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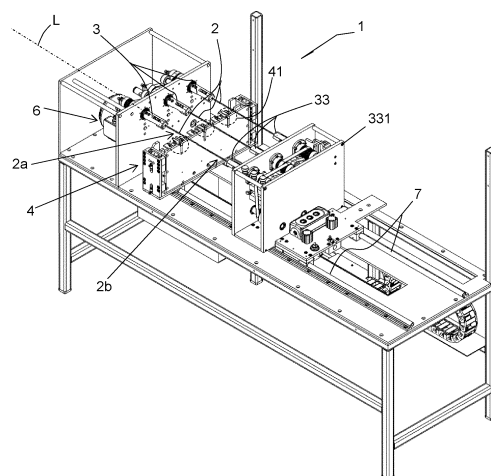
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(54) **APPARATUS AND METHOD FOR BINDING A BUNDLE OF CABLES OR SEVERAL THREAD-LIKE ELEMENTS AND FORMING A BUNCH**

(57) The invention relates to an apparatus (1) and method for binding a bundle (2) of cables or several thread-like elements and forming a bunch, comprising a first head (3) prepared for holding the cables of the bundle at a first end (2a); a second head (33) prepared for holding the cables of the bundle at a second end (2b); and a binding unit (4) for binding the bundle arranged between the first and second heads (3, 33) for holding the bundle with the interposition of a tape (5) with an adhesive face (5a) applied against the bundle. The apparatus further comprises drive means (6) conferring to the first and second heads (3, 33) the capability to rotate in a synchronised manner about the longitudinal axis (L) of the bundle to cause the bundle to rotate around itself and to bring about the coiling or winding of the tape by its adhesive face around the bundle.



**Fig. 1**

## Description

### Technical field of the invention

[0001] The invention relates to an apparatus and method for binding a bundle of cables or several thread-like elements and forming a bunch. The apparatus and method are particularly suitable for binding, with the aid of adhesive tape, electrical cables, optical fibre cables, wires, etc.

### Background of the invention

[0002] Twisting machines for bringing together and combining bundles of cables or several thread-like elements which, in a facility, must be extended in an orderly manner between two common or very close connection points for each individual cable or thread-like element are known today.

[0003] One example of a twisting machine is described in patent document EP 2777053. The machine comprises two heads prepared for holding a bundle of cables to be twisted at respective ends and having the capability to rotate in opposite directions, such that by keeping one head stationary and causing the other head to rotate or causing both heads to rotate but in opposite directions, the twisting of the cables, the ends of which are held by said heads, around themselves takes place.

[0004] Once the twisting operation has ended, it is desirable for the twisting to not come undone, for which purpose the cables in the twisted bundle are bound, that is, held together, to form a bunch.

[0005] One way to bind a bundle of cables is by means of an adhesive tape, namely by tightly coiling or winding it around the previously twisted bundle of cables.

[0006] An example of a binding device of particular interest is described in patent document EP 3412585. The device comprises a wrapping head rotatably mounted on a bearing, having two swivel jaws between which the bundle to be bound can be manually arranged.

[0007] The binding device comprises a tape supply mechanism which arranges an extended adhesive tape on the entry of the wrapping head, as a type of entry barrier, having a length that is much greater than that of the perimeter of the bundle to be bound. This tape is arranged with an adhesive face oriented opposite the wrapping head and is pulled into the wrapping head when the bundle to be bound is introduced in said head, namely between its two jaws, furthermore bringing about the tape being adhered to the bundle and being folded over itself, determining at least one tail end of excess tape. In this position, with the bundle being firmly held, the rotation of the wrapping head about the bundle, which is kept stationary, is achieved, and the jaws bring about the coiling or winding of the tail end of excess tape by its adhesive face on said bundle.

[0008] Apparatuses which combine the twisting technique described above with binding devices also of the

type herein described are known for automating to a greater extent the twisting and subsequent binding process. In these apparatuses, the binding devices are mounted in the apparatus with the capability to move closer to and move away from the bundle, which is held at its ends by respective heads. That is, instead of manually introducing the bundle into the wrapping head of the binding devices, the binding devices are displaced in order to introduce and extract, in each binding operation, the bundle from between the swivel jaws of the wrapping head.

[0009] Among other aspects, the technical solution implementing a binding device of this type is mechanically complex. The wrapping head must be rotatably mounted in the binding apparatus, whereby implying the incorporation of means for transmission means from a power unit. Since the binding device must be displaced towards or away from the bundle in each binding operation, this complicates the transmission or requires mounting the power unit so as to be integral with the binding apparatus in order to move jointly with same. This circumstance is further complicated when apparatuses comprise more than one binding device, each with its wrapping head which must be actuated for rotation.

[0010] Likewise, the rotational actuation of the wrapping head, or where appropriate, heads must be very precise. For example, it must be assured that the movement thereof is stopped, with the swivel jaws always being oriented so that the bundle being bound can be extracted and the new bundle to be bound can be introduced. In other words, the wrapping head must always be stopped in the same angular position with respect to the chassis of the binding device, which requires specific controls.

[0011] A first objective of the present invention relates to an apparatus and a method that are alternatives to known apparatuses and methods.

[0012] It is desirable for the new apparatus to be constructively simpler, without renouncing the quality of the binding operations, the performance speed of known apparatuses, and without renouncing the level of automatism either.

[0013] The constructive simplicity which is intended to be achieved will allow not only manufacturing costs but also maintenance and repair costs to be reduced.

### Description of the invention

[0014] The proposed apparatus is suitable for wrapping an adhesive tape around a thread-like element whether said element is formed by a bundle of individual thread-like elements or by a single thread-like element. In the first case, the apparatus allows the bundle of thread-like elements, for example, cables, to be bound to form a bunch.

