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(54) A method for the production and forwarding for wrapping of rolls of strip material, particularly sheet metal, and a cutting device usable in this method.

(57) Rolls (2) of strip material, such as sheet copper alloy, of predetermined widths which are generally different from each other are formed by unwinding and shearing a roll (7) and winding the sheared strips of material side by side on a single common collecting reel (9); a tubular cardboard element (3) is previously mounted on this reel (9) and receives the sheared strips with the formation thereon of a plurality of coaxially adjacent rolls (2); subsequently the semi-finished product thus formed is removed from the reel (9) of the shearing machine (5) and mounted rigidly on a carrier cradle (20) and the tubular element (3) is sectioned into as many sections as there are rolls (2) formed thereon, by means of a cutting head (22) which moves along the axis of the tubular element (3), within the latter; the sections are cut in lengths equal to the widths of the respective rolls (2) wound on each of them and are then forwarded to a wrapping line for the rolls (2).

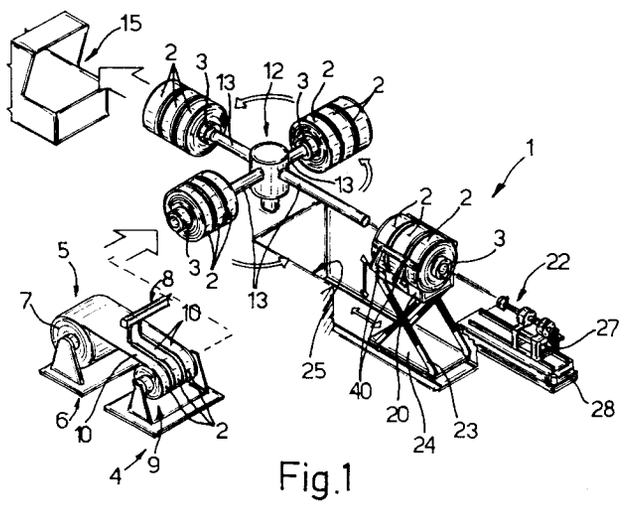

Fig.1

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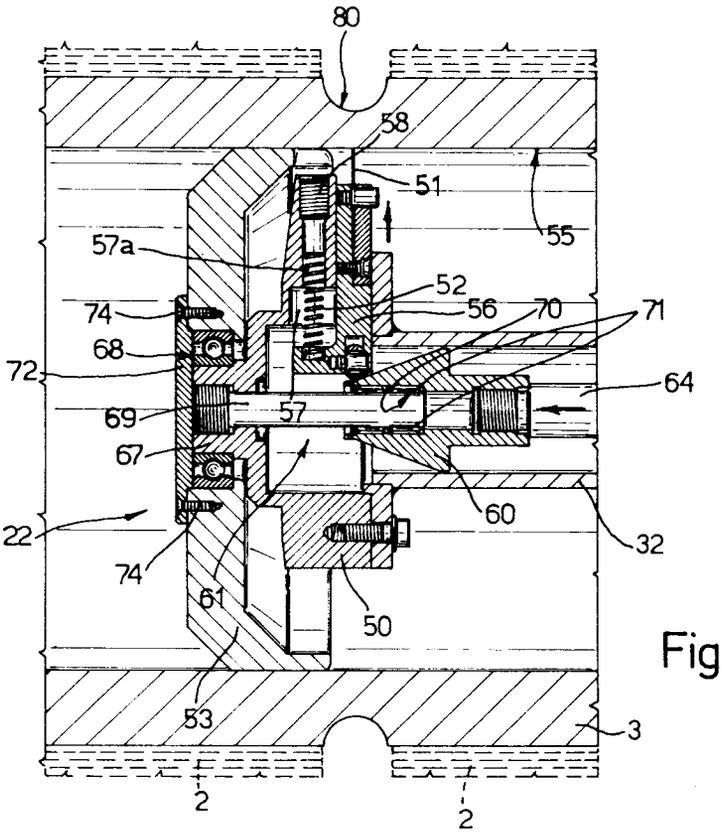
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Fig.5

The present invention relates to a method for the production and forwarding for wrapping of rolls of strip material, particularly sheet metal. The invention also relates to a cutting device usable in this method.

It is known that strip material, typically sheet metal intended to be worked by pressing or bending, is produced in rolls of commercial widths starting from rolls of larger widths coming directly from the rolling mill or from any subsequent heat treatments, by unwinding of the said roll and cutting longitudinally in the direction of unwinding, the roll thus being reduced to a plurality of strips each of which is wound so as to form a roll of the desired width. This operation is normally carried out by a shearing machine, the rolls of sheared material being collected in a position immediately alongside on a common winding reel of the shearing machine.

Depending on the technique used, the rolls of sheared strip may be wound on a bare spindle or on cardboard cylinders each of width equal to that of the respective roll.

In the first case the strips must be fixed in the chuck of an expandable spindle, use frequently being made of double-sided adhesive tape to fix the first turn to the rest of the sheared roll which causes problems in the removal of the rolls wound on the spindle since the first turn of each roll may end beneath the turns of the adjacent roll or remain gripped by the spindle chuck, making it extremely difficult to separate the rolls and subsequently forward them to the wrapping line where the rolls are wrapped for sale.

In the second case, the operators of the shearing machines must obtain cardboard cylinders cut to measure from an entire tube, which operation must be carried out off line and with the aid of a circular saw, and must then mount the cylinders on the winding spindle, centring them on the axis of the shearing machine and leaving interspaces between them, which operations are all slow and complicated. Moreover, during the expansion of the winding spindle it can easily happen that one or more of the cardboard cylinders breaks and must be replaced, with considerable loss of time.

Both of the known methods of working thus involve long stoppages of the shearing machine, either for the removal of the rolls, or during their formation, with consequent high costs and low productivity.

