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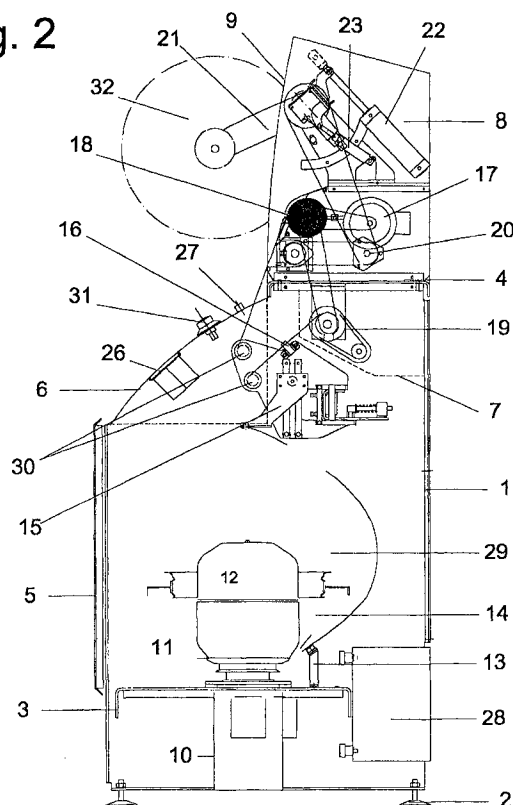
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(54) **SINGLE-POSITION DOUBLE TWISTING TWISTER WITH PRECISION WEAVE PICKUP**

(57) The object of the present invention is related to a double twisting frame with precision cross gathering, characterised in that the production modules are designed to work autonomously and independently and especially provided with directly motorized spindles for

work with threads of different diameters (linear densities) and materials, both natural and synthetic, and gathered on large format spools with precision crossing. The modules can work simultaneously at their maximum production capacity since all of their elements are independent.

Fig. 2



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Description

OBJECT OF THE INVENTION

[0001] The object of the present invention is related to a double twisting frame, whose production module is designed to work autonomously and independently and especially conceived with spindles that are directly motorized for working with both natural and synthetic threads of different diameters (linear densities) and materials, and gathered on large format spools with precision crossing.

BACKGROUND OF THE INVENTION

[0002] Over the past few years the market has had certain defects in the production process of twisted threads for industrial and technical use.

[0003] Manufacturers of continuous synthetic continuous Polyester, Nylon, Polypropylene and Aramidic fibre threads, as well as Rayon for industrial and technical use, are continuously increasing the weight of gathering spools that they are selling to their clients, as in the following examples:

[0004] Polyester (PES) spools, until a few years ago, weighed a maximum of 10.5 kg, and weights of over 16 kg. are currently in use.

[0005] For Nylon 6.6 (Du-Pont), weights of up to 12.8 kg are being reached, when a few years ago the maximum weight was 8 to 10.5 kg., and so on for all types of continuous synthetic threads.

[0006] Since threaders sell these heavier and larger sized spools to their clients, the twisting process, which is the step that follows spinning-draw down, has come to need new developments and technology in order to be able to install directly into the machines gathering spools with greater capacity than that which was previously used.

[0007] Currently, the manufacturing of threads twisted at several strands, as in a sewing thread or fishing line, consists of a process with several steps which makes the final cost of the thread more expensive.

[0008] The market for industrial and technical thread twisters is by nature a market in which each client manufactures a wide variety of different threads and thus clients need great versatility in their equipment in order to produce many different kinds of thread simultaneously.

[0009] The machines currently existing on the market are made up of a large number of spindles arranged with two sides, with independent controls for each side so that two different kinds of linear densities (types of material) and twists can be produced simultaneously, the gathering control is the same for all of the positions of each of the sides, the folding of the receiving spools being irregular.

[0010] As an example, listed below are the known patents of this type of machines:

No: P0403644

TITLE : THREADING OR TWISTING MACHINE, ESPECIALLY DOUBLE TWISTING FRAME

No: P0340473

TITLE : DOUBLE THREAD TWISTING FRAME

No: P0337068

TITLE : MACHINE FOR DOUBLE TWISTING THREAD

No: P2130621.8(21-6-71)

TITLE : SPINNING OR TWISTING MACHINE, ESPECIALLY DOUBLE THREAD TWISTER MACHINE.

[0011] As can be observed in the previously mentioned patents, the evolution of the manufacturers double twisting machines for these kinds of threads has been mostly directed at attempting to fit into their machine design a large number of spindles and gathering spools of greater dimensions. What none of the manufacturers has produced so far is a kind of double twisting machine that provides greater versatility and facilitates the process of twisting more than two types of thread and a larger number of twists per metre simultaneously.

DESCRIPTION OF THE INVENTION

[0012] In order to solve the problems derived from the current situation, the single-position double twisting frame with precision cross gathering has been created, offering a number of advantages, essentially originating in the total freedom and flexibility in parameter and activation selection in each one of the modules.

[0013] It facilitates simultaneously obtaining on several modules spools of different formats and dimensions, so that a different length of spool can be reached in each module.

[0014] The possibility to individually control the speed of the drive roller and the distributor of each module, depending on the width of the thread, spool filling will always be the most appropriate both in length and density of the thread crossing.

[0015] It guarantees that the maximum thread production capacity will be obtained in each module.

[0016] As a consequence of the above, the activation of both the spindle and gathering being independent, threads of different physical characteristics can be produced in different modules of a single machine, reaching the maximum possible capacity in each module, depending solely on the type of thread.

[0017] The incorporation of new modules into machines in the manufacturing process can be carried out without interrupting their functioning, since they do not share any common elements.

[0018] The distribution plan of the machine is completely versatile. It does not necessarily have to be linear, as usual, since there are no common activation elements.

[0019] The installation of the machine in the factory is

much simpler than usual and can be carried out by the client himself since there are no large structures to be assembled, aligned and levelled, so that the set-up of the production process is much quicker.

[0020] On the other hand, the spindle activated directly by the motor, without any transmission, offers the advantage of producing neither noise nor vibration, as well as requiring reduced maintenance since there are no transmissions to lubricate and gauge.

[0021] It is a twisting frame with a double twisting system, that is, for each mechanical revolution of the spindle, the thread is twisted twice; the first twist is carried out in its route starting from the spool (35) and leading to its tip (36), the second twist is carried out in the route followed by the thread from the tip (36) to the tip (15), for this reason it is called the 2x1 twister.

[0022] The machine is modular, that is, each machine has its own structure, in which a spindle with motor and complete electrical parts is assembled, a precision cross gatherer and other auxiliary elements.

[0023] Its specific use is for twisting technical and industrial threads of thick densities made up of continuous filament and single or multi-filaments of different materials and widths.

[0024] It does away with the problem of lack of versatility since each position is completely individual and separated from the rest, providing the client with the choice of working with completely different threads and products in each of the positions or threads, saving wasted time due to changing articles.

[0025] The spool ending in precision crossing is adequate for sale, avoiding later re-spooling. This type of fold allows the spools to be wound at high speed and to store larger quantities of thread.

[0026] Because of its construction and design, both the electrical and mechanical maintenance expenses are decreased due to its simplicity, and the breakdown of one of the modules does not affect the normal functioning of the rest of the modules.