[0015] The apparatus comprises a first head prepared for holding the cables of the bundle at a first end; a second head prepared for holding the cables of the bundle at a

second end, where the first and second heads can be arranged at a distance suitable for tensing the bundle; and a binding unit for binding the bundle arranged between the first and second heads suitable for holding the bundle with the interposition of a tape with an adhesive face applied against the bundle, for example exerting pressure between the bundle and the tape, for which purpose the binding unit is equipped with a tape supply mechanism and a cutting mechanism for separating the tape from a tape store.

**[0016]** Essentially, the apparatus is characterised in that with the binding mechanism being stationary, holding the bundle with the interposition of the tape, the apparatus comprises drive means conferring to the first and second heads the capability to rotate in a synchronised manner about the longitudinal axis of the bundle to cause the bundle to rotate around itself and, by taking advantage of the greater friction force existing between the bundle and the tape than between this tape and the binding unit, to bring about the coiling or winding of the tape by its adhesive face around the bundle.

**[0017]** This manner of proceeding entails greater constructive simplicity than those technical proposals based on moving a wrapping head or heads around the bundle to be bound for coiling or winding the adhesive tape on the bundle. The proposal of the present invention inverts the technical principle implemented to date, by moving the bundle instead of moving the wrapping head or heads during the binding operation, which are kept stationary. Likewise, the proposed solution renders the apparatus versatile for being able, prior to the binding operation, to twist the cables forming the bundle to be bound.

**[0018]** In a variant of interest, the binding unit has a clamp mechanism suitable for clamping the bundle, holding it such that with the clamp mechanism being stationary, clamping the bundle with the interposition of the tape, the drive means of the apparatus conferring to the first and second heads the capability to rotate in a synchronised manner about the longitudinal axis of the bundle to cause the bundle to rotate around itself and, by taking advantage of the greater friction force existing between the bundle and the tape than between this tape and the clamp mechanism of the binding unit, to bring about the coiling or winding of the tape by its adhesive face around the bundle. Better control of the held bundle and tape assembly is thereby achieved.

**[0019]** In a variant of interest, the clamp mechanism comprises a set of first and second arms linked to one another so that they can move away from or move closer to one another to a sufficient extent so that they can receive and clamp, respectively, the bundle with the interposition of the tape, holding them, configured such that they determine between one another a seating for tightly housing the bundle with the interposition of the tape during the clamping thereof, the clamp mechanism further comprising an actuator to prearrange or tighten the first and second arms against one another when the rotation of the bundle around itself is achieved, with the clamp

mechanism being stationary.

**[0020]** According to a variant of the invention, the seating has a general teardrop shape, there being distinguished a bottom with an essentially semi-circular shape, which allows to be adapted to different thicknesses of the bundle to be bound, being prolonged towards an entry of the clamp mechanism defining a pulling space for a first tail end of the tape to be coiled or wound about the bundle and the width of which decreases towards the entry of the clamp mechanism.

**[0021]** The first and second arms can be configured such that there are distinguished a proximal or receiving area for the bundle and the opposing faces of which determine respective pushing ramps enabling the automatic separation of the first and second arms by simple pushing of the pack formed by the bundle and the tape; and a distal area, the surfaces of the opposing faces of which determine between one another the seating for tightly housing the bundle with the interposition of the tape.

**[0022]** According to a simple but effective constructive solution, the first and second arms of the clamp mechanism are rotatably mounted in the binding unit with respect to respective parallel shafts located in the proximal area of the first and second arms, such that the rotation of the first and second arms in opposite directions causes them to move away from or move closer to one another.

**[0023]** It is envisaged that the actuator is formed by a component or components with elastic properties which press the first and second arms of the clamp mechanism, by default, against one another and which force must be overcome in order to separate the first and second arms to a sufficient extent so as to receive and house in the seating the bundle with the interposition of the tape, thus dispensing with motors, actuators or the like.

**[0024]** According to another feature of the apparatus, in a variant thereof, the tape supply mechanism and the cutting mechanism are configured for arranging, in each binding operation, the tape previously separated from the tape store between the clamp mechanism and the bundle to be bound, forming a type of barrier between the entry of the clamp mechanism and the bundle. The tape supply mechanism and the cutting mechanism act in a coordinated manner to leave a portion of tape of unequal length on each side of the bundle.

**[0025]** In one embodiment, it is furthermore envisaged that the tape supply mechanism and the cutting mechanism may be configured for arranging, in each binding operation, the tape previously separated, and furthermore drawn, from the tape store between the clamp mechanism and the bundle to be bound, forming a type of barrier between the entry of the clamp mechanism and the bundle. Since the tape is previously drawn, correct attachment between the tape and the bundle is favoured.

**[0026]** Preferably, the binding unit is mounted with the capability to move closer to and move farther away from the bundle to be bound to a sufficient extent so that, starting from a position away from the bundle to be bound in a first phase, it is moved towards the bundle to a sufficient

extent so as to receive and arrange between the first and second arms of the clamp mechanism, namely in the seating, the bundle to be bound with the interposition of the tape; in a second phase, it, and with it the mechanism or, where appropriate, the associated clamp mechanisms, are kept stationary, while the synchronised rotation of the first and second heads about the longitudinal axis of the bundle in order to cause it to rotate around itself and to bring about the coiling or winding of the tape by its adhesive face around the bundle is achieved; and in a third phase, it is moved towards the position away from the bundle with the tape already coiled or wound around same, thus releasing the bound bundle from between the first and second arms of the clamp mechanism.

**[0027]** The apparatus according to the invention is readily adaptable for binding more than one bundle in a simultaneous or coordinated manner. To that end, it may comprise several pairs with first and second heads each having and holding respective associated bundles in parallel; and it may comprise one or more binding units each with the same number of clamp mechanisms as pairs of first and second heads the apparatus has and which are displaced, by the movement of the corresponding binding unit, in unison or en bloc, towards and away from the mentioned bundles in order to perform the binding operations.

