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

(11) EP 2 055 471 A1

(12) EUROPEAN PATENT APPLICATION

(43) Date of publication:
06.05.2009 Bulletin 2009/19

(21) Application number: **08425597.5**

(22) Date of filing: **11.09.2008**

(51) Int Cl.:
B31C 3/00 *(2006.01)* ***B31C 11/00*** *(2006.01)*
B26F 1/00 *(2006.01)* ***B65D 3/26*** *(2006.01)*

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

(30) Priority: **14.09.2007 IT FI20070205**

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(54) Machine and method for the production of tubes through winding of one or more strips of web material and tube thereby obtained

(57) The machine comprises a winding group (5) for winding one or more strips around a spindle (1) to form a tubular element (T). The machine also provides a cutting group (31), which cuts the tubular element into single tubes. Furthermore, a scoring member (51) is also provided, for scoring the tubular element along at least one perforation line.

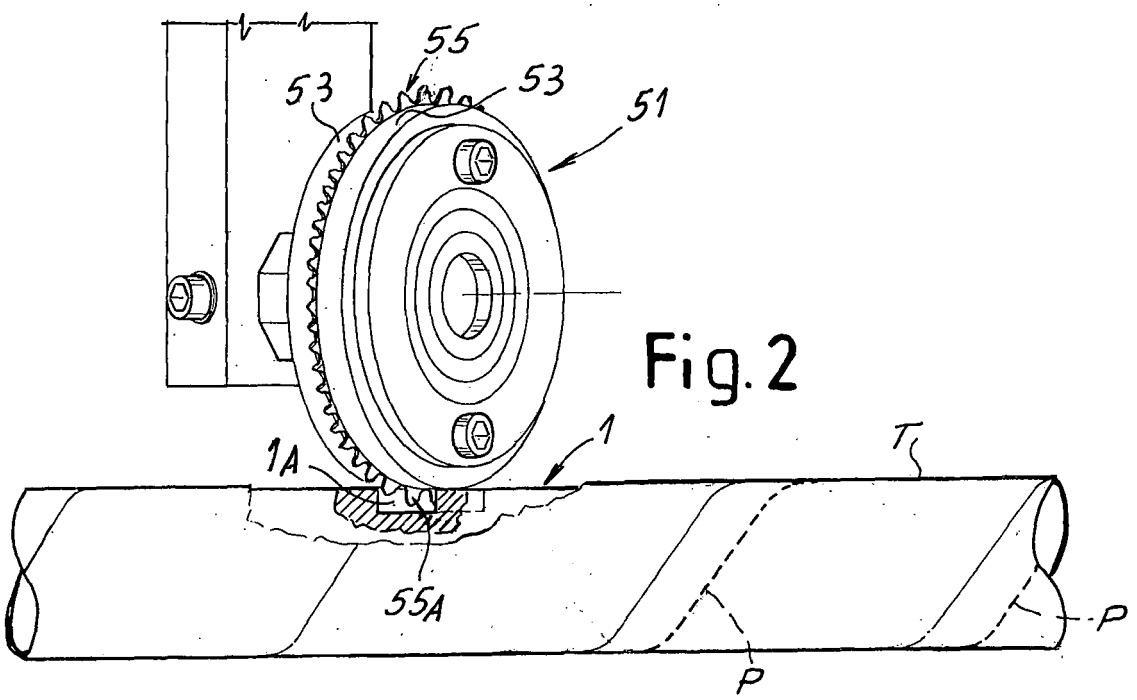

Fig. 2

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Description

Technical Field

[0001] The present invention relates to a machine for the production of tubes through winding of one or more strips of web material around a forming spindle, for example and in particular (but not exclusively) strips of cardboard.

[0002] The invention relates also to a method for the production of tubes of wound web material, as well as to a tube or tubular core for winding rolls and rolls of web material wound around tubes of the above mentioned type.

State of the Art

[0003] In many industrial fields, and in particular in the field of paper converting and of production of tissue paper and tissue paper items, as toilet paper, kitchen towel, absorbent paper or the like, rolls of paper wound around tubes or winding cores, made of plastic or more frequently of cardboard, are produced. The tubular winding cores are produced in machines for continuous production of tubes or of tubular elements, which are subsequently divided into single tubes, which are in turn used in the rewinding machines for the production of logs, rolls or reels of web material. In some applications, the logs are subsequently cut into single small rolls of smaller axial length to be packaged and sold. A machine of this type, also called core winder, is described for example in US-A-5873806.

