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(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 (30), 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 including a rotary plate (21) positioned on a plane substantially at a right angle to the axis of the stacking element (18), the rotary plate (21) containing a hole (31) for the entry, guiding and conveying of loops (15), this entry, guiding and conveying hole (31) having a first extreme position with its axis (26) parallel to the axis (27) of the stacking element (18) and with an eccentricity **"1"** in relation to that axis (27) and a second extreme position in which its own axis (26) coincides substantially with the axis (27) of the stacking element (18).

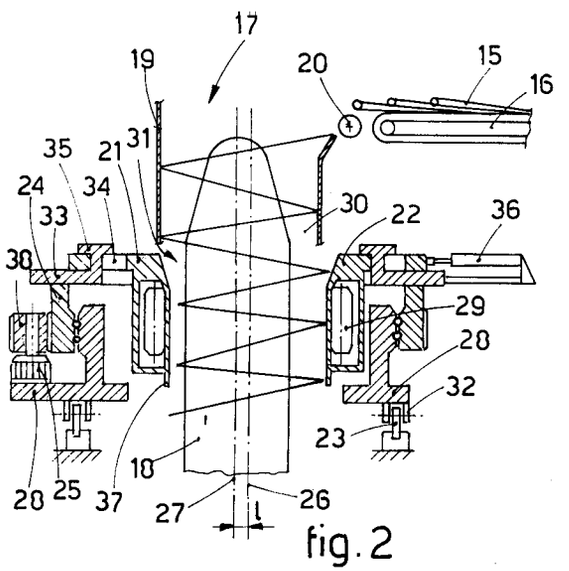

fig. 2

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

To be more exact, the device according to the invention is employed in a rolling plant at the coil-forming station located downstream of the rolling train and cooling area.

This invention is suitable to cooperate with the conventional assemblies that form and convey 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 pre-arranged 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 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 a 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 provide for the ability to alter and adjust the eccentric depositing of the loops in a desired manner, nor does it make possible in any case a possible axial depositing of the loops according to the axis of the stacking element. Moreover, this document provides for the use of an appropriately shaped and conformed guide element, and this situation entails complex and accurate calculations to produce the correct form and yet other drawbacks.

Moreover, in this document of the prior art each discharged loop is displaced by the rotary deflector substantially as soon as the loop leaves the removal conveyor, that is to say, there is no first guiding segment positioned substantially on the same axis as the stacking element, whereas in a first guiding segment each loop has time to take up an orderly and correct position.

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

Furthermore, the deflector does not apply a guiding action to the falling loops but applies only a lateral displacement action, thus causing deformations of the loops.

Besides, the drive system for setting 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 disclose 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 depositing of the loops to be altered in a desired manner, even during working, and also makes possible a depositing of loops on the same axis as each other or also on the axis of the stacking element when so necessitated by the coil-forming method.

According to the invention the device is advantageously, but not only, suitable to cooperate with a coil-forming chamber containing a relative axial stacking element, the chamber having a substantially vertical axis, and the description that follows will refer to that chamber.

The device according to the invention includes a substantially circular plate positioned in cooperation with the stacking element in a position at least below the zone of discharge of the loops from the conveyor.

This plate, which has a perimeter at least greater than the perimeter of the stacking element, cooperates with means suitable to rotate the plate about a substantially parallel axis advantageously coinciding with the axis of the coil-forming chamber, this axis in this case being substantially vertical.

This rotary plate contains a loop entry, guiding and conveying hole associated at its the upper end with an intake cooperating with the downstream end of the conveyor belt delivering the loops; this intake is at least partly flared upwards so as to assist entry of the loops discharged from the conveyor.

According to the invention a substantially cylindrical guide element coaxial with the axis of the stacking element is included above the plane defined by the rotary plate and cooperates directly with the zone of release by the conveyor conveying the loops.

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

The asymmetric depositing device according to the invention thus acts on loops which are already correctly positioned and guided even where the discharge from the conveyor means takes place in a very fast and disorderly manner.