The object of the invention is to provide a method for the production and forwarding for wrapping of rolls of strip material obtained by shearing of a wider roll, which does not suffer from the disadvantages described above and which, in particular, can be carried out without loss of time, with high productivity and low running costs.

According to the invention, there is therefore provided a method for the production and forwarding for wrapping of rolls of strip material, particularly strips of sheet metal, including a shearing step in which a plurality of rolls of the strip material of predetermined widths are formed simultaneously by the unwinding of a single roll of the strip material of suitable width, cutting it longitudinally in the direction of unwinding and by the winding of the strips of sheared material side by side on a single common collecting spindle of a shearing machine; characterised in that, before the shearing step, a disposable tubular element is mounted on the collecting spindle of the shearing machine which then receives the sheared strips with the formation thereon of a plurality of the said rolls disposed coaxially adjacent each other; and in that subsequently the semi-finished product thus obtained is removed from the spindle of the shearing machine, is coupled to means for supporting the rolls and is subjected to a cutting step in which the tubular element is sectioned into as many sections as there are rolls formed thereon; the cutting step being effected by a cutting head which is moved along the axis of the tubular element and within the latter so as to cut the tube into sections each of a length equal to the width of the respective roll wound thereon.

Thus the sole operation to be carried out in the shearing machine is that of mounting a whole tube or bush of cardboard on the winding spindle and fixing the strips to the cardboard bush with double-sided adhesive tape, which operation may be carried out quickly and without taking much time in centring on the axis of the shearing machine since the cardboard tube is generally longer than the width of the roll to be sheared. Moreover, there is no longer danger of breakage during the expansion of the spindle since the whole tube is much stronger than the individual cut cylinders thereof used in the prior art. Finally, the anchoring of the sheared material to the cardboard tube is easier than to the bare spindle and there are no longer problems in the removal of the rolls.

The operation of cutting the tube into pieces so that the individual rolls can be passed on to the packaging machine separately is also very simple and quick when it is carried out from inside the tube, as provided for by the invention, and, in any case, is effected independently of the operation of the shearing machine whereby it does not affect the length of the operating cycle of the latter.

Preferably, to facilitate the cutting of the tube into pieces, before the roll of strip material is sheared, the disposable tubular element is subjected to an incision step in which a plurality of annular grooves is formed in its outer surface, these then being used as reference elements in the

cutting step.

The invention also relates to a cutting device usable in the method of the invention to effect the separation of the rolls wound coaxially, side by side, on the common disposable tubular support element; which device is characterised by comprising: a supporting cradle for the rolls provided with movable means for gripping the rolls themselves for providing radial support for the rolls around the outside thereof at at least three points distributed over an arc of more than 180°; means for moving the cradle relative to the rolls perpendicular to the axis of the tubular element; and a cutting head adapted to move relative to the cradle along the axis, and within, the disposable tubular element to cut the latter into the same number sections as there are rolls carried by the tubular element, each having a predetermined length; the cutting head including a first drum carried so as to be fixed for rotation with a rotatable shaft and in turn carrying a plurality of blades movable radially outwardly against the action of resilient means, and a second drum mounted for free rotation and coaxially on the first drum adapted to couple slidingly with a peripheral inner surface of the tubular element to be cut.

Further characteristics and advantages of the invention will be apparent from the description which follows of one non-limitative embodiment, given with reference to the appended drawings, in which:

Figure 1 is a schematic perspective view of the cutting device of the invention and of an installation for carrying out the method of the invention;

Figure 2 illustrates the initial steps in the method of the invention;

Figures 3 and 4 are front and side elevational views respectively of two component elements of the device of the invention on a larger scale than Figure 1;

Figure 5 is a sectioned elevational view of a cutting head of the device of Figure 1 during the cutting step; and

Figures 6 and 7 schematically illustrate two different variations of a cutting step of the method of the invention.

With reference to Figures 1 to 4, reference number 1 indicates a cutting device for separating a plurality of rolls 2 of strip material of predetermined widths, generally different from each other, wound coaxially and side by side on a common disposable tubular support element 3; the element 3 is constituted, in the particular, non-limitative embodiment described, by an ordinary tube or bush of cardboard of predetermined length and thickness, and the rolls 2 are generally constituted by bands or strips of sheet metal.

The cutting device 1 (Figure 1) is illustrated as integrated in a plant 4 for the production and for the forwarding for wrapping of the rolls 2, the parts of which upstream and downstream of the device 1 are known; more particularly, the plant 4 comprises a known shearing machine 5 illustrated extremely schematically in Figure 1, in turn comprising an unwinding reel 6 for receiving a roll 7 of strip material to be cut into the rolls 2, a shearing assembly 8 and a winding spindle or reel 9 on which the rolls 2 are formed.The roll 7 of overall width equal to the sum of the widths of the rolls 2 to be obtained, comes from the rolling mill, after any heat treatments, and is unwound by the rotation of the reel 6 and is cut longitudinally in known manner, in the direction of unwinding, by the shearing assembly 8 so that the roll 7 is reduced to a plurality of strips 10 each of which is wound to form a roll 2 of desired width on the winding reel 9.

The plant 4 further comprises a known cross-shaped, storage carousel 12 located immediately downstream of the machine 5 and having, for example, four arms 13 for supporting the rolls 2, and a known wrapping line 15 for wrapping the rolls 2, only the initial part of which is illustrated schematically; the cutting device 1 is located adjacent the carousel 12, as is also the line 15, so as to be positioned relative to the flow of the rolls 2, indicated by the arrows (Figure 1), on that side of the carousel 12 downstream of the machine 5 and upstream of the line 15 respectively. It is clear that, in a possible variation not illustrated, both the machine 5 and the line 15 could be in other positions, even quite remote from the carousel 12, as long as suitable, known transport means, for example fixed conveyor devices or motor-driven carriages, are provided for conveying the rolls 2 from this to the carousel 12 and vice versa.

