(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) **EP 3 049 331 B1**

(12) **EUROPEAN PATENT SPECIFICATION**

(45) Date of publication and mention of the grant of the patent:
22.08.2018 Bulletin 2018/34

(21) Application number: **14789860.5**

(22) Date of filing: **02.09.2014**

(51) Int Cl.:
B65B 13/18 *(2006.01)* ***B65B 13/22*** *(2006.01)*
B65B 57/04 *(2006.01)* ***B65B 11/04*** *(2006.01)*
F15B 5/00 *(2006.01)* ***F15B 15/28*** *(2006.01)*
B65B 11/00 *(2006.01)*

(86) International application number:
PCT/HU2014/000079

(87) International publication number:
WO 2015/036807 (19.03.2015 Gazette 2015/11)

(54) **MACHINE FOR STRETCH WRAPPING LOADS WITH STRETCHABLE FILM**

MASCHINE FÜR STRECKVERPACKUNGSLASTEN MIT DEHNFOLIE

MACHINE D'EMBALLAGE SOUS FILM ÉTIRABLE DE CHARGES À L'AIDE D'UN FILM ÉTIRABLE

(84) Designated Contracting States:
AL AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HR HU IE IS IT LI LT LU LV MC MK MT NL NO PL PT RO RS SE SI SK SM TR

(30) Priority: **12.09.2013 HU P1300528**

(43) Date of publication of application:
03.08.2016 Bulletin 2016/31

(73) Proprietor: **Köröspack Kft.**
2750 Nagykörös (HU)

(72) Inventor: **GÁL, János**
H-6640 Csongrád (HU)

(74) Representative: **Varnai, Aniko**
Interinno Patent Office
Margit krt. 73.
1024 Budapest (HU)

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Description

[0001] The invention relates to a machine for wrapping loads with stretchable film.

[0002] The vertical and top surface of loads can also be wrapped using the machine.

[0003] There is a great variety of load stretch wrapping machines known in the practice.

[0004] Using the machine described in the German publication of registration number DE 3633680 the load is put on a turntable and a shrinkable cap made of a shrinkable film is put on the load.

[0005] The load wrapped with the shrinkable cap is rotated by the turntable and a burner nozzle fastened on a vertically moving carriage shrinks the upper and lower parts of the shrinkable cap circularly and the lateral part along a screw line performing a programmed movement.

[0006] The application of the shrinkable cap provides appropriate protection to the load owing to the wrapping the upper part of the load.

[0007] The disadvantage of the machine is that the shrink-hood must be made previously and put onto the load. The manufacturing of the cap requires manual labor, in addition the specific demand of film is great, as well as the energy requirement of the shrinking is also great enough.

[0008] In the last decade the significantly cost effective wrapping with stretchable film is applied in more and more increasing degree because of the above mentioned disadvantage of the wrapping with shrinkable film.

[0009] The specific demand of film of the wrapping with stretchable film weight approximately one fifth part of that of the shrink hood and the indispensable high energy requirement of the shrinking does not arise. The common distinctive features both of the simplest hand-operated machines and the fully automated ones applied for the stretch wrapping with stretchable film are that they have turntables and a carriage applicable for the vertical movement of the film.

[0010] The above mentioned structural units of the machines make possible that the prestretched film wraps the load along a screw line as result of the rotating movement of the load and the vertical movement of the film. The stretch of the film, the overlap and the number of film windings can be changed depending on the properties of the load and the requirements of fastening. The patent description of HUP 210302 discloses a very advantageously applicable machine enabling the stretch wrapping of
loads with stretchable film also on the top surface of the load with the film applied for the wrapping of lateral surface.

[0011] The solution ensures the perfect protection of the goods through continuity of the film, rendering unnecessary applying a shrink hood in this way.

[0012] The essence of the machine according to the solution is that the film applied for stretch wrapping the lateral surface of the load by winding up along a screw line is led above the load and tilted from vertical position to horizontal one during the rotation of the load. The film is then tilted back to the vertical position during a descending movement and the wrapping of the upper part is made in this way.