[0027] The modular conception of the double twisting frame facilitates synchronisation of one or several modules in combinations with a modular ring machine, such as the machine disclosed in the patent application PCT/ES00/00270 (see ways of synchronising in fig. 9). By facilitating the simultaneous twisting of the first strands with the double twisting frame and re-twisting all of the strands with the ring machine (in figure 11 the formation of a thread in a ring machine, from three threads 39, 40 and 41 produced by three twister modules of the invention is shown), it reduces handling, labour, decreasing waste and improving the quality of the thread in the twisting process.

[0028] This modular conception of the double twisting frame with the ring machine reduces energy consumption since the first twists are made with the double spindle, the energy consumption being less than in other twisting systems that carry out the same process.

Description of the parts of the machine.

1. FRAME

5 **[0029]**

1. Structure
2. Fairing

10 2. INTEGRAL DOUBLE TWISTING SPINDLE - MOTOR

[0030]

- 2-1 Motor
- 15 2-2 Mobile part
- 2-3 Static part
- 2-4 Exterior anti-twist magnets
- 2-5 Thread tension regulators
- 2-6 Thread winder

20

3. BALLOON ARM THREADGUIDE

[0031]

- 25 3-1 Thread-guide arm
- 3-2 Thread sensor

4. GATHERING

30 **[0032]**

- 4-1 Activation
- 4-2 Cylinder
- 4-3 Arm
- 35 4-4 Distribution axis
- 4-5 Overfeeding

5. CONTROL

40 **[0033]**

- 5-1 Electric
- 5-2 Pneumatic

45 1. FRAME

[0034]

- 1-1 Structure

50

[0035] The machine has a single block configuration, its structure being made up of two pieces of steel bent into a U shape and assembled in vertical position. On the lower part a fold has been made, which is used to lodge the footing that support the whole machine. A piece of steel sheeting bent into a U shape and held down by screws in the lateral beds serves as a basis for the spool motor.

[0036] Another piece of bent steel sheeting, located on the upper end of the sides, serves as a basis for the arm and input group, also affixed with screws onto the lateral beds.

[0037] This construction design facilitates joining modules together, laterally adjoining them and affixing them to one another by way of silenblock screws which join the aforementioned vertical plates, so that a machine whose number of modules is as large as is physically possible is formed, depending solely on the characteristics of the workshop. In addition, the adjacent modules can be joined in other ways, by way of intermediate joining parts, so that the machine made up of several modules can be adapted into very diverse assemblies.

1-3 FAIRING

[0038] Besides its structure, the machine avails of all of the necessary protection and safety elements for all of its moving parts, its structure being covered by fairing consisting of:

- Frontal sliding protection, for protecting the balloon or covering which is formed by the thread when it is drawn by the booster.
- Function programmer cover, emergency stop and auxiliary switch.
- Fixed tensioner housing and winch axis cover.
- Back cover.
- arm protection cover and power supply transmission protective covering.

2. INTEGRAL DOUBLE TWISTING SPINDLE- MOTOR

2-1 MOTOR

[0039] The motor is an alternating current asynchronous triphasic one controlled by a frequency shifter for adjusting speed. The motor is especially made with a conical upper output axis, with an integrated supporting flange and speed detector. It is affixed to the structure in vertical position by buffers that absorb vibrations. The structure that supports the spindle motor is made up of a sheet of steel bent into a U shape and affixed by screws onto the lateral beds in horizontal position. A double twisting spindle is assembled on the motor.

2-2 MOVING PART

[0040] On the conical axis of the motor, a sheath with hole in it is assembled on top of which a reserve disc and the balloon forming plate are affixed. On the upper part of the sheath a group of bearings is assembled, covered by a bearing shell which is the basis of the static part.

2-3 STATIC PART

[0041] Made up of a circular base pressure mounted onto the bearing shell mentioned above. It affixes a cylindrical container of plate metal and allows the thread input spool to be lodged inside of it. This container is made up of a basis and an open upper cover in its central piece which facilitates changing and handling of the input spool.

[0042] A locator affixed on the static part positions the input spool. On the periphery of the basis, and spread at 120°, three groups of magnets are lodged, which prevent the static part from spinning and allow the thread balloon to spin between these magnets and the exterior ones.

2-4 EXTERIOR ANTI-SPIN MAGNETS

[0043] Exterior magnets are assembled onto the spindle container, affixed onto the structure that supports the motor of the spindle by way of three support bases, spread at 120° so that they coincide with the magnets lodged in the static part.

2-5 THREAD TENSION REGULATORS

[0044] The control of the tension of the thread from the balloon is carried out by two groups of tensioners which are assembled on the vertical part of the centre of the spindle. The lower tensioner is adjustable and is located on the upper central area of the basis of the static part. The upper tensioner is affixed and rests on the locator plate lodged on the input spool.

2-6 THREAD WINDER

[0045] For input spools with two or more strands a winder must be used to help obtain uniform tension throughout the spool winding process.

[0046] It is made up of a central ring and two diametrically opposed arms, at the ends of which are lodged thread-guide eyes; a tube which goes through the centre of the spool to the entrance of the moving part of the spindle is situated coming out of the centre from the upper tensioner onwards, and the thread is sent through the middle of this tube from point 1 to point 2. Depending on the density of the thread to be processed, it may be necessary to install several weight washers on the central ring of the winder in order to adjust the uniformity of the tension.

1. BALLOON THREADGUIDE ARM

3-1 THREADGUIDE ARM.

[0047] It is located on the double twisting spindle and has the purpose of affixing the thread balloon proceeding from the double twisting spindle and guide it to the

booster roller, to later send it back to the gatherer. This thread-guide is made up of a plate support basis on which a ceramic threading eye is lodged. Its assembly on the arm positions the ceramic threading eye on the vertical of the centre of the double twisting spindle, facilitating its height adjustment.

[0048] The support arm is affixed to the structure by a hinge that facilitates its horizontal turning in order to allow the input spool of the spindle to be loaded.

[0049] This hinge is constructed so that it only allows two fixed positions, one in working position and the other in open position for changing the input spool.

3-2 THREAD SENSOR.

[0050] An electronic optical sensor, affixed on a plate basis to the thread-guide arm and located between the first thread-guide pulley and the booster roller, detects the presence of moving thread. The function of this sensor consists in stopping the machine when the thread is broken during the twisting process or when the thread from the input spool finishes.

4. GATHERER

[0051] In order to make clear what precision cross gathering refers to, it is necessary to define the different modalities of gathering or winding thread and the differences among them.

[0052] There are traditionally two winding modalities:

Irregular winding (42).

Precision winding (43).

[0053] In irregular winding (fig. 8) a fixed relationship is held between the peripheral speed of the spool and the speed of the thread movement. Thus, the cross angle of the threads is maintained constant whilst the proportion of rings, that is, the number of turns of the spool for each double routing, is reduced as the diameter increases. This kind of spooling has the advantage of offering a very homogenous spooling density, although on the contrary it has a disadvantage in that with this kind of spooling, patterns appear in sections which can negatively affect winding properties.

[0054] Precision spooling (fig. 8) is carried out due to a constant proportion of rings between the number of spool revolutions and the thread movement speed. Thus, the proportion of rings is maintained constant during the whole spooling process.

