March 29, 1966 C. O. L. NORMAN 3,243,137

BRAKING DEVICE FOR A WIND-OFF REEL

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Fig. 1

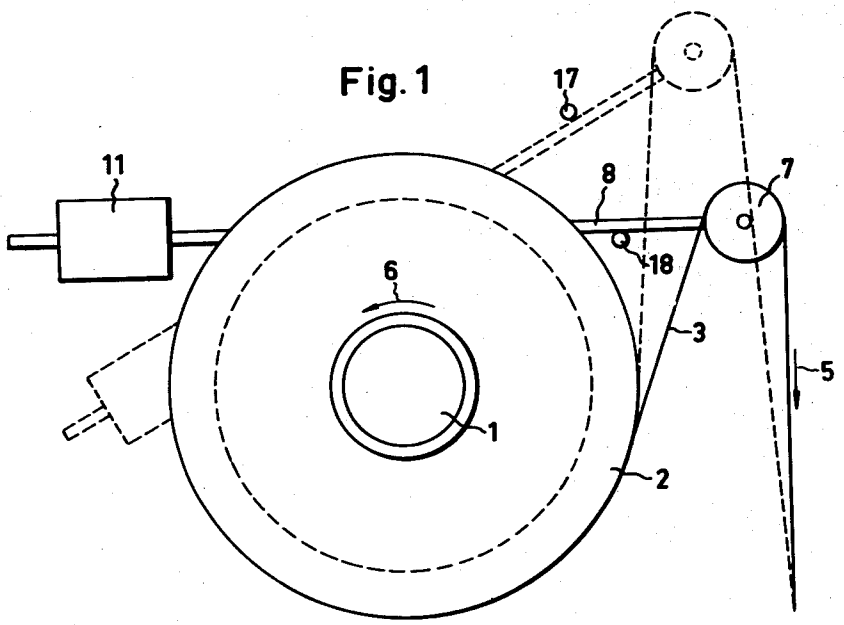
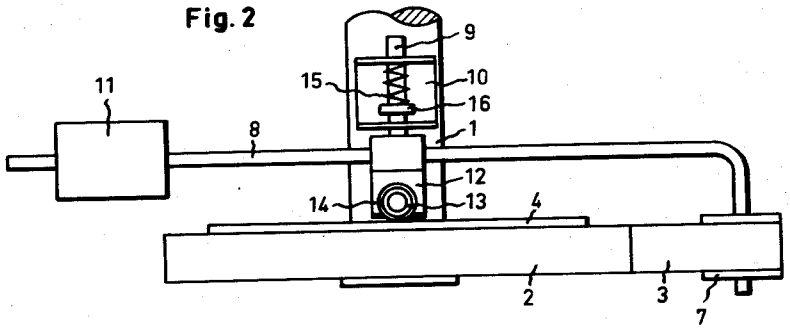


Fig. 2

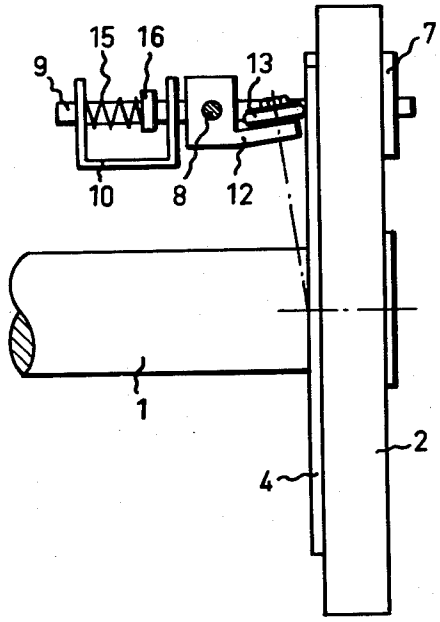


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Fig. 3



United States Patent Office 3,243,137 Patented Mar. 29, 1966

3,243,137

BRAKING DEVICE FOR A WIND-OFF REEL

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Filed Dec. 19, 1963, Ser. No. 331,737
Claims priority, application Sweden, Jan. 5, 1963, 122/63
5 Claims. (Cl. 242—75.43)

The present invention is related to braking devices for rotatable reels, drums, bobbin spindles or the like, from which a material band is to be wound off.

In wind-off devices of this type it is often required that the tension in the band or thread wound-off from the reel be maintained as constant as possible during the winding-off and that the reel be immediately stopped in case of disruption or breakage of the band. For this purpose a braking device for the reel is necessary, which can automatically control the braking of the reel so that the band is wound-off from the reel with a constant tension, said braking device being also effective to bring the reel to a rapid standstill in case of disruption of the band. Various braking devices for this purpose are known in the art, but particularly for wind-off devices, where the desired tension in the wound-off material band is comparatively small and the permissible variations in this tension are small, as, e.g., for the winding-off of band-tobacco, thin paper strips, textile threads and similar materials from a bobbin, no simple braking device has hitherto been available, which has been capable of sufficiently evenly and continuously varying the braking of the wind-off reel in dependence of the tension in the wound-off material band and of rapidly stopping the reel in case of disruption of the band.