With particular reference to Figures 3, 4 and 5, the device 1 comprises a cradle support 20 for the rolls 2 having movable gripper means for gripping the rolls themselves and a cutting head 22 movable relative to the cradle 20 on the axis of the rolls 2 supported thereby; in this particular case the cradle 20 is fixed to a known elevator device 23, for example a carriage movable by means of four mechanical actuators to ensure perfect vertical positioning, carried by a carriage 24 slidable by hydraulic means within a channel 25 coaxial with the cutting head 22.

The channel 25 extends from beneath one of the arms 13 of the carousel 12 located substantially coaxially with the head 22 up to the latter; the head 22 is freely rotatable and projects over the channel 25 from a motorised frame 27 (Figure 4), movable on a straight base 28 aligned with the channel 25 and the axis of the arm 13 overlying it at any time (as a result of the rotation of the carousel 12) towards and away from the cradle 12 itself. In particular, the frame 27 is driven by a motor 29

through a screw/nut transmission 30 and in turn carries a motor 31 connected to rotate a hollow drive-shaft 32 in the sense indicated by the arrow (Figure 4) which is freely rotatable in supports 35 fixed to the frame 27 and connected to the motor 31 by a known transmission 34. Thus the cradle 20 is movable relative to the rolls 2 carried by the arm 13 projecting over the channel 25 for engagement in a respective element 3 both perpendicular to the axis of the tubular element 3 and parallel thereto.

In the non-limitative embodiment illustrated, the means for gripping the rolls 2 consist of two opposing pairs of rocker arms 40 (Figures 1 and 3) projecting on opposite sides and laterally of the cradle 20 and rocking about pins 41 parallel to the axis of the rolls 2 carried by the cradle 20 between the position illustrated in broken outline and that illustrated in continuous outline in Figure 3; the free ends of each pair of arms 40, opposite the pins 41, are connected to respective idle rubber rollers 42 disposed parallel to the pins 41 and arranged to contact the rolls 2 carried by the cradle 20 in the manner illustrated in Figures 1 and 4; this ensures that the strips are clamped at the moment when they are separated by the cutting of the cardboard bush 3, as will be explained; moreover, each assembly constituted by a set of rolls 2 and the respective cardboard bush or element 3 is arranged facing the cutting head 22 and on the axis thereof and is supported at at least three points around the outside of the rolls 2 (the rollers 42 and the cradle 20 itself) arranged on an arc of more than 180°, in this particular case each spacing being about 120°.

The cutting head 22 which, on the basis of what has been described, is movable along the axis of the element 3 of the group of rolls 2 engaged at the time in the cradle 20 and into the element 3 itself, comprises (Figure 5) a first drum 50 fixed to the shaft 32 for rotation therewith and in turn carrying a plurality of blades 51 movable radially outwardly against the action of respective helical springs 52, and a second cylindrical, cup-shaped drum 53 partially housing the drum 50 at its concave end; the drum 53 is freely rotatable relative to, and coaxial with, the drum 50 and its outer diameter is selected so that it is a sliding fit in the peripheral inner surface 55 of the tubular element 3 to be cut.

The blades 51 are in the form of circular discs and are freely rotatable on and project partly from slides 56 which are substantially L-shaped in radial section (only one of which is illustrated in Figure 5 for simplicity) and which are radially slidable on the drum 50, in this particular case within respective parallel radial channels 57 therein in correspondence with respective seats 57a for the springs 52; the slides 56 cooperate with the springs 52, each of which is packed with desired preloading between one arm of the respective L-shaped slide 56 extending parallel to the axis of rotation of the drum 50 and a respective adjustable shoulder fixed to the drum 50 and defined by a respective threaded screw 58 screwed radially into the drum 50 at the radially outer end of the respective seat 57a.

Each slide 56 is urged by its preloaded spring 52 so that its opposite end, or that nearer the axis of rotation of the drum 50, cooperates with an element 60 with an inclined face, in this particular case defined by a frusto-conical buffer, housed for axial sliding movement within an axial cavity 61 in the drum 50 into which the channels 57 converge, and partly within the hollow rotary shaft 32 to which the drum 50 is fixed. The buffer or element 60 is screwed on to one end of a rod 64 so as to project therefrom, the rod being mounted coaxially within the shaft and slidable therein so as to be movable along the axis of rotation of the drum. At its opposite end (Figure 4) the rod 64 projects from the shaft 32 and is connected by a lever transmission 65 to an actuator 66, for example of pneumatic type, fixed to the frame 27.

Support for the drum 53 is provided by a hub 67 of the drum 50, with the interposition of a rolling bearing 68, and by a threaded pin 69 which also supports the element 60 at the end opposite the rod 64 and, for this purpose, is engaged in a blind hole 70 in the element 60 with the interposition of rollers 71; the whole is closed by a cover 72 fixed to the end of the drum 53 by screws 74. Thus it is possible to replace the drum 53 by one which is identical but of different outer diameter and to adjust the radial travel of the slides 56 (and consequently of the blades 51) so that the same head 22 can be adapted to operate on groups of rolls 2 wound on tubular elements 3 of different dimensions and thicknesses.

With reference to figures 6 and 7, the cutting head 22 optionally includes sensor means for detecting any variations in radial thickness of the tubular element 3, in this particular case, the presence or lack of presence of annular grooves 80 (illustrated out of scale in exaggerated dimensions for better visibility) in an outer cylindrical surface 81 of the element 3.