[0004] In some types of rolls, in particular with great diameter, for professional, commercial or industrial use, the tubular winding core is designed in such a way so that it can be removed from the center of the roll, this latter thus can be unwound from the central axis rather than peripherally, as usually occurs with the rolls for domestic use, which normally have a smaller diameter. These latter are necessarily unwound by the user, starting from the outermost turn whilst the tubular core remains inside the roll, until the roll is expired, and it cannot be axially extracted from the roll.

[0005] Usually, the tubular elements from which the tube are obtained for forming the winding cores of the web rolls, tissue paper, but also further articles in sheet form in the form of continuous web, such as non-woven, plastic or the like, are generally obtained through helical winding of one or more strips of web material, typically cardboard. When a single strip is used, this is helically wound so that its longitudinal edges overlap between one turn and the other in order to form a continuous element. When tubes of greater consistency are required, two or more strips are helically wound one over the other, duly staggered.

[0006] There are also core winders that wind the strips of web material around a forming spindle with a longitudinal instead of helical development.

Summary of the Invention

[0007] According to one aspect, the invention provides a machine, or a so-called core winder, for the production of tubes, which can have additional functional features with respect to the features of the tubes generally used for winding rolls for domestic use.

[0008] Substantially, in one embodiment the invention discloses a machine for the production of tubes through winding of one or more strips of web material around a forming spindle, comprising: a winding group which winds the strip or the strips around the spindle in order to form a tubular element; and a cutting group, which cuts the tubular element into single tubes; and a member for generating a tearing line, i.e. a weakening line along the tubular element. The tearing or weakening line is a line of preferential tearing along which the tensile resistance of the web material forming the tube is reduced with respect to the resistance of the basic material. A tearing line or weakening line can be a scoring or perforation line formed by a scoring or perforating member. A scoring line can be formed by a superficial cut or notch, or preferably by an intermittent or discontinuous cut or a series of notches in the wall of the tubular element. A perforation line is a line of small cuts, apertures, notches or other discontinuities in the material forming the tube. In general the tearing line or weakening line can be formed by any kind of means which locally reduces the tensile strength of the material forming the tube, so that the latter tears along the tearing or weakening line by applying a relatively small traction force, such that the user can remove the winding core from the center of a roll and unwind the roll from the hole which has been left free by the removal of the winding core.

[0009] Amachine according to the invention can produce tubes formed by strips of web material wound, preferably according to a helical development, which can be torn along the perforation line also when around the tube a roll of web material has been formed, as for example tissue paper, plastic film or other. The tubes so produced are particularly suitable for packaging rolls of web material for domestic use, as toilet paper, kitchen towel wound in rolls of limited diameter, typically between 10 and 20 cm. The scoring or perforation, or in general the tearing or weakening line can be a single line or more perforation lines can be provided, preferably with substantially helical development. The inclination of the perforation line or lines can be equal to the inclination along which the strips of web material are helically wound. However, it would also be possible that the perforation lines have a different development, for example a greater or smaller inclination with respect to the inclination of the wound strip or strips, which form the tube.

[0010] When the roll of web material has such a tubular winding core, the user can choose between using the roll in a traditional manner, i.e. unwinding it starting from the outmost turn, and using it unwinding it starting from the innermost turn after having removed the tubular winding

core, in the same way as it usually occurs with the rolls of great diameter for industrial use. The tubular winding core is extracted simply by pulling it axially, so that it breaks along the scoring line obtained by the core winder during winding the strip or strips, which form the tube.

[0011] In the industrial rolls, the winding core is produced by winding cardboard strips in such a way that their edges do not overlap, but rather they produce a continuous helical channel. Inside the cardboard strips so helically wound an inner strip is arranged, which is wound without leaving free spaces. The inner strip is of such a grammage that it can be torn easily by pulling the winding core from an end of the roll.

