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WARPING MACHINE WITH A PLURALITY OF BRAKES FOR BRAKING A WARP BEAM, CONTACT ROLLER AND MEASURING ROLLER

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Fig. 1

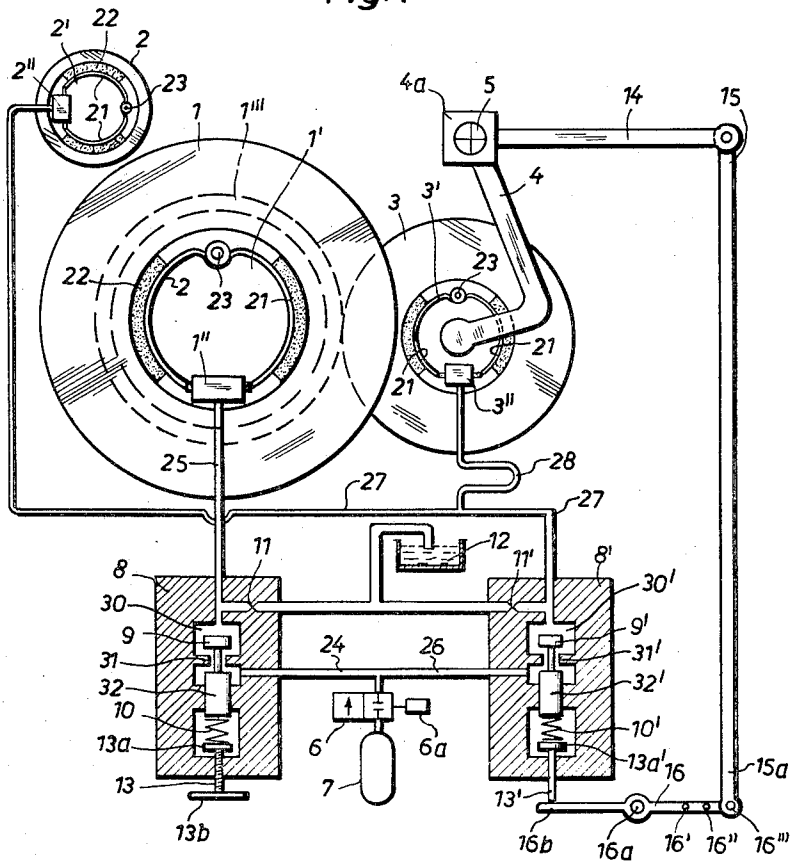
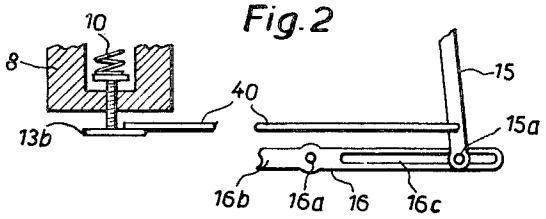


Fig. 2



Rolf Stock, inventor

By Wenderoth, Lind and Ponack,

attorneys

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WARPING MACHINE WITH A PLURALITY OF BRAKES FOR BRAKING A WARP BEAM, CONTACT ROLLER AND MEASURING ROLLER

Rolf Stöck, Uzwil, Sankt Gallen, Switzerland, assignor to Maschinenfabrik Benninger A.-G., Uzwil, Sankt Gallen, Switzerland

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The present invention relates to an improved apparatus for braking a warp beam, contact roller and measuring roller including means for automatically adjusting the braking force applied to the contact roller and measuring roller such that the braking distance for warp beam, contact roller and measuring roller is the same or substantially the same, irrespective of the point of time during a yarn winding operation when the warp beam is braked.

It is known to the art to be of importance, particularly for full-width warping machines, that the warp beam, the measuring roller and the contact roller be braked very quickly, nonetheless, however, with the same or substantially same braking or stopping distance. The first mentioned requirement that such components be braked very quickly is attributable to the fact that it is desired to knot broken yarn or thread ends before such broken yarn end becomes wound about the warp beam. The latter mentioned requirement that an equal braking distance be available for all such aforementioned components, is based upon the desire that the length measuring apparatus i.e. measuring roller for example, exactly indicate the length of yarn wound onto the warp beam, as well as further, that no slip appear between the yarn package on the warp beam and the contact roller which might tend to damage and fray the aforesaid yarn package.