This spooling is characterised by the lack of patterns in sections. Spools with good winding properties are obtained, thus allowing for high output speeds. In addition, it presents a high spooling density; the main advantage that this kind of spooling offers depending on the number of threads is obtained when the winding speed is increased by 38% in a single spool volume.

4-1 ACTIVATION

[0055] An asynchronous three-phase motor with alternating current controlled by a frequency shifter is what moves the assembly; this motor is coupled onto a transmission made up of pinions and toothed straps; power is supplied to the spool take-in roller directly from this transmission, and power is also supplied by this mechanism to the capstan or booster roller. Power and speed are transmitted from the spool support axis, by way of a group of pinions and toothed straps, to a transmission made up of conical pulleys, whose speed from the output axis is adjustable by way of a threaded axis, thus allowing different speeds to be obtained in the grooved axis of the distributor, which, by way of a mechanism, transforms the rotation speed into a linear back and forth movement along said distributor axis.

4-2 CYLINDER

[0056] Its function is to carry out the movement of the thread gathering spool by friction, having assembled on the latter two synthetic rubber bands, thus obtaining efficient movement of the receiving spool without slipping.

[0057] This cylinder is built of chromate steel and includes a central part, the cylinder itself, and a neck on either side of it, on which the anti-slip rubber bands are lodged. The two necks of the cylinder rest on ball bearings.

4-3 ARM

[0058] Support assembly for the spool, which is made up of a rigid metal structure held by bearings onto the arms where the gathering spool holding PINOLAS are assembled.

These arms, by way of their central support basis, are connected to pneumatic cylinders (22), (23), (24) and (34), each one carrying out a different function.

[0059] (22). Raising and lowering piston, which has the function of lifting the arm assembly in order to load the nucleus, generally made of cardboard, on which the thread will be gathered, and to unload when it is full.

[0060] (23). Compensatory piston, carrying out three functions:

A. When the gathering spool is empty, the piston works directing the arms towards the centre of the machine, thus increasing the friction of this roller against the drive cylinder. This works so because, at first, the gathering cylinder has a very light weight and without this supplementary force there might be too much sliding between it and the drive cylinder.

B. Once the gathering spool has obtained a certain diameter and weight this cylinder remains in a position that could be defined as "0", that is, not applying any force to the support arms of the gathering

spool.

C. Starting from this moment, and as the spool is filled to the limit, this piston applies force on the arms opposing that of the spool, thus causing the force that the spool would apply on the drive cylinder, due to the weight increase as it fills, to decrease, causing the pressure of the spool on the drive cylinder to be maintained constant during the whole of the filling process.

[0061] (24). Anti-vibration brake piston.

[0062] It is made up of two pistons assembled on each of the support arms of the gathering spool; it carries out the function of stopping the vibrations that the gathering spool would make during the whole of the thread gathering process, holding it still and stable on the drive cylinder throughout this process.

[0063] (34). Arm opening piston.

[0064] Assembled on a support bar of the arms and held onto one of them, its mission is to open and close the arm in order to put in the tube containing the thread, and take it out once it is full.

4-4 THREAD DISTRIBUTING AXIS.

[0065] Assembled opposite the gathering spool, its function is to distribute thread on the latter, carrying out precision crossover on the gathering spool.

[0066] This axis, on which a crossed threading has been built, receives the rotation force of the conical pulleys which, as already mentioned in point 4-1, have adjustable speed. A mechanism that modifies the rotating movement of the axis with a linear back and forth movement, in order to distribute the thread on the spool with absolute precision by way of a needle assembled on this mechanism.

4-5 SUPERCHARGING

[0067] The booster roller is the component that pulls the thread from the winding spool assembled on the spindle. This roller, assembled on a basis over the winding spindle, is activated by way of a motor pulley located on the drive cylinder axis (See point 4-1).

[0068] The axis rests on bearings assembled on a support basis. At the other end, the chromate steel booster roller is assembled, held to the axis by a peg. The counter roller is a chromate steel cylinder of a smaller size than the latter, which turns freely on bearings. These bearings in turn rest on an axis that is inclined in relation to the booster cylinder axis and rests on a support basis.

5- CONTROL

5-1 ELECTRIC.

[0069] The adjustment of the motors of the machine is carried out by frequency shifters that are lodged in the electrical manoeuvring and control housing, made of steel sheeting, located on the lower back part of the module and assembled on (antivibratory) silenblocks; the shifters are controlled and synchronised by a function programmer located on the front fairing of the machine, which controls all of the variables or parameters of the functioning of each module. The function programmer includes a control card, a keyboard and a screen and facilitates introducing, modifying and controlling fundamental parameters such as spindle speed, drive cylinder speed and other auxiliary elements. If at some point one wishes to introduce the same parameters collectively into several modules simultaneously, this can be done with a master programmer with functions that, by way of the communications bus, transmit the same instructions to the different programmers of the selected modules, with the possibility of independently modifying individual parameters of each module at any time.

5-2 PNEUMATIC.

[0070] The pneumatic mechanisms include the pistons assembled on the gathering spool, whose functions have been mentioned in point 4-3. (Arm); The group of electrovalves, control mechanisms of the pistons assembled on the lower inner part of the machine, whose control is carried out by the programmer (see point 5-1, electrical part), and filter equipment, air pressure regulator and lubricator, maintain the compressed air in perfect working condition, pressure regulators also being assembled in the cylinders (22), (23), (24) and (34). Additionally, in order to manoeuvre the pistons, a step-by-step control is assembled on the front panel of the machine, which each time it is pressed activates the pistons following a logical working sequence.

DETAILED DESCRIPTION OF THE DIAGRAMS

[0071] In order to provide improved understanding of the object of the present invention, a preferred embodiment of the single-position double twisting frame with precision cross gathering is disclosed below based on the figures mentioned:

Fig. 1 RAISED LATERAL AND FRONT PLAN
Fig. 2 VERTICAL CROSS-SECTION OF MODULE
Fig. 3 RAISED OR FRONT CROSS-SECTION
Fig. 4 FRONT AND PROFILE VIEW OF THE ARM
Fig. 5 THREADGUIDE ARM AND BOOSTER
Fig. 6 KINEMATIC DIAGRAM OF ARM AND BOOSTER

Fig. 7 DIAGRAM OF THE DOUBLE TWISTING SPINDLE

Fig. 8 SPOOLING TYPE DIAGRAM

Fig. 9 DIAGRAM OF LINK BETWEEN TWISTING FRAME AND RING MACHINE

Fig. 10 COMBINATION OF LINK BETWEEN RING MACHINE AND TWISTING FRAME

Fig. 11 FIRST AND SECOND TWIST THREAD OBTAINING PROCESS

PREFERRED EMBODIMENT OF THE INVENTION

[0072] In order to provide a better understanding of the object of the invention a preferred embodiment of the same is disclosed below.

The single-position double twisting frame with precision cross gathering on spools is made up, in each of its modules, of the following main groups.