[0012] Through a machine according to the invention it is possible to obtain, in a substantially more economical manner and with lower consumption of materials, a tubular winding core which has the same functionality as the rolls of industrial type, i.e. with the possibility to be extracted axially from the roll through breakage, but with a more easy and economical assembling technique, suitable for use in rolls of the domestic type.

[0013] Further advantageous characteristics of the machine or core winder according to the invention are illustrated in the appended claims and described in more detail below with reference to an example of a non limiting embodiment of the invention.

[0014] According to a further aspect, the invention relates to a method for producing tubes in wound strips of web material, comprising the steps of:

a. feeding at least one strip of web material towards a forming spindle;
b. winding the strip or strips of web material around the forming spindle in order to form a continuous tubular element;
c. cutting the continuous tubular element into single tubes;

further comprising the step of scoring the tubular element with a perforation line or more generally forming a tearing or weakening line along the tubular element, e.g. a line of preferential tearing having a reduced tensile strength.

[0015] Further advantageous features and embodiments of the method according to the invention are set forth in the appended claims.

[0016] An object of the invention is a tube or tubular core for winding rolls of web material, formed by at least one wound strip of web material, characterized in that it has at least one scoring and tearing line extending along the development of the tube.

[0017] A further object of the present invention is also a roll of web or sheet material, for example paper, such as tissue paper or the like, wound around a tubular core or tube of the type defined above.

Brief description of the drawings

[0018] The invention will be better understood by means of the description below and the attached drawing, which shows a non-restrictive practical embodiment of the invention. More particularly, in the drawing:

figure 1 is a schematic side view of a machine for the production of tubes of web material through helical winding of cardboard strips or similar, whereto the present invention applies;
figure 2 shows a detail of the area in which the engraving or perforating member is arranged;
figure 3 is a schematic view of a portion of a tube of web material produced according to the invention;
figure 4 shows a schematic longitudinal cross section of a portion of a tube produced according to the invention through winding of two overlapping strips of web material;
figure 5 shows a section analogous to that of figure 4, but of a tube obtained through the winding of a single strip; and
figure 6 shows a roll which uses a tubular core or tube produced according to the invention.

Detailed description of an embodiment of the invention

[0019] Figure 1 shows a core winder or machine for the production of tubes obtained through winding of one or more strips of web material, for example cardboard. In its general structure, the machine illustrated in figure 1 corresponds to the machine described in US-A-5873806, whose content is integrally incorporated in the present description and which can be referred to for greater construction details on the machine as a whole. It should be understood that, as it will be more apparent from the description below, the invention can be implemented also on core winder having a different configuration, for example as regards the winding group and/or the cutting group.

[0020] The core winder of figure 1 will be described below limited to the elements necessary for understanding of the present invention, the other elements being known by those skilled in the art.

[0021] The machine, indicated as a whole with the number 2, has a bearing structure 3, which supports a forming spindle 1. This latter is supported through a support 4 in a fixed or rotatable manner. In this later case, the spindle 1 is idle around its longitudinal axis. In some embodiments the spindle 1 can consist of an idle portion and a fixed portion, or can be designed in any other suitable manner.

[0022] Number 5 indicates as a whole a winding group through which strips S of web material N fed by reels (not shown) are helically wound around the spindle 1. The number of strips of which a tube is formed can vary also in accordance with the mechanical resistance that the tube must have. In some cases it is possible to use a single strip, or rather two or more mutually staggered wound strips. The strip or strips wound around the forming spindle 1 are stabilized through one of the traditional

systems, for example by gluing, by means of a glue applied upstream of the winding group in a manner known and therefore not shown.

[0023] The winding group 5 comprises a belt entrained around an idle pulley 9 and around a motorized pulley 11, the rotation of which is controlled by a motor 13. In a known manner, the belt 7 has a first branch 7A, which forms a helical loop around the spindle 1 and the strip or strips S of web material N which wind around the spindle itself, as well as a straight branch 7B which extends between the two pulleys 9 and 11. The winding group 5 can be adjusted in inclination through a handwheel 17 and a threaded bar 19 so as to adjust the angle of winding of the branch 7A of the belt 7 and thus the inclination of the turns formed by the strips of web material N wound around the forming spindle 1.