The maximum permissible brake moment or couple is determined by the sliding or anti-friction characteristics of the yarn material wound upon the warp beam. Previous known prior art braking apparatus which serve the purpose of providing an equal braking path for warp beam, measuring roller and contact roller exhibit the disadvantages that, on the one hand, the braking moment at the warp beam does not remain constant during the winding operation, therefore the maximum permissible braking moment cannot be completely made use of, and, on the other hand, for distributing the braking force to individual components of the full-width warping machine elements are provided which possess a considerable mass and which must be moved during a braking operation, thus delaying response of the brakes.

It is, therefore, a primary object of the present invention to overcome the aforementioned disadvantages.

Another important object of the present invention is the provision of an improved apparatus for automatically adjusting the braking force applied to at least a first operable element in dependence upon the changing mass of a second operable element, whereby the braking path for said first and second elements remains equal or substantially equal.

Still a further important object of this invention is to provide improved means for automatically adjusting the braking force applied to a contact roller and measuring roller of a warping machine such that the braking distance of the warp beam upon which the warp threads are wound, the contact roller and measuring roller is the same or substantially the same, irrespective of the point of time during the winding operation when the warp beam is braked.

Yet a further important object of this invention is the provision of a warping machine incorporating a warp beam, measuring roller and contact roller, including means whereby the braking distance for these components is automatically adjusted to be equal or substantially equal in dependence upon the wound yarn package of the warp beam.

A further important object of the present invention is the provision of an improved automatic control means for maintaining equal or substantially equal the braking path of a warp beam, contact roller and measuring roller of a warping machine, such control means permitting accommodation to the characteristics of the particular yarn being wound.

In accordance with the teachings of the present invention a warping machine, incorporating a number of brakes for braking a warp beam, contact roller and measuring roller, is provided with adjustment means which effect that a constant relationship of the braking forces is maintained during every magnitude of the brake force in spite of the fact that during a warping operation the working load changes at the warp beam. Characteristic of the invention is that pressure regulator means are provided and operably associated with the brakes of the contact roller and measuring roller, as well as there also being provided adjustment means controlled by the momentary diameter of the yarn package at the warp beam, wherein said adjustment means continually adjust the pressure appearing at the pressure regulator means relative to the pressure effective at the brakes of the warp beam such that the braking path of warp beam, measuring roller and contact roller is equal or substantially equal.

Other features, objects and advantages of the invention will become apparent by reference to the following detailed description and drawing in which:

FIGURE 1 schematically illustrates an embodiment of warping machine constructed in accordance with the teachings of the present invention; and

FIGURE 2 is a fragmentary view showing details of a somewhat modified system with respect to that of FIGURE 1.

Directing attention now to the drawing, it will be seen that the warping machine schematically depicted in FIGURE 1, of which only enough structure has been illustrated to enable comprehension of the inventive concepts, incorporates a warp beam 1 and a measuring roller 2 cooperating with this warp beam 1 in order to measure the length of the yarn material wound onto the latter. Any standard measuring roller can be employed which will serve such purpose. In the present instance, it can be assumed that the measuring roller 2 contacts the rim of the warp beam 1, and since there is a definite correlation between the rotation of the warp beam 1 and that of the measuring roller 2 it is easily possible to ascertain the exact amount of yarn wound onto such warp beam 1. Quite obviously, a modified construction could be employed where the measuring roller 2 is directly in contact with the wound yarn package 1''' at the warp beam 1. The warp beam 1 and measuring roller 2 are rotatably mounted in suitable manner in the machine frame (not shown). Additionally, a contact or pressure roller 3 is pivotally mounted by means of a lever arm 4 at its sleeve or bushing 4*a* to rock about a pivot shaft 5 in such a manner as to evade the increasing diameter of the yarn package 1''' opposite to the contact pressure.

