United States Patent

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[72] Inventor **Jean Gaudin**
Montigny les Cormeilles, France

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[73] Assignee **Societe De Constructions Mecaniques De Creil**
Creil, France
a corporation of France

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[33] **France**
[31] **No. 155514**

[54] **TENSIONING DEVICE FOR USE IN WINDING MULTIPLE STRIPS UPON A COMMON MANDREL**
6 Claims, 2 Drawing Figs.

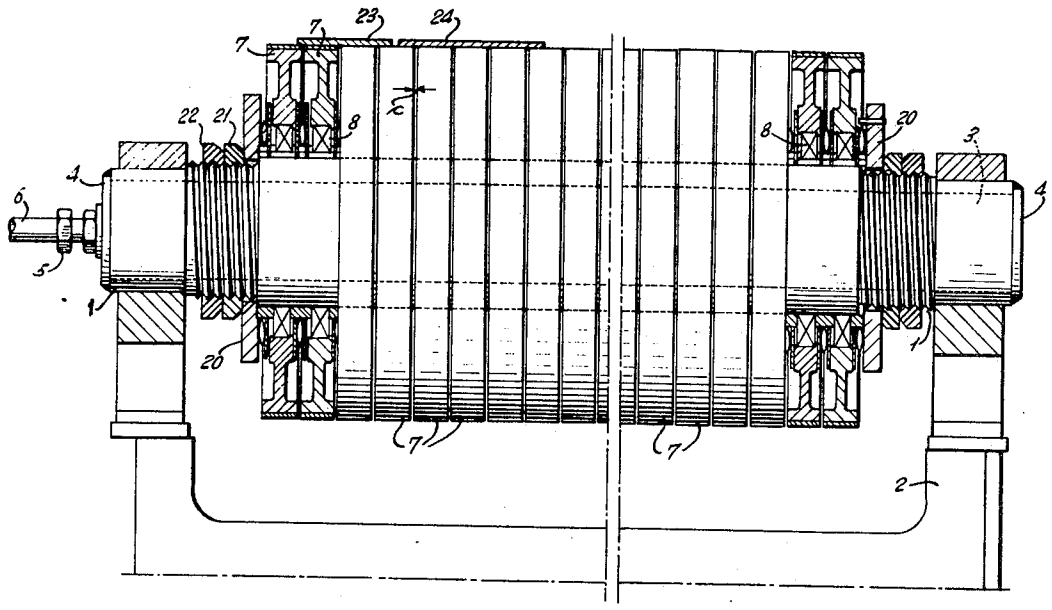
[52] **U.S. Cl.** **226/195;** 242/75.2
[51] **Int. Cl.** **B65h 23/10**
[50] **Field of Search** 226/195, 39; 29/113; 242/75.2

[56] **References Cited**
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Primary Examiner—Richard A. Schacher
Attorney—Karl Rath

ABSTRACT: Multiple strips are passed, on their way to a common winding mandrel, in friction pressure contact with the edges of a multiplicity of juxtaposed braking rings freely rotatively mounted upon a drum forming part of a strip-tensioning device. The braking rings are spaced by pairs of intervening spacing rings mounted upon the drum to move freely axially but locked against rotation relative thereto. The composite stack of alternate braking and spacing rings is held under resilient axial pressure by means of discrete ring-shaped pneumatic expansion chambers interposed between each pair of spacing rings, whereby to allow the braking rings to slip individually and to thereby maintain a desired closeness of the winding tensions of the strips.