In the embodiment of Figure 6, the sensor means comprise a known feeler 85 pivotable on and projecting axially from the drum 53; in a withdrawn position, illustrated in broken outline; the feeler 85 is housed within the radial dimensions of the drum 53 and does not interfere with the axial insertion of the head 22 into the tube 3 or its removal therefrom; in its extended position, illustrated in continuous outline, the feeler 85 projects radially at that end 86 of the tube 3 near to which the head 22 is brought and is able to slide on the

surface 81 at least through a limited distance along the length of the tube 3 to identify a first groove 80 formed close to the end 86. The feeler 85 is connected to a known PLC (not illustrated) programmed to control successive advancements beyond the first groove 80.

In the embodiment illustrated in Figure 7, however, the sensor means comprise one or more emitters 88, of known type, for example ultrasound, supported by the drum 53 such that the waves emitted thereby pass through the thickness of the tube 3 to detect any variations in thickness due to the presence of one of more grooves 80.

The line is completed by an automatic centring station (not illustrated) of any known type between the roll axis (the axis of the assembly rolls 2/bush 3) and the axis of the cutting head 22, for example having an optical laser centring system.

In accordance with the method of the invention, a series of rolls 2 of predetermined widths are formed from a roll 7 of suitable width by a shearing step carried out by the machine 5 as described above. According to the invention, however, before the shearing step is carried out, a disposable tubular element 3 of predetermined thickness and length is mounted on the collecting spindle 9 of the shearing machine 5, this tubular element in any case being wider than the width of the roll 7; once the shearing step has been carried out, in entirely conventional, known manner, it is thus the bush or element 3 and not the bare reel 9 which receives the sheared strips 10 with the consequent formation thereon of a plurality of rolls 2 located coaxially adjacent each other on the element 3 (Figure 2).

Subsequently the semi-finished product thus obtained, constituted by the element 3 and the respective group of rolls 2, is removed from the reel 9 and stored on the free arm 13 of the carousel 12 closest to the machine 5 by the simple fitting of the tube 3 axially onto the arm itself. The carousel 12 is then rotated through a fraction of a revolution, corresponding to the angular distance between the arms 13, until the arm 13 carrying the said semi-finished product reaches a position above the channel 25 in front of the cutting head 22. At this point, the rolls 2 are coupled to the support means constituted by the cradle 20 and the rollers 42; while the semi-finished product is supported over the channel 25 by the arm 13, the cradle 20, which has its arms 40 arranged in the position shown in broken outline (Figure 3), is brought by the carriage 24 beneath this arm and, by actuation of the elevator 23, is brought into contact with the rolls 2 which rest thereon (Figure 3).

At this point the arms 40 are rotated so as to make the rollers 42 clamp the rolls 2 against the cradle 20; due to the suitable relative angular positioning (symmetrical and on an arc greater than 180°) of the rollers 42 and the supporting seat of the cradle 20 for the rolls 2, the entire semi-finished product is self-centred and clamped on the cradle 20 at the moment of clamping, and remains fixed thereto. Subsequently the cradle 20 is moved towards the head 22 through a distance sufficient to remove the tube 3, with the rolls 2, from the arm 13,and tube 3 by means for example of the said automatic centring station, not illustrated, is moved into a position in which it is strictly coaxial with the shaft 32, any adjustments being effected by means of the elevator 23. The motor 29 is then actuated to advance the frame 27 automatically towards the channel 25 with the consequent sliding insertion of the head 22 into the tube 3, coaxially thereof to bring the drum 53 close to the end 86.

During this insertion of the head 22 into the tube 3, the rod 64 is held in its withdrawn position relative to the drum 53 by the actuator 66 so that the blades 51 do not project radially beyond the outer diameter of the drum 53 and hence do not interfere with the inner surface 55 of the tube 3.

Finally, the motor 29 reverses the travel of the head 22 to bring the blades 51 into correspondence with the axial position of the first roll 2, in line with that side thereof nearer the end 86, the shaft 32 is rotated and the actuator 66 advances the rod 64 so as to cause the progressive radial projection of the slides 56 from the drum 50; the blades 51 consequently come into contact with the surface 55, are rotated by friction about their own axes as a result of the rotation of the drum 50, like the satellites of an epicyclic reduction gear, and progressively penetrate ever further into the thickness of the tube 3, sectioning the latter in a radial direction, from the inside towards the outside. During this cutting operation, moreover, the cutting head 22 is kept in abutment with the disposable tubular element 3 being cut by virtue of the cooperating contact of the drum 53 with the inner surface 55 of the tube 3.

On the basis of what has been described, a first section of the tube 3 which projects axially from the roll 2 closest to the end 86 is thus removed (without the production of chips or sawdust but by blade-cardboard incision); subsequently, the cutting head 22, after withdrawal of the blades 51, is further withdrawn so as to bring the blades 51 successively into a plurality of predetermined axial positions in which they are arranged in line with the opposite ends of each roll 2 and, in each of which positions, the tube 3 is again cut, as described above, to section the tube 3 into as many sections (in addition to the first one mentioned above) as there are rolls 2 which have been formed on the tube 3, each of a length equal to the width of the respective roll 2 wound thereon. Dur-

ing these operations, the rolls 2 remain stationary relative to each other in that they are firmly clamped on the cradle 20 whether the tube 3 is entire or otherwise.

