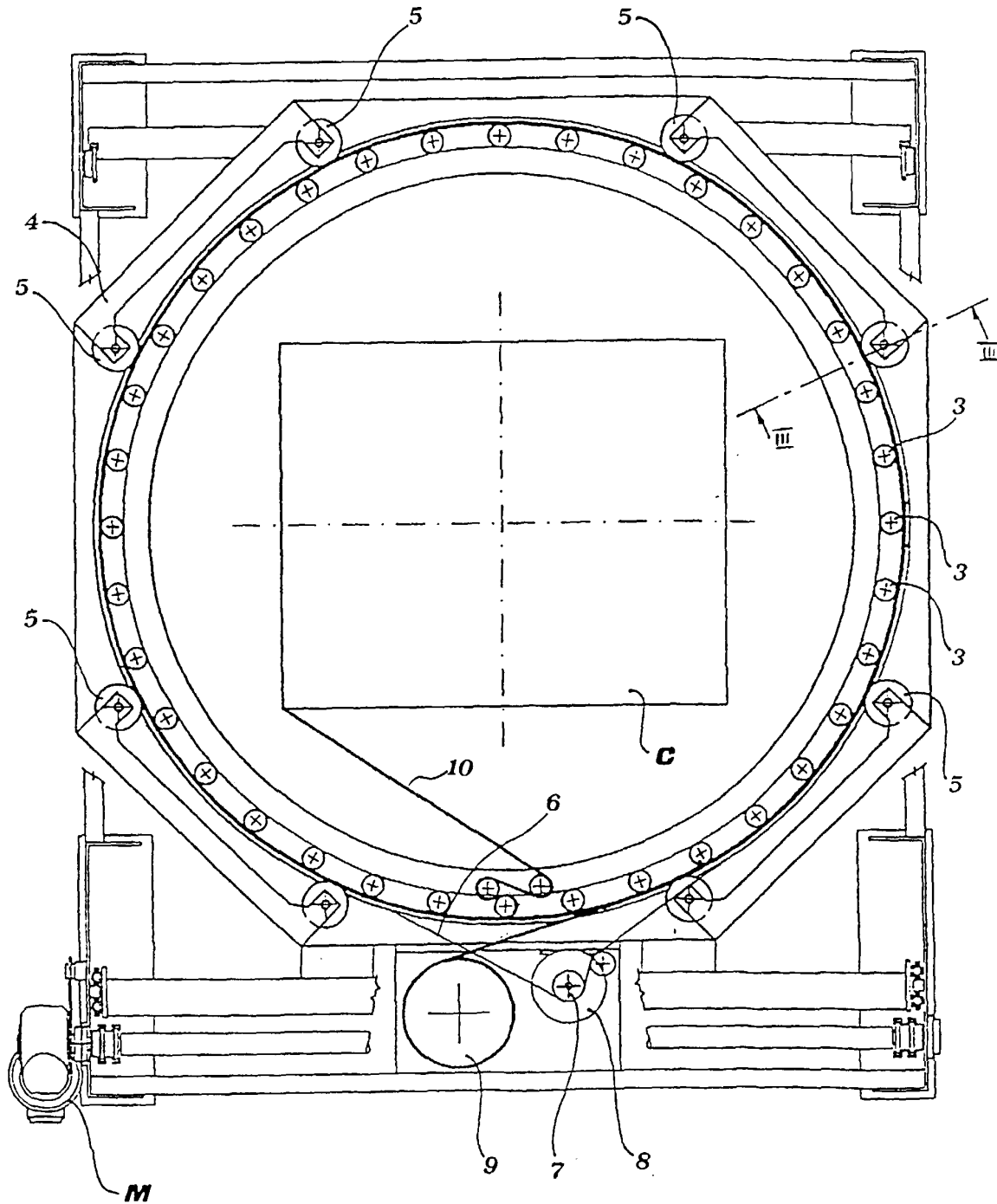


Fig. 2