An object of the present invention is, therefore, to provide a braking device for a rotatable wind-off reel or a similar device for band-shaped material, which is of a simple construction and is capable of evenly and continuously varying the braking of the wind-off reel in dependence on the tension in the wound-off material, even if this tension is small so as to maintain the tension substantially constant, while the braking device also can very rapidly stop the wind-off reel in case of disruption of the wound-off material band.

According to the invention there is provided a braking device for a rotatable wind-off reel for band-shaped material which a rotatable roller having a portion of its periphery in contact with a rotating part of said reel and being angularly displaceable about an axis through the point of contact between the periphery of the roller and said rotating part of said reel and substantially perpendicular to the axis of rotation of the roller, guiding means for said material band wound-off from the reel, said guiding means being displaceable under the influence of the tension of the material band running over said guiding means and a counter-acting force, said guiding means and said roller being mechanically interconnected through motion transferring means in such a way that said roller is displaced about said displacement axis in dependence on the displacement of said guiding means, in such a direction that the axis of rotation of the roller is displaced towards a position parallel with the direction of movement of said rotating part of the reel, when the tension in the wound-off material band decreases, and towards a position perpendicular to the direction of movement of said rotating part, when the tension in the material band increases.

The invention and its mode of operation will be further described with reference to the accompanying drawing, which by way of example shows a braking device according to the invention for a bobbin spindle for the winding-off of band-tobacco from a bobbin mounted on

the spindle. In the drawing FIG. 1 is a side view from the outer end of the spindle, showing the bobbin spindle with a bobbin mounted thereon and the braking device; FIG. 2 is a top view perpendicular to the shaft of the spindle and FIG. 3 is a side view perpendicular to the shaft of the spindle.

The drawing shows a spindle shaft 1, which is rotatably journalled in a manner not shown in the drawing and on the outer end of which a bobbin 2 with a band 3 of band-tobacco is mounted. The spindle 1 is provided with a circular disc 4, which is perpendicular to the axis of rotation of the spindle and rotating together with the spindle. The disc 4 serves as a lateral support for the bobbin 2 on the spindle and cooperates with the braking device according to the invention. The band 3 is pulled by suitable means not shown in the drawing in the direction of the arrow 5 and is thus wound-off the bobbin 2, which will rotate together with the spindle 1 in the direction of the arrow 6.

The braking device according to the invention comprises a guide pulley 7, over which the wound-off band 3 runs. The pulley 7 is rotatably journalled in one end of a double-armed lever 8, which by means of a pivot 9 is pivotally mounted in a stationary support 10. The opposite end of the double-armed lever 8 is provided with a weight 11, which tends to swing the lever 8 in a counter-clockwise direction in FIG. 1, about its pivot 9. This is, however, counteracted by the tension in the material band 3 running over the guide pulley 7, as this tension is applying a clockwise moment to the lever 8 about its pivot 9.

When the tobacco-band 3 is wound-off from the bobbin 2, the lever 8 will consequently assume a position of equilibrium somewhere between the stationary limit stops 17 and 18, which position is dependent on the actual tension in the wound-off band 3. The weight 11 is preferably displaceable along the lever 8 so that the tension in the wound-off band 3 can be adjusted to a preselected value. On the lever 8 a console 12 is mounted, on which a roller 13 is journalled so that it is freely rotatable. The periphery of the roller 13 is preferably provided with a rubber ring 14 or the like and is kept in contact with one side of the disc 4 by a coil spring 15 acting between the stationary support 10 and a ring 16 on the pivot 9 of the lever 8. Preferably the ring 16 is displaceable along the pivot 9 so that the tension of the spring 15 and thus the contact pressure between the roller 13 and the disk 4 can be adjusted. As shown in the drawing, the roller 13 is so mounted on the console 12, that the point of contact between the periphery of the roller 13 and the side surface of the disc 4 is disposed substantially on the pivot axis of the lever 8, due to which the roller 13 will be angularly displaced about this axis, when the lever is moving between the limit stops 17 and 18 in dependence on any variations in the tension in the wound-off band 3.

When the spindle 1 and thus the disc 4 are rotating in the direction of the arrow 6, while the band 3 is wound-off from the bobbin 2, the roller 13 will evidently roll on the disc 4. In the position of the lever 8 shown in full lines in the drawing the plane of rotation of the roller 13 is substantially tangential to the direction of rotation of the disc 4, due to which a pure rolling motion of the roller 13 on the disc 4 will exist. In this position there is consequently no mutual slip between the periphery of the roller 13 and the disc 4 and as the roller is freely rotatable, e.g., by means of ball bearings or the like, the roller 13 has in this position no braking effect upon the disc 4, the spindle 1 and the bobbin 2. As the contact between the periphery of the roller 13 and the disc 4 is not normally restricted to a point, the axis of rotation of the roller 13 is preferably somewhat oblique relative to the plane of the disc 4 so that in each point within the contact

surface between the periphery of the roller and the disc 4 the periphery of the roller and the disc will have the same speed.