After the cutting step, the rolls 2 are uncoupled from the support means, separated and forwarded to the wrapping line 15. In this particular case, the head 22 is withdrawn from the tube 3, which has just been cut into sections,and the cradle 20 is returned beneath the arm 13; the rolls 2, which have just been rendered independent of each other in that they are supported only by the respective section of the tubular disposable element 3, which has just been cut, are so fitted back onto the same arm; then, the arms 40 are opened, freeing the rolls 2, which remain engaged on the arm 13, the carousel 12 is rotated so as first to bring a new semi-finished product to be cut into the position in front of the head 22 and then to bring the group of rolls 2 which have been separated into a position in front of the line 15; from here the rolls 2 are taken from the arm 13, one at a time, and supplied to the line 15 until the arm 13 is empty. On subsequent rotation of the carousel 12 this represents itself in front of the machine 5 to take on a new semi-finished product to be brought to the head 22.

In a preferred embodiment of the method of the invention, in order to enable the axial positions in which the blades 51 of the head 22 should be stopped to cut the tube 3 to be determined precisely, before the shearing step and after the mounting of the tube 3 on the reel 9 (figure 2), the tube 3 is subjected to an incision step in which annular grooves 80 are formed in its outer peripheral surface 81. More particularly, the grooves 80 are formed in predetermined axial positions with the use of respective separator discs 90 existing in the shearing machine 5 and normally used only to keep the turns of the various rolls 2 being formed on the reel 9 separated from each other; thus the grooves 80 are formed in positions such that, at the end of the shearing step, they are in line with the opposite sides of each roll 2 of strip material, as illustrated in Figure 2 and, above all, without the need for additional operations.

The grooves 80 may thus be used during the cutting step as reference elements for the sectioning of the disposable tubular element 3 providing that their position can be identified, for example by means of the sensors 88; clearly it would suffice for the head 22 to be controlled by an electronic central control unit (not illustrated, for example the PLC already mentioned) arranged to receive the signals from the sensors 88 so that all the cutting operations described above may be carried out completely automatically and with great precision.

However, since the width of each roll 2 is already known, this information may be input into the control unit at the beginning and then it will suffice to identify, for example by means of the feeler 85, the axial position only of the first groove 80, that is, the one at which the first cut is to be made, the subsequent positions being calculable by the control unit by subtraction, account being taken of the width of each roll 2.

It is, however, clear that the presence of the sensors 85, 88 and of the grooves 80 is not strictly necessary in that the initial positioning of the head 22 for the first cutting operation could be carried out manually, the subsequent movements being, in each case calculable by a central control unit automatically on the basis of a knowledge of the width of the various rolls 2.

Claims

1. A method for the production and forwarding for wrapping of rolls of strip material, particularly sheet strip metal, including a shearing step in which a plurality of rolls of the strip material of predetermined widths are formed simultaneously by the unwinding of a single roll of the strip material of suitable width and its cutting longitudinally in the direction of unwinding and by the winding of the strips of sheared material side by side on a single common collecting spindle of a shearing machine;
characterised in that, before the shearing step, a disposable tubular element is mounted on the collecting spindle of the shearing machine which then receives the sheared strips with the formation thereon of a plurality of the said rolls disposed coaxially and adjacent each other; and in that, subsequently, the semi-finished product thus obtained is removed from the spindle of the shearing machine, is coupled to means for supporting the rolls and is subjected to a cutting step in which the tubular element is sectioned into as many sections as there are rolls formed thereon; the cutting step being effected by a cutting head which is moved along the axis of the tubular element and within the latter so as to cut the tube into sections each of a length equal to the width of the respective rolls wound thereon.

2. A method according to Claim 1, characterised in that, after the cutting step, the rolls, each supported by a respective one of the sections of the disposable tubular element, are disconnected from the support means, separated and forwarded to a line for packaging of the rolls.

3. A method according to Claim 1 or Claim 2, characterised in that, before the step of shearing the roll of strip material, the disposable

tubular element is subjected to an incising step in which a plurality of annular grooves is formed in its outer surface.

4. A method according to Claim 3, characterised in that the grooves are formed in predetermined axial positions by respective separator discs of the shearing machine in such a manner that, after the shearing step, they are located in line with the edge of each respective roll of strip material; the grooves being used during the cutting step as reference elements for the sectioning of the disposable tubular element.

5. A method according to any one of the preceding Claims, characterised in that a cardboard tubular disposable element is used.

6. A method according to any one of the preceding Claims, characterised in that, during the cutting step, the cutting head is held against the disposable tubular element and in that the latter is sectioned in a radial direction, from the inside to the outside of the disposable tubular element.

7. A cutting device for separating a plurality of rolls of strip material of predetermined widths wound coaxially and side by side on a common disposable tubular support element; characterised in comprising a cradle for supporting the rolls provided with movable means for gripping the rolls so as to provide radial support for the rolls on the outside thereof at at least three points distributed along an arc of more than 180°; means for moving the cradle relative to the rolls perpendicular to the axis of the tubular element; and a cutting head adapted to move relative to the cradle along the axis and within the disposable tubular element to cut the latter into as many sections as there are rolls carried by the tubular element, each having a predetermined length; the cutting head including a first drum carried so as to be fixed for rotation with a rotatable shaft and in turn carrying a plurality of blades movable radially outwardly against the action of resilient means, and a second drum mounted for free rotation and coaxially on the first drum adapted to couple slidingly with a peripheral inner surface of the tubular element to be cut.

8. A cutting device according to Claim 7, characterised in that the blades are in the form of circular discs and are carried so as to be freely rotatable on, and partly projecting from, respective slides mounted so as to be radially slidable on the first drum; the slides being urged by resilient means such that their ends nearer the axis of rotation of the first drum cooperate with an inclined plate element movable along the axis of rotation.

9. A cutting device according to Claim 8, characterised in that it includes an actuator for moving said inclined plate element and sensor means for detecting any variations in the radial thickness of the tubular element.