FRAME

INTEGRAL DOUBLE TWISTING SPINDLE

BALLOON THREADGUIDE ARM AND BOOSTER GATHERER

CONTROL

DESCRIPTION OF THE MODULE

[0073] The frame has a single-bodied configuration made up of a structure with two steel sheets (1), folded at their lower ends where the bases of the machine are attached (2), elements which are used to level the module, on each of the steel sheets (1) it holds ready-to-use fittings (38), where the joining screw of several modules are attached; a "U" shaped, bent steel sheet (3) affixed by screws onto the lateral beddings serves as a basis for the motor (10), winding plate (11), and axis and spindle balloon (12). Another steel sheet (15) located in the middle area of the structure and screwed to the two plates of the structure serves as a holder for the ceramic and thread presence sensor. On the upper part of the structure, another sheet (4) of folded steel screwed onto the lateral plates serves as a support basis for the booster group (19) and for the Arm, see fig. 5.

[0074] The spindle is made up of the motor (10) which is affixed to the structure in a vertical position by way of a sheet (3), screwed onto the structure, the mobile part (11), on which the reserve discs are assembled, and the balloon formation plate, the static part (12), including the circular basis which is pressure mounted and the cylindrical sheeting container (14), which facilitates lodging the thread spool inside of it, on the periphery of the basis and spread at 120° three groups of magnets (13) are lodged, thus avoiding the spinning of the static part (12). For very thick threads, since the aperture made by the thread being twisted could collide against the walls of machine and be damaged, an arm (29) is inserted, thus decreasing said aperture and avoiding possible damage to the thread.

[0075] Balloon guiding arm (15), located on the double twisting spindle (12), that guides the thread towards the booster roller (19), by way of thread-guide rollers (30); the thread sensor (16) is located between the first and second roller, its function being to stop the machine due to breakdown or lack of thread.

[0076] The modules are provided with the necessary safety elements, both electrical and mechanical, and mounted on the structure are the door for accessing the spindle (5), guide roller and thread sensor protective covering (6), fixed tensioner and winch housing protective covering (7), rear arm cover (8) and input arm cover (9).

[0077] Thread gathering is carried out by a drive consisting of a motor (17), which is coupled by a mechanical transmission onto the support axis of the drive cylinder (18), and this transmits movement to the capstan (19). From the drive cylinder (18), it makes the spool turn (32), which is supported by the arms (21), and the latter are coupled onto four pneumatic cylinders (pistons): (22) spool raising and lowering piston, (23) friction force regulator piston, (24) spool stability regulator piston, and (34) piston for opening and closing the thread gathering spool loading arm, this transmits power by way of mechanical transmission to a set of speed adjusting conical pulleys (33), and these pulleys transmit movement to the distribution screw spindle (25).

[0078] All of the electrical adjustment and control equipment of the module is located in a housing (28) especially prepared for this purpose, the control and function programming buttons are on the front panel of the machine, (26) function programmer, (27) step-by-step pneumatic arm cylinder buttons, (31) safety stop knob.

Claims

1. Single-position double twisting frame, with precision cross gathering, including one or more unitary production modules, each of which is made up of a structure or frame made up of steel sheeting (1) and each module is joined to the adjacent modules by way of joining members (38) screwed onto the sheets (1), **characterised in that:**

- each unitary production module is totally independent from the others in all of its production and control components, lacking mechanical control elements connected to other modules, which facilitates simultaneous processing with other modules, and whatever the type and characteristics of the products processed by other modules of the same machine, threads of different material and diameters in order to finally obtain gathering spools with precision crossing, thus facilitating the functioning of all of the modules of the machine at their maxi-

mum capacity simultaneously, in accordance
 with the characteristics of the thread to be pro-
 cessed, since each module is provided with a
 motor (10), a power supply system (11) and
 (12) and a gathering arm (21), all completely 5
 independent, all of the parameters being con-
 trolled by an independent function programmer
 (26) for each module with the option of working
 in coordination with the programmers of the rest
 of the modules, all of which provide each mod- 10
 ule with the capability to work simultaneously
 with other modules and with different working
 speed parameters, gathering system with dif-
 ferent crossing formats depending on the type
 of thread, and consequentially, the capability to 15
 obtain, simultaneously in all of the modules,
 spools whose characteristics in number of me-
 tres, types of crossover, kinds of thread, may
 be different for every one of the modules of the 20
 machine so that all of the modules can work at
 their maximum productive capacity simultane-
 ously.

a higher winding speed. The spool thus obtained
 being adequate for sale without requiring posterior
 re-spooling.

2. Double twisting frame with precision cross gather-
 ing according to claim 1, **characterised in that** it is 25
 designed to be assembled in series, that is, several
 single-position modules are laterally joined to one
 another so that they can form a single rigid struc-
 ture, the group of modules forming a straight or
 polygonous open or closed line. 30
3. Double twisting frame with precision cross gather-
 ing according to claim 1, **characterised in that**
 each module includes a built-in function program-
 mer independent from the function programmers of 35
 the rest of the modules, which facilitates setting dif-
 ferent production parameters.
4. Single-position double twisting frame with precision
 cross gathering according to claim 1, **character-** 40
ised in that two or more modules of the double
 twisting frame can be synchronised with a module
 from the unitary, autonomous and independent pro-
 duction modules of the twisting frame-ring lap
 former, patent application (PCT/ES00/00270), facil- 45
 itating simultaneous twisting of the first strands with
 the double twisting frame and re-twisting all of the
 strands with the ring twister with the advantage of
 reducing manipulation, thus avoiding waist and ob-
 taining quality twist pair and rigidity of the thread 50
 since the first and second twists are simultaneous.
5. Single position double twisting frame with precision
 cross gathering according to claim 1, **character-** 55
ised in that the application of cross gathering in sin-
 gle-position twisting frames facilitates obtaining a
 higher spooling density to that of irregular crossing
 and thus a heavier gathering spool weight and also