[0013] The machine according to the patent has a base frame, a turntable mounted in it and a mast fastened on the base frame. A carriage vertically moving the film is mounted on the mentioned mast and bushing is supporting the carriage.

[0014] A shaft is inserted into the bushing and a reel of film is connected to the one end and the tilting actuator is connected to the other end of the shaft.

[0015] A sensor for the vertical (basic) position and a sensor for the horizontal position are mounted on the base frame, triggering flags mounted on the turntable associated to the corners of the load, as operating elements controlling the tilting.

[0016] The disadvantage of the machine is that the stretch tension value can attain only the nearest digital value according to the step values, so it cannot be followed proportionally, consequently the tension of the film cannot be set precisely.

[0017] As the tension continuously changes, the film can occasionally be torn by the sharp corners of a load. There is another problem that the film can break to inside the corners of the most loaded lower layers of the loads packed in cardboard and corrugated paper boxes.

[0018] It is a widespread solution to sense the tension of the film by leading the film around a swing axle loaded with a spring. Using this solution, when the tension of the film between the load and the pre-stretching unit increases, it forces to deviate the swingarm loaded with spring and there are digital sensors (usually inductive ones) arranged along the circular arc described by the shaft, and the sensors transmit signals of discrete values about the tension of the film to the control system, which responds to them by changing the braking force of the film.

[0019] According to another solution the swingarm deviating along a circular arc under influence of the tension of the film is pulled or pushed by one or more springs with quasi constant force - between the two end positions of the deviation - to the direction corresponding to the smaller tension of the film. The problem with this solution is that the pulling or pushing force of the springs is not linear along the length of pulling or pushing, consequently a pre-stretching unit with springs has also not linear but progressive behavior.

[0020] A possible consequence of this operation is that a machine combined with digital control is amenable to oscillation and sets tension of the film in wide range. Consequently an excessive tension can arise, which can result in tearing or loosening. It can even cause the winding up of the film onto the rubber covered cylinders, and force to stop the packing process. The pre-stretching of film with loading by spring has also another problem, that it cannot be adjusted, repeated and measured.

[0021] We set ourselves an aim to develop an im-

proved machine eliminating the above mentioned disadvantages.

[0022] The patent description of USP 4706443 discloses a wrapping machine and operation for wrapping and operation for wrapping load with stretchable film under substantially constant tension during the wrapping operation.

[0023] This machine is provided with pre-streching rollers (18, 32), pre-streching motor (20), a dancer arm (40) provided with roller (38), an air cylinder (52) with piston (54).

[0024] The machine is provided with an air regulator and a motor control (88).

[0025] The machine of the above patent is capable for wrapping only the side surfaces of the load on pallet by stretch film, trying to avoid the film breakage, which mainly happens on edges bordered by two neighboured plains of the load.

[0026] The constant tension of the film, as mentioned in the title of the patent should be understood as a tension restrictedly changing between two limits.

[0027] The machine of the patent is only able to change the film feeding speed after the stepping over the bottom level and the top level of film tension,

[0028] The machine can not intervene in the intermediate positions as shown on figure 9 of the description.

[0029] The "constant" film tension may be understood only between certain limits.

[0030] The machine according to the patent is used to minimize the breakage on the edges, and it is not effective enough to avoid film breakage on the corners.

[0031] The motor of the above patent is a DC motor.

[0032] In the solution of USP 4458467 is used a conventional stretch wrapping machines which capable wrapping only the side surfaces of the load by stretch wrapping machinery.

[0033] In the patent description they try only to avoid the film breakage on edges bordered by two neighboured plains of the load. In the solution are used DC motors.

[0034] The aim of our invention to develop a machine for wrapping vertical and top surface of loads with stretchable film.

[0035] The machine of our invention is following the angular displacement directly proportional to the film tension between the load and the pre-stretching rollers with the signals of an analogous displacement transducer.

[0036] The analogous displacement transducer can accept not only a small number of digital values but even several hundreds of individual values.