**[0028]** In a variant of interest, the set of first heads is operated by a first common servomotor; and the set of second heads is operated by a second common servomotor, the apparatus having programmable means for synchronising the actuation of the first and second servomotors. However, it is also envisaged that both the set of first heads and the set of second heads are operated by a single motor, this motor being appropriately connected by means of transmissions and clutch systems to the set of first and second heads, such that such heads can rotate in the same direction, in the inverse direction, or one of the sets of heads can be stopped.

**[0029]** According to a simple constructive solution, the apparatus comprises guide means, to which there are coupled with the capability to slide along said guide means at least the first or second head or, where appropriate, at least one of the sets of first and second heads; as well as the binding unit or, where appropriate, at least one of the binding units.

**[0030]** There is also disclosed a method for binding a bundle of cables or several thread-like elements and forming a bunch, which comprises a first head holding the cables of the bundle at a first end; a second head holding the cables of the bundle at a second end; arranging the first and second heads at a distance suitable for tensing the bundle; a binding unit for binding the bundle arranged between the first and second heads holding the bundle with the interposition of a tape with an adhesive face applied against the bundle, for which purpose the binding unit is equipped with a tape supply mechanism and a cutting mechanism for separating the tape from a tape store; and with the binding unit being stationary,

holding the bundle with the interposition of the tape, causing the bundle to rotate around itself through drive means conferring to the first and second heads the capability to rotate in a synchronised manner about the longitudinal axis of the bundle and, by taking advantage of the greater friction force existing between the bundle and the tape than between this tape and the binding unit, to bring about the coiling or winding of the tape by its adhesive face around the bundle. This method can be performed by means of the apparatus described above, for example.

**[0031]** There is also disclosed a bundle of cables or several thread-like elements, bound forming a bunch according to the method described above.

## **Brief description of the drawings**

**[0032]**

Figure 1 is a perspective view of an apparatus according to the invention;

Figures 2a to 2d schematically show a clamp mechanism in several instants during a binding operation; Figures 3a to 3c schematically and more generally show a clamp mechanism together with the tape supply mechanism and cutting mechanism of a binding unit in several instants after a binding operation; and Figures 4a to 4c schematically show another binding unit in several instants during a binding operation.

## **Detailed description of an embodiment**

**[0033]** Figure 1 shows a perspective view of an apparatus 1 which exemplifies the invention. The apparatus 1 is versatile and suitable both for binding a bundle 2 of thread-like elements by means of an adhesive tape and forming a bunch and for applying the adhesive tape to a single thread-like element, for example, for visual marking or labelling purposes.

**[0034]** The operation of the apparatus 1 for binding a bundle 2 of thread-like elements, for example, in the form of electrical cables will be explained below.

**[0035]** The exemplary apparatus 1 is prepared for working on a total of three different or identical bundles 2 simultaneously.

**[0036]** For each bundle 2 to be bound and in a known manner, the apparatus comprises a pair of first and second heads 3, 33 prepared for firmly holding the ends 2a and 2b of the associated bundle 2. Accordingly, the apparatus 1 is equipped with three pairs of heads 3, 33, with each pair intended for holding a corresponding bundle 2 at its opposing ends.

**[0037]** The apparatus 1 is prepared so that the sets of first and second heads 3, 33 can be arranged at a distance suitable for tensing the bundles 2. For such purpose, the apparatus 1 is equipped with guide means 7, exemplified in the form of a pair of bars determining a type of rail, fixed to the frame of the apparatus and extending in a direction parallel to the longitudinal direction

L of the bundles 2 to be bound; and the set of second heads 33 is supported by a common carriage 331 mounted so as to slide along these guide means 7.

**[0038]** In the apparatus 1, the first and second heads 3, 33 of each pair of heads has the capability to rotate about the longitudinal axis L of the bundle 2 held between them. A rotation in the opposite direction may be used for tightly twisting, providing a braided-like finish, the thread-like elements, where appropriate cables, forming the bundle 2. A synchronised rotation in the same direction will cause the held bundle 2 to rotate around itself. To produce the rotation of the sets of first and second heads 3, 33, the apparatus 1 may comprise drive means 6 formed by a single motor or can be equipped with independent motors, one dedicated to the set of first heads 3 and the other one dedicated to the set of second heads 33, or even independent motors per head. In any case, the use of belt, chain, or similar transmissions is envisaged for driving the first and second heads 3, 33 from an output shaft of a common drive motor should this be the case. The necessary synchronism of the motors can be achieved in a known manner using controllers and/or servomotors.

**[0039]** To bind the bundles 2, the apparatus 1 comprises a binding unit 4 arranged between the first and second heads 3, 33. The binding unit 4 is also mounted so as to slide along the guide means 7, where it can be arranged in the desired area along the bundles 2. Though not depicted, it is evidently contemplated that the apparatus 1 can have more similar binding units 4 for the purpose of binding one and the same bundle 2 in more than one desired area.

**[0040]** The depicted binding unit 4 has, in correspondence with the number of bundles 2, three clamp mechanisms 41 suitable for each one to clamp, that is to hold, a bundle 2 to be bound by means of an adhesive tape. To that end, each clamp mechanism 41 has associated therewith a tape supply mechanism 45 for supplying tape 5 which will be used for binding and a cutting mechanism 46 for separating the tape from a tape store, all this as explained in greater detail below.

**[0041]** Either the binding unit 4 or the clamp mechanisms 41 have the capability to move in a direction essentially normal to the bundles 2. Therefore, each clamp mechanism 41 will have at least two degrees of freedom: for being positioned along the associated bundle 2 and for moving closer to or moving away from the bundle 2 in order to operate on same during the binding operation. This mobility is known and will therefore not be explained in further detail.

**[0042]** A clamp mechanism 41 according to the invention and its linking with the bundle 2 to be bound and the tape 5 to be used for that end has been illustrated in Figures 2a to 2d in different instants during a binding operation which is characteristic of the apparatus 1 of the invention.