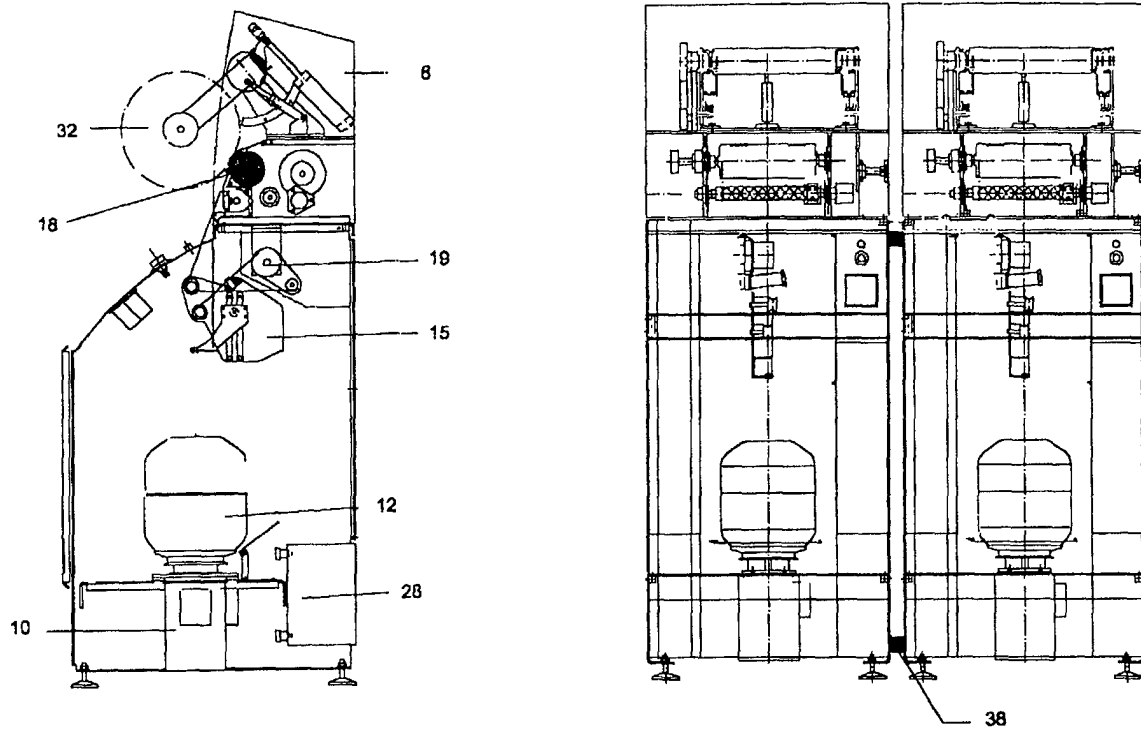


Fig. 1

Fig. 2

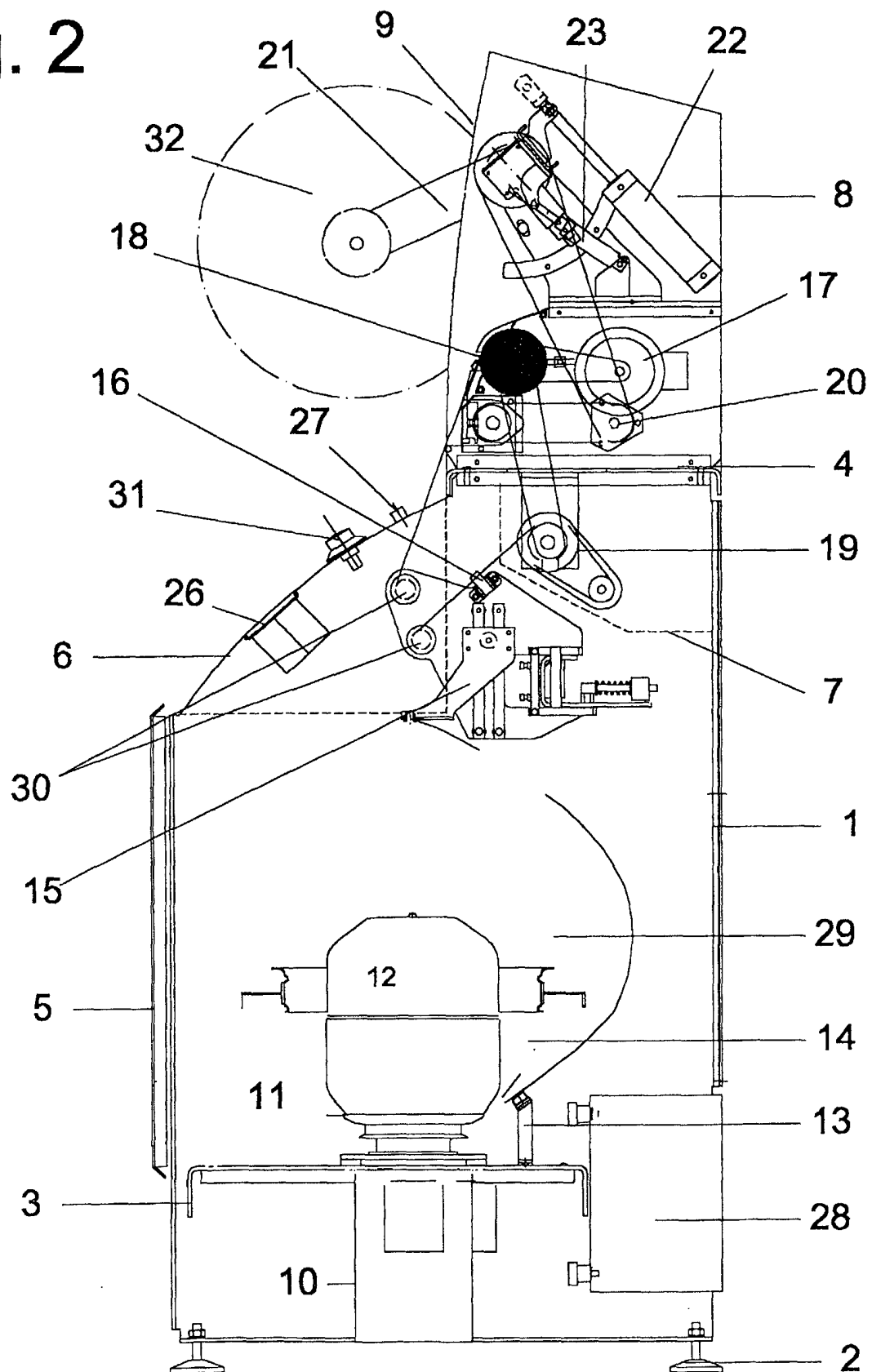


Fig. 3

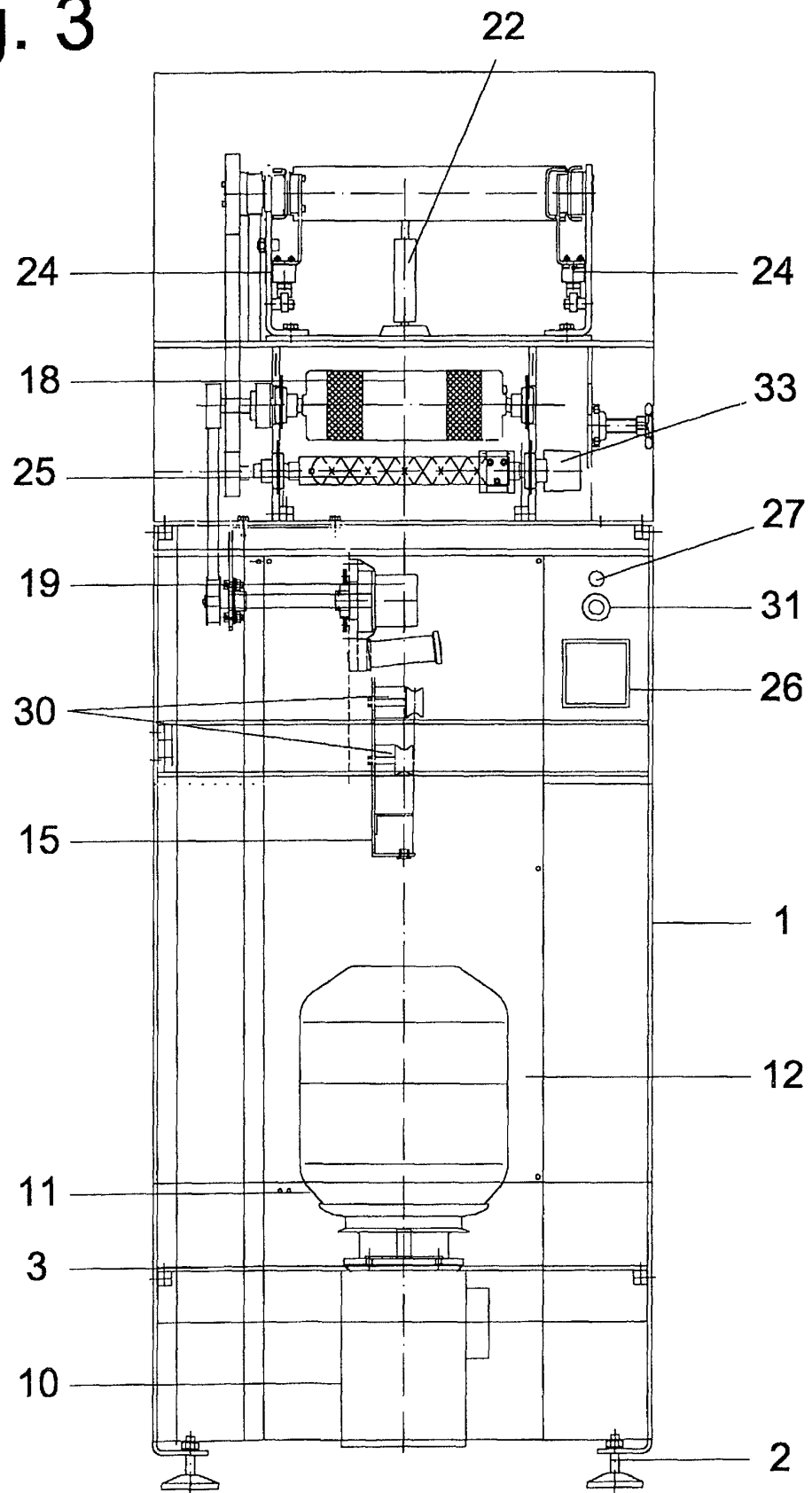