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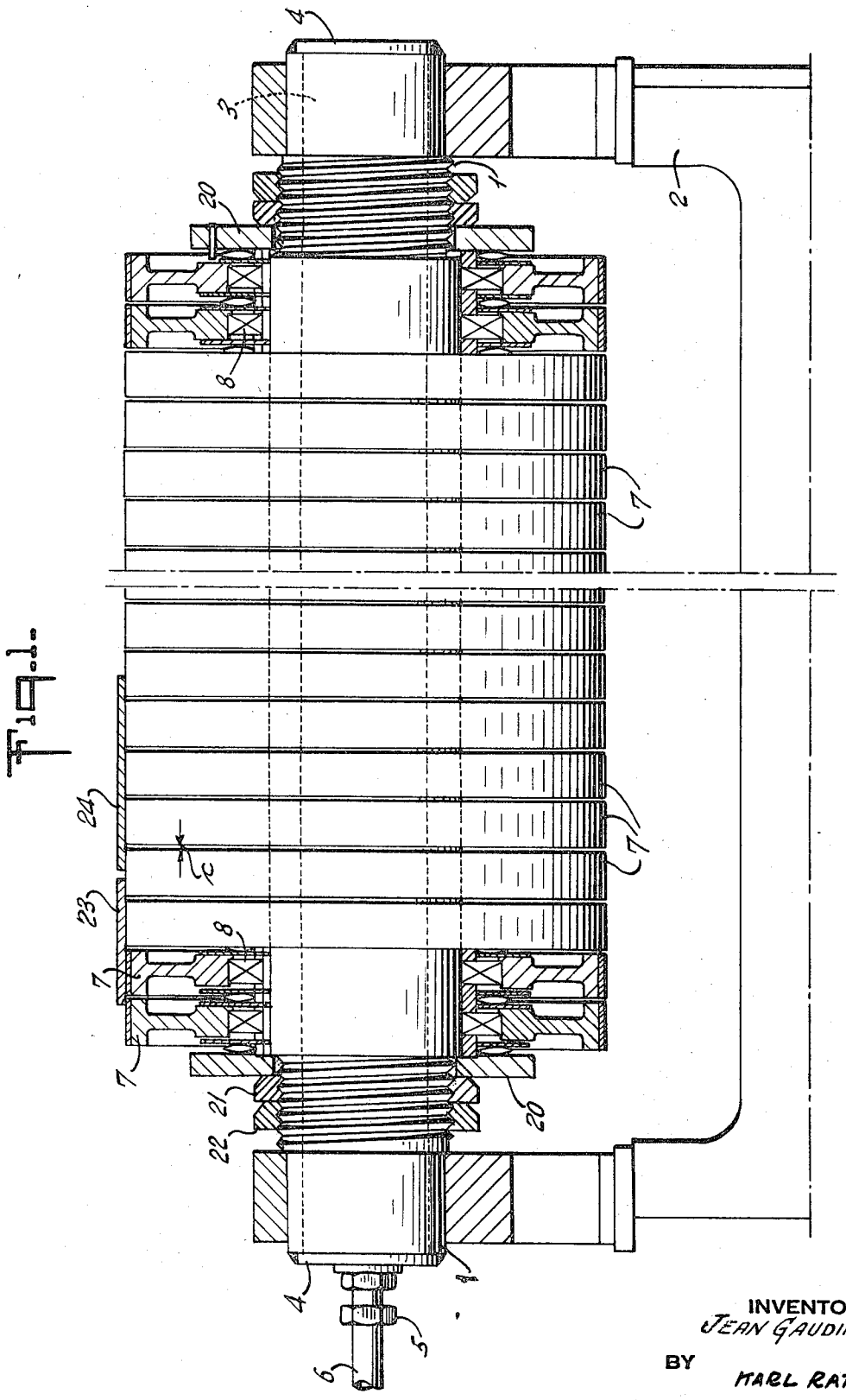
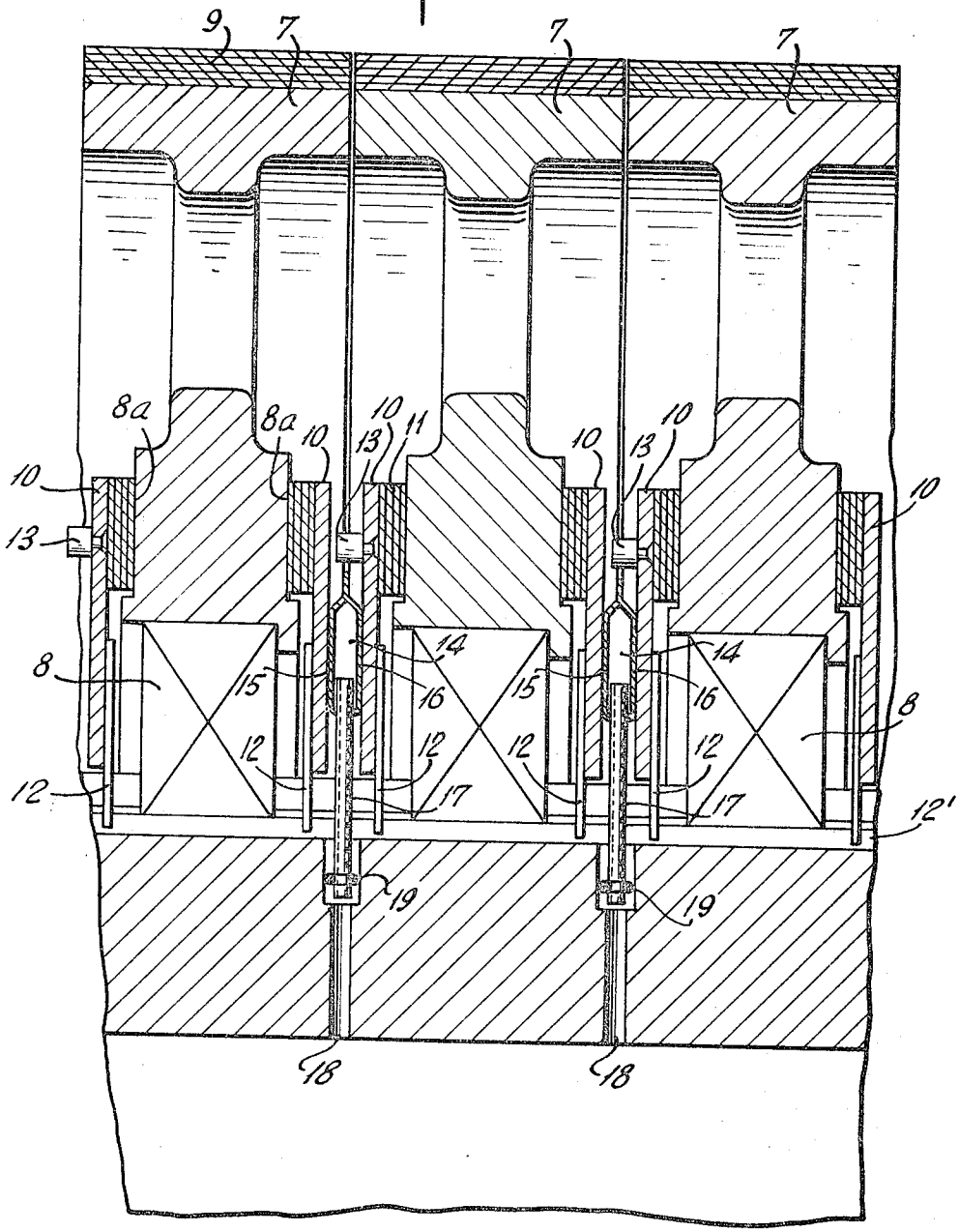