According to one embodiment of the invention the entry, guiding and conveying hole machined in the rotary plate extends downwards into a guide channel, which surrounds the stacking element of the loops circumferentially and has a diameter at least greater than that of the stacking element and advantageously substantially almost equal to the diameter of the loops.

According to the invention the axis of the loop entry, guiding and conveying hole is parallel to, but does not coincide with, the axis of rotation of the rotary plate.

In particular, this entry, guiding and conveying hole is offset in relation to the axis of the stacking element.

In other words, the entry, guiding and conveying hole is machined in the rotary plate eccentrically, with a desired value of eccentricity, in relation to the axis of rotation of the rotary plate so as to achieve an asymmetric depositing of the loops about the stacking element as the loops are discharged from the conveyor.

In this way the entry, guiding and conveying hole together with the guide channel associated therewith, defines by the rotation of the rotary plate a circumference of a passage for the loops, this circumference being eccentric in relation to the stacking element; this eccentricity may vary progressively and sequentially from a maximum value in one direction to a maximum value in the opposite direction.

The outer periphery of the guide channel cooperates with idler rollers, which act as a bearing for the rotation of the rotary plate during the process of depositing of the loops.

According to a variant the guide channel is not included, and the idler rollers act, below the entry, guiding and conveying hole, as guide means for the loops being discharged into the coil-forming chamber.

According to the invention the rotary plate is associated with means which enable the positioning of the axis of the entry, guiding and conveying hole to be altered as desired in relation to the axis of the stacking element.

It is thus possible to alter in a desired manner the value of the eccentricity of the depositing of the loops, even during working, from a determined maximum value with an eccentricity **"1"** to a determined minimum value with a nil eccentricity.

In the latter case, in particular, the rotary plate takes up a position in which it is possible to obtain axial depositing of the loops in relation to the stacking element by placing the relative entry, guiding and conveying hole on the same axis as the axis of the stacking element.

The eccentric position of the entry, guiding and conveying hole in relation to the stacking element, together with the rotation of the rotary plate in which the loop entry and conveying hole is machined, enables a depositing of the loops to be achieved whereby the loops are staggered in relation to each other according to a pre-arranged periodical sequence.

The depositing performed in this way enables a coil to be produced which is improved in terms of

its occupation of space in a vertical direction, its density, its stability and balance and its compactness.

Moreover, the coils thus produced can cooperate more effectively and uniformly with any cooling systems since the individual loops can be lapped in an easier and more uniform manner by the action of such cooling systems.

The attached figures are given as a non-restrictive example and show a preferred embodiment 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 is a lengthwise section of the device according to the invention;

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

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 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 a substantially vertical axis 27 so as to form a coil.

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

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

A rotary plate 21 positioned on a plane substantially at a right angle to the axis of the stacking element 18 is included below the cylindrical guide element 19; in this plate 21 is machined a hole 31 for the entry, guiding and conveying of loops 15.

The rotary plate 21 and the cylindrical guide element 19 define a coil-forming chamber 30 about the periphery of the stacking element 18.

The entry, guiding and conveying hole 31 for loops 15 cooperates at its upper end in this case with an intake 22 upwardly flared to assist entry of the loops 15 discharged from the conveyor 16 and guided by the cylindrical guide element 19 into the coil-forming chamber 30.

The entry, guiding and conveying hole 31 for loops 15 has a diameter at least greater than the diameter of the stacking element 18 and coinciding substantially with the diameter of the loops 15.

This entry, guiding and conveying hole 31 is associated at its lower end with a cylindrical guide channel 37 which surrounds the stacking element 18 circumferentially.

According to the invention the rotary plate 21 is solidly associated at its lower end with a rotary disk 33, which in turn is solidly fixed to a lower plate 24, which is installed on a stationary support 28 and acts as a motion-transmission element and as a bearing for the rotary plate 21 and rotary disk 33.