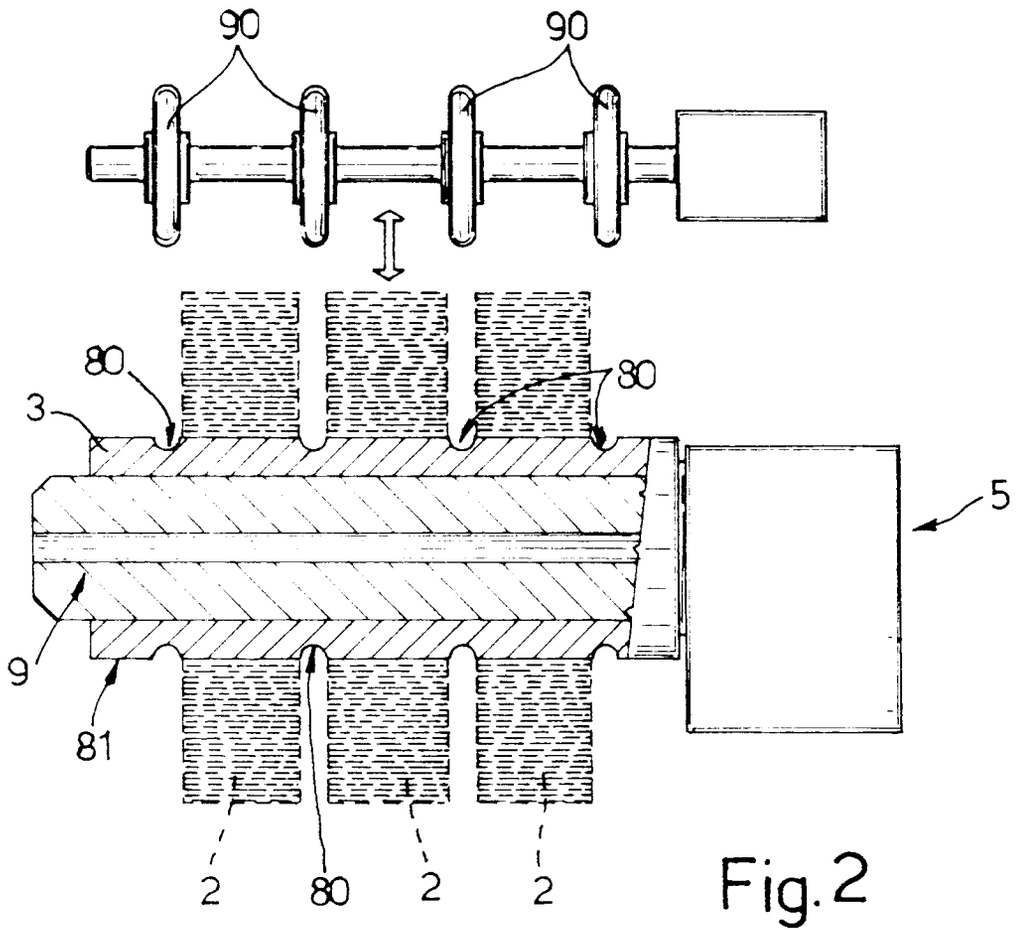
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Fig.2

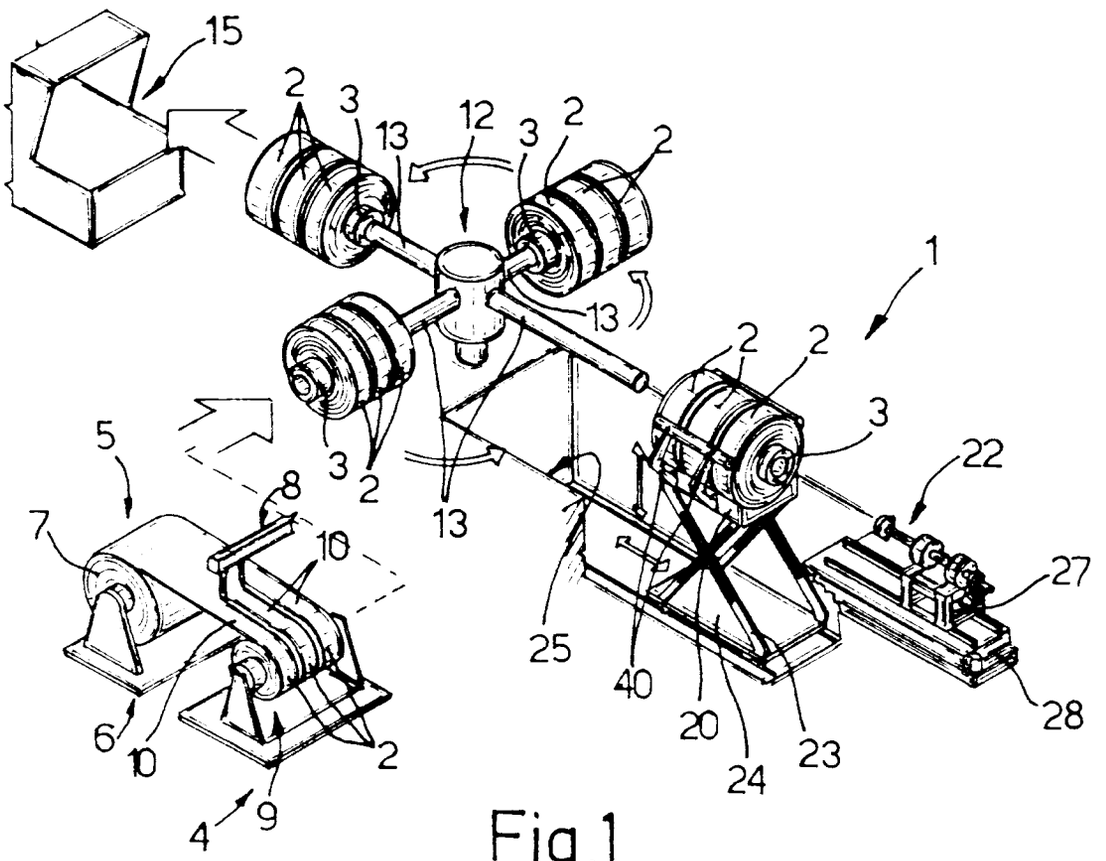
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Fig.1