[0037] In our solution the measurement of the tension is more accurate, the regulating action is quicker and the difference of the tensions to be compensated becomes smaller.

[0038] The pre-stretching motor responds quicker, more accurately and with smaller redundancy under the influence of the increased tension

[0039] The required value of the film tension can be better approached and kept by means of the regulating action of increased accuracy during the whole duration of the wrapping.

[0040] Our solution was not obvious for an expert in full knowledge of the description of USP 4706443 and USP4458467.

[0041] In our invention an analogous displacement transducer is sending is sending signals to a frequency changer, which is characterized by the resultant of the pressure set and the pulling force of the film.

[0042] The frequency changer can regulate the rotary speed of the pre-streching motor until the quantity of the film becomes equal to wrap the vertical and top surface of the load.

[0043] The subject matter of the invention is a machine for wrapping vertical and top surface of loads with stretchable film having a base frame, a turntable mounted in it and a mast fastened to the base frame, a carriage moving vertically a film reel is fastened to the mast, bushings are formed on the carriage, a shaft is inserted through it, a tilting actuator is connected to the one end and a film reel is connected to the other end of the shaft and a home position sensor and a horizontal position sensor are arranged on the base frame, tilting controlling triggering flags associated to the corners of the load and a home position actuating element are fastened to the turntable, it is provided with a swinging film tension setting unit connected to the other end of the shaft, which unit has pre-stretching rollers provided with a pre-stretching motor, a leading roller containing an arm provided with a roller, a tension setting pneumatic cylinder provided with an analogous displacement transducer and equipped with a piston provided with magnet, furthermore a pressure regulator is fastened to the frame of the film holding and pre-stretching unit, wherein the film winded off from the film reel is led between pre-stretching rollers one connected to another with a transmission and one of them is driven by a pre-stretching motor then the film is led around a leading roller having an arm rotating around a center of rotation and the arm is provided with a roller, it is connected to the piston provided with magnet, which is mounted in a tension setting pneumatic cylinder.

[0044] The characteristics of the machine are the followings: the pressure regulator - which is in connection with the tension setting pneumatic cylinder being regulated by the resultant of the pressure and the pulling force of the film - is applicable to set a reference value and several pre-sets of pressure in it, the tension setting pneumatic cylinder is in connection with the analogous displacement transducer, which is in signal connection with a frequency changer, which is regulating the rotary speed of the a pre-stretching motor.

[0045] The turntable of the machine is driven with a turntable driving motor.

[0046] The piston provided with magnet of the machine is moved between two end positions in relation to the set reference value through the pressure regulator.

[0047] The machine according to the invention is shown in the Figures 1 and 2.

[0048] The Figure 1 shows the schematic representation of the machine, while the Figure 2 shows the regulating elements of the machine and their connections.

[0049] The Figure 1 shows an advantageous embodiment of the machine. The solution covers among others also those machines having more than two pre-stretching rollers and their drive can be either identical to the one shown or different from it.

[0050] The base frame 1, the turntable 2 mounted in it and the load 13 is positioned on the turntable 2 are shown in the Figure 1.

[0051] The carriage 4 vertically moving the film reel 7 is fastened to the mast 3 mounted on the base frame 1 and bushing 5 are formed on the carriage 4.

[0052] A shaft 6 is inserted into bushing 5, a tilting actuator 8 is connected to the one end and a film tension setting unit 22 is connected to the other end of it.

[0053] The home position sensor 9 and the horizontal position sensor 10 are arranged on the base frame 1, and (tilting controlling) triggering flags 12A, 12B, 12C, 12D are controlling the tilting associated to the corners of the load 14, as well as a home position sensor 9 are mounted on the turntable 2.

[0054] The swinging film tension setting unit 22 fastened to the frame of the film holding and pre-stretching unit 23 has pre-stretching rollers 7A provided with a pre-stretching motor 20, a leading roller 7B containing an arm provided with a roller 7C, a tension setting pneumatic cylinder 16 having an analogous displacement transducer 17 and supplied with a piston provided with magnet 16A, a pressure regulator 18 and a frequency changer 15.

