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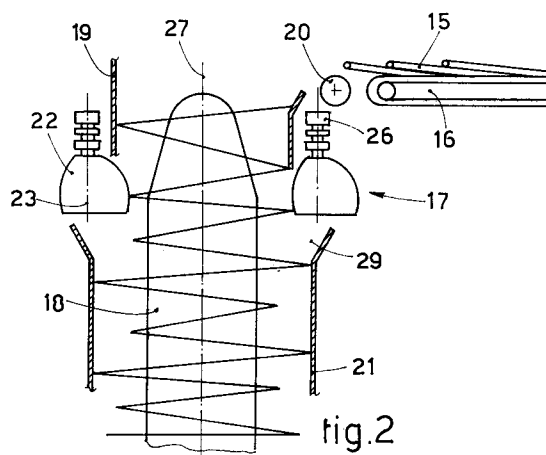
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I-33100 Udine (IT)**(54) **Device for the asymmetric depositing of loops**

(57) Device for the asymmetric depositing of loops, which cooperates with a coil-forming station (17) comprising at least one stacking element (18) positioned within a coil-forming chamber (29), the loops (15) being fed by a conveyor means (16) the downstream end of which cooperates directly with the intake of the coil-forming station (17), in which device a plurality of rotary guide cams (22) is included in cooperation with the coil-forming chamber (29) or with the stacking element (18) and above the latter (18) and can rotate in a synchronised manner with stationary axes (23) of rotation, the guide cams (22) having substantially the same outline as each other and being arranged in an angularly variable manner which can be varied from a minimum value to a maximum value and viceversa within an arc of 180°, the outlines of the guide cams (22) as a whole defining a circumference having a diameter approximately equal to the diameter of the loops (15) and smaller than the diameter of the coil-forming chamber (29), the guide cams (22) in rotation defining progressively a circumference of a passage with a maximum eccentricity in one direction and a circumference of a passage with a maximum eccentricity in the opposite direction after passing through a circumference of a passage coaxial with the axis (27) of the stacking element (18).

**EP 0 686 438 A1**

This invention concerns a device for the asymmetric depositing of loops, as set forth in the main claim.

In particular, the device according to the invention is applied within a rolling plant in the coil-forming station positioned downstream of the rolling train and cooling area.

This invention is suitable to cooperate with conventional assemblies for the forming and conveying of the loops and enables the method of distributing the loops on the stacking element to be perfected.

In conventional rolling plants the slabs or billets subjected to the various rolling stages, for instance when leaving the finishing train, undergo a preliminary cooling before being sent to the loop-forming station. This station contains a rotary headstock which forms the loops and generally drops them onto a prearranged removal element consisting of a removal conveyor belt, for instance.

The loops on this conveyor belt can cooperate further with controlled cooling systems.

At the downstream end of the removal conveyor belt the loops are discharged onto a suitable stacking element to form a coil.

The coils thus formed then undergo the normal processes of compaction, tying and anything else required for their later use.

The discharge of the loops onto the relative stacking element entails problems owing to the uneven and disorderly array which the loops may take up in falling from the conveyor belt.

The loops, when they are superimposed on each other in a disorderly manner, form an unbalanced, unstable and incompact coil with a low density of loops.

The state of the art discloses a plurality of systems to improve the distribution of the loops in the step of forming coils with the purpose of making the formed coil more stable and compact and thus minimising the space taken up by the coil during the subsequent steps of transport and storage.

Patent US RE 26,052 discloses the employment of a rotary deflector, the arm of which extends radially towards the inside of the coil-forming chamber and defines, together with the opposite side of the coil-forming chamber, a distance which is substantially the same as the diameter of the coil being formed.

DE-A-1.235.100 too discloses the use of a rotary deflector with an arm directed towards the inside of the coil-forming chamber so as to restrict the possibility of the loops being arranged in an uneven and disorderly manner.

These systems of the state of the art arrange substantially the formation of coils in which the loops are positioned on each other in an orderly

way.

But this is not the best solution in terms of the stability of the formed coil and of the density and compactness thereof. Moreover, this arrangement may lead to problems during cooling of the coil inasmuch as it is impossible to cool all the loops effectively and evenly in this case.