[0024] The strips of web material N are wound and pushed by the belt 7 around and along the spindle 1, thus forming a continuous tubular element T formed by one or more helically wound strips. As indicated in the introductory part, the winding can be obtained also with a different machine, in which the strips are wound longitudinally, surrounding the forming spindle and arranged with the edges parallel to the axis of the tube being forming and of the forming spindle.

[0025] Downstream of the winding area, in which the winding group 5 is arranged, the machine 2 has a cutting group indicated as a whole with 31 and which can assume different configurations. In the embodiment illustrated in figure 1, as described in greater detail in the document US-A-5873806, the cutting group 31 is provided with an alternating motion according to the double arrow f31 in order to follow the feed movement of the tube being formed around the spindle 1 during a cutting phase and to return to a starting position in the inactive return phase of the cutting device or cutting group 31. The cutting group 31 includes a carriage 33 movable through an actuator. On this carriage cutting wheels or cutting discoidal blades are arranged, which engage and alternatively disengage with respect to the tubular element T being formed around the spindle 1 in order to divide said continuous tubular element T into single tubes or sections of tube.

[0026] In an intermediate position between the winding group 5 and the cutting group 31 the machine 2 is provided characteristically with a scoring member 51, which has the function of producing a score or perforation, or tearing line, along the continuous tubular element T formed on the spindle 1. Here below the term "scoring member" will be used to designate the unit 51, but it shall be understood that in more general terms the member 51 can be a cutting, perforating or aperturing member, or in general any device suitable to generate a tearing or weakening line, i.e. a line of preferential tearing and/or reduced tensile strength of the basic material forming the tubular element T.

[0027] In the illustrated embodiment, the scoring member 51 generates a helical scoring line with an inclination substantially equal to that of the strips of web material N wound around the spindle 1 for forming the tubular element T. However, it would also be possible to produce this scoring or perforation line with a different inclination, although maintaining it helical. In some alternative embodiments, the tubular element T can be formed by surrounding the spindle 1 with strips of web material N, which develop longitudinally along the axis of the spindle, i.e. parallel to the axis itself. In this case the scoring line produced by the scoring member 51 will be still helical, whilst the strips will be oriented with an angle equal to 0° with respect to the axis of the tubular element T formed on the spindle 1. Moreover, when the strips are helically wound, as mentioned above, the winding angle can be adjusted and modified for example according to the mechanical features, which the tube so produced must have. Vice versa, the inclination of the perforation or scoring angle, defined by the orientation of the axis of the tool or engraving member 51, can remain constant, for example equal to an average value comprised between the maximum and the minimum winding angle of the strips S.

[0028] As shown in particular in figure 2, in some embodiments the scoring member 51 has the shape of a wheel comprising one and preferably two rings 53 of elastically yielding material, for example natural or synthetic rubber. Between the two rings 53 a toothed blade 55 is arranged, constituting the actual scoring or perforating tool. The toothed blade 55 has individual teeth 55A, which penetrate preferably through the entire thickness of the tubular element T, which can be formed from one or more strips of web material N wound around the spindle 1.

[0029] As shown in figure 2, in correspondence of the area in which the scoring wheel or tool 51 works against the forming spindle 1, this latter has preferably a groove 1A inclined with respect to the longitudinal axis of the spindle 1. The groove 1A has an inclination substantially corresponding to the inclination of the helical perforation or scoring line produced by the scoring tool or member 51. It would also be possible to provide on the forming spindle 1 more grooves 1A with adjustable width and/or depth and/or inclination so as to choose the form and/or the dimension and/or the inclination of the perforation line helically formed around the longitudinal development of the tubular element T.

[0030] Figure 3 schematically shows a portion of a tubular element T formed by one or more strips S of web material N helically wound around the geometrical axis A-A of the tubular element T. B indicates the helical line defined by the longitudinal edges of the strip S of wound web material forming the outer surface of the tubular element T. P indicates a perforation or score line, with helical development, formed by the teeth of the engraving member 51.

[0031] Figure 4 shows a section according to the line IV-IV of a tubular element T produced through the staggered and overlapping turns of two strips of web material indicated in this figure respectively with S and S1. B indicates the helical line visible on the outer surface of the

tubular element T formed by the longitudinal edges of the strip S, whilst inside the tubular element T a helical line B1 will be visible, formed by the longitudinal edges of the inner strip S1. P indicates the scoring or perforation line which, as it is apparent in this enlarged figure, crosses the entire thickness of the tubular element T, i.e. the thickness of both the mutually staggered and overlapping wound strips S, S1.