[0055] The film winded off from the film reel 7 is led between the pre-stretching rollers 7A connected one to another with a transmission 19 and one of them is driven with the pre-stretching motor 20, then the film is led around a leading roller 7B having an arm moving around a centre of rotation and the arm is provided with a roller 7C.

[0056] The arm provided with the roller 7C is connected to a piston provided with magnet 16A and the piston provided with magnet 16A is arranged in a tension setting pneumatic cylinder 16 provided with an analogous displacement transducer 17.

[0057] The piston provided with magnet 16A is connected to a pressure regulator 18 and a frequency changer 15. The frequency changer 15 is connected also to the pre-stretching motor 20 of the pre-stretching rollers 7A.

[0058] The turntable 2 is driven with a turntable driving motor 21.

[0059] The piston provided with magnet 16A is moved by a pressure regulator 18 between two end positions in relation to the set reference value.

[0060] We applied advantageously the product SM6 of the company Bosch Rexroth or the one named SMAT of the company Festo as analogous displacement transducer 17.

[0061] The transmission 19 can be of any usual type, advantageously one with chain, V-belt, gears, timing belt etc.

[0062] The Figure 2 shows the tension setting pneumatic cylinder 16 having the piston provided with magnet 16A and the analogous displacement transducer 17 connected to the pressure regulator 18.

[0063] The machine contains a tension setting pneumatic cylinder 16 equipped with a piston provided with magnet 16A, charged on one side and a pressure regulator 18 connected to it, applicable for setting the tension of the film in relation to a targeted reference value. The tension setting pneumatic cylinder 16 is provided with an analogous displacement transducer 17 measuring the position of the piston provided with magnet 16A, The transducer transforms the position to an electric signal characterizing it and regulates with that the film pre-stretching motor 20 through a frequency changer 15. In the case where the tensile force characterizing the tension of the film is less than the original reference value set by the tension setting pneumatic cylinder 16 and the pressure regulator 18 belonging to it, the piston provided with magnet 16A moves towards the one end position.

[0064] The rotary speed of the pre-stretching motor 20 is then diminished; it wraps the load 13 with less film during a unit of time until that film quantity during the unit of time becomes equal to or less than the quantity sufficient to wrap the load 13.

[0065] The load 13 "pulls" the film because of that, it becomes stretched and the force characterizing its tension moves the arm provided with roller 7C towards the position characterizing the tersioned film. The piston provided with magnet 16A of the tension setting pneumatic cylinder 16 will be moved towards the other end position at the same time. Consequently, the analogous displacement transducer 17 sends accelerating signal to the frequency changer 15, which sends accelerating signal to the pre-stretching motor 20.

[0066] The current position of the piston provided with magnet 16A is regulated by the resultant of the pressure set and the pulling force arising on the film. The pulling or pushing force of the tension setting pneumatic cylinder 16 can be set in the whole length of path, the pressure can be measured, so the stretching force can be repeated.

[0067] The horizontal axis of the film tension setting unit 22 encloses an angle of twentyfive degrees with the radial direction of the main rotating movement, so the upper edge of the film turned to horizontal on the side of the real or imaginary centre of the main rotating movement is not elongated in such a great extent that it could lose the ability of shrinking back.

[0068] The advantages of the machine according to the invention are as follows:

It follows the angular displacement directly proportional to the film tension between the load 13 and the pre-stretching rollers 7A with an analogous signal of a contactless displacement transducer 17, which can accept not only a small number of digital values but even several

hundreds of individual values. The measurement of the tension is more accurate, the regulating action is quicker and the difference of the tensions to be compensated becomes smaller.

[0069] The pre-stretching motor 20 responds quicker, more accurately and with smaller redundancy under the influence of the increased tension

[0070] The required value of the film tension can be better approached and kept by means of the regulating action of increased accuracy during the whole duration of the wrapping.