EP-A-0583099 teaches the use of a rotary deflector having a surface curved in three dimensions and affecting only part of the circumference so as to accompany and displace sideways the loops discharged from the relative conveyors according to a path about a nominal circumference of the coil. This document does not make possible the variation and regulation in a desired manner of the eccentric nature of the depositing of the loops, nor does it make possible in any case an axial depositing of the loops according to the axis of the stacking element; it requires an appropriately and three-dimensionally shaped and conformed element for its use, and this situation entails complex and accurate calculations to produce the correct form and yet other drawbacks.

Moreover according to this document of the prior art each discharged loop is displaced by the rotary deflector substantially as soon as it leaves the conveyor belt, that is to say, there is not a first guide segment positioned substantially on the same axis as the stacking element where each loop has the time to take up an orderly and correct position.

In view of the present speeds of discharge of the loops from the feeder conveyor and in view of the disorder in which the loops lie on the feeder conveyor before being discharged, the result is that the deflector does not act in the same manner on all the loops, thus leading to an incorrect, inaccurate and uneven action of lateral displacement.

Moreover, this deflector does not apply a guiding action to the forming loops but exerts only a lateral displacement action, thus causing deformations of the loops.

Moreover, the drive system to set the deflector in rotation is complicated and hard to regulate.

The present applicants have designed, tested and embodied this invention to overcome these problems and to obtain at the same time a coil which has an even, compact and orderly distribution of loops with a high density.

This invention is set forth and characterised in the main claim, while the dependent claims describe variants of the idea of the main embodiment.

The purpose of the invention is to provide a device which enables the loops to be deposited asymmetrically on the coil being formed.

The device according to the invention has a very simple concept and embodiment and is very simple to set to work and operate.

Moreover, the device according to the invention enables the value of the asymmetric positioning imparted to the loops during their depositing to be regulated very simply in a desired manner even during the progress of work and also makes possible the depositing of coaxial loops or also the depositing of loops coaxial with the axis of the stacking element if that is required by the coil-forming method.

Moreover, the device according to the invention ensures in each step a correct and accurate guiding of the loops which are progressively superimposed on each other to form the coil.

The device according to the invention cooperates with a stacking element having its axis advantageously, but not only, substantially vertical and we shall refer to this in the description that follows.

The device according to the invention includes a plurality of guide cams able to rotate with a stationary axis of rotation in a synchronized manner about that axis.

According to a first embodiment of the invention the axes of rotation of the guide cams define between them a circumference coaxial with the axis of the stacking element.

According to a variant the axes of rotation of the guide cams are inclined by a desired value in relation to the axis of the stacking element so as to define a cone the vertex of which lies substantially on the axis of the stacking element.

A substantially cylindrical guide element coaxial with the axis of the stacking element is included above the plane defined by the guide cams and cooperates directly with the zone of release by the means conveying the loops.

This guide element has the purpose of guiding the descent of the loops along a first segment towards the stacking element so that all those loops arrive in a correct and uniform manner in cooperation with the asymmetric depositing device according to the invention.

This asymmetric depositing device thus acts on loops which have already been correctly positioned and guided even when the discharge from the conveyor means takes place in a very quick and disorderly manner.

The lateral surface of these guide cams protrudes at least partly into the annular chamber, or coil-forming chamber, positioned downstream of the guide element, in which the coils pass from the conveyor means to the stacking element.

According to the invention the guide cams are installed eccentrically on their respective axes of rotation, and this eccentricity of positioning of the guide cams varies progressively within an arc of 180° from a maximum value to a minimum value along the circumference of positioning of the axes

of rotation of the guide cams.

In other words, the guide cams are fitted around the stacking element in such a way that their lateral surface protrudes into the coil-forming chamber in a manner increasing progressively within an arc of 180° and decreasing progressively within the other 180°.

Thus the guide cams together define between them during their rotation a circumference for the passage of the coils being deposited on the stacking element, this circumference being eccentric in relation to the axis of the stacking element, the value of the eccentricity varying progressively, sequentially and periodically during the depositing of the loops.

The value of this eccentricity changes from a maximum value in one direction to a maximum value in the other direction and passes through a nil value coinciding with the axis of the stacking element.

The circumference of the passage, being eccentric in relation to the stacking element, enables a depositing to be carried out whereby the loops are offset from each other according to a pre-arranged and periodical mating sequence.

The depositing carried out in this manner enables a coil to be produced which is improved in terms of occupation of space in a vertical direction, density, uniformity, stability and balance of the coil and compactness.

