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BRAKING DEVICE FOR USE IN THE WINDING OF A NUMBER OF STRIPS UPON A COMMON MANDREL

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Fig. 1.

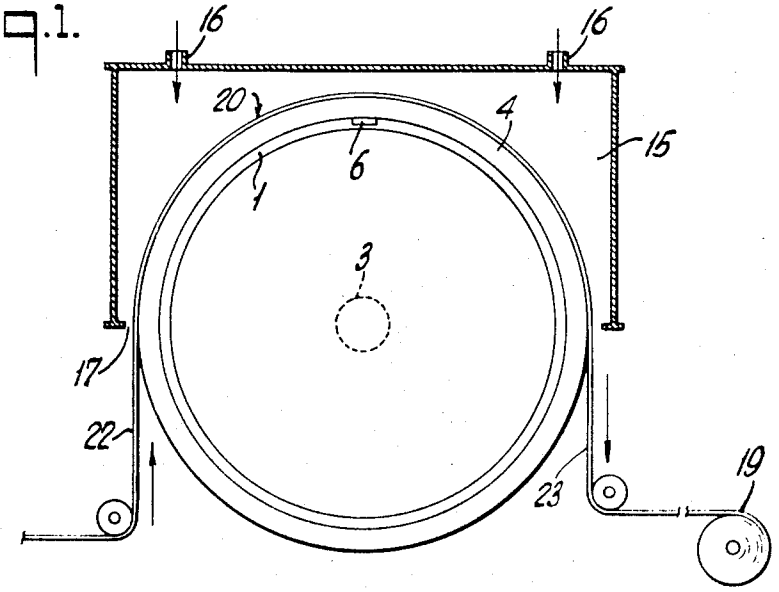
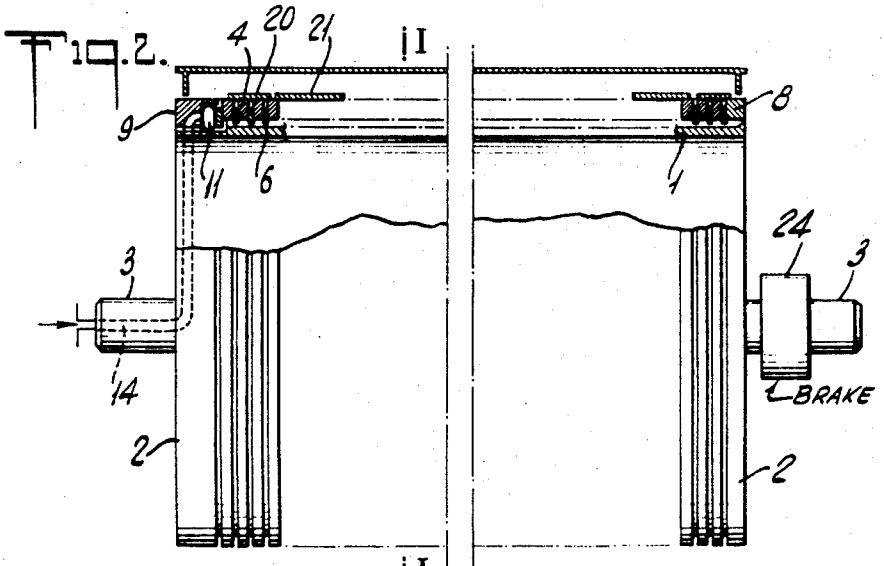


Fig. 2.



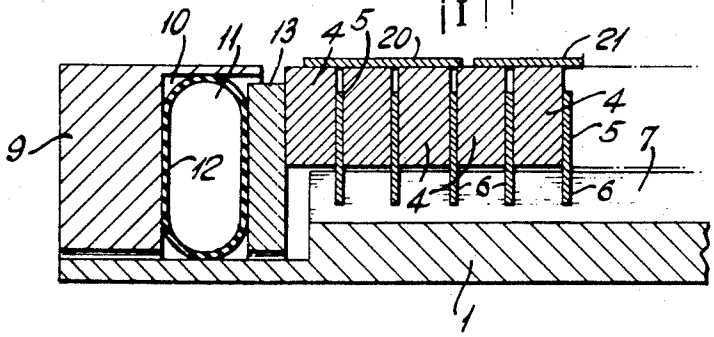


Fig. 3.

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BRAKING DEVICE FOR USE IN THE WINDING OF A NUMBER OF STRIPS UPON A COMMON MANDREL

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U.S. Cl. 242—75.2 10 Claims

ABSTRACT OF THE DISCLOSURE

In winding juxtaposed strips upon a common mandrel, varying tensions of the strips are equalized by a braking device comprising a multiplicity of juxtaposed braking rings freely rotatively mounted upon a drum. The juxtaposed strips to be wound are applied to engage an arc-shaped area of the cylindrical surface formed by the edges of the rings and the strips are maintained in intimate friction contact with said surface by fluid pressure. The braking rings are spaced by intervening spacing rings of lesser diameter and mounted upon the drum to move freely axially but being locked against rotation. The resultant composite stack of alternate braking and spacing rings is held under predetermined axial pressure by an inflatable fluid pressure chamber.