Fig. 4

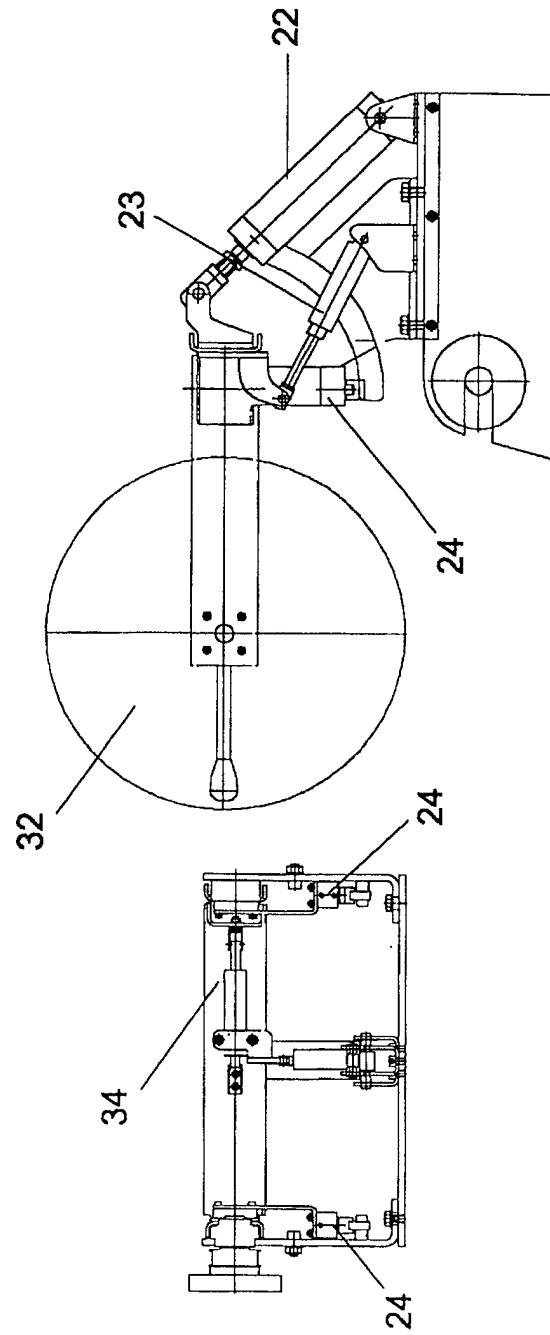


Fig.5

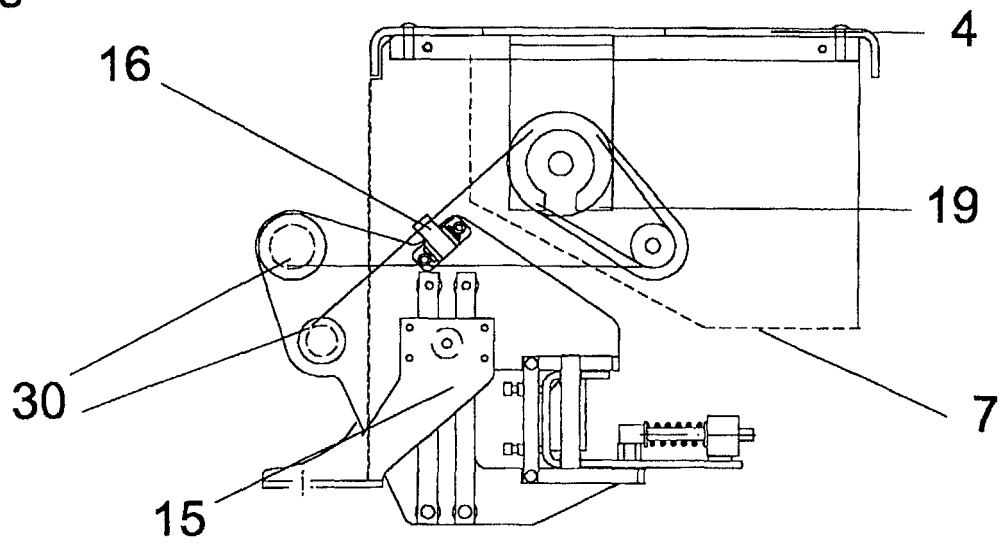


Fig. 6

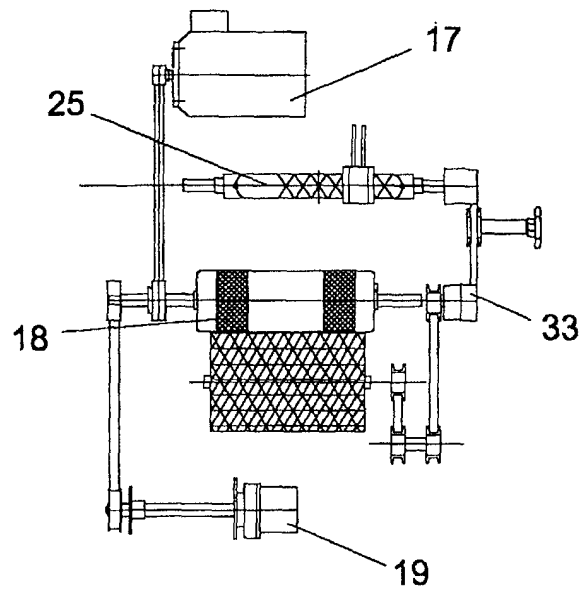