Fig. 1.

INVENTOR
JEAN GAUDIN

BY
KARL RATH
ATTORNEY

Fig. 2.



INVENTOR
JEAN GAUDIN
BY
KARL RATH
ATTORNEY

TENSIONING DEVICE FOR USE IN WINDING MULTIPLE STRIPS UPON A COMMON MANDREL

The present invention relates to a device for regulating the rate of winding or the winding tensions of multiple strips upon a winding arbor or mandrel common thereto.

A known tensioning device for the aforesaid purpose, as shown and described by the present applicant's copending Pat. application Ser. No. 668,422, filed Sept. 18, 1967, comprises a multiplicity of juxtaposed and axially aligned braking rings which are rotatively mounted upon a drum and supported for axial movement relative thereto. The juxtaposed strips to be wound are passed, on their way to the winding mandrel, in friction contact with the outer edges of said rings and the rate of rotation of the rings is controlled by friction brakes consisting of thin spacing rings located between said braking rings and arranged to be rotatable with said drum while sliding freely axially thereon. An axial clamping force acting on the composite stack of braking and spacing rings is provided by an inflatable chamber located at one of the extremities of the drum, the opposite end of which carries a fixed abutment.

In a device of the aforedescribed type, with the strips being maintained at an adequate friction pressure with the peripheral surface provided by the outer edges of braking rings, that is, a pressure in excess of the axial clamping pressure of the rings, there will occur a selective slippage between individual adjoining braking and spacing rings caused by differences in the translatory speeds of the strips, in such a manner as to maintain a desired closeness of the winding tensions of the strips upon the common winding mandrel, as described and explained in greater detail in the aforementioned copending application.

An important object of the present invention is to ensure a more uniform distribution of the axial braking pressure between the braking and spacing rings in a device of the referred to type, to further improve the constancy or closeness of the winding tensions of the strips and in turn the effectiveness and reliability of the winding apparatus.