The present invention relates to the winding of strips or webs consisting of any material, more particularly to the simultaneous winding of a number of juxtaposed strips upon a common receiving arbor or mandrel, a main object of the invention being the provision of apparatus to control the winding tensions of the strips, in such a manner as to keep the same at a substantially constant value throughout the winding operations and to result in coils of substantially uniform tightness.

In metallurgical and other plants, it is customary to slit the webs of great length by unwinding the same from a supply roll, the strips or webs being slit or cut in the longitudinal direction by means of shearing mechanism, such as circular blades or cutters, the partial strips being thereafter wound upon a common receiving arbor or mandrel.

It is furthermore customary in practice, in carrying out winding operations of this type, for equalizing purposes, to provide a catenary sag between the shearing and winding mechanisms and to maintain this sag, such as by operating the shearing devices in synchronism with the rotation of the winding mandrel.

In the employment of a combined slitting and winding operation of this type, it is observed, for reasons well known, that the height of the sag is not constant for each of the partial strips cut from an original wider strip, whereby to result in differences in the linear velocities of the strips being wound and, in turn, in non-uniform winding tensions or irregularly wound coils upon the common arbor or mandrel.

As a consequence, when several strips, produced for example from a single strip by slitting, or originating from any other source involving variations of the strip velocities, have to be wound upon a single mandrel in such a way that the winding tensions of all the strips are uniformly close, each of the strips must of necessity be subjected to some braking action prior to winding.

When handling strips of metal or magnetically active material, the partial strips may for this purpose be individually subjected to the braking action of electric eddy currents, to control the winding tensions of the strips, such as shown and described in applicant's copending patent application Ser. No. 559,834, filed June 23, 1966, entitled Apparatus for Winding Electrically Conducting Metal Strips, now Patent No. 3,380,686.

While braking or strip tension control devices of the type according to the foregoing patent have been found to operate satisfactorily, they cannot of course be employed for the winding of strips made of non-metallic or non-conducting materials.

Accordingly, a further object of the present invention is the provision of multiple strip tensioning means of the referred to type for use in connection with the winding of multiple strips consisting of any material upon a common mandrel.

Another object of the invention is the provision of a strip tensioning device of the referred to type, especially for use in conjunction with the winding of multiple strips made of any material upon a common mandrel, said device affording an individual control of the strip tensioning forces, to result in substantially uniformly wound coils upon a common receiving arbor or mandrel.

Yet another object of the invention is the provision of a multiple strip braking device of the referred to type, enabling the braking force or stress on the strips to be varied simply and economically, to control the winding tension and to suit existing operating conditions and requirements.

The invention, both as to the foregoing and ancillary objects as well as novel aspects thereof, will be better understood from the following detailed description of a preferred practical embodiment, taken in conjunction with the accompanying drawing forming part of this specification and in which:

FIG. 1 is a transverse section, taken on line I—I of FIG. 2, of a multiple strip braking device constructed in accordance with the principles of the invention:

FIG. 2 is an elevation, partly shown in section, of the device according to FIG. 1; and

FIG. 3 is a fragmentary view, on an enlarged scale, more clearly showing the upper left-hand portion of FIG. 2.

Like reference numerals denote like parts in the different views of the drawing.

With the foregoing objects in view, the invention involves essentially the provision of a braking device for the control of the winding tensions of a plurality of strips on their way to a common winding mandrel, said device being composed of a multiplicity of aligned and superposed braking rings rotatably mounted upon a drum forming a support therefor. The rings, the outer edges of which present a cylindrical bearing surface for the application thereto in contact with a predetermined arc-shaped portion thereof of said strips, prior to their winding upon said mandrel, are maintained under a suitable axial pressure by resilient means, preferably in the form of an inflatable toroidal chamber acting upon one end of the stack of braking rings. Advantageously, the braking rings alternate with special spacing rings being of lesser outer diameter than the former and also mounted upon said drum such as to be blocked against rotation thereby but freely axially sliding thereon together with the braking rings. The strips applied to said bearing surface are maintained in frictional contact therewith at a predetermined pressure, by suitable fluid pressure applying means, in such a manner as to enable rotation of the braking rings relative said spacing rings against the braking force of said resilient means, to individually control the winding tensions of the strips. Variations of the strip velocities are thus readily equalized by corresponding relative rotation or slippage of the respective disks engaged by the different strips being

wound. In order to afford an additional control of the braking force and in turn of the winding tension, the drum may be mounted for rotation and fitted with further preferably adjustable braking means, in a manner as will become further apparent and understood from the following description in reference to the drawing.