[0032] Figure 5 shows a section similar to that of figure 4, where however the tubular element T is formed by winding only one strip S. In figure 5 the line B is again indicated, formed by the helical wound edge and visible from the outside of the strip S, whilst P indicates the continuous helical perforation line, which in this case crosses the thickness of the single strip S forming the tubular element.

[0033] Figure 6 shows a roll R of sheet material F wound around a tubular core AT formed by a section of the tubular element T manufactured by the machine 1 and having the structure described above, i.e. constituted by longitudinal or helical winding of one or more strips of web material, with a scoring or tearing or perforation line P preferably with helical development. The end user can easily extract the tubular winding core AT from the roll R by simply grasping an end thereof and tearing by traction according to the arrow f (figure 6). The scoring or perforation line P obtained during the manufacturing phase by the scoring member 51 will break under the effect of the tensile stress exerted, thus allowing extraction of the tubular core T in the form of a helical strip having edges defined by the perforation line P.

[0034] It is understood that the drawing only shows an example provided by way of a practical demonstration of the invention, which can vary in forms and arrangements without however departing from the scope of the concept underlying the invention. Any reference numerals in the appended claims are provided for the sole purpose of facilitating reading in the light of the description and the drawing, and do not in any manner limit the scope of protection represented by the claims.

Claims

1. A machine for the production of tubes through winding of one or more strips of web material around a forming spindle, comprising: a winding group, which winds said strip or strips around said spindle in order to form a tubular element; and a cutting element, which cuts said tubular element into single tubes; **characterized in that** it comprises a member for generating a tearing line along said tubular element.

2. Machine as claimed in claim 1, **characterized in that** said member for generating a tearing line cooperates with said spindle for generating said tearing line along the continuous tubular element as it moves forward along the spindle.

3. Machine as claimed in claim 1 or 2, **characterized in that** said member for generating a tearing line is designed and arranged to generate a substantially helical tearing line.

4. Machine as claimed in claim 1, 2 or 3, **characterized in that** said member for generating a tearing line is selected from the group including: a perforating member, a slitting member, a scoring member, a cutting member.

5. Machine as claimed in one or more of the previous claims, **characterized in that** said winding group is designed and arranged so as to helically wind said strip or strips of web material around said spindle.

6. Machine as claimed in one or more of the previous claims, **characterized in that** said member for generating a tearing line is a toothed wheel.

7. Machine as claimed in claim 6, **characterized in that** said toothed wheel comprises at least one ring of elastically yielding material and preferably two rings of elastically yielding material, adjacent to an annular arrangement of scoring teeth.

8. Machine as claimed in one or more of the previous claims, **characterized in that** said spindle has a groove forming a counter-blade cooperating with said member for generating a tearing line.

9. A method for the production of tubes in wound strips of web material, comprising the steps of:

   a. feeding at least one strip of web material towards a forming spindle;
   b. winding said at least one strip of web material around said forming spindle in order to form a continuous tubular element;
   c. cutting said continuous tubular element into single tubes;

   characterized by generating a tearing line along said tubular element.

10. Method as claimed in claim 9, **characterized in that** said tearing line has a substantially helical development around the axis of the tubular element.

11. Method as claimed in claim 9 or 10, **characterized by** helically winding said at least one strip of web material around said spindle.

12. Method as claimed in claim 9, 10 or 11, **characterized by** helically winding around said spindle at least two mutually offset and overlapping strips of web material.

13. Method as claimed in claim 11, **characterized by** generating said tearing line across the thickness of both said at least two strips of web material.

14. Tube formed by at least one wound strip of web material, **characterized in that** it has at least one tearing or weakening line extending along the development of said tube.