[0071] The swinging film tension setting unit 22, which can be operated with motor-driven pre-stretching and at several pre-sets of pressure, adjustable in analogous way can be a separate complement of the machine wrapping with stretchable film, which can be built on all types of the machines wrapping with stretchable film, e. g. to the constructions with rotating arm or rotating ring, and the wrapping with film can be solved on a machine wrapping with stretchable film of any type with a relatively small cost using the stretchable film used for wrapping the lateral surfaces of the load 13.

List of symbols

[0072]

1	base frame
2	turntable
3	mast
4	carriage
5	bushing
6	shaft
7	film reel
7A	pre-stretching rollers
7B	leading roller
7C	arm provided with roller
8	tilting actuator
9	home position sensor
10	horizontal position sensor
11	home position actuating element
12A, B, C, D	(tilting controlling) triggering flags
13	load
14	corners of the load
15	frequency changer
16	tension setting pneumatic cylinder
16A	piston provided with magnet
17	analogous displacement transducer
18	pressure regulator
19	transmission
20	pre-stretching motor
21	turntable driving motor
22	film tension setting unit
23	frame of the film holding and pre-stretching unit

Claims

1. A machine for wrapping vertical and top surface of loads (13) with stretchable film having a base frame (1), a turntable (2) mounted in it and a mast (3) fastened to the base frame (1), a carriage (4) moving vertically a film reel (7) is fastened to the mast (3), bushings (5) are formed on the carriage (4), a shaft (6) is inserted through it, a tilting actuator (8) is connected to the one end and a film reel (7) is connected to the other end of the shaft (6) and a home position sensor (9) and a horizontal position sensor (10) are arranged on the base frame (1), tilting controlling triggering flags (12A, 12B, 12C, 12D) associated to the corners (14) of the load (13) and a home position actuating element (11) are fastened to the turntable (2) it is provided with a swinging film tension setting unit (22) connected to the other end of the shaft (6), which unit has pre-stretching rollers (7A) provided with a pre-stretching motor (20), a leading roller (7B) containing an arm provided with a roller (7C), a tension setting pneumatic cylinder (16) provided with an analogous displacement transducer (17) and equipped with a piston provided with magnet (16A), furthermore a pressure regulator (18) is fastened to the frame of the film holding and pre-stretching unit (23), wherein the film winded off from the film reel (7) is led between pre-stretching rollers (7A) one connected to another with a transmission (19) and one of them is driven by a pre-stretching motor (20) then the film is led around a leading roller (7B) having an arm rotating around a center of rotation and the arm is provided with a roller (7C), it is connected to the piston provided with magnet (16A), which is mounted in a tension setting pneumatic cylinder (16), **characterized by that** the pressure regulator (18) - which is in connection with the tension setting pneumatic cylinder (16) being regulated by the resultant of the pressure and the pulling force of the film - is applicable to set a reference value and several pre-sets of pressure in it, the tension setting pneumatic cylinder (16) is in connection with the analogous displacement transducer (17) which is in signal connection with a frequency changer (15), which is regulating the rotary speed of the a pre-stretching motor (20).

Patentansprüche

1. Eine Maschine für Einwicklung der senkrechten und oberen Oberflachen der Pakere (13) mit einer Dehnfolie, die einen Grundrahmen (1), einen darin montierten Drehtisch (2) und einen zum Grundrahmen (1) befestigten Mast (3) hat, ein eine Folienrolle (7) senkrecht bewegender Wagen (4) ist zum Mast (3) befestigt, es sind Lagerbüchsen (5) auf dem Wagen (4) ausgeformt, eine Achse (6) ist dadurch einge-