**[0043]** Figures 2a to 2d allow showing that the clamp mechanism 41 comprises a set of first and second arms

42, 43 linked to one another to change their relative position. In the example, the first and second arms 42, 43 are rotatably mounted in the binding unit with respect to respective parallel shafts 42a, 43a, such that the rotation of the first and second arms 42, 43 in opposite directions causes them to move away from or move closer to one another. The first and second arms 42, 43 are further configured such that there are distinguished therein a proximal area, the opposing faces of which determine respective pushing ramps 42b, 43b; and a distal area, the opposing faces of which have respective surfaces 42c, 43c which determine between one another a seating 44 for tightly housing the bundle 2 with the interposition of the tape 5. The clamp mechanism 41 further has actuating means for prearranging or keeping the clamp mechanism 41 in a standby position, similar to a closed clamp position A. The invention contemplates that these actuating means may be formed by elastic means acting between the first and second arms 42, 43 or individual elastic means which each press a corresponding arm against the other arm. The elastic means can be implemented in the form of a spring or the like.

**[0044]** With all this, the operating method of the apparatus 1 is explained with the aid of the sequence of Figures 2a to 2d and 3a to 3c:

- Starting from the standby or closed clamp position A illustrated in Figure 2a, the supply mechanism 45 supplies tape 5 which is arranged, as a type of barrier, between the bundle 2 to be bound and an entry 48 into the clamp mechanism 41; and the cutting mechanism 46 separates the tape 5 from a tape store 55 (see Figures 3a to 3c). The tape 5 is arranged with its adhesive face 5a oriented towards the bundle 2 to be bound.
  - In a first phase of the binding operation, the binding unit 4, or by default the clamp mechanism 41, is moved towards the bundle 2 to a sufficient extent so as to introduce the bundle 2 with the interposition of the tape 5 between the first and second arms 42, 43 of the clamp mechanism 41, all this as illustrated in Figures 2b and 2c. This movement is indicated with arrow V1 in Figure 2a. Logically, it could also be the bundle 2 that moves towards the binding unit 4 or the clamp mechanism 41.
- It should be pointed out that:

- The ramps 42b, 43b of the proximal ends of these first and second arms 42, 43 enable the automatic separation of the first and second arms 42, 43 - by rotation about their shafts 42a, 43a - by simple pushing of the pack formed by the bundle 2 and the tape 5. This rotary movement is indicated with arrows G1 in Figure 2b.
- The movement of the binding unit 4, or by default of the clamp mechanism 41, towards the

bundle 2 and the outer leading curvature of the proximal ends of first and second arms 42, 43 produces the bending of the tape 5 which is applied against the perimeter of the bundle 2 by its adhesive face 5a.

◦ The tape supply mechanism 45 and the cutting mechanism 46 act in a coordinated manner to leave a portion of tape of unequal length on each side of the bundle 2, which determines a first long tail end 51 of excess tape 5, in reference to the drawings on the left side of the bundle 2, and a second shorter tail end 52 of excess tape 5 which, due to the effect of the pushing exerted by the first and second arms 42, 43 when pressed towards the closed clamp position, can be applied and adhered against the first long tail end 51 of excess tape 5.

- In a second phase of the binding operation, with the clamp mechanism 41 being stationary and with its first and second arms 42, 43 tending to approach one another, the synchronised rotation in one and the same direction about the longitudinal axis L of the first and second heads 3, 33 holding the bundle 2 in order to cause it to rotate around itself and to bring about the coiling or winding of the long tail end 51 of tape 5 by its adhesive face 5a around the bundle 2 by gripping the short tail end 52 of the tape 5 with it, is achieved. This rotational movement of the bundle 2 is indicated with arrow G2 in Figure 2d.

It should be pointed out that:

◦ The specific shape of the seating 44 determined between the first and second arms 42, 43 of the clamp mechanism 41 contributes to this effect of winding or coiling the first tail end 51 of excess tape 5. This seating has a general tear-drop shape, there being distinguished a bottom 44a with an essentially semi-circular shape, which allows to be adapted to different thicknesses of the bundle 2 to be bound, being prolonged towards the entry of the clamp mechanism 41 defining a pulling space 44b for the first tail end 51 of excess tape 5, the width of which decreases towards an entry 48 of the clamp mechanism 41. Preferably, in this pulling space 44b the first and second arms 42, 43 have a concave curved shape seen in a perspective view of the bundle 2. This concave curved shape also prevents the second tail end 52 of excess tape 5 from being ejected out of the clamp mechanism 41 when the bundle 2 is caused to rotate in the mentioned clamp mechanism 41 in the event that it does not adhere to the first tail end 51 of excess tape 5.

- In a third phase of the binding operation, the binding

unit 4, or by default the clamp mechanism 41, is moved in the opposite direction with respect to the first phase, moving away from the now bound bundle 2, to a sufficient extent so as to extract the bundle 2 wrapped with the tape 5 from between the first and second arms 42, 43 of the clamp mechanism 41. Preferably, the clamp device 41 is arranged in the standby position depicted in Figure 2a. This phase is depicted in the drawings of Figures 3b to 3c, and the backwards movement of the binding unit 4 is indicated by arrow V2.

**[0045]** It should be pointed out that the aforementioned concave curved shape which the first and second arms 42, 43 present in the pulling space 44b now favours such arms from automatically separating from one another - by rotation about their shafts 42a, 43a but in the opposite direction with respect to that indicated in Figure 2b - by simple pushing of the bundle 2 wrapped with the tape 5, arranging the clamp mechanism 41 in a position similar to an open clamp position. This rotational movement of the first and second arms 42, 43 is indicated with arrows G3 in Figure 3b.

**[0046]** It is also envisaged that the binding unit 4 may be provided with other elements which allow the holding of the bundle 2 with the interposition of the tape 5 with its adhesive face 5a applied against the bundle 2, such that it will also allow a winding or coiling to be performed as described above.