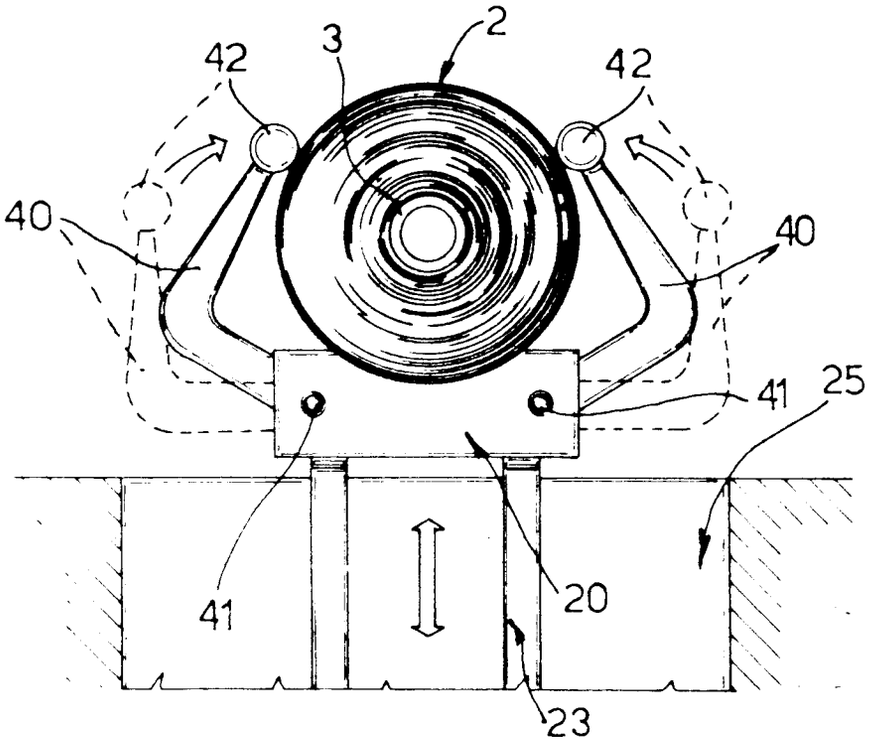
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Fig. 3

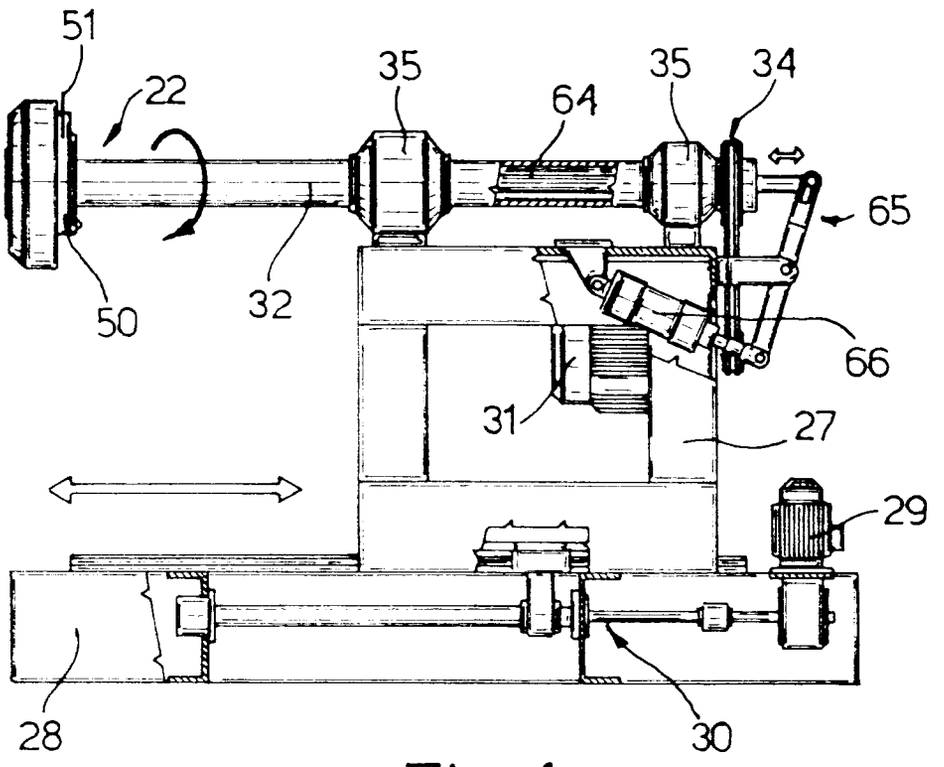
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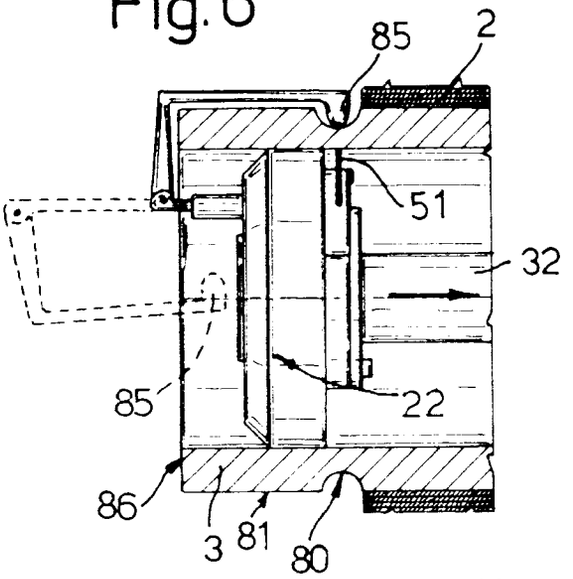
Fig. 4