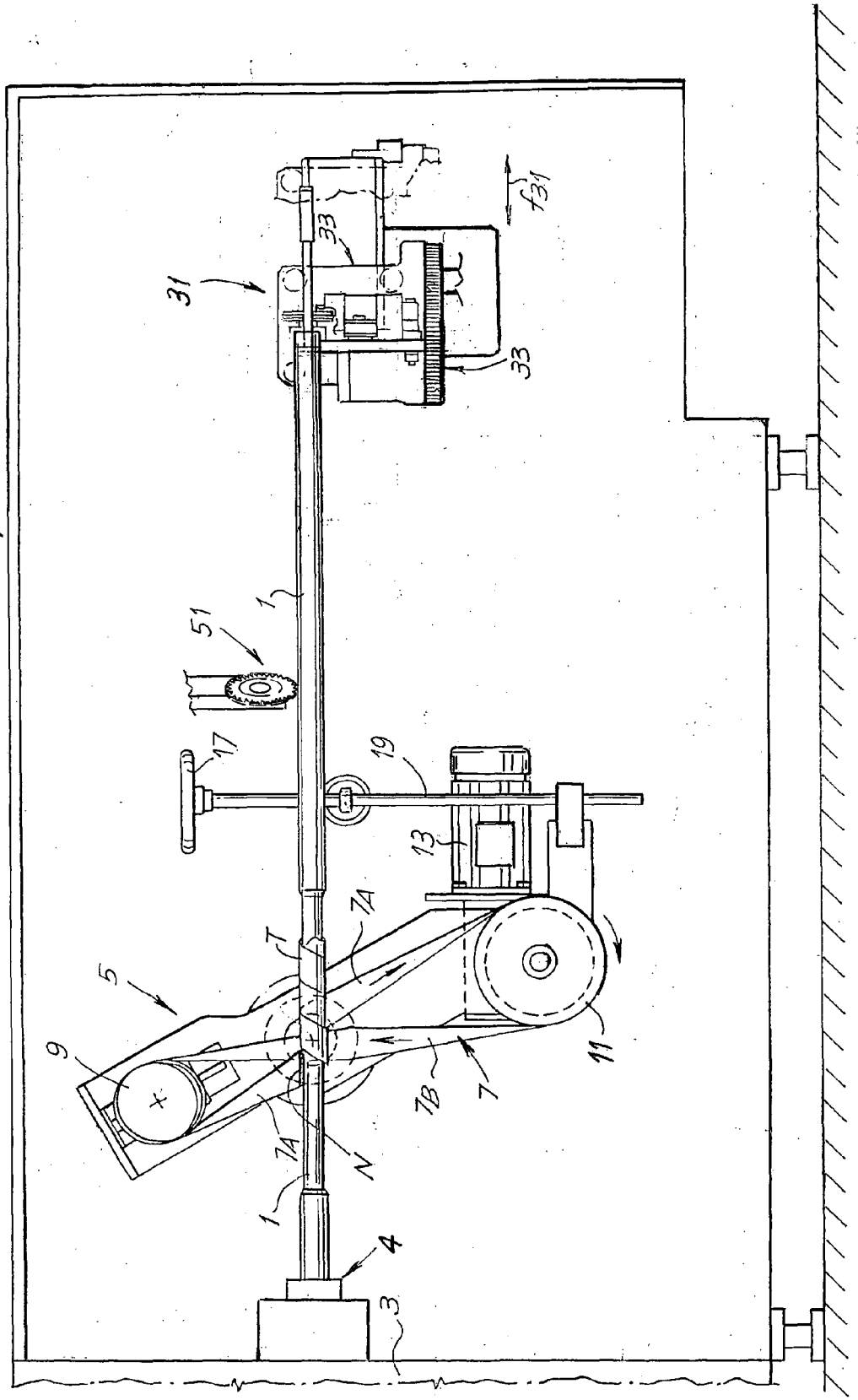
15. Tube as claimed in claim 14, **characterized in that** said tearing or weakening line has a substantially helical development around the axis of the tube.

16. Tube as claimed in claims 14 or 15, **characterized in that** said strip or strips of web material are helically wound around the axis of the tube.

17. Tube as claimed in one or more of claims 14 to 16, **characterized in that** it is formed in at least two staggered and overlapping strips of web material, helically wound around the axis of said tube, said tearing or weakening line extending into the thickness of both said overlapping strips.