**[0047]** In this sense, Figures 4a to 4c present an alternative embodiment in which the binding unit is provided with a surface 49 which determines a seating for tightly housing and holding the bundle 2 with the interposition of the tape 5, as illustrated in Figure 4a. Logically, the binding unit 4 can have one or more surfaces 49 which allow the housing of different bundles 2. It can be observed that in the variant of Figures 4a to 4c, the holding surface 49 is curved to facilitate the seating of the bundle 2 and the tape 2. Logically, the surface 49 could also be straight or have a groove to facilitate the holding of the bundle 2 and the tape 5. After moving the surface 49 of the binding unit 4 closer until holding, while stationary, the bundle 2 and the tape 5 as shown in Figure 4b, the winding or coiling can be carried out as described above, performing the synchronised rotation in one and the same direction about the longitudinal axis L of the first and second heads 3, 33 holding the bundle 2 in order to cause it to rotate around itself and to bring about the coiling or winding of the long tail end 51 of tape 5 by its adhesive face 5a around the bundle 2, gripping the short tail end 52 of the tape 5 with it. This rotational movement of the bundle 2 is schematically shown in Figure 4c, thus achieving the coiling or winding of the tape 5 by its adhesive face 5a around the bundle 2 as well.

## Claims

1. An apparatus (1) for binding a bundle (2) of cables or several thread-like elements and forming a bunch, comprising a first head (3) prepared for holding the cables of the bundle at a first end (2a); a second head (33) prepared for holding the cables of the bundle at a second end (2b), where the first and second heads (3, 33) can be arranged at a distance suitable for tensing the bundle (2); and a binding unit (4) for binding the bundle arranged between the first and second heads (3, 33) suitable for holding the bundle with the interposition of a tape (5) with an adhesive face (5a) applied against the bundle (2) for which purpose the binding unit (4) is equipped with a tape supply mechanism (45) and a cutting mechanism (46) for separating the tape (5) from a tape store (55), the apparatus being **characterised in that** with the binding unit (4) being stationary, holding the bundle (2) with the interposition of the tape (5), the apparatus comprises drive means (6) conferring to the first and second heads (3, 33) the capability to rotate in a synchronised manner about the longitudinal axis (L) of the bundle (2) to cause the bundle to rotate around itself and, by taking advantage of the greater friction force existing between the bundle (2) and the tape (5) than between this tape and the binding unit (4), to bring about the coiling or winding of the tape by its adhesive face (5a) around the bundle.
  2. The apparatus (1) according to claim 1, **characterized in that** the binding unit (4) has a clamp mechanism (41) suitable for clamping the bundle.
  3. The apparatus (1) according to claim 2, **characterized in that** the clamp mechanism (41) comprises
    - a set of first and second arms (42, 43) linked to one another so that they can move away from or move closer to one another to a sufficient extent so that they can receive and clamp, respectively, the bundle (2) with the interposition of the tape (5), configured such that they determine between one another a seating (44) for tightly housing the bundle (2) with the interposition of the tape (5) during the clamping thereof, the clamp mechanism further comprising
      - an actuator (47) to prearrange or tighten the first and second arms (42, 43) against one another when the rotation of the bundle (2) around itself is achieved, with the clamp mechanism (41) being stationary.
  4. The apparatus (1) according to the preceding claim, **characterized in that** the seating (44) has a general teardrop shape, there being distinguished a bottom (44a) with an essentially semi-circular shape, which allows to be adapted to different thicknesses of the bundle (2) to be bound, being prolonged towards an entry (48) of the clamp mechanism (41) defining a pulling space (44b) for a first tail end (51) of the tape (5) to be coiled or wound about the bundle (2) and the width of which decreases towards the entry (48) of the clamp mechanism (41).
  5. The apparatus (1) according to claims 3 or 4, **characterized in that** the first and second arms (42, 43) are configured such that there are distinguished
    - a proximal or receiving area for the bundle (2) and the opposing faces of which determine respective pushing ramps (42b, 43b) enabling the automatic separation of the first and second arms (42, 43) by simple pushing of the pack formed by the bundle (2) and the tape (5), and
    - a distal area, the surfaces (42c, 43c) of the opposing faces of which determine between one another the seating (44) for tightly housing the bundle (2) with the interposition of the tape (5).
  6. The apparatus (1) according to the preceding claim, **characterized in that** the first and second arms (42, 43) of the clamp mechanism (41) are rotatably mounted in the binding unit (4) with respect to respective parallel shafts (42a, 43a) located in the proximal area of the first and second arms (42, 43), such that the rotation of the first and second arms (42, 43) in opposite directions causes them to move away from or move closer to one another.
  7. The apparatus (1) according to any one of claims 3 to 6, **characterized in that** the actuator (47) is formed by a component or components with elastic properties which press the first and second arms (42, 43) of the clamp mechanism (41), by default, against one another and which force must be overcome in order to separate the first and second arms (42, 43) to a sufficient extent so as to receive and house in the seating (44) the bundle (2) with the interposition of the tape (5).
  8. The apparatus (1) according to any one of claims 2 to 7, **characterized in that** the tape supply mechanism (45) and the cutting mechanism (46) are configured for arranging, in each binding operation, the tape (5) previously separated from the tape store (55) between the clamp mechanism (41) and the bundle (2) to be bound, forming a type of barrier between the entry of the clamp mechanism (41) and the bundle (2), and **in that** the tape supply mechanism (45) and the cutting mechanism (46) act in a coordinated manner to leave a portion of tape of unequal length on each side of the bundle (2).
  9. The apparatus (1) according to the preceding claim,

**characterized in that** the tape supply mechanism (45) and the cutting mechanism (46) are configured for arranging, in each binding operation, the tape (5) previously drawn and separated from the tape store (55) between the clamp mechanism (41) and the bundle (2) to be bound, forming a type of barrier between the entry of the clamp mechanism (41) and the bundle (2), and **in that** the tape supply mechanism (45) and the cutting mechanism (46) act in a coordinated manner to leave a portion of tape of unequal length on each side of the bundle (2).

