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APPARATUS FOR LOOSENING TIGHTLY WOUND REELS OF STRIP

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Fig:1

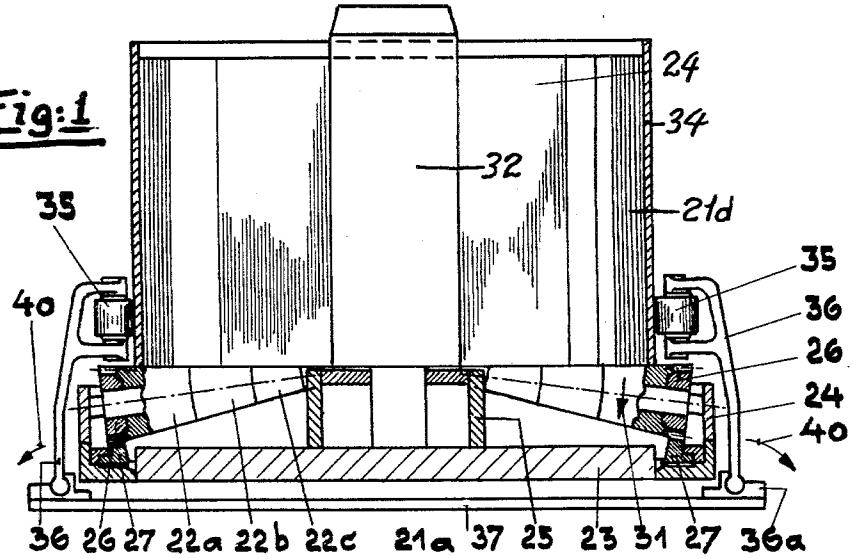
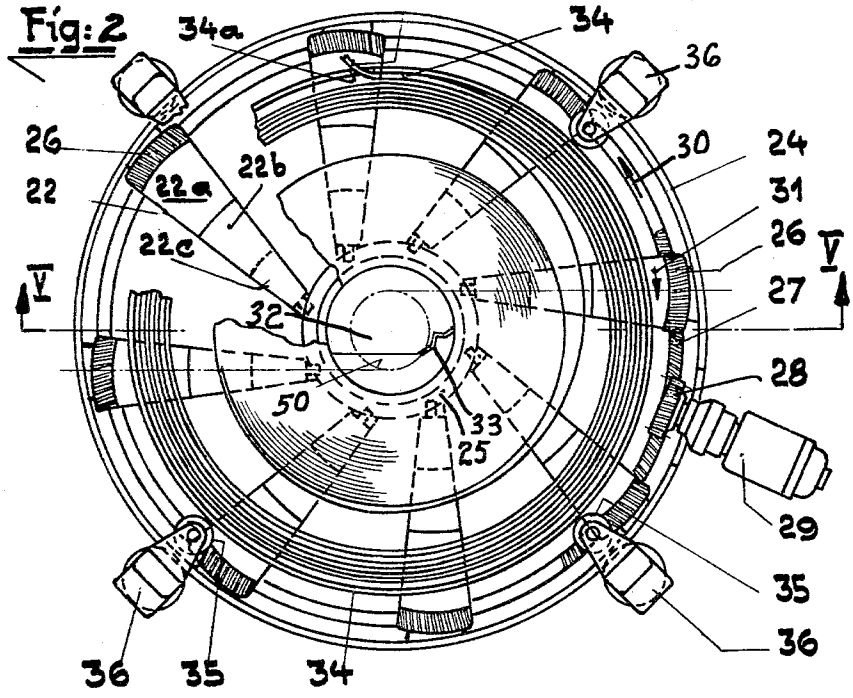


Fig:2



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APPARATUS FOR LOOSENING TIGHTLY WOUND REELS OF STRIP

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Thin metal sheets are usually rolled in the form of strip. Due to the strong reduction in the cold rolling mill, the rolled strip is usually very hard and must therefore be annealed in an inert gas atmosphere. Strip which requires, in view of the material properties or the quality required by the user, longer annealing, is usually annealed in the reeled up condition, that is to say, in the form of a bundle. For this annealing of whole bundles, there are known many constructions of furnaces, capable of receiving even the heaviest bundles with the widest strip. Known annealing furnaces with inert gas atmosphere operate in such a way that, in addition to the direct transfer of heat by radiation, heat is also indirectly transferred by the circulating inert gas. The fan-circulated gas has here the object of distributing the heat created at the inner walls of the furnace uniformly over the interior and to the surfaces of the annealing material which are remote from the furnace walls and are not affected by direct radiation.