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 drawings forming part of this specification and in which:

FIG. 1 is an elevation, shown partly in section, of a multiple strip-tensioning device constructed in accordance with the principles of the invention and suitable for use when winding multiple strips upon a common mandrel; and

FIG. 2 is a fragmentary view to an enlarged scale more clearly showing a part of FIG. 1.

According to the invention, there is provided a tensioning device of the referred to type for use when winding a plurality of strips on a common arbor or mandrel, said device comprising essentially a multiplicity of juxtaposed braking wheels or rings rotatively mounted upon a stationary drum common thereto, pairs of friction spacing rings located between adjacent braking rings, to effect selective braking thereof, and a plurality of discrete pneumatic expansion chambers located each between a pair of braking rings and adapted to control the operation of the friction or spacing rings.

According to a preferred embodiment of the invention, the drum is tubular and connected with a source of supply of compressed air common to all the expansion chambers, in the manner as will become further apparent as the description proceeds.

In a strip-tensioning device of the foregoing type, the total axial clamping force is divided between the plurality of expansion chambers, wherefore the useful volume of each chamber need only be relatively small and it is possible to make the chambers not of an elastic or very deformable material, such as natural or synthetic rubber or an equivalent plastic material, but rather of thin gauge metal of stainless steel or the like, each chamber having two opposite walls deformable in the manner of a diaphragm under pressure of the compressed air introduced therein.

Apart from the functional advantages obtained by the provision of discrete expansion chambers for each pair of adjoining braking rings, the chambers can be economically produced and each may advantageously be formed by two dish like members hermetically welded along their central plane of union to provide a ring-shaped pressure chamber.

Referring more particularly to the drawings, in which like reference numerals denote like parts in the different views thereof, the device shown comprises a fixed drum **1** carried by supports or brackets **2** forming part of the frame of the winding machine. The drum **1** is tubular, its internal cavity being marked **3** in the drawing FIG. **1**. The extremities of the drum are hermetically closed by plugs **4** with numeral **5** diagrammatically showing the union of a compressed air supply pipe **6** coming out of the internal cavity **3**.

The drum **1** carries a multiplicity of juxtaposed braking rings or wheels **7** each rotatably mounted upon the drum by means of ball bearings **8**. A predetermined clearance *c* is provided between the sides of the wheels **7**, this clearance being of the order of 0.2 mm., to allow the wheels to turn independently of each other. The sides **8***a*, FIG. **2**, of the hubs of the wheels **7** are machined to form annular friction surfaces and the wheels are furthermore provided with a peripheral friction lining **9**, while the assembly or stack of wheels is held in place on the drum **1** by means of two end plates or abutments **20**, FIG. **1**, adjustable by means of securing nuts **21** and lock nuts **22**.

As more clearly shown in FIG. **2**, there is provided at either side of each wheel **7** a thin spacing or friction ring **10** which, on its face adjoining the corresponding friction surface **8***a* carries a friction lining **11**. Each ring **10** carries or forms a lug or tab **12** which is engaged in a longitudinal keyway **12'** in the drum **1**. On the face of the rings **10** opposed to the lining **11** are secured cogs or the like projections **13** in appropriate number, to serve as centering means for the ring-shaped expansion chambers **14**. The keyway **12'** may also serve as a means to hold the inner races of the ball bearings **8**.

Each expansion chamber **14** is formed of two annular dishlike members **15** and **16** appropriately made of stamped stainless metal or steel of small thickness and secured one to the other by hermetic welding along their central plane of union. To each of the expansion chambers **14** is connected an inner radial tube **17** which is in communication with a corresponding radial passage **18** drilled in the wall of the hollow drum **1**, the union between the tube **17** and the passage **18** being illustrated diagrammatically at **19** in the drawing.

In operation, air compressed to the appropriate pressure, which may be adjustable, is fed through the pipe **6** into the internal cavity **3** of the drum **1**, whereby to penetrate through the passages **18** and the tubes **17** into all the expansion chambers **14** in which the internal pressure is consequently identical. Due to this pressure, the members **15** and **16** are laterally deformed to a slight extent, sufficient nevertheless to spread apart the two spacing rings **10** adjacent thereto and to apply the friction linings **11** of these rings against the sides **8***e* of the hubs of the braking wheels or rings **7**, in such a manner as to exert a braking pressure thereon, as the rings are rotated by the strips **23**, **24**, FIG. **1**, being wound upon a common mandrel (not shown).