The lower plate 24 is driven by a gearwheel 38 associated with a motor 25.

During the step of depositing of the loops 15 the lower plate 24 is set in rotation, thus imparting rotary motion to the rotary plate 21 and the rotary disk 33.

The rotary plate 21 has an axis of rotation which coincides substantially with the axis 27 of the stacking element 18, thus producing the asymmetric depositing of the loops 15.

According to the invention the rotary plate 21 has at least one position in which the axis 26 of the entry, guiding and conveying hole 31 for the loops 15 is substantially parallel to, but does not coincide with, the axis 27 of the stacking element 18.

In this case the eccentricity as between the stacking element 18 and the entry, guiding and conveying hole 31 for the loops 15 is referenced with **"1"**.

In a typical case of application, where the diameter of the stacking element 18 is about 850 mm. and the diameter of the entry, guiding and conveying hole 31 for loops 15 is about 1300 mm., the value of **"1"** is about 80 to 140 mm., but advantageously between 100 and 120 mm.

In general the eccentricity **"1"** of the entry, guiding and conveying hole 31 for loops 15 has a value between about 8% and about 15% of the diameter of the entry, guiding and conveying hole 31.

This eccentricity of the entry and conveying hole 31 together with the rotation of the rotary plate 21 leads to a depositing of the loops 15 about the stacking element 18 according to a staggered, prearranged and periodical sequence in relation to the axis 27 of the stacking element 18.

This asymmetric and progressively staggered arrangement of the loops 15 about the circumference defined by the stacking element 18 leads to greater filling of space, better stability, greater density and greater compactness of the coil produced.

According to a variant idler rollers 29 acting as a bearing during rotation of the rotary plate 21 are

included on the circumference of the guide channel 37.

According to another variant the guide channel 37 is not included and the idler rollers 29 cooperate directly from below with the entry, guiding and conveying hole 31 so as to guide the loops 15 during descent of the latter 15 about the stacking element 18.

According to the invention a plurality of holes or slots 34 are machined and advantageously distributed symmetrically in the rotary plate 21. An abutment element 35 advantageously machined directly from the rotary disk 33 located below the rotary plate 21 is inserted into each of the holes or slots 34. These abutment elements 35 advantageously are T-shaped so as to act as a lateral abutment and also as a vertical abutment for the rotary plate 21.

However, other vertical abutment elements too can be used for the rotary plate 21 and can be jacks for instance.

According to the invention it is possible to alter in a desired manner the eccentricity of the loop entry, guiding and conveying hole 31 in relation to the axis 27 of the stacking element 18 by associating the rotary plate 21 with independent actuator means such as a jack 36, for instance, fitted to the rotary disk 33 in this case.

This adjustment ability enables the eccentricity **"1"** to be altered between maximum and minimum values, which are determined by the dimensions of the holes or slots 34. This enables a desired, more or less eccentric depositing of the loops 15 about the stacking element 18 to be produced, or else a perfectly symmetric depositing to be carried out, where necessary for the processing requirements, by making the axes 26 and 27 coincide.

According to a variant the device to deposit the loops 15 asymmetrically comprises also wheels or analogous means 32 associated with rails or guides 23.

These wheels make possible the alteration of the position of the rotary plate 21 in relation to the stacking element 18 in a desired manner and also the movement of the device during maintenance or other corrective action.

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 (30), 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 characterized in that it includes a rotary plate (21) positioned on a plane substantially at a right angle to the axis of the stacking element (18), the rotary plate (21) containing a hole (31) for the entry, guiding and conveying of loops (15), this entry, guiding and conveying hole (31) having a first extreme position with its axis (26) parallel to the axis (27) of the stacking element (18) and with an eccentricity **"1"** in relation to that axis (27) and a second extreme position in which its own axis (26) coincides substantially with the axis (27) of the stacking element (18).

2. Device as in Claim 1, in which the entry, guiding and conveying hole (31) contains at its lower end a guide channel (37) coaxial with the axis (26) of that hole (31).