10. The apparatus (1) according to any one of claims 3 to 9, **characterized in that** the binding unit (4) is mounted with the capability to move closer to and move farther away from bundle (2) to be bound to a sufficient extent so that, starting from a position away from the bundle (2) to be bound

- in a first phase, it is moved towards the bundle (2) to a sufficient extent so as to receive and arrange between the first and second arms (42, 43) of the clamp mechanism (41), namely in the seating (44), the bundle (2) to be bound with the interposition of the tape (5),

- in a second phase, it, and with it the mechanism or, where appropriate, the associated clamp mechanisms (41), are kept stationary, while the synchronised rotation of the first and second heads (3, 33) about the longitudinal axis (L) of the bundle (2) in order to cause it to rotate around itself and to bring about the coiling or winding of the tape (5) by its adhesive face (5a) around the bundle (2) is achieved, and

- in a third phase, it is moved towards the position away from the bundle (2) with the tape (5) already coiled or wound around same, thus releasing the bound bundle (2) from between the first and second arms (42, 43) of the clamp mechanism (41).

11. The apparatus according to the preceding claim, prepared for binding more than one bundle (2) in a simultaneous or coordinated manner, **characterized in that** it comprises several pairs with first and second heads (3, 33) each having and holding respective associated bundles (2) in parallel; **in that** it comprises one or more binding units (4) each with the same number of clamp mechanisms (41) as pairs of first and second heads (3, 33) the apparatus has and which are displaced, by the movement of the corresponding binding unit (4), in unison or en block, towards and away from the mentioned bundles (2) in order to perform the binding operations.

12. The apparatus according to any one of the preceding claims, **characterized in that** it comprises guide means (7), to which there are coupled with the ca-

pability to slide along said guide means (7)

- at least the first or second head (3, 33) or, where appropriate, at least one of the sets of first and second heads, and

- the binding unit (4) or, where appropriate, at least one of the binding units.

13. A method for binding a bundle (2) of cables or several thread-like elements and forming a bunch, which comprises:

- a first head (3) holding the cables of the bundle at a first end (2a);

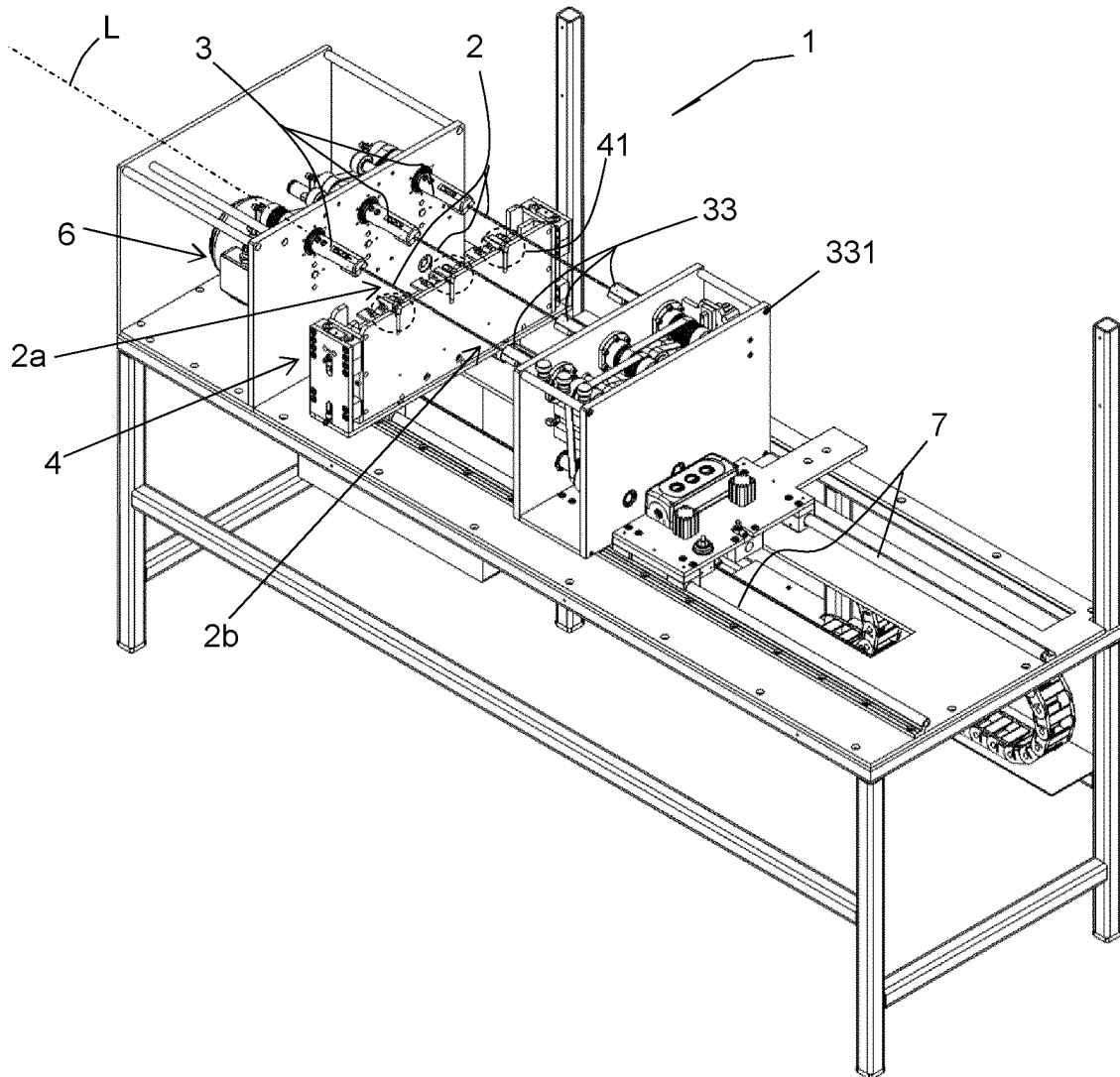
- a second head (33) holding the cables of the bundle at a second end (2b);