It is to be appreciated that the warp beam 1 as well as the measuring roller 2 and contact roller 3 are each provided with a suitable braking means 1', 2' and 3' respectively. Since the braking system or means 1', 2' and 3' is similar in construction for each of the aforemen-

tioned beam or roller components, only the brake means 1' of the warp beam 1 will be considered, with at least certain of the corresponding elements being designated with the same reference numerals for the brake means 2' and 3' of the measuring roller 2 and contact roller 3 respectively. In the illustrated embodiment, such brake means 1' is constructed similar to the conventional automobile brake system for example, and accordingly is comprised of brake shoes 21 provided with suitable brake linings 22, with such brake shoes being pivotably mounted at pivot shaft 23. Additionally, the brake means 1', 2' and 3' are each provided with a brake cylinder 1'', 2'' and 3'' respectively, for actuating in known manner the associated brake shoes 21, whereby warp beam 1, measuring roller 2 and contact roller 3 can be braked.

More specifically, each of the brake cylinders 1'', 2'' and 3'' can be supplied, as required, with pressure medium, pressurized oil for example, delivered from a suitable storage means 7 or from another appropriate pressure oil or pressure gas source. The selective feed of pressure oil from the storage means 7 to the brake cylinder 1'' as well as to the brake cylinders 2'' and 3'', is controlled by means of a slide means or slide valve 6 possessing a response time which is as quick as possible. The slide means 6 can be controlled, for example, by means of an electromagnet 6*a*. In the closed position of the slide means 6 shown in the drawing the pressurized medium is prevented from reaching the brake cylinders 1'', 2'' and 3'', wherefore no braking force is exerted upon the warp beam 1, measuring roller 2 and control roller 3. On the other hand, if the electromagnet 6*a* is actuated then the slide valve or slide means 6 moves to the right, thereby permitting the pressurized medium of storage means 7, assumed to be oil for example, to reach the brake cylinder 1'' via branch line 24, a pressure regulator 8 and conduit 25. Likewise, pressurized medium from storage means 7 reaches the brake cylinder 2'' of the measuring roller 2 and the brake cylinder 3'' of the contact roller 3 via branch line 26, a pressure regulator 8' and line or conduit 27. It should be recognized that conduit 27 is provided with a flexible hose portion 28 leading to the brake cylinder 3'' in order to accommodate for the aforementioned movements carried out by the control roller 3.

It will be seen that each pressure regulator 8 and 8' is provided with a central compartment 30 and 30' respectively, in which there is slidably disposed a respective oil pressure control piston 9 and 9'. Each control piston 9 and 9' is adapted to seat on a valve seat 31 and 31' respectively, in order to cut-off flow of pressure medium to the associated brake cylinders 1'', 2'' and 3'' when the pressure acting upon such brake cylinder reaches a preset value, as will be explained shortly. Additionally, each control piston 9 and 9' includes a respective further piston 32 and 32' adapted to bear against a respective spring 10 and 10' accommodated internally of each pressure regulator 8 and 8' respectively.

The spring 10 of the pressure regulator 8 bears against a support plate 13*a* carried by threaded spindle means 13. The spindle means 13 can be rotated by operating knob 13*b* in order to vary the stress of the spring 10, to thereby regulate the pressure appearing at the brake cylinder 1''. In other words, depending upon the adjusted stress of the pring 10 the pressure medium will flow from the pressure supply source 7 to the brake cylinder 1'' via the branch line 24 and central compartment 30 and conduit 25, since the control piston 9 is held by such spring 10 away from its valve seat 31. However, as soon as the pressure within the conduit 25 equals or slightly exceeds the force applied by the spring 10 against the piston 32, the control piston 9 is forced downwardly to seat upon the valve seat 31, whereby the flow of pressure medium to the brake cylinder 1'' is cut-off. It will thus be appreciated that pressure regulator 8 serves to cut-off the flow of pressure oil to the brake cylinder 1'' in accordance with the stress applied to the spring 10, and as adjusted by the spring-stress regulating mechanism 13, 13*a*, 13*b*. Thus, the regulating mechanism 13, 13*a*, 13*b* is used to control and vary the cut-off pressure for the brake cylinder 1'' in dependence upon the properties and characteristics of the particular yarn or thread material being wound at the relevant time upon the warp beam 1.

It should be appreciated that the pressure regulator 8' functions in corresponding manner with regard to the brake cylinders 2'' and 3'' of the measuring roller 2 and contact roller 3 respectively. However, in this case the stress applied to the spring 10' and thereby the oil pressure effective at brake cylinders 2'' and 3'', is automatically adjusted as a function of the movement of the contact roller 3 displaced during yarn winding by means of an automatic adjustment means operably associated with the support bolt or pin 13' for spring 10'. The details of this automatic adjustment means will be considered shortly.