Fig.6



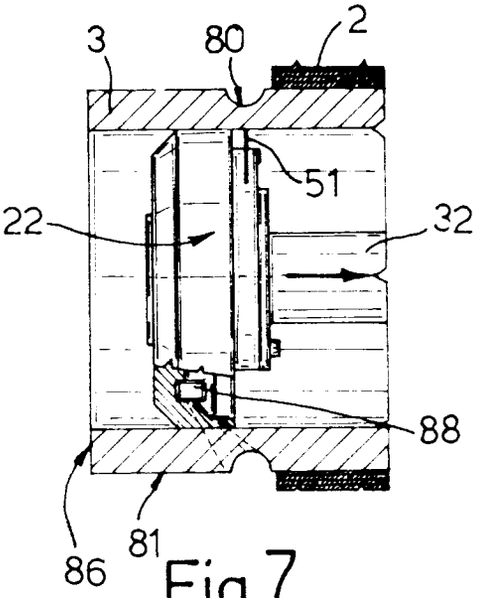


Fig.7

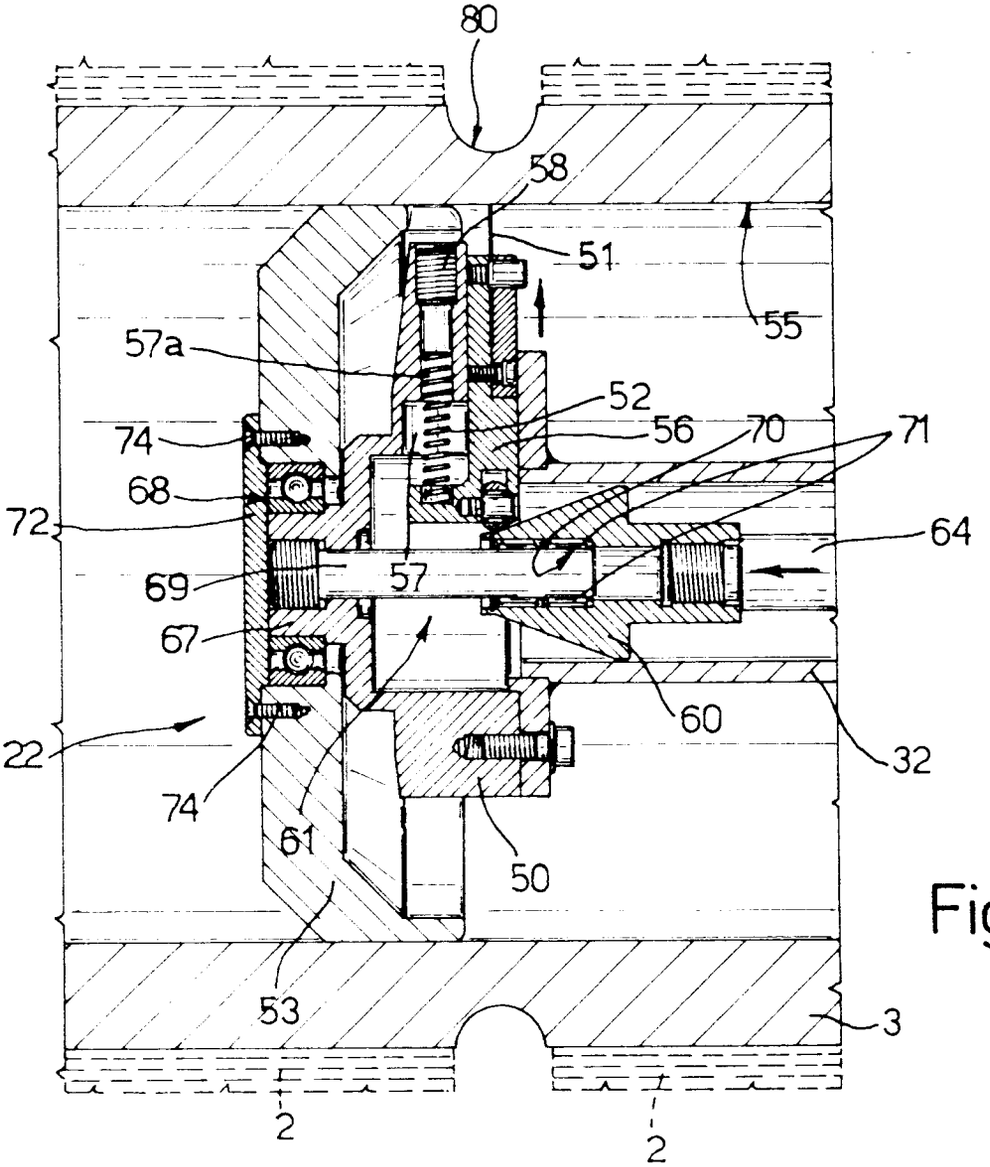


Fig.5

European Patent Office

EUROPEAN SEARCH REPORT

Application Number
EP 94 11 4958

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.6)
A	US-A-4 191 318 (ROGERS) * column 2, line 42 - column 4, line 27; figures *	1,2,7	B21C47/00 B65H18/10 B26D3/16
A	AU-B-603 759 (CHRISTODOULOU) * claim; figures *	1,6-9	

TECHNICAL FIELDS SEARCHED (Int.Cl.6)

B21C
B65H
B26D

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	20 January 1995	Barrow, J

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
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