The braking force will be the same for all the wheels or rings **7**, although there may be relative angular displacement between the wheels owing to the different tensions of the strips passing thereover. Because of this arrangement there will be a uniform tightening of the turns of the strips in the coils formed upon the common winding mandrel. As is understood, the drum **1** is positioned "upstream" of the winder or mandrel and the strips **23**, **24**, ... may be held at an adequate friction pressure with the peripheral areas of the wheels **7** in any suitable manner (not shown), preferably by means of compressed air in the manner shown and described by the copending application mentioned hereinabove, to which reference is made for other details of the construction and operation of the tensioning device not specifically mentioned herein.

There is thus provided by the invention a multiple strip tensioning device of the referred to type which will ensure a constant braking force throughout between adjacent pairs of braking wheels and friction rings by the action of the individual or discrete expansion chambers one for each elemental braking device. As can be seen, where a single inflatable or expansion chamber is used, as in the above-mentioned copending application, acting upon the composite stack of alternate braking and spacing rings, a relative rotation between certain of the adjacent rings of the stack will result in an increased pressure on the remaining rings, whereby to render it difficult to achieve a desired uniformity or closeness of the winding tension or tightness of the coils being wound from the multiple strips.

On the other hand, the use of individual expansions chambers according to the present invention, one for each cooperating pair of braking and friction rings, ensures a constant friction or pressure for any of the elemental braking devices formed by said rings, independently of the condition of the remaining devices, that is, whether at rest or in operation as determined by the varying translatory speeds of the strips being wound.

This, in turn results in an improved constancy or closeness of the winding tensions of the individual strips **23**, **24**,...being wound.

As can be seen, the number of wheels **7** or braking rings advantageously exceeds the greatest number of strips to be wound, whereby each strip **23**, **24**,...engages a plurality of wheels. As a consequence, the same tensioning device may be used in conjunction with multiple strips of varying numbers and/or widths. Besides, the strips may be applied to a suitable arc-straped portion of the outer cylindrical surface provided by the wheels **7** or linings **9**, encompassing an angle of 180° and less, as shown in the aforementioned copending application.

In the foregoing the invention has been described in reference to a preferred exemplary device or embodiment. It will be evident, however, that variations and modifications, as well as the substitution of equivalent parts or elements for those shown and described for illustration, may be made without departing from the broader scope and spirit of the invention. The specification and drawings are accordingly to be regarded in an illustrative rather than in an restrictive sense.

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 frictionally supporting a plurality of strips applied, on their way to said mandrel, to an arc-shaped fractional portion of the outer surface formed by the edges of said rings;

3. pairs of spacing rings intervening between each two adjacent braking rings;

4. means to lock said spacing rings against rotation but to allow of free axial movement thereof relative to said drum;

5. a pair of abutments fast on said drum, to confine the stack of alternate braking and spacing rings therebetween; and

6. a plurality of ring-shaped pneumatic expansion chambers interposed each between a pair of spacing rings, to apply axial pressure to said stack.

2. A tensioning device as claimed in claim **1**, said drum being in the form of a tube with means to seal the inside space thereof and to feed thereto a compressed gaseous medium, and means including a plurality of radial ducts in said drum, to connect said chambers to said space.

3. A tensioning device as claimed in claim **1**, said drum being in the form of a tube with means to seal the inside space thereof and to feed thereto a compressed gaseous medium, means including a plurality of radial ducts in said drum, to connect said chambers to said space, and friction linings applied to the adjoining sides of said spacing rings and said braking rings.

4. A tensioning device as claimed in claim **1**, each of said expansion chambers consisting of a pair of dish-shaped elastic members secured one to the other along their central plane of union.

5. A tensioning device as claimed in claim **1**, said drum being in the form of a tube with means to hermetically seal the inside space thereof and to feed thereto a compressed gaseous medium, each of said expansion chambers consisting of a pair of dish-shaped elastic sheet metal members secured on to the other along their central plane of union, and a plurality of feeding tubes each extending from one of said chambers into radial ducts in said drum, to connect said chambers with said space.

6. A tensioning device as claimed in claim **1**, said drum being in the form of a tube with means to hermetically seal the inside space of said tube and to feed thereto a compressed gaseous medium, said rings provided with central hubs on the opposite faces thereof, said spacing rings provided with friction lining on their sides facing said hubs, and means including a plurality of radial ducts in said drum, to connect said chambers to said space.