It will be recalled that it was mentioned that if at the brake cylinders 1'', 2'' and 3'' there is attained a pressure which corresponds to the pressure adjusted at the associated pressure regulator or pressure cut-off means 8 and 8', then the oil pressure displaces the control pistons 9 and 9' against the force of the springs 10 and 10' respectively, to such an extent that the flow of further pressurized oil to the brakes 1', 2' and 3' is shut-off. In order to prevent an increase of the oil pressure at the brake cylinders 1'', 2'' and 3'' in the presence of small leakage losses at the control or sealing pistons 9 and 9' respectively, as well as to render it possible to release the brakes after a renewed closing of the slide 6, there are provided throttling locations 11 and 11' which continually permit a small quantity of oil to flow out of the brake lines or conduits 25, 27 and 28 into the oil tanks or reservoir 12. Also, a pressure loss appearing in the brake cylinders 1'', 2'' and 3'' is automatically equalized by opening the control pistons 9 and 9' under the action of the force of the springs 10 and 10'.

The braking moment which is effective at the warp beam 1 can be adjusted by means of the threaded spindle 13, rotation of which enables varying the effective spring force of the spring 10. The braking moment of the brake 2' of the measuring roller 2 as well as the brake 3' for the contact roller 3 is automatically adjusted in accordance with the changing mass of the warp beam 1 during yarn winding by means of the automatic adjustment means, here shown by way of example as comprising linkage system 14, 15 and 16. The lever 14 can be integral with or operatively connected to the lever arm 4 to partake in pivotable movements experienced by this lever arm 4 as the size of the yarn package 1''' changes during winding. Moreover, the lever 14 is connected with a rod 15 articulated to a further lever 16 pivotably mounted at fulcrum 16*a* and operably bearing against the pin or bolt 13'.

Quite obviously, the automatic adjustment means incorporating lever 14, rod 15 and lever 16 can be replaced by other suitable means, as for example cams which will carry out substantially the same function to achieve the same result. It will be appreciated that as the diameter of the yarn package 1''' increases the contact roller 3 is displaced to the right of the drawing, levers 4 and 14 are pivoted counterclockwise, the rod 15 being moved upwardly, thereby rocking the lever 16 so that the free end 16*b* moves downwardly to thereby decrease the stress of the spring 10'. As a result, the sealing or control piston 9, can be closed by a correspondingly smaller oil pressure appearing in the conduit or lines 27, 28 which, in effect means that, a smaller oil pressure appears at the brake cylinder 2'' and 3'' so that a longer braking path is provided for the measuring roller 2 and contact roller 3.

It will be appreciated that this longer braking path of the measuring roller 2 and contact roller 3 has been adjusted in accordance with the increased braking path of the warp beam 1, the mass of which has increased to the extent of the wound yarn package 1''', and such that the braking path of warp beam 1, measuring roller 2 and contact roller 3 is the same or substantially the same, ir-

respective of the period of time during yarn winding that it is desired to brake these various elements. Moreover, the lever system **14**, **15**, **16** or other equivalent transmission means of the automatic adjustment mechanism exhibits such a characteristic that it always regulates the pressure for the measuring roller brake **2''** and the contact roller brake **3''** such that the braking path or distance for the warp beam **1**, measuring roller **2** and contact roller **3** is always the same or substantially the same.

In accordance with the adjustment of the brake **1'** of the warp beam **1** and the specific weight of the yarn package, undertaken by threaded spindle **13**, the control of the pressure regulator **8'** for the brake **2'** and **3'** of the measuring roller **2** and contact roller **3** respectively, can be adjusted by regulating the point of articulation or pivot point of the rod **15** at the lever **16** by means of the spaced holes **16'**, **16''** and **16'''** providing a stepwise finer adjustment. Regulation of the aforesaid pivot point can be effected in a stepless manner by suitable means, for example by providing lever **16** with an elongated slot—as will be explained shortly in conjunction with FIGURE 2—in which the end **15***a* of the rod **15** can be supported at a desired location along such slot to provide for the aforesaid finer adjustment possibility.