18. A roll of sheet material wound around a tube as claimed in one or more of claims 14 to 17.

Fig. 1



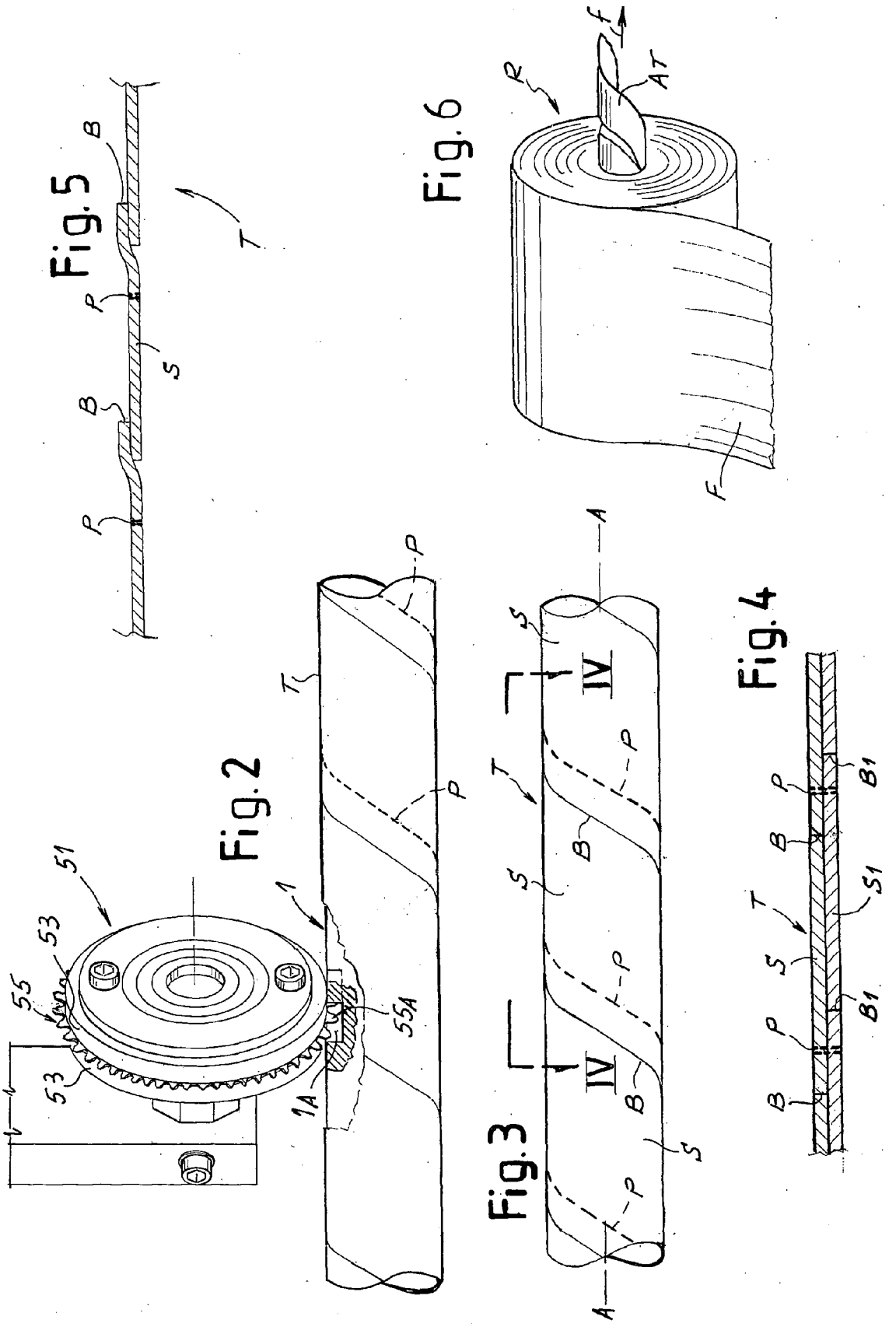


Fig.5
B
P
S
B
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Fig.6
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Fig.2
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Fig.3
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Fig.4
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EUROPEAN SEARCH REPORT

Application Number
EP 08 42 5597

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TECHNICAL FIELDS SEARCHED (IPC)

B31C
B26F
B65D

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
Munich	9 March 2009	Farizon, Pascal

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REFERENCES CITED IN THE DESCRIPTION

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