Fig. 7

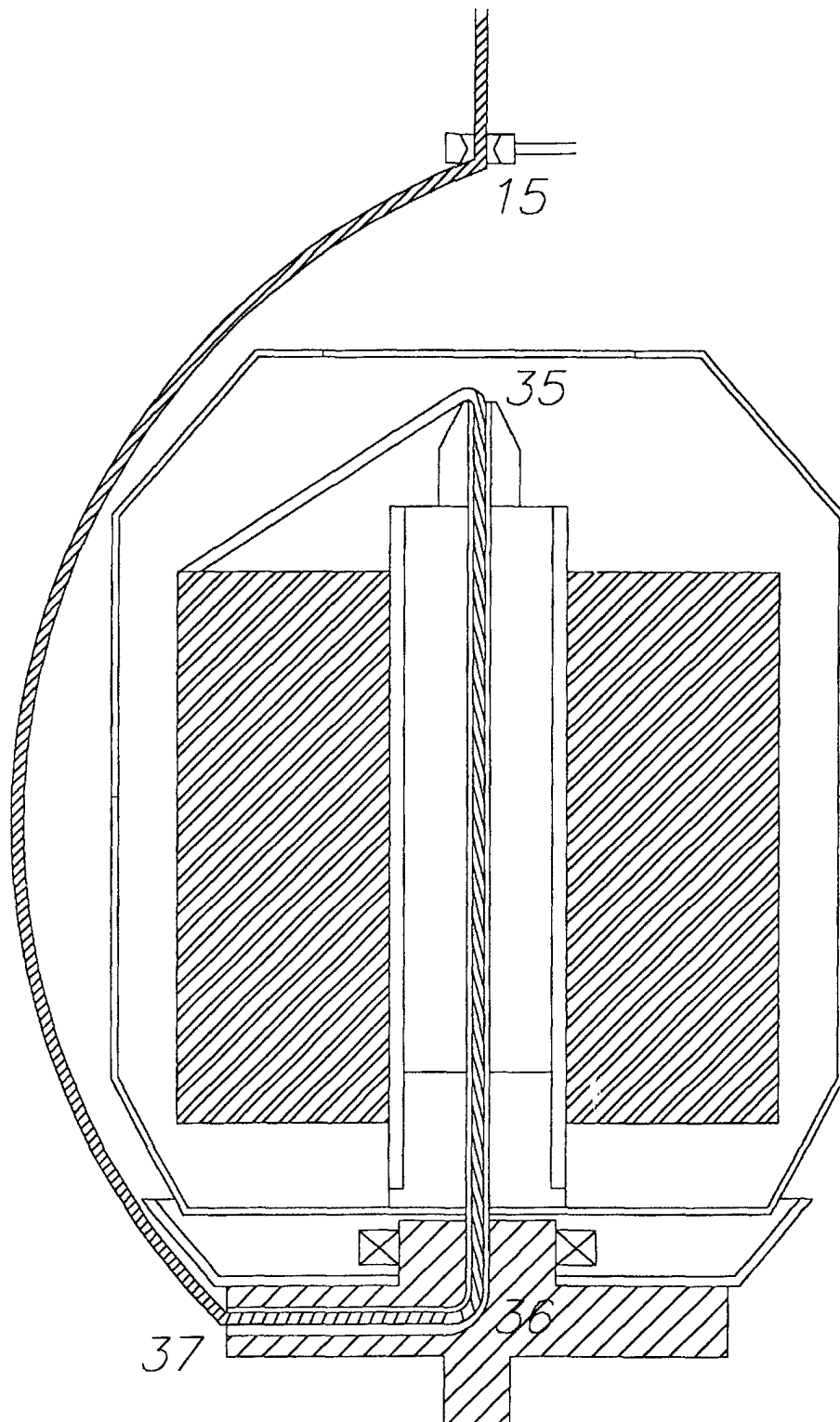


Fig. 8

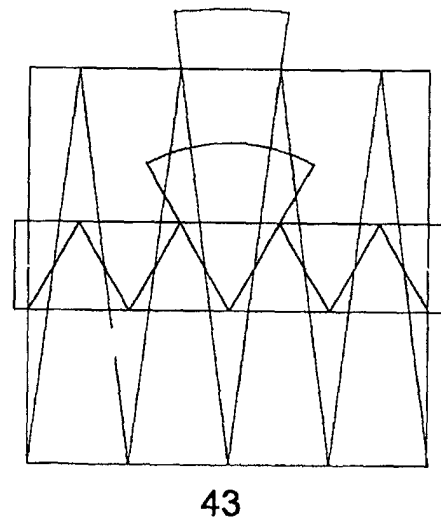
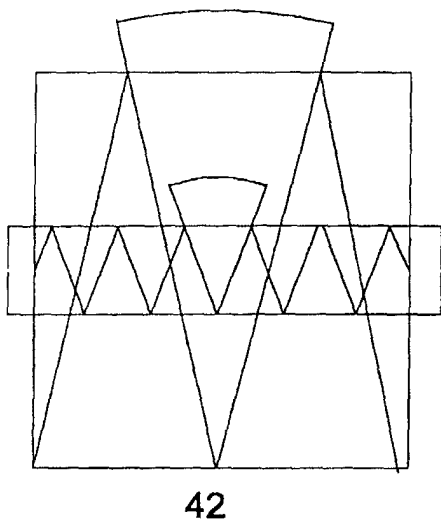