- arranging the first and second heads (3, 33) at a distance suitable for tensing the bundle (2);

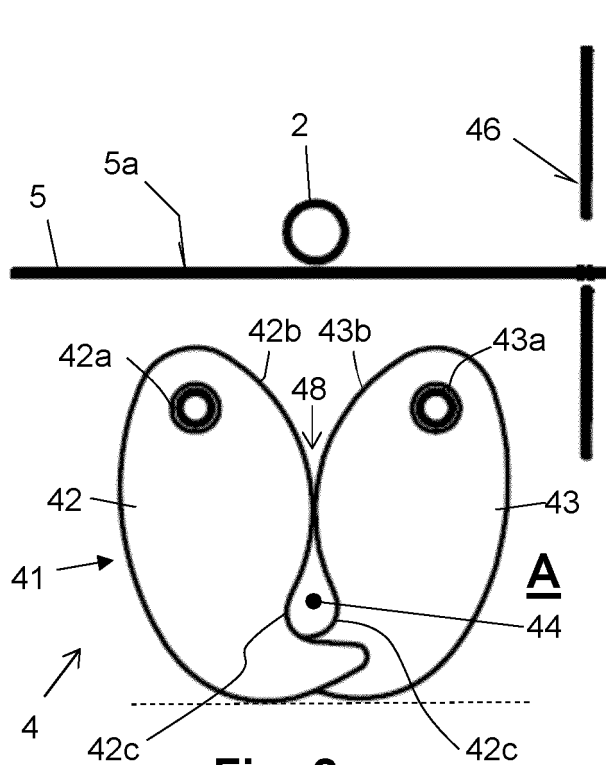
- a binding unit (4) holding the bundle with the interposition of a tape (5) with an adhesive face (5a) applied against the bundle (2) for binding the bundle arranged between the first and second heads (3, 33), for which purpose the binding unit (4) is equipped with a tape supply mechanism (45) and a cutting mechanism (46) for separating the tape (5) from a tape store (55); and  
- with the binding unit (4) being stationary, holding the bundle (2) with the interposition of the tape (5), causing the bundle to rotate around itself through drive means (6) conferring to the first and second heads (3, 33) the capability to rotate in a synchronised manner about the longitudinal axis (L) of the bundle (2) and, by taking advantage of the greater friction force existing between the bundle (2) and the tape (5) than between this tape and the binding unit (4), to bring about the coiling or winding of the tape by its adhesive face (5a) around the bundle.

14. A bundle (2) of cables or several thread-like elements, bound forming a bunch according to the method of the preceding claim.