Moreover the coil thus produced can cooperate more effectively and uniformly with any cooling systems since the single loops can be lapped more easily and evenly by the action of the cooling systems.

According to the invention the device enables a depositing to be also achieved whereby the loops are discharged in an orderly manner on the axis of the stacking element and each of the guide cams is correctly positioned and kept stationary in that position during the whole period of the cycle of formation of the coil.

The attached figures are given as a non-restrictive example and show some preferred embodiments of the invention as follows:-

Fig.1 is a partial diagram of a rolling line to which the device according to the invention is applied;

Fig.2 shows a lengthwise section of the device according to the invention;

Fig.3 is a plan view of the device according to the invention;

Fig.4 shows a first variant of Fig.2;

Fig.5 shows another variant of Fig.2.

In a typical rolling line 10 shown in Fig.1 a slab or billet is rolled continuously in a rolling train comprising at least one roughing rolling mill stand 11 and a finishing train 12.

The rolled product is fed into a cooling area generically referenced with 13 and thence to a loop-forming headstock 14.

Loops 15 formed by the loop-forming headstock 14 are discharged onto a conveyor belt 16 generally associated with cooling means.

The loops 15 are discharged from the downstream end of the conveyor belt 16 into a coil-forming station 17, in which the loops 15 are stacked on each other about a stacking element 18 having an axis 27, in this case, substantially vertical so as to form a coil.

In this case the coil-forming station 17 comprises a first stationary, cylindrical, tubular element 19 which cooperates directly with the downstream end of the conveyor belt 16 and/or with a possible feeder roller 20.

This first cylindrical, tubular element 19 has the task of guiding the loops 15 discharged from the conveyor 16 along a first segment of their descent into the coil-forming station 17.

A second cylindrical element 21 is included below the first cylindrical, tubular element 19 and has a diameter greater than the diameter of the stacking element 18 and surrounds that stacking element 18 circumferentially.

A coil-forming chamber 29 is defined between the stacking element 18 and the second cylindrical element 21.

According to the invention a plurality of guide cams 22 are positioned on one single horizontal plane in an intermediate vertical position between the first cylindrical, tubular element 19 and the second cylindrical element 21 which surrounds the stacking element 18.

All these guide cams 22 rotate in a synchronised manner about stationary axes 23, and the lateral surface of the guide cams 22 extends radially and at least partly into the coil-forming chamber 29.

In the embodiment shown in Fig.2 the axes 23 of the guide cams 22 together define a circumference which is substantially coaxial with the axis 27 of the stacking element 18.

In the variants of Figs.4 and 5 the respective axes 23a and 23b of the guide cams 22 are inclined in relation to the axis 27 of the stacking element 18 so as to define a cone having its vertex lying on the axis 27 of the stacking element 18; in the example of Fig.4 the vertex of the cone faces in a downward direction, whereas in the example of Fig.5 the vertex of the cone faces in an upward direction.

The synchronisation of the rotation of the guide cams 22 is ensured by a transmission chain 24, which gets its motion from a motor 25, which is advantageously a variable speed reduction unit, the chain 24 being connected to each specific guide

cam 22 by suitable transmission means 26.

The transmission chain 24 is wound about transmission rollers 28 between one guide cam 22 and the adjacent guide cam 22.

In the embodiment shown in Fig.3 the guide cams 22 are installed eccentrically in relation to their own axes of rotation 23 and have a substantially cylindrical outline.

In the embodiment of Fig.2 the guide cams 22 have an outline which is at least partly substantially tapered.

In particular, according to the imaginary circumference defined by all the axes 23 of rotation in one direction or the other, each guide cam 22 is installed progressively offset in relation to the adjacent guide cam 22.

In this way the surfaces of the guide cams 22 protruding into the coil-forming chamber 29 define with each other a circumference eccentric in relation to the axis 27 of the stacking element 18, this circumference having a diameter smaller than the diameter of the coil-forming chamber 29.

The eccentricity of this circumference varies progressively and periodically according to the synchronised rotation of the guide cams 22 so as to define for the loops 15 a progressively variable passage progressively and periodically offset in relation to the stacking axis 27.

This progressively variable eccentricity of the downward travel of the loops 15 causes an asymmetric arrangement of the loops 15 about the circumference defined by the stacking element 18, thus achieving a greater filling of space, better stability, greater density and greater compactness of the coil produced.

The axial positioning of the guide cams 22 can be altered in a desired manner so as to impart to the loops progressively discharged from the conveyor 16 a more or less accentuated asymmetry.