3. Device as in Claim 1, in which the entry, guiding and conveying hole (31) cooperate with guide rollers (29) having their axis substantially parallel to the axis (26) of that hole (31).

4. Device as in any Claim 2, in which the guide rollers (29) cooperate with the outer periphery of the guide channel (37).

5. Device as in any claim hereinbefore, in which a tubular cylindrical 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 rotary plate (21) and the discharge zone of the conveyor means (16).

6. Device as in any claim hereinbefore, in which the eccentricity **"1"** of the entry, guiding and conveying hole (31) for the loops (15) is equal to between 8% and 15% of the diameter of the entry, guiding and conveying hole (31).

7. Device as in any claim hereinbefore, in which the rotary plate (21) includes at its upper end an upwardly flared intake (22) for the entry, guiding and conveying of loops (15).

8. Device as in any claim hereinbefore, in which the rotary plate (21) includes means to alter and regulate the eccentricity of the entry, guiding and conveying hole (31) in relation to the axis (27) of the stacking element (18).

9. Device as in Claim 8, in which the means to alter and regulate the eccentricity comprise slot means (34) machined on the periphery of the rotary plate (21) and associated with at least lateral stationary abutments (35), the rotary plate (21) being associated with jack

means (36) for its at least lateral displacement.

10. Device as in any claim hereinbefore, which comprises wheels (32) for lateral displacement.

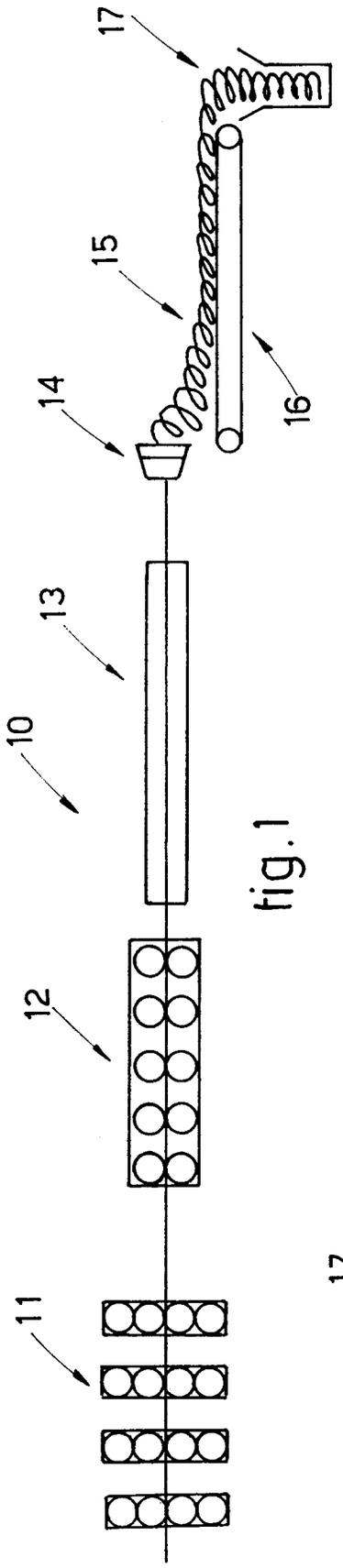

fig.1

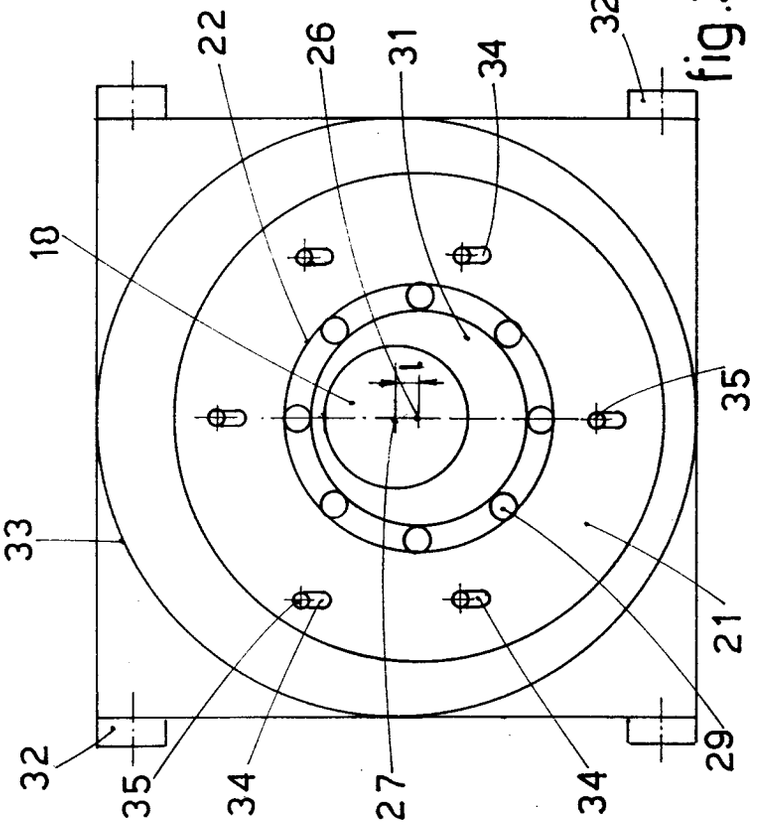

fig.3

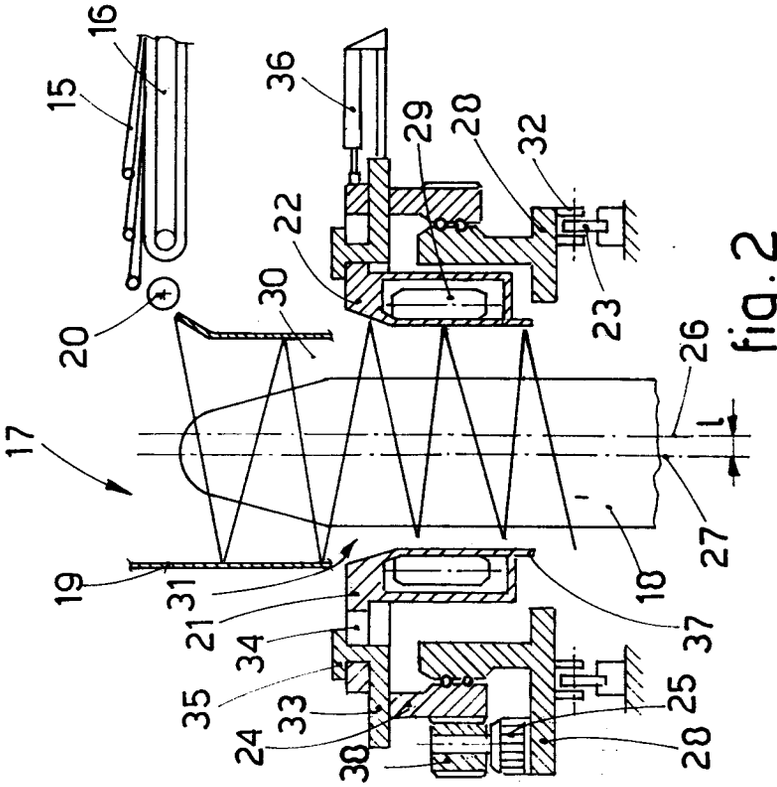

fig.2

European Patent Office

EUROPEAN SEARCH REPORT

Application Number
EP 95 10 7585

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)
D,A	EP-A-0 583 099 (STARVASKI) * column 3, line 37 - column 4, line 20; claims; figures 3,4,7 *	1-3	B21C47/14
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	Date of completion of the search	Examiner
THE HAGUE	24 August 1995	Peeters, L

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
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