passt, eine Kippvorrichtung (8) ist mit dem einen Ende der Achse (6) und eine Folienrolle (7) ist mit dem anderen Ende der Achse (6) verbunden, ein Sensor der Grundstellung (9) und ein Sensor der waagerechten Position (10) sind auf dem Grundrahmen (1) montiert, das Kippen kontrollierende mit den Ecken (14) des Pakets (13) verbundene ausschaltende Signalflaggen (12A, 12B, 12C, 12D) und ein die Grundstellung bewegende Element (11) sind zu dem Drehtisch (2) befestigt, der mit einer die Spannung der Folie einstellenden schwingenden Einheit (22) versehen ist, die mit dem anderen Ende der Achse (6) verbunden ist, die Einheit hat vorspannenden Rollen (7A), einen vorspannenden Motor (20) und eine mit einer Rolle (7C) versehenen Arm, einen die Vorspannung einstellenden mit einem analogen Sender der Verschiebung (17) und mit einem Magnet (16A) ausgerüsteten Kolben versehene pneumatische Zylinder (16) enthaltende leitende Rolle (7B) und auch ein Druckregler (18) ist auf dem Rahmen der die Folie haltende und vorspannende Einheit (23) befestigt, darin die Folic von der Folienrolle (7) abgewickelt und zwischen den vorspannenden Rollen (7A) geleitet wird, die miteinander durch eine Transmission (19) verbunden und nur ein von ihnen mit dem vorspannenden Motor (20) angetrieben wird, dann die Folie wird um die leitende Rolle (7B) geführt, die mit einem um ein Zentrum drehenden Arm und mit einer Rolle (7C) versehen ist, der Arm ist mit dem mit dem Magnet (16A) versehenen und im pneumatischen Zylinder (16) montierten Kolben verbunden, ***damit gekennzeichnet dass*** der Druckregler (18), der mit dem Spannung einstellenden pneumatischen Zylinder (16) verbunden ist, der durch die Resultierende des Drucks und der spannenden Kraft der Folie geregelt wird, eignet sich, einen Referenzwert und mehreren vorherig eingestellten Druckwerte darin einzustellen, der die Spannung einstellende pneumatische Zylinder (16) mit dem analogen Sender der Verschiebung (17) verbunden ist, der mit einem Frequenzregler (15) durch eine Signalverbindung verbunden ist, und der Letzte die Drehzahl des vorspannenden Motors (20) regelt.

Revendications

1. Une machine à couvrir les superficies verticales et supérieures des charges (13) avec un film étirable, qui a un châssis de base (1) dans lequel une table tournante (2) est montée et un mât (3) est fixé au châssis de base (1), un chariot (4) mouvant verticalement une bobine de pellicule (7) est monté au mât (3), coussinets à galet (5) sont formés sur le chariot (4), un arbre (6) est emboîté à travers celui-là, un mécanisme à faire basculer (8) est accouplé à l'un bout de l'arbre (6) et une bobine de pellicule (7) est accouplée à l'autre bout de l'arbre (6), un détecteur de position de départ (9) et un détecteur de position horizontale (10) sont montés sur le châssis de base (1), les drapeaux déliants (12A, 12B, 12C 12D) contrôlants le basculement accouplés avec les coins (14) du charge (13) et un élément mouvant le position de départ (11) sont montés sur la table tournante (2) qui est équipé avec un mécanisme oscillant (22) réglant la tension de la pellicule le mécanisme est accouplé à l'autre bout de l'arbre (6), ce mécanisme a les rouleaux de précontrainte (7A) équipés avec un moteur de précontrainte (20) un rouleau dirigeant (7B) ce qui contient un bras équipé avec un rouleau (7C) et un cylindre pneumatique (16) ajustant la tension équipé avec un transmetteur analogique de déplacement (17), un piston ayant un aimant (16A), ensuite un régulateur de pression (18) est monté sur le châssis du mécanisme soutenant la pelicule et donnant la force de précontrainte (23) dans lequel la pellicule se déroule de la bobine de pelicule (7), elle est guidée entre les rouleaux de précontrainte (7A), ceux-ci sont couplés avec une transmission (19) entre eux et seulement un d'eux est entraîné par le moteur de précontrainte (20), ensuite la pelicule est guidée autour du rouleau dirigeant (7B) ce qui est équipé avec un bras tournant autour un centre de rotation et équipé avec un rouleau (7C) ceci est connectée au piston équipé avec l'aimant (16A) monté dans le cylindre pneumatique (16) réglant la tension de la pelicule ***caractérisé par*** que le régulateur de pression (18) étant en connection avec le cylindre pneumatique (16) réglé par la résultante de la pression et la force de tension de la pelicule est applicable à ajuster une valeur de référence et plusieurs valeurs de pression ajustés préalablement, le cylindre pneumatique (16) réglant la tension de la pelicule est en connection avec le transmetteur analogique de déplacement (17) qui est en connection par signal avec un changeur de fréquence (15) réglant la vitesse de rotation du moteur de précontrainte (20).