During the annealing of a tightly wound strip bundle, as it is received from the cold rolling mill, the heat penetrates only from the edges, that is to say from the end faces of the bundle, into the individual turns, because there is a layer of air between each turn, acting as an insulator. In consequence, the edges of the strip are exposed to the heat for a much longer period than the centre. This, as well as the fact that the centre of the windings of a tightly wound strip is only insufficiently affected by the inert gas, causes certain differences in the quality of the sheet, apparent especially in a coarser grain structure along the edges.

In order to eliminate these disadvantages, it is already known to open tightly wound reels coming from the mill by rewinding the same. During this rewinding, a wire or thread, particularly of nylon, is wound into the newly formed reel, and this is removed after the rewinding is finished. In this manner there is formed an open reel in the shape of a spiral, with spaced individual turns through which the inert gas may flow. This method of open annealing has been found very successful, especially because the heating up rate of the reel to be annealed is considerably improved.

However, these known rereeling devices for carrying out the rereeling described above are very complicated, bulky, and occupy much space. First, in order to achieve the smooth run-off of the strip from the tightly wound reel, the strip must first be tensioned, and thereby necessarily be stretched. Down-stream of the tensioning device, the strip must be supplied to the reeling mechanism practically without tension, and the strip, together with the thread, must be loosely fitted over the last turn. Particular difficulties are encountered where thicker strip of hard and brittle material is to be re-reeled, because the strip must be given a different radius of curvature for every successive turn. In order to realize this object, expensive and complicated electric controlling and synchronizing arrangements are necessary for regulating the run of the strip during the re-reeling. A further disadvantage is that the thread to be incorporated, usually of nylon, must have a certain minimum thickness, in order to withstand the stresses imposed on it during the pulling out. Thus,

there result very large reel diameters, especially during the re-reeling of very thin strip.

The present invention has the object of providing a method and an apparatus, whereby these difficulties and drawbacks may be avoided.

According to the invention, the tightly wound strip is placed with one face on a support provided with a fixed, non-rotating core, and the outer winding is slackened until it forms a sufficiently large circle and may be mounted in a cylindrical outer shell, which is rotatable and surrounds the support and the reel, so that by rotating this outer cylinder in the appropriate direction one winding after the other is pulled off the smaller, tightly wound reel, forming a larger diameter reel; during the pulling off, a force delaying the radially expanding movement is applied, preventing the firm contact between a turn and the preceding turn. In this manner, an open reel with gaps between the individual turns is formed. Starting with the outermost turn, the individual turns are loosened and given a larger diameter, whilst the innermost turn may remain in its previous position. The strip itself need not be stretched or pass through any tensioning or straightening devices; this is of special advantage in the case of heavy gauge or brittle materials, and with materials with sensitive surfaces.

Of importance is also a further feature of the invention, namely that the force necessary for delaying the expansion of the turn running off the tightly wound reel, may be provided by a mechanically produced braking effect. In this way, the method of the invention may be adapted to the conditions and requirements, producing an optimum output and working rate for the processing of any kind of strip.

An apparatus embodying these features is very small, and requires only little more space than the diameter of the expanded reel. The device is simple, cheap, of very sturdy construction, reliable in operation, and has a long working life.

In a preferred embodiment of this apparatus, the supporting surface for receiving the reel comprises several conical rollers, arranged in a star-like manner about a stationary non-rotating core, wherein the conical rollers are positioned obliquely in relation to the radial of the core. This construction has the advantage of requiring no further means in order to delay the expansion movement of the turns pulled off the reel. Due to the oblique position of the taper rollers, the turn is given a bias preventing it from resting completely against the preceding outer turn.

This device for carrying out the method of the invention, comprises only a single working station with one driving unit, eliminating the control and synchronizing arrangements that are necessary with known rereeling devices.

The invention will be further described, by way of example, with reference to the accompanying drawings, showing the preferred embodiment of the apparatus for carrying out the method according to the invention. The drawings are diagrammatic and restricted to the essential parts of the apparatus, whilst constructional details which are within the knowledge of the expert are omitted.

In the drawings:

FIG. 1 is a sectional side elevation of the apparatus of the invention; and

FIG. 2 is a plan view of the apparatus of FIG. 1.

In the embodiment illustrated, the force delaying the expansion movement of the strip is produced by a mechanically generated braking effect.