Fig. 9

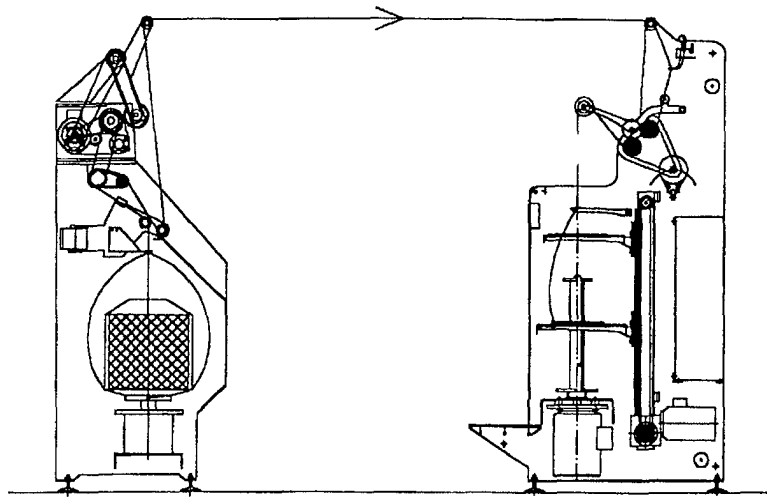


Fig. 10

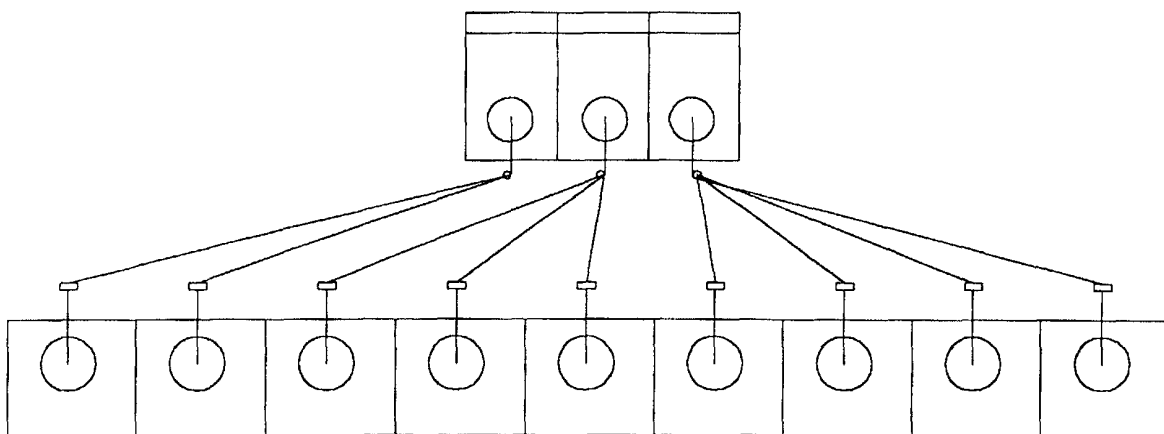
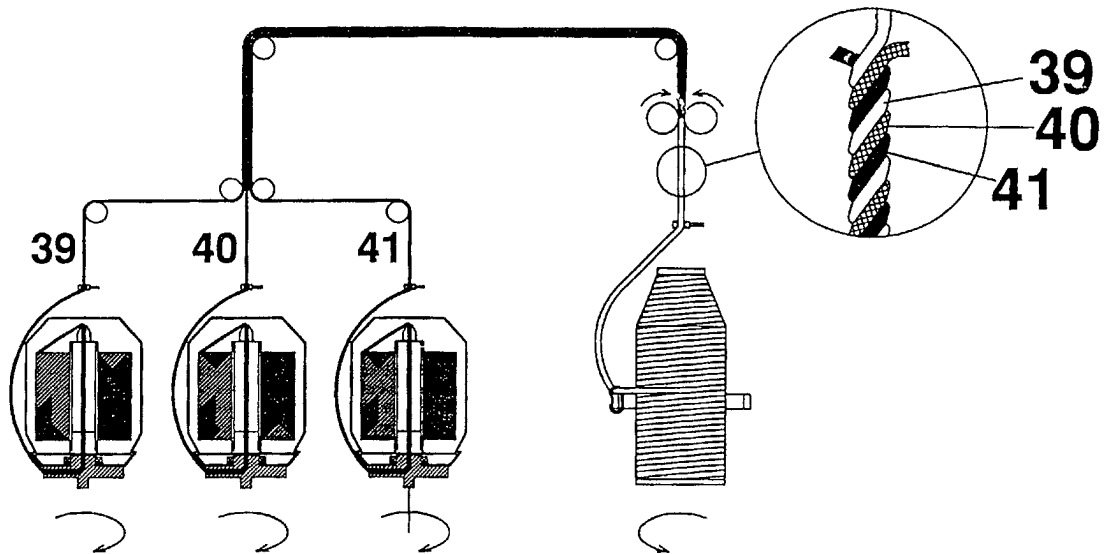


Fig 11



INTERNATIONAL SEARCH REPORT

International application No.

PCT/ES01/00495

A. CLASSIFICATION OF SUBJECT MATTER		
IPC ⁷ D01H 1/10 According to International Patent Classification (IPC) or to both national classification and IPC		
B. FIELDS SEARCHED		
Minimum documentation searched (classification system followed by classification symbols)		
IPC ⁷ D01H+		
Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched		
Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)		
CIBEPAT, EPODOC, WPI, PAJ		
C. DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
E	WO 0148283 A1 (HERMANOS TALLERES GALAN, S.A.) 05.07.2001, page 11, lines 8-16; claims 1; figures 1, 2	1-3
Y	US 4354342 A (ROBERT M. RUMSEY et al.) 19.10.1982, page 4, lines 45-61; figure 1	1,3
Y	DE 4224755 A (BUDIG PETER KLAUS) 03.02.1994 (abstract) [in line] [recovered 26.02.2002] recovered from EPO WPI DATABASE	1,3
A	US 4562388 A (HORST WOLF) 31.12.1985, column 3, lines 5-26; figure 1	1-3
A	WO 9901597 A1 (GALAN I LLONGUERAS, Jordi) 14.01.1999, page 7, lines 5-22; pages 9, lines 10-18; figures 1-3	1-3
☐ Further documents are listed in the continuation of Box C. ☒ See patent family annex.		
* Special categories of cited documents: "A" document defining the general state of the art which is not considered to be of particular relevance "E" earlier document but published on or after the international filing date "L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified) "O" document referring to an oral disclosure, use, exhibition or other means "P" document published prior to the international filing date but later than the priority date claimed "T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention "X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone "Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art "&" document member of the same patent family		
Date of the actual completion of the international search		Date of mailing of the international search report
27 February 2002 (24.02.2002)		07 March 2002 (07.03.2002)
Name and mailing address of the ISA/ S.P.T.O		Authorized officer
Facsimile No.		Telephone No.

Form PCT/ISA/210 (second sheet) (July 1992)

INTERNATIONAL SEARCH REPORT

International application No.

PCT/ES01/00495

Box I Observations where certain claims were found unsearchable (Continuation of item 1 of first sheet)

This international search report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1. ☐ Claims Nos.:
because they relate to subject matter not required to be searched by this Authority, namely:

2. ☒ Claims Nos.: **4 and 5**
because they relate to parts of the international application that do not comply with the prescribed requirements to such an extent that no meaningful international search can be carried out, specifically:

3. ☐ Claims Nos.:
because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a).

Box II Observations where unity of invention is lacking (Continuation of item 2 of first sheet)

This International Searching Authority found multiple inventions in this international application, as follows:

1. ☐ As all required additional search fees were timely paid by the applicant, this international search report covers all searchable claims.
2. ☐ As all searchable claims could be searched without effort justifying an additional fee, this Authority did not invite payment of any additional fee.
3. ☐ As only some of the required additional search fees were timely paid by the applicant, this international search report covers only those claims for which fees were paid, specifically claims Nos.:

4. ☐ No required additional search fees were timely paid by the applicant. Consequently, this international search report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.:

Remark on Protest

- ☐ The additional search fees were accompanied by the applicant's protest.
☐ No protest accompanied the payment of additional search fees.

INTERNATIONAL SEARCH REPORT

Information on patent family members

International Application No

PCT/ES01/00495

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
WO 0148283 A	05.07.2001	AU 5988300 A EP 1172469 A	09.07.2001 09.07.2001
US 4354342 A	19.10.1982	AU 5457080 A JP 55103319 A JP 59036681 B JP 1257196 C EP 0017261 AB US 4246746 A CA 1123278 A AU 530043 B CA 1152822 A DE 3070767 D	07.08.1980 07.08.1980 05.09.1984 29.03.1985 15.10.1980 27.01.1981 11.05.1982 30.06.1983 30.08.1983 25.07.1985
DE 4224755 A	03.02.1994	DE 4224755 A	03.02.1994
US 4562388 A	31.12.1985	DE 3309789 AC FR 2542767 AB JP 59204929 A IT 1173863 B	20.09.1984 21.09.1984 20.11.1984 24.06.1987
WO 9901597	14.01.1999	US 6260341 B	17.07.2001