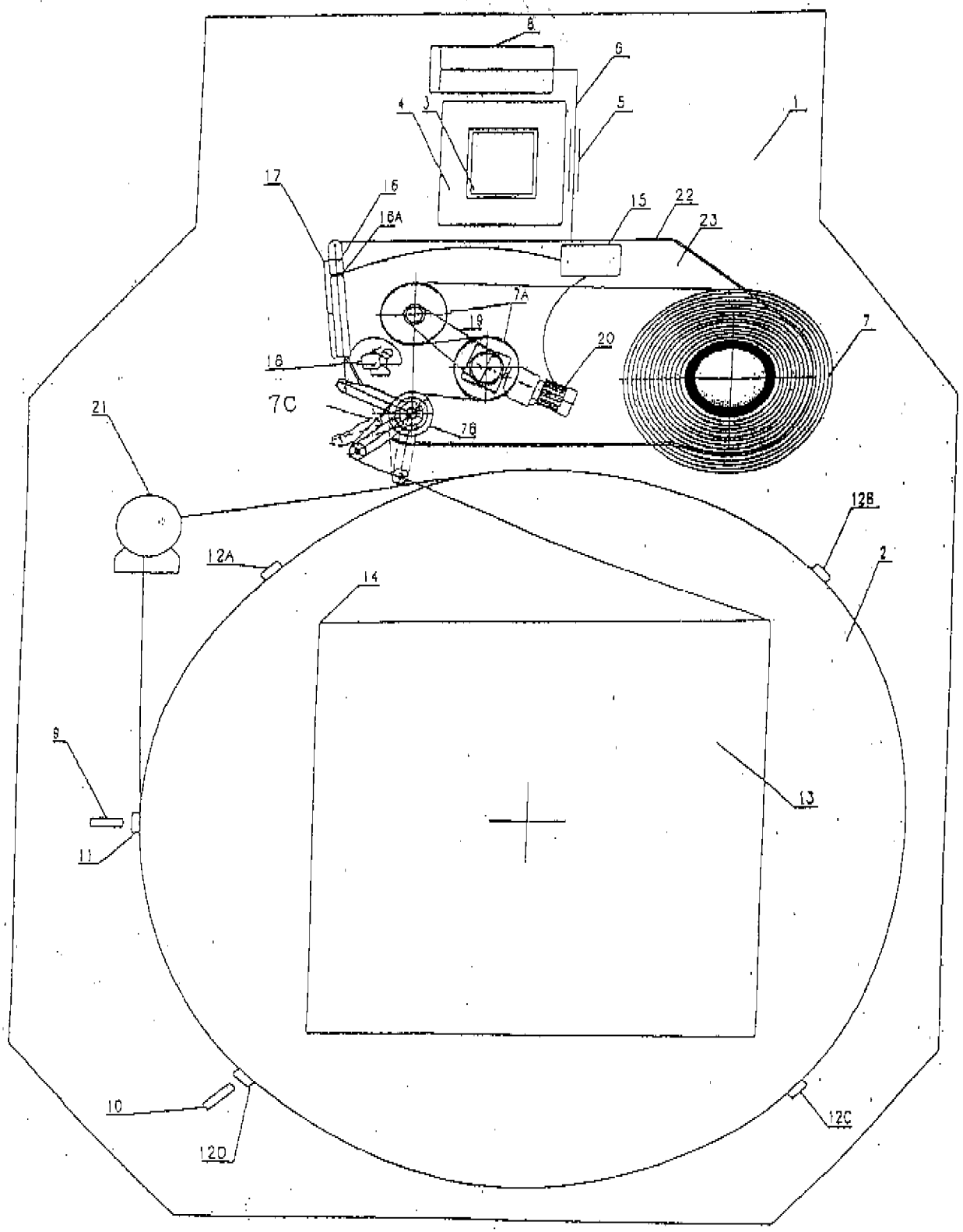
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FIG. 1