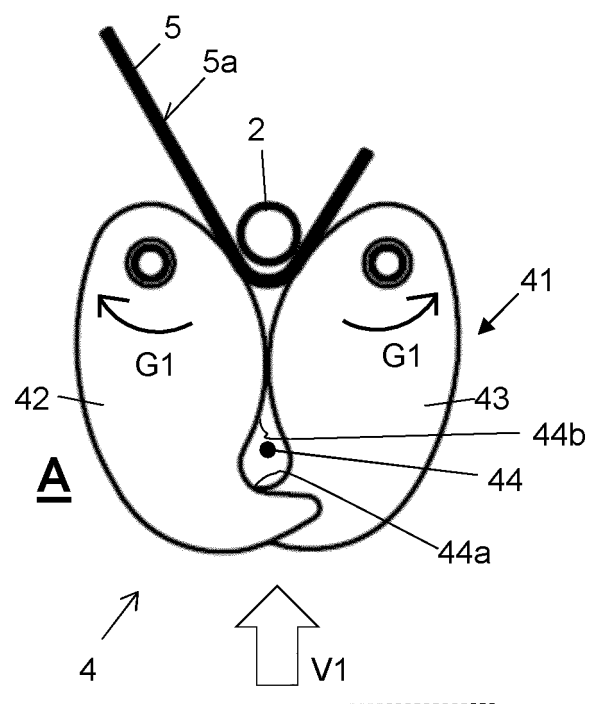




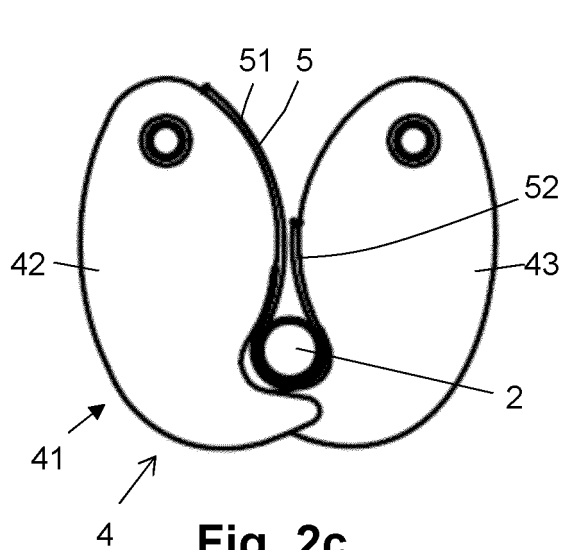
**Fig. 1**



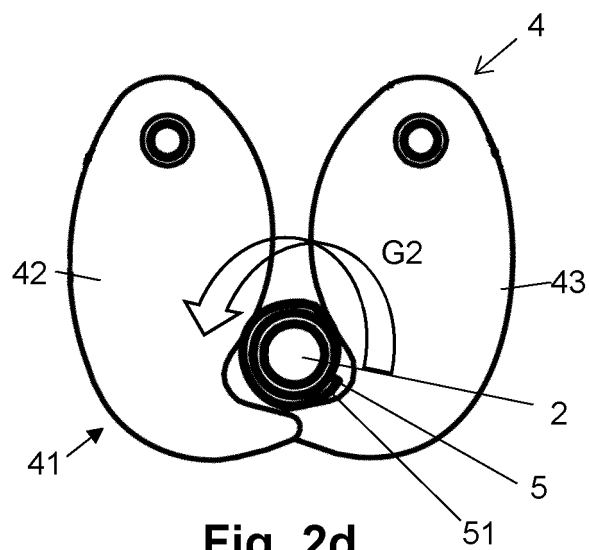
**Fig. 2a**



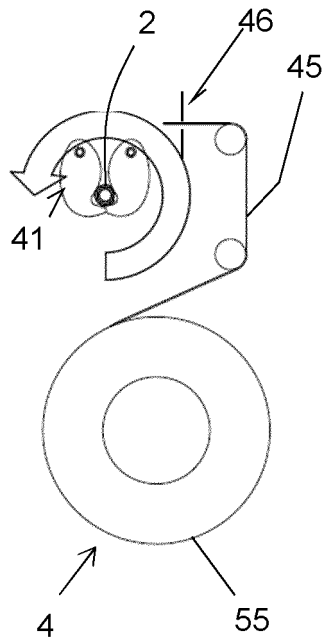
**Fig. 2b**



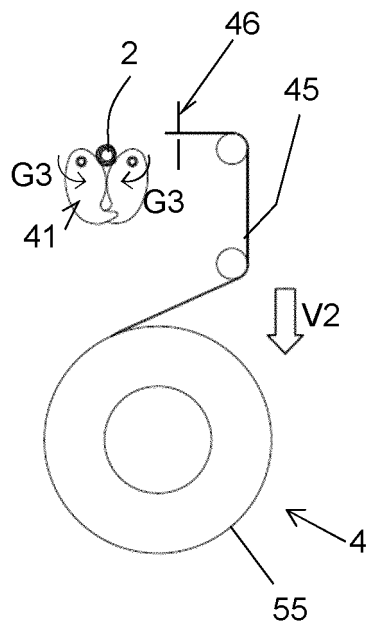
**Fig. 2c**



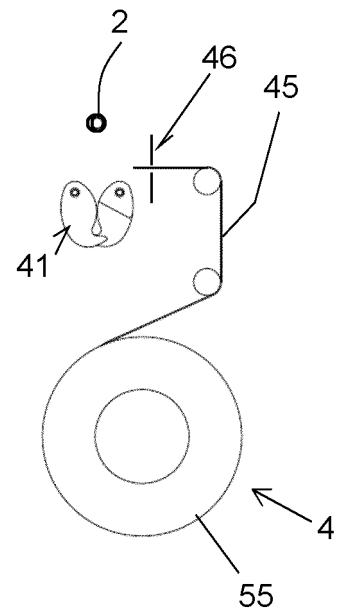
**Fig. 2d**



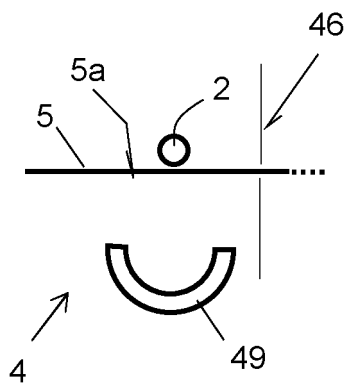
**Fig. 3a**



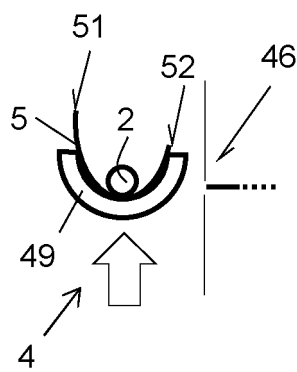
**Fig. 3b**



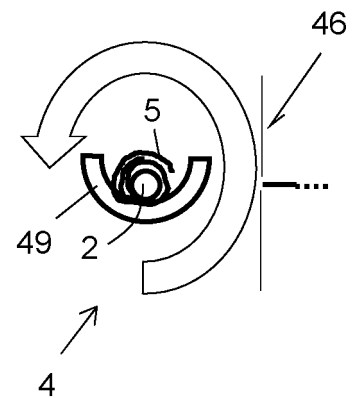
**Fig. 3c**



**Fig. 4a**



**Fig. 4b**



**Fig. 4c**

## INTERNATIONAL SEARCH REPORT

International application No

PCT/ES2021/070536

## A. CLASSIFICATION OF SUBJECT MATTER

INV. B65B13/18 B65B27/10 H01B13/012 H01B13/02  
ADD.

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)  
B65B H01B

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)

EPO-Internal, WPI Data

## C. DOCUMENTS CONSIDERED TO BE RELEVANT

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X	US 2019/221331 A1 (STAUBLI DOMINIK [CH] ET AL) 18 July 2019 (2019-07-18)	14
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X	Komax Ag: "NEWS DAS KUNDENMAGAZIN", 1 January 2016 (2016-01-01), pages 1-24, XP055491772, Internet Retrieved from the Internet: URL: <a href="http://www.komaxgroup.com/-/media/Wire/Files/Downloads/News/Komax_News_2016_2_DE.pdf?la=de-DE&amp;hash=6CA628E4I547C8EFE6997C183C24B18D9B897F81">http://www.komaxgroup.com/-/media/Wire/Files/Downloads/News/Komax_News_2016_2_DE.pdf?la=de-DE&amp;hash=6CA628E4I547C8EFE6997C183C24B18D9B897F81</a> [retrieved on 2018-07-11] pages 6,7	14
A	----- -/-	1-13

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Date of the actual completion of the international search

27 October 2021

Date of mailing of the international search report

05/11/2021

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Lawder, M

INTERNATIONAL SEARCH REPORT

International application No  
PCT/ES2021/070536

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
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**REFERENCES CITED IN THE DESCRIPTION**

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