These guide cams 22 can also be positioned and kept stationary in those positions during the whole coil-forming cycle in such a way that all the loops 15 are discharged on the axis 27 of the stacking element 18 or all the loops 15 are discharged in an orderly manner and are superimposed on each other according to an axis parallel to the axis 27 of the stacking element 18.

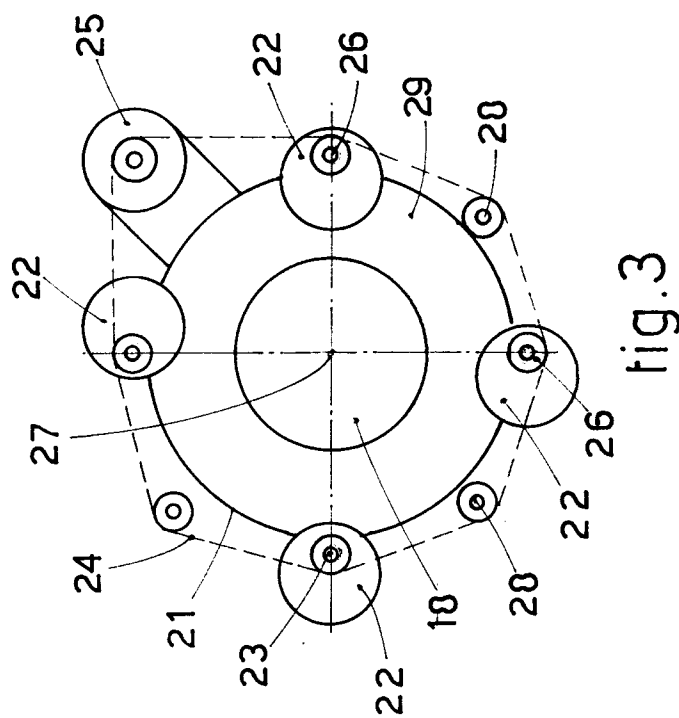
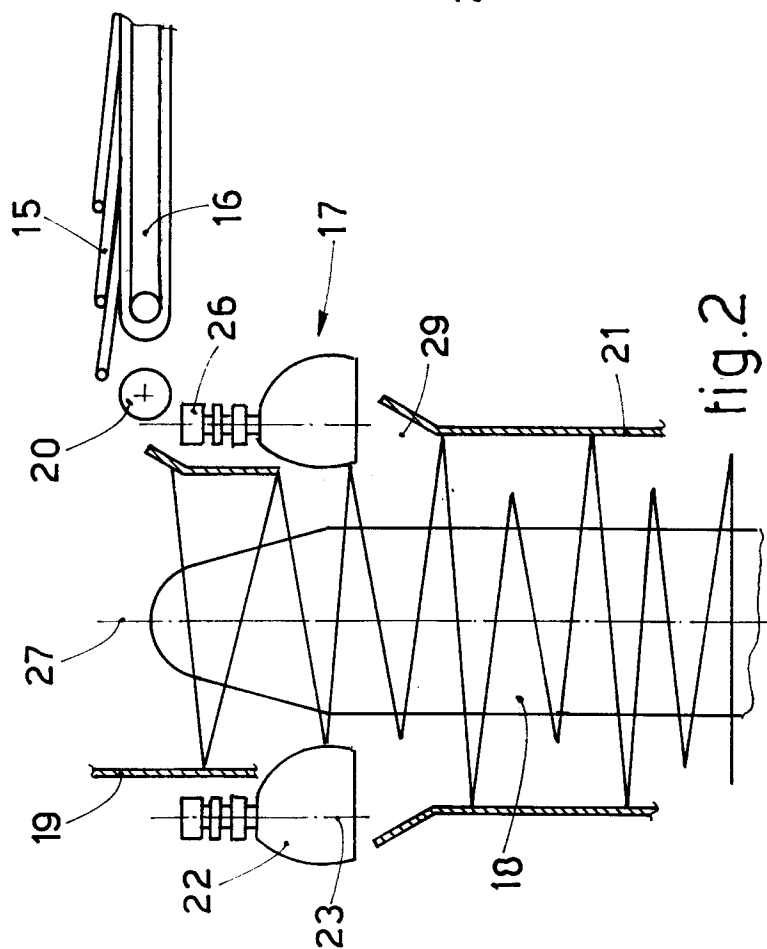
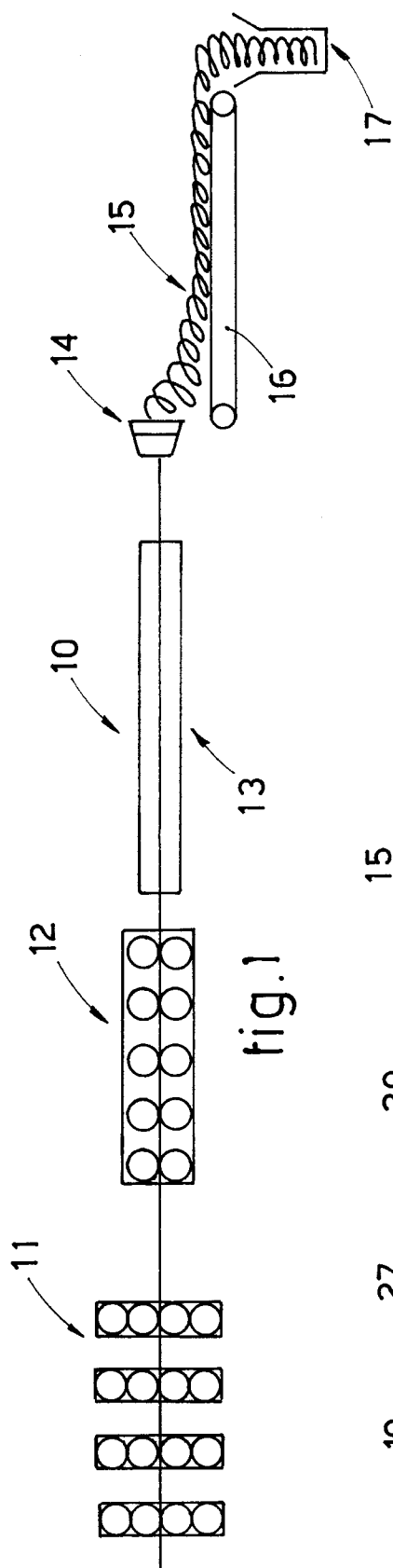
Claims