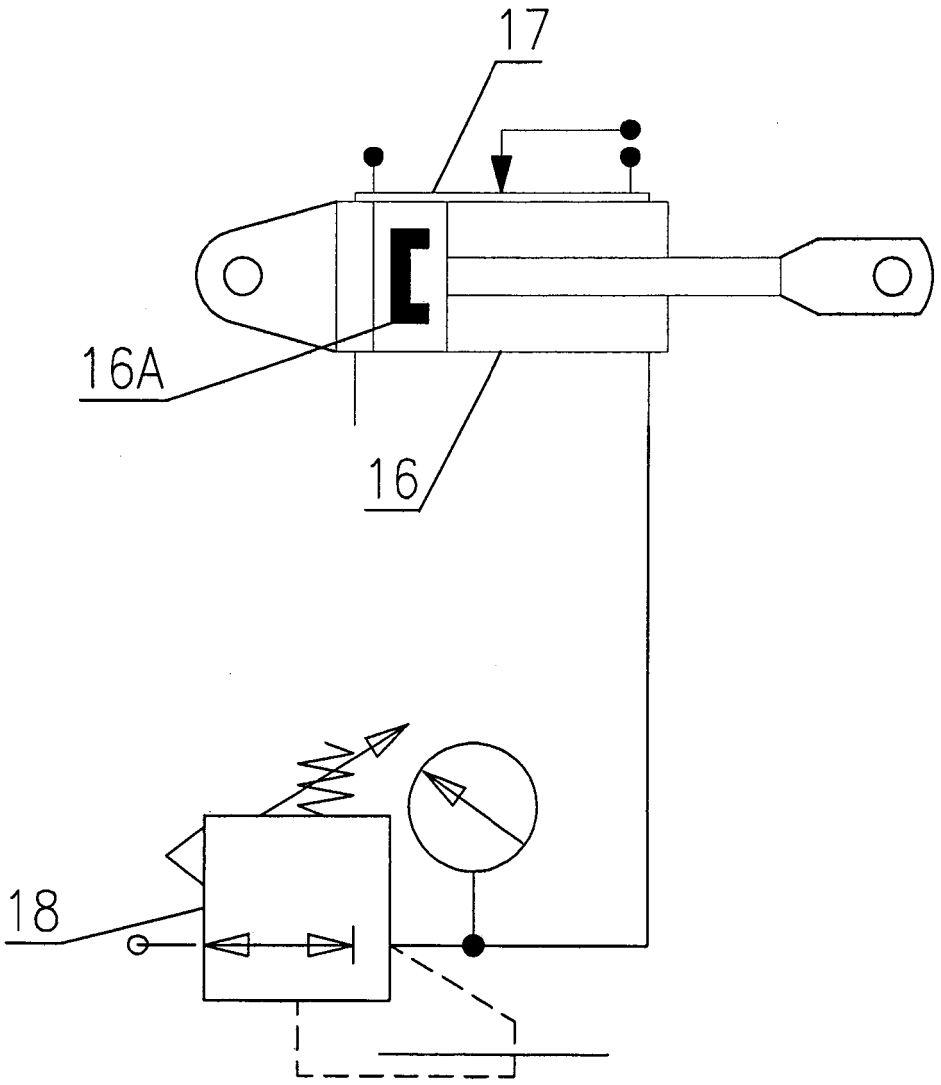

FIG. 2

REFERENCES CITED IN THE DESCRIPTION

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