Moreover, the adjustment of the spindle **13** and the point of articulation of the rod **15** at holes **16'**, **16''** and **16'''** etc., can also be combined with suitable means such that the same can be carried out from a single operating element. Such a possibility is provided with the modified arrangement of FIGURE 2 wherein the lever **16** is provided with an elongated slot **16***c* for slidably receiving the end **15***a* of the rod **15**. The operating knob **13***b* is connected to one end of a lever or connecting rod **40** operatively secured at its other end with the rod **15**. By virtue of this arrangement, and as the operating knob **13***b* is rotated, for example in a direction increasing the stress of spring **10**, the connecting rod **40** simultaneously pulls the lever end **15***a* to the left of the drawing, whereby the effective pivot point of the lever **15** is altered, thereby at the same time providing a finer regulation of the stress applied to the spring **10'** of the pressure regulator **8'**, for reasons explained heretofore.

While there is shown and described present preferred embodiments of the invention it is to be distinctly understood that the invention is not limited thereto but may be otherwise variously embodied and practised within the scope of the following claims.

What is claimed is:

1. A warping machine comprising a warp beam, contact roller and measuring roller, brake means for braking said warp beam, contact roller and measuring roller, pressure regulator means operably connected with said brake means of said contact roller and said measuring roller, adjustment means responsive to the momentary diameter of a yarn package wound onto said warp beam for continually automatically regulating the pressure at said pressure regulating means with respect to the pressure effective upon said brake means for said warp beam such that the braking path for warp beam, measuring roller and contact roller is substantially equal, adjusting means for adjusting the braking force acting on the warp beam to a predetermined value, and pressure regulating means operatively connected with the brake means of the warp beam and acting on said adjusting means to maintain a constant braking force acting on the warp beam with increasing weight of the beam during a winding operation.

2. A warping machine according to claim **1** including a pressure regulator for regulating braking moment effective at said warp beam in accordance with the yarn material handled by said warp beam, said automatic adjustment means for said pressure regulating means for said contact roller and said measuring roller including means

accommodating said adjustment means to the regulated braking moment effective at said warp beam.

3. A warping machine according to claim **2** wherein said pressure regulator for said warp beam is operatively connected with said automatic adjustment means such that setting of said pressure regulator automatically is effective upon said accommodating means for said adjustment means, and a single operating member for setting said pressure regulator for said warp beam.

4. A warping machine according to claim **2** including means connecting said pressure regulator for said warp beam with said adjustment means for said pressure regulator means of said contact roller and said measuring roller, and a common operating member for controlling said pressure regulator and simultaneously effective upon said means accommodating said adjustment means to the regulated braking moment effective at the warp beam.

5. A warping machine comprising a warp beam, at least one roller member cooperating with said warp beam, brake means for selectively braking said warp beam and said roller member, pressure regulator means for controlling the pressure effective at said brake means for said warp beam, pressure regulator means for controlling the pressure effective at said brake means for said roller member, and means responsive to changing brake path of the warp beam during operation thereof for adjusting the pressure regulator means of said roller member such that the brake path of the warp beam and roller member are substantially the same.

6. A warping machine according to claim **5** wherein said pressure regulator means for said warp beam includes a regulating mechanism for setting the cut-off pressure in accordance with material handled by said warping machine.

7. A warping machine according to claim **6** wherein said means for adjusting the pressure regulator means of said roller member comprises a linkage system.

8. A warping machine according to claim **7** wherein said linkage system includes means for varying the operating characteristics of said linkage system in accordance with the setting of said regulating mechanism.

9. A warping machine according to claim **5** wherein said one roller member is mounted for pivotable movement and operably connected with said means for adjusting the pressure regulator means of said roller member.

10. A warping machine according to claim **9** including a source of pressurized medium for said brake means communicating with the respective pressure regulator means for said warp beam and said one roller member.

11. A warping machine comprising a warp beam, at least one roller member cooperating with said warp beam, brake means for selectively braking said warp beam and said roller member, pressure regulator means for controlling the pressure effective at said brake means for said warp beam, pressure regulating means for controlling the pressure effective at said brake means for said roller member, and means responsive to increasing mass of the warp beam during operation thereof for adjusting the pressure regulator means of said roller member such that the braking path of the warp beam and roller member are substantially the same.

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DONALD W. PARKER, *Primary Examiner.*

L. K. RIMRODT, *Assistant Examiner.*