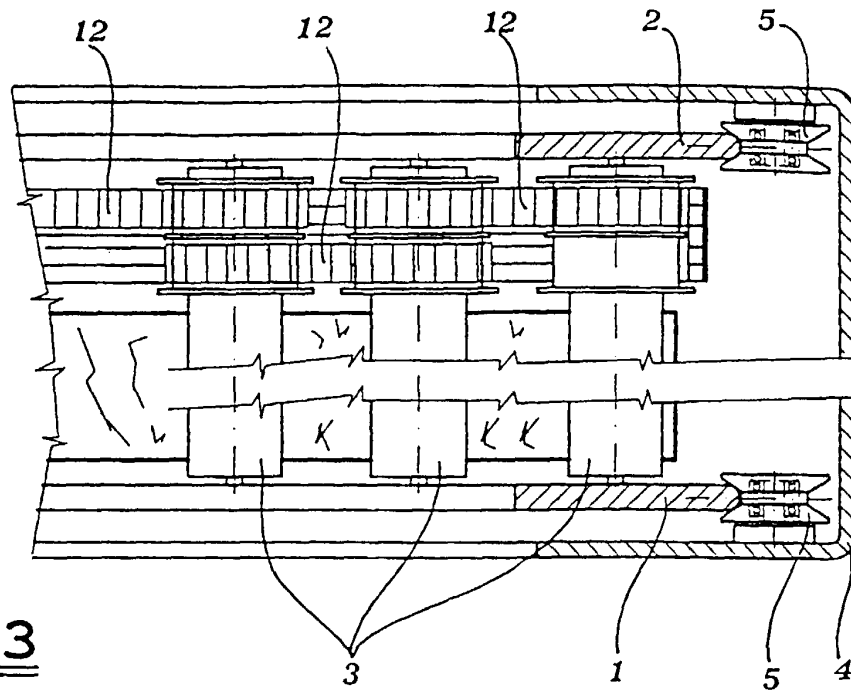


Fig. 3

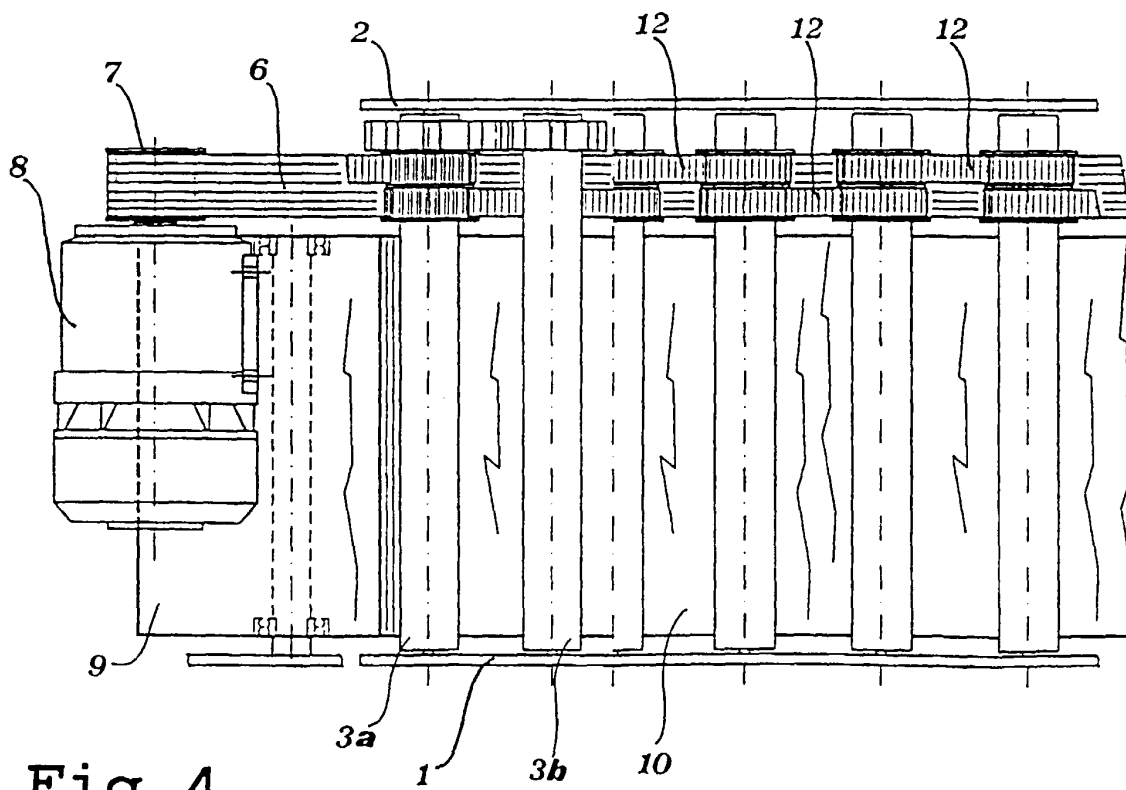