In this embodiment, the supporting surface for receiving the reel 21 consists of several conical rollers 22 with horizontal upper edges, arranged in star shape on a base

plate 23 between two rings 24 and 25 receiving their bearings. The roller arrangement is such that the conical rollers are not arranged radially, but tangentially about an imaginary inner circle 50. The axes of the rollers 22 form therefore an angle with the radii of the apparatus. The conical rollers are each subdivided, for example, into sections 22*a*, 22*b*, 22*c*. The outermost frusto-conical section 22*a* is fixed on the roller spindle, whilst the thinner sections 22*b*, 22*c* are independently rotatable on the spindle. The outer end of each roller 22 also carries a gear 26 mounted on the roller spindle. All the gears 26 engage into a gear rim 27 mounted in the base plate 23, connected to a pinion 28 with a motor 29, and rotatable in the direction of the arrow 30, so that all the conical rollers 22 are uniformly driven in the sense of the arrow 31. In view of the obliquity of the roller spindles, this gear drive requires a skew-bevel toothing.

The centre of the device has a fixed non-rotating core 32, having a clamping device 33 in the shape of a vertical slot in the core 32, serving to hold the inner strip end. The outer shell 34, mounted loosely on the conical rollers 22 and centered on the device preferably by means of several centering and guide rollers 35 in cross-wise arrangement, and acting on the shell from the outside, is driven by frictional contact with the rollers 22. Arms 36 carrying the centering or guide rollers 35, are rockable in a bearing 36*a* so that the guide rollers 35 may be rocked out in the direction of the arrow 40 to facilitate the fitting and lifting of the shell 34. The operation of this device is substantially the same as that described above. When the reel 21 and the outer shell 34 have been fitted, and the outer shell 34 centered by the guide rollers 35, the inner strip end is fixed to the core and the outer strip end to the outer shell 34 in the slot 34*a*. Then the driving mechanism is actuated and the conical rollers 22, and with them the outer shell 34 rotate. The inwardly facing roller sections 22*b*, 22*c*, rotatably mounted on the roller spindles, are at first held by the weight of the tight stationary reel 21, so that the lower edge of the strip cannot be damaged by sliding along the rollers 22.

The turns detached from the reel by the rotation of the shell 34 move radially outwardly and slide over the rotating roller sections 22*a*. Since the conical rollers 22*a* and their spindles form an angle with the radii of the apparatus, the turns passing over the revolving rollers are affected by a tension normal to the axial direction of the rollers 22, generating with the tangential force of the turns a force component radially directed towards the core. Thus, the turns are biased, preventing them from firmly resting against the preceding outer turns.

With the decreasing diameter of the tight reel during the re-reeling, the inner roller sections 22*b* and 22*c* are successively released and entrained by the revolving roller spindles. In order to produce a uniformly expanded reel, the outer shell 34 must be uniformly driven and slipping must be avoided between the rollers 22*a* and the outer shell 34, whereby the outer shell might be retarded relative to the movement of the conical rollers.

The embodiment described herein merely exemplifies the principle of the invention and may be modified by alterations in the assembly and in the construction, without departing from this principle. It is, for example, possible to design the apparatus with a stationary outer shell whilst rotating the core and thereby the tight reel. It is also possible, in order to produce a high operating speed, to rotate the outer shell and the core in opposite directions. Furthermore, the device may be swivelable, in order to facilitate the mounting and removal of new reels.

What I claim is:

1. Apparatus for loosening a tightly wound bunch of strip, comprising: a base-plate, a stationary central vertical core mounted on the base-plate, an inner ring and an outer ring associated concentrically with the base-plate, a plurality of spindles each journaled at one end in the inner ring and at the other end in the outer ring, and each extending nearly but not quite radially towards the vertical axis of the core, a plurality of conical rollers, one on each spindle, these rollers collectively constituting a supporting means for the coil of strip, a rotatable cylindrical outer casing, large enough to enclose the bunch of strip in its ultimate loosened form when resting on the said supporting means, means for attaching the outer edge of the bunch of strip to the outer casing, and means for rotating the outer casing relatively to the inner vertical core, the deflection of the spindles from a radial direction being in such a sense as to retard the radially proceeding expansion of the individual turns, so as to leave a space between the turns as they are successively drawn off from the tightly wound bunch.

2 Apparatus for loosening a tightly wound bunch of strip as claimed in claim 1, each of the conical rollers being divided into sections, the outermost section of each roller, which is the section of greatest diameter, being mounted fast upon its spindle, whilst the remaining roller sections, which are of smaller diameter, are freely rotatably upon their spindles, and can only be driven by friction from their adjacent larger roller sections and from their spindles, and the apparatus further comprising means for driving all the roller spindles from a common source of power.

3. Apparatus for loosening a tightly wound bunch of strip as claimed in claim 2, the means for rotating the outer casing being constituted by the means for driving the roller spindles in conjunction with the friction between the roller spindles and the outer casing.

4. Apparatus for loosening a tightly wound bunch of strip as claimed in claim 1, further comprising means, acting upon the external surface of the outer casing, for guiding and centering the said casing, the said guiding and centering means being rockable outwards to facilitate placing the bunch of strip and the outer casing in position.

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