1. Device for the asymmetric depositing of loops, which cooperates with a coil-forming station (17) comprising at least one stacking element (18) positioned within a coil-forming chamber (29), the loops (15) being fed by a conveyor means (16) the downstream end of which cooperates directly with the intake of the coil-

forming station (17), the device being characterised in that a plurality of rotary guide cams (22) is included in cooperation with the coil-forming chamber (29) or with the stacking element (18) and above the latter (18) and can rotate in a synchronised manner with stationary axes (23) of rotation, the guide cams (22) having substantially the same outline as each other and being arranged in an angularly variable manner which can be varied from a minimum value to a maximum value and viceversa within an arc of 180° , the outlines of the guide cams (22) as a whole defining a circumference having a diameter approximately equal to the diameter of the loops (15) and smaller than the diameter of the coil-forming chamber (29), the guide cams (22) in rotation defining progressively a circumference of a passage with a maximum eccentricity in one direction and a circumference of a passage with a maximum eccentricity in the opposite direction after passing through a circumference of a passage coaxial with the axis (27) of the stacking element (18).

2. Device as in Claim 1, in which the the axes (23) of the guide cams (22) are arranged according to a circumference coaxial with the axis (27) of the stacking element (18).
3. Device as in Claim 1, in which the axes (23a-23b) of the guide cams (22) are arranged according to a cone having its vertex lying substantially on the axis (27) of the stacking element (18).
4. Device as in any claim hereinbefore, in which a cylindrical tubular element (19) positioned with its axis coinciding substantially with the axis (27) of the stacking element (18) is included between the plane defined by the guide cams (22) and the zone of discharge of the conveyor means (16).
5. Device as in any claim hereinbefore, in which the guide cams (22) have a tapered outline.
6. Device as in any claim hereinbefore, in which the guide cams (22) in a position of non-rotation have at least one position in which their outlines define a circumference having an axis substantially coaxial with the axis (27) of the stacking element (18).