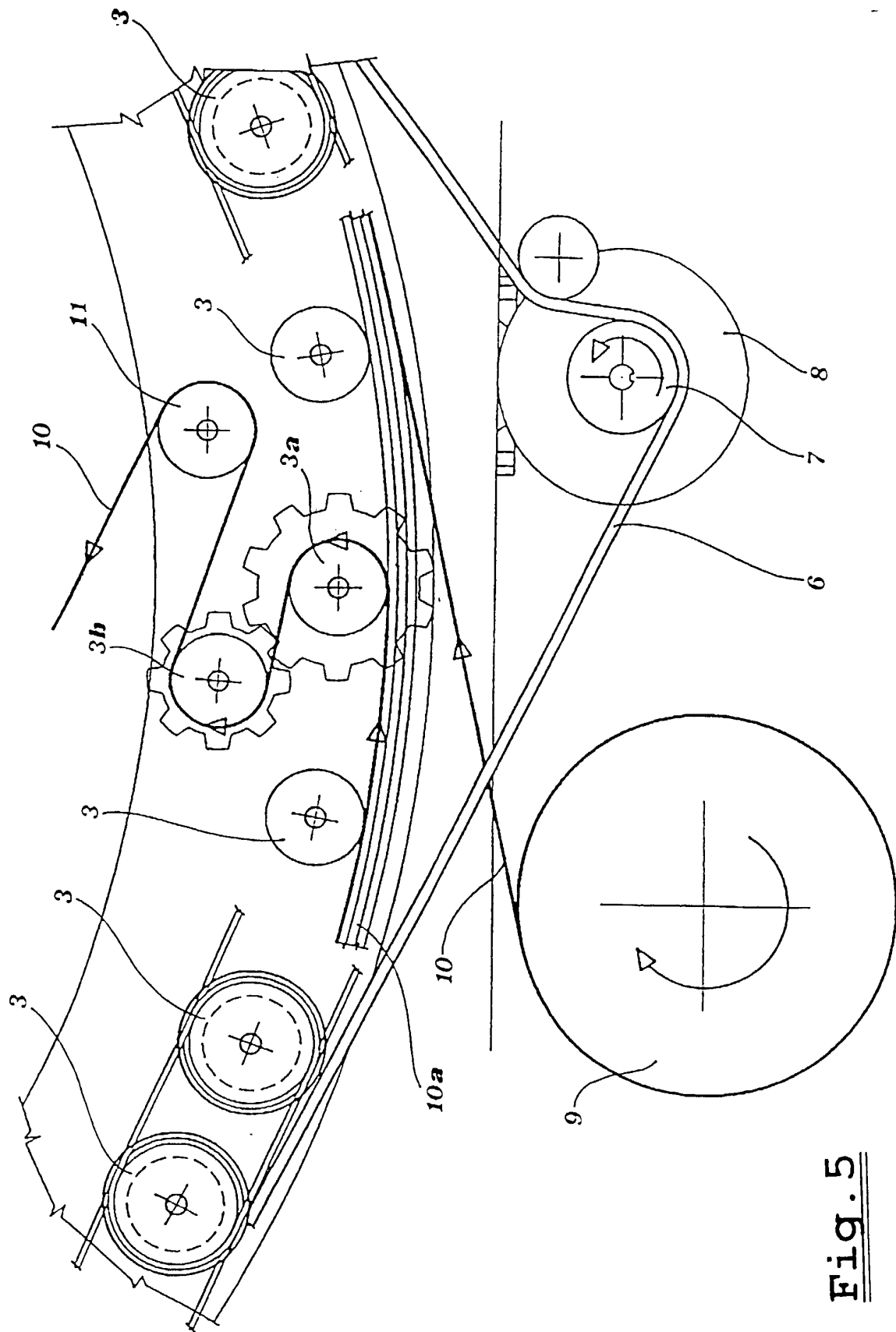