Freely rotatably mounted on a cylindrical drum or barrel **1**, connected at its end faces **2** to an arbor **3**, are a plurality of aligned and superposed braking rings **4** separated from each other by relatively thin spacing rings **5** of lesser outer diameter than the rings **4**. The rings **5** have projections **6** at their inner periphery, in the form of castellations or the like, which engage in corresponding longitudinal grooves **7** in the drum **1**, whereby the rings **5** are rigid in rotation with the drum **1**, in contrast to the freely rotating rings **4**, the latter and the rings **5** being, however axially, slidable, for the purpose as will become apparent as the description proceeds.

The drum **1** forms or carries a fixed abutment **8** at one end and a head **9** at its other end, forming at its side facing the rings **4** an annular housing **10** adapted to receive an inflatable toroidal chamber **11** supported by its outer face against the bottom **12** of the housing **10** and having its outer periphery engaging the annular wall of the head **9** which bounds the housing **10** towards the outside and against the drum **1** by its internal periphery. The interior face of the inflatable member **11** is applied against an annular spacing piece **13** disposed between said chamber and the first ring of the stack of rings **4**. There is indicated diagrammatically at **14** the passage or conduit through the arbor **3** for supplying compressed air or a like pressurized fluid to the chamber **11**.

The device is completed by an open-ended casing **15** enclosing the upper portion of the drum **1** and fitted with inlets **16** for the admission of compressed air or the like into the chamber enclosed by said casing and the drum **1**. The casing substantially engages at **17** the strips **20**, **21**, etc. which pass on to the rings **4**, to provide a fluid escape gap, the supply to the casing **15** of compressed air being sufficient in all cases to compensate for the air escaping between the edge of the casing and the drum or strips applied thereto.

In the embodiment of the invention shown by the drawing, the inlet and outlet portions **22** and **23** of the strips, being passed around suitable guide rollers, are parallel, but they could also form any desired angle between them, provided that the arc over which the strips engage the rings **4** is sufficient to provide adequate friction between the strips and rings. After leaving the drum **1**, the strips are wound upon a receiving or winding mandrel **19** rotated as indicated by the arrow in the drawing.

In operation, the introduction of compressed air or the like into the chamber **11** causes the latter to resiliently apply the rings **4** against the rings **5** via the spacing member **13**, at the same time as the compressed air contained in the casing **15** brings about the application of the strips **20**, **21**, etc. against the arc-shaped bearing surface of peripheries of the rings **4** within said casing. As can be seen, in an arrangement as shown, that is, with the outer diameter of the spacing rings **5** being less than the diameter of the braking rings **4**, a substantial number of rings, forming multiples of the number of strips **20**, **21**, etc. to be tensioned, are provided, thus allowing the same device to be used for the winding of varying numbers of strips of either the same or different widths.

The braking device according to the invention may operate, for example, by immobilizing, by any appropriate means, the arbor **3** of the drum, or by maintaining the drum in a stationary position. The rings **4** are then driven in rotation by the strips **20**, **21**, etc., such rotation being braked or decelerated to the extent that the chamber **11** applies them with adjustable force against the rings **5**. With the force of application of the rings **4** against the rings **5** being uniformly distributed between all the rings, the latter will exert a constant braking action on all the strips which are themselves applied at constant pressure against the peripheries of the rings **4** by the compressed air in the casing **15**. In this way, there is obtained a substantially uniform closeness between the coils of all the strips wound on the receiving mandrel **19**.

According to a modified operation, controlled rotation may be applied to the drum **1** by a suitable braking device **24** acting on its arbor **3**. It is then the strip which advances at the lowest speed which determines the speed of rotation of the drum, all the remaining strips passing at greater speeds driving in rotation the rings which they engage, whereby again to ensure a braking effect on all the strips and to result in a substantially uniform winding tension or closeness of the turns wound upon the receiving mandrel **19**.

Evidently, the pressure of inflation of the expanding chamber **11** and the braking force exerted on the arbor **3** may be adjustable, in an effort to vary the degree of closeness of the turns of the wound or coiled strips. In any case, the strips must be applied against the periphery of the rings **4** by the effect of compressed air or a like fluid medium in the casing **15** with a force exceeding the friction exerted between the rings **4** and the rings **5**.

The function of the braking device according to the invention will be further understood from the following. Assuming, for the sake of argument, the rings **4** to be connected at their peripheries, to form an integral cylindrical bearing surface for the strips **20**, **21**, etc., friction braking is effected between the rings **4** and the rings **5** by the former being driven or rotated by the strips, provided a proper pressure to be applied to the outside of the strips by the fluid medium in the casing **15**. Assuming all the strips to be fed to the device at the same initial velocity, the strips will then be braked or decelerated equally, determined by the braking force applied by the toroidal chamber **11**, whereby to result in a predetermined uniform winding tension or tightness of the coils wound upon the mandrel **19**.