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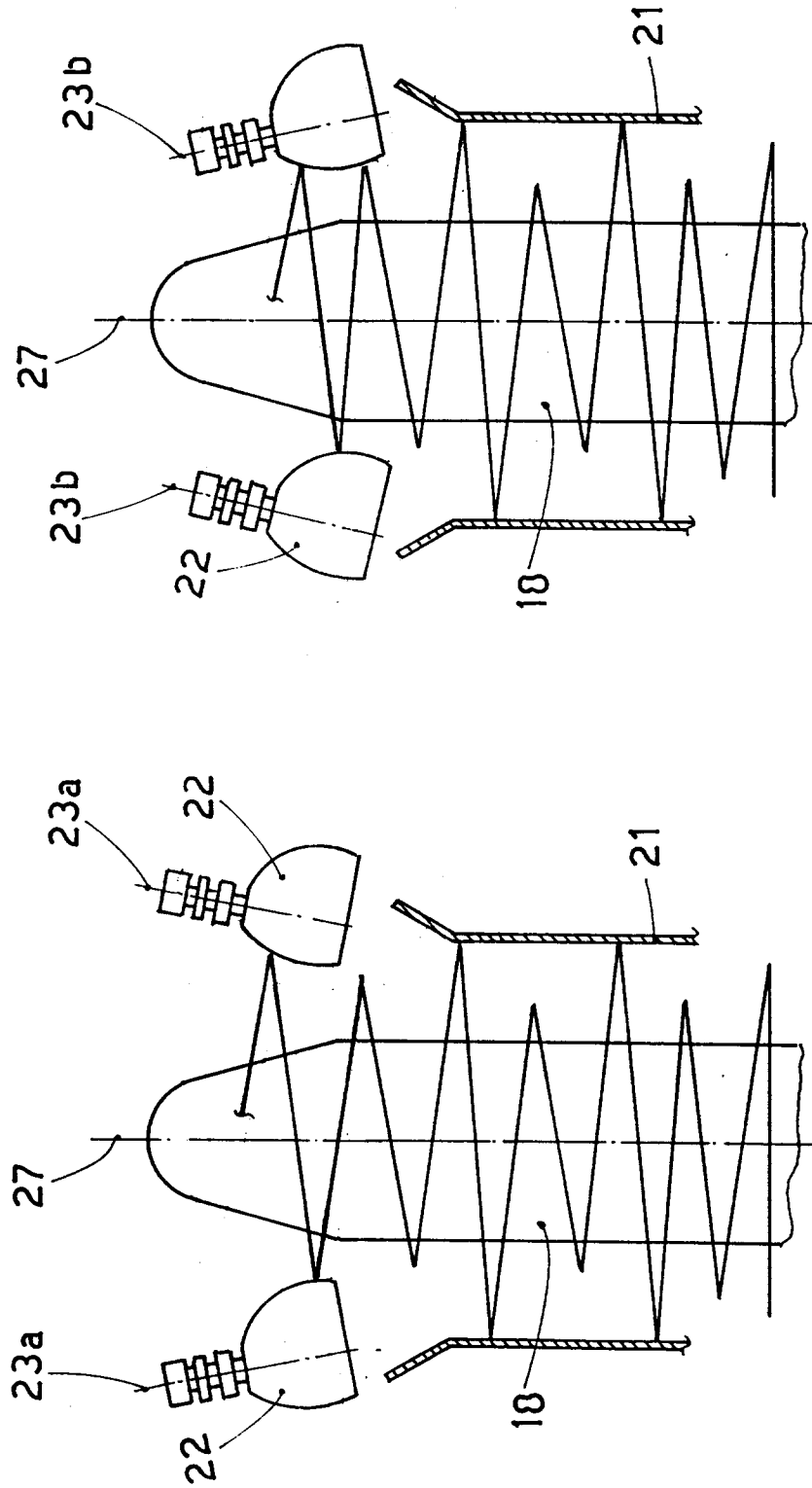


fig. 4

fig. 5



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EUROPEAN SEARCH REPORT

Application Number
EP 95 10 7504

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-2 527 662 (STEVENS) * the whole document * ---	1	B21C47/14
D,A	EP-A-0 583 099 (STARVASKI) * column 3, line 37 - column 4, line 20; claims; figures 3,4,7 * ---		
D,A	DE-A-12 35 100 (DEMAG) ---		
D,A	US-A-RE26052 (CRUM) -----		
			TECHNICAL FIELDS SEARCHED (Int.Cl.6)
			B21C
The present search report has been drawn up for all claims			
Place of search THE HAGUE		Date of completion of the search 25 August 1995	Examiner Peeters, L
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