Fig. 4



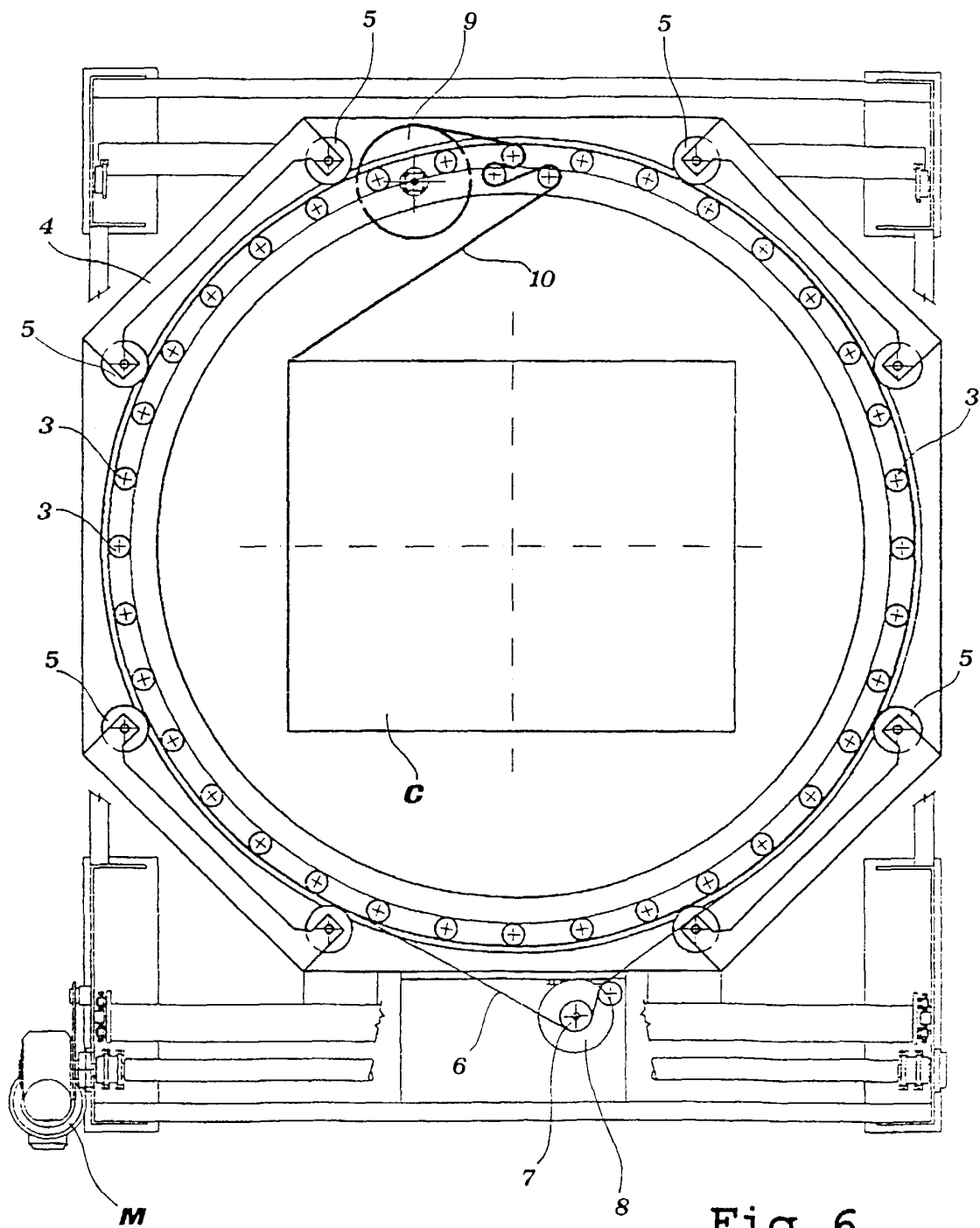


Fig. 6

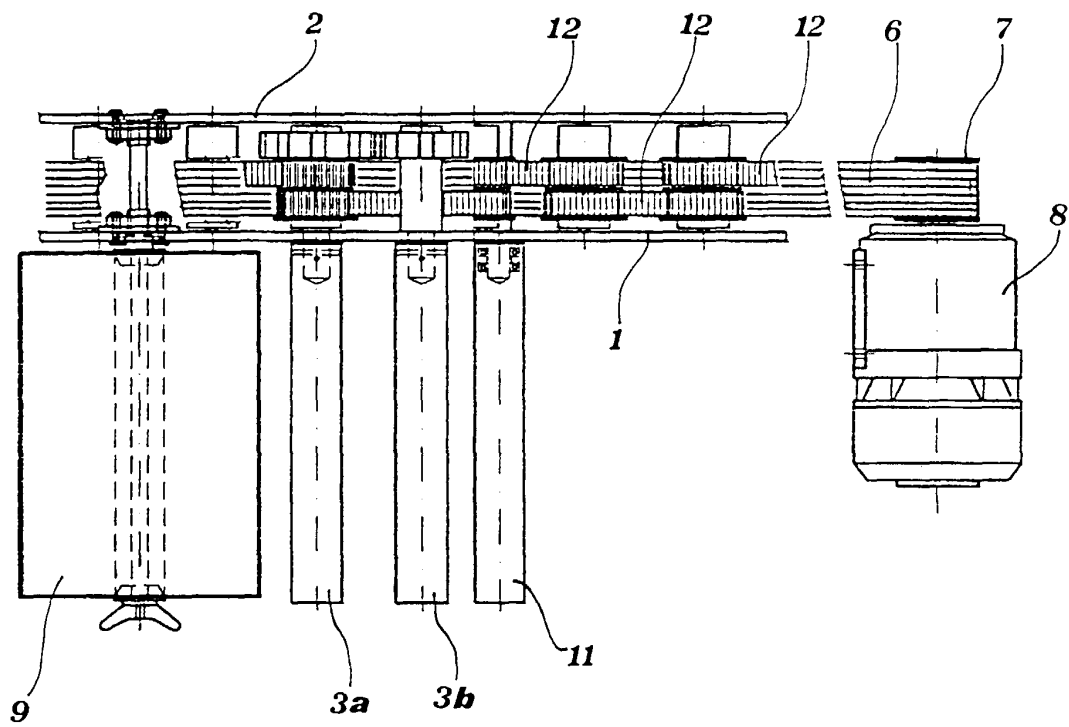


Fig. 7