On the other hand, if the initial velocities of the strips differ from each other, as in the majority of practical applications, it will no longer be possible to ensure a uniform winding tension, in that some of the strips will be decelerated to a more or lesser degree than the remainder of the strips by the common braking force applied by the inflated chamber **11**. This difficulty is overcome according to the invention by the subdivision of the braking surface into a multiplicity of discrete and narrow areas provided by the edge surfaces of the rings **4**, whereby to allow of relative rotation or slippage of the rings engaged by different strips, to in turn enable a ready equalization of the varying strip winding tensions and to result in substantially uniformly wound coils of a desired tightness, determined by the braking force applied by the chamber **11** and braking means **24**.

I claim:

1. A tensioning device for use in the winding of a plurality of strips upon a common rotating mandrel comprising in combination:

(1) a drum,

(2) a multiplicity of juxtaposed braking rings freely rotatively mounted upon said drum for supporting a plurality of strips applied, on their way to said mandrel, to an arc-shaped fractional area of the cylindrical surface formed by the edges of said rings,

(3) spacing rings intervening between and having a lesser outer diameter than said braking rings,

(4) means to lock said spacing rings against rotation but to allow of free axial movement thereof relative to said drum,

(5) resilient means to exert an axial pressure upon the stack of alternate braking and spacing rings, and

(6) means to apply a predetermined fluid pressure to said arc-shaped area, to maintain a friction pressure between the strips and said braking rings in excess

of the axial pressure between adjoining braking and spacing rings.

2. A braking device as claimed in claim 1, said resilient means being comprised of an inflatable toroidal fluid chamber disposed at one end of said drum and acting upon said stack in the axial direction against a fixed abutment at the opposite end of said drum.

3. A braking device as claimed in claim 2, including an annular housing at one end of said drum enclosing said chamber, to allow said chamber to expand in the axial direction only towards said rings.

4. A braking device as claimed in claim 2, including an annular spacer interposed between said chamber and said rings.

5. A braking device as claimed in claim 1, said last-mentioned means being comprised of an open-ended casing enclosing part of said drum, to provide a fluid escape gap between the edge of said casing and the strips engaging said braking rings, to provide a fluid chamber by said casing and said drum, and means to supply a compressed fluid to said further fluid chamber, to maintain a substantially constant contact pressure between said strips and braking rings.

6. A braking device as claimed in claim 1, said drum being stationary.

7. A braking device as claimed in claim 1, including means to freely rotatably support said drum, and further braking means to control the rotation of said drum.

8. A tensioning device for use in the winding of a plurality of strips upon a common rotating mandrel comprising in combination:

(1) a drum,

(2) a multiplicity of juxtaposed braking rings freely rotatively mounted upon said drum for supporting a plurality of strips applied, on their way to said mandrel, to an arc-shaped fractional area of the cylindrical surface formed by the edges of said rings,

(3) spacing rings intervening between said braking rings,

(4) means to lock said spacing rings against rotation but to allow of free axial movement thereof relative to said drum,

(5) resilient means to exert an axial pressure upon the stack of alternate braking and spacing rings, and

(6) means to apply a predetermined fluid pressure to said arc-shaped area, to maintain a friction pressure between the strips and said braking rings in excess of the axial pressure between adjoining braking and spacing rings.

9. A tensioning device as claimed in claim 8, said last means being comprised of an open-ended casing enclosing part of said drum, to provide a fluid escape gap between the edge of said casing and the strips engaging said braking rings, and means to introduce a compressed fluid into said casing, to maintain a substantially constant contact pressure between said strips and said braking rings.

10. A tensioning device for use in winding a plurality of strips upon a common rotating mandrel comprising in combination:

(1) a drum,

(2) a multiplicity of juxtaposed braking rings freely rotatively mounted upon said drum for supporting a plurality of strips applied, on their way to said mandrel, to an arc-shaped fractional area of the cylindrical surface formed by the edges of said rings,

(3) spacing rings intervening between and having a lesser outer diameter than said braking rings,

(4) means to lock said spacing rings against rotation but to allow of free axial movement thereof relative to said drum,

(5) resilient means to exert an axial pressure upon the stack of alternate braking and spacing rings, and

(6) means to maintain a predetermined frictional pressure between said strips and said braking rings in excess of the axial pressure between adjoining braking and spacing rings.

References Cited

UNITED STATES PATENTS

2,961,183	11/1960	Herr	242—75.2
3,386,679	6/1968	Foulon et al.	242—75.2

NATHAN L. MINTZ, Primary Examiner