If in this position of the braking device the tension in the wound-off band 3 decreases, the lever 8 will swing in a counter-clockwise direction in FIG. 1 about its pivot 9 towards the stationary limit stop 17. Due to this swinging movement of the lever 8, the roller 13 will be displaced so that its direction of rotation is no longer approximately parallel with the direction of rotation of the disc 4. Consequently, a pure rolling motion of the roller 13 on the disc 4 will no longer exist, but a mutual slip will arise between the periphery of the roller 13 and the disc 4, so that a friction force will arise at the contact point between the roller and the disc. This friction force is directed perpendicularly to the direction of rotation of the roller 13. The magnitude of the friction force is primarily determined by the contact pressure of the roller 13 against the disc 4 and of the friction coefficient between the periphery of the roller and the disc 4, but is substantially independent of the magnitude of the angular displacement of the roller 13, i.e., of the position of the lever 8 between the limit stops 17 and 18. Of this friction force, however, only the component tangential to the axis of rotation of the disc 4 will have any braking effect upon the disc 4 and thus the spindle 1, whereas the component of the friction force directed radially relative to the axis of rotation of the disc 4 will not have any braking effect. The component of the friction force, which is active for the braking of the disc 4 and the spindle 1 and thus the bobbin 2, will evidently increase continuously from zero, when the lever 8 moves from the limit stop 18 towards the limit stop 17. Due to the braking of the spindle 1 and the bobbin 2 mounted thereon, the tension in the wound-off band 3 will increase again, until an equilibrium is reached between the tension and the moment applied to the lever by the counter-weight 11 and this position of equilibrium will correspond to the preselected desired tension in the band 3.

In case of disruption of the wound-off band 3 the lever 8 will swing under the influence of the counter-weight 11 to the end position determined by the stationary limit stop 17 so that the maximum braking effect arises and the spindle 1 with the bobbin 2 mounted thereon is immediately stopped.

The braking device according to the invention has consequently the characteristic feature that it can smoothly and continuously control the braking force within a wide range from zero to a preselected maximum value in dependence on the tension in the wound-off band. The braking device can be used for very small tensions in the wound-off band and can be made very sensitive for small variations in the tension, as a very small force is required for swinging the lever 8 about its pivot 9 and this force is substantially completely independent of the magnitude of the braking force. This is due to the fact that the braking force is influencing the rotating brake roller 13 and thus the lever 8 at a single point, which is disposed on the pivot axis of the lever, whereby the braking force cannot apply any moment on the lever.

Although the braking device according to the invention shown in the drawing and described above has proven to be very advantageous for a bobbin spindle of the illustrated type, it is evident that several other forms of the invention are possible and may even be preferable for other types of wind-off reels. It is obvious, e.g., that the lever 8 can be influenced by a spring means instead of the counter-weight 11. Further it is not necessary that the brake roller 13 be in contact with a surface on the reel,

which is perpendicular to the axis of rotation of the reel, but it may instead be in contact with any other rotating surface of the reel, for example, directly against the shaft of the spindle 1 in the embodiment shown in the drawing. In this case another type of transfer mechanism is of course necessary between the brake roller 13 and the guide pulley 7. It is essential, however, that the brake roller is angularly displaced in such a way in dependence on the movement of the guide pulley that the axis of rotation of the brake roller is displaced towards a position parallel with the direction of movement of the rotating part of the wind-off reel, against which the brake roller is in contact, when the tension in the wound-off material band decreases, and towards a position perpendicular to the direction of movement of said rotating part, when the tension in the band increases.

I claim:

1. In combination, a rotatable reel for a band of material and a braking device for said reel, said braking device comprising a rotatable roller having a periphery in contact with a rotating part of said reel, said roller being angularly displaceable about an axis through the point of contact between the periphery of the roller and said rotating part of the reel and substantially perpendicular to the axis of rotation of said roller, guide means for the passage of said band of material which is wound off said reel, said guide means being displaceable under the influence of the tension in the wound-off band running over said guide means and a counter-acting force, motion transferring means interconnecting said guide means and said roller in such a way that the roller is angularly displaced about said displacement axis in dependence on the displacement of said guide means so that the axis of rotation of the roller is displaced towards a position parallel with the direction of movement of said rotating part of the reel, when the tension in the band decreases, and towards a position perpendicular to the direction of movement of said rotating part, when the tension in the band increases.

2. The combination as claimed in claim 1, wherein said roller is pressed against said rotating part of the reel by a substantially constant spring force.

3. The combination as claimed in claim 1, wherein the periphery of said roller is provided with a friction layer.

4. The combination as claimed in claim 1, wherein said motion transferring means includes a lever pivotable about a stationary axis, said guide means being mounted on said lever such that the tension in the band running over said guide means applies a moment to said lever about said stationary axis thereof, and means for applying a counter-acting moment to said lever, said roller being rotatably mounted on said lever with its displacement axis substantially coaxial with said stationary axis of the lever.

5. The combination as claimed in claim 4, wherein said roller is in contact with a rotating surface of said reel substantially perpendicular to the axis of rotation of the reel.

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