Dec. 20, 1960 N. E. KLEIN ET AL 2,964,826

BRAKE SYSTEM

Original Filed March 1, 1954 4 Sheets-Sheet 1

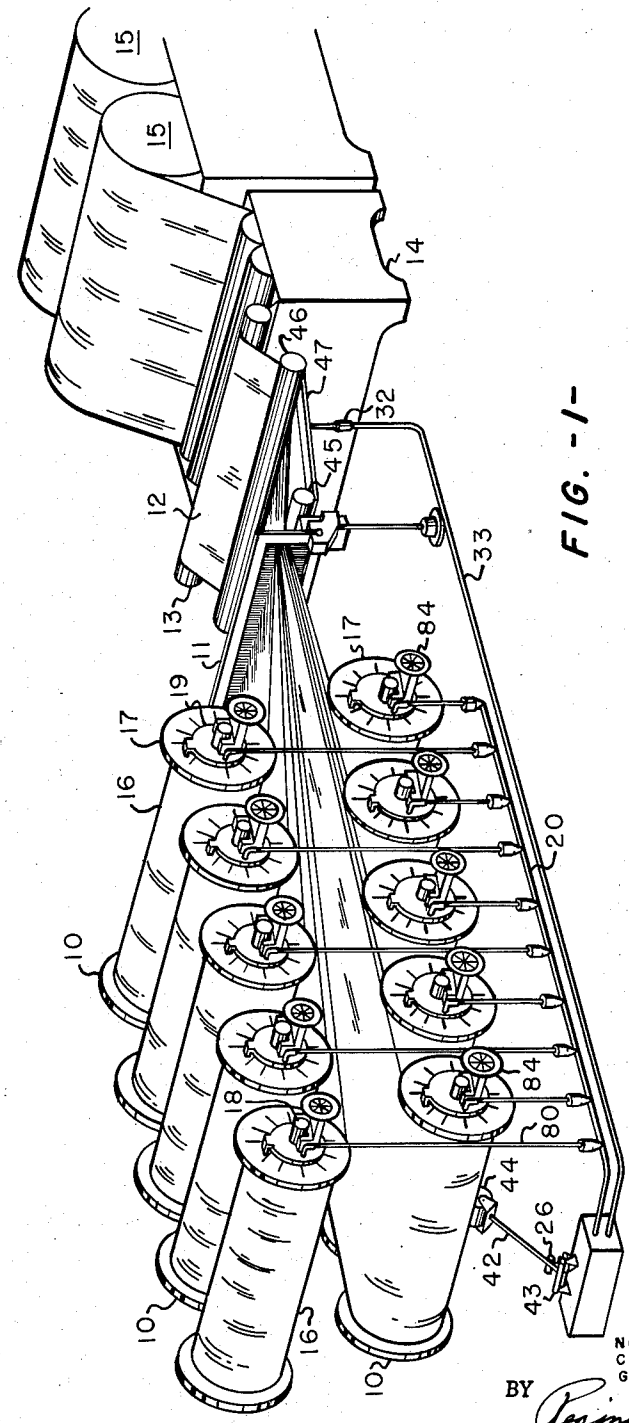


FIG. -1-

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BRAKE SYSTEM

Original Filed March 1, 1954 4 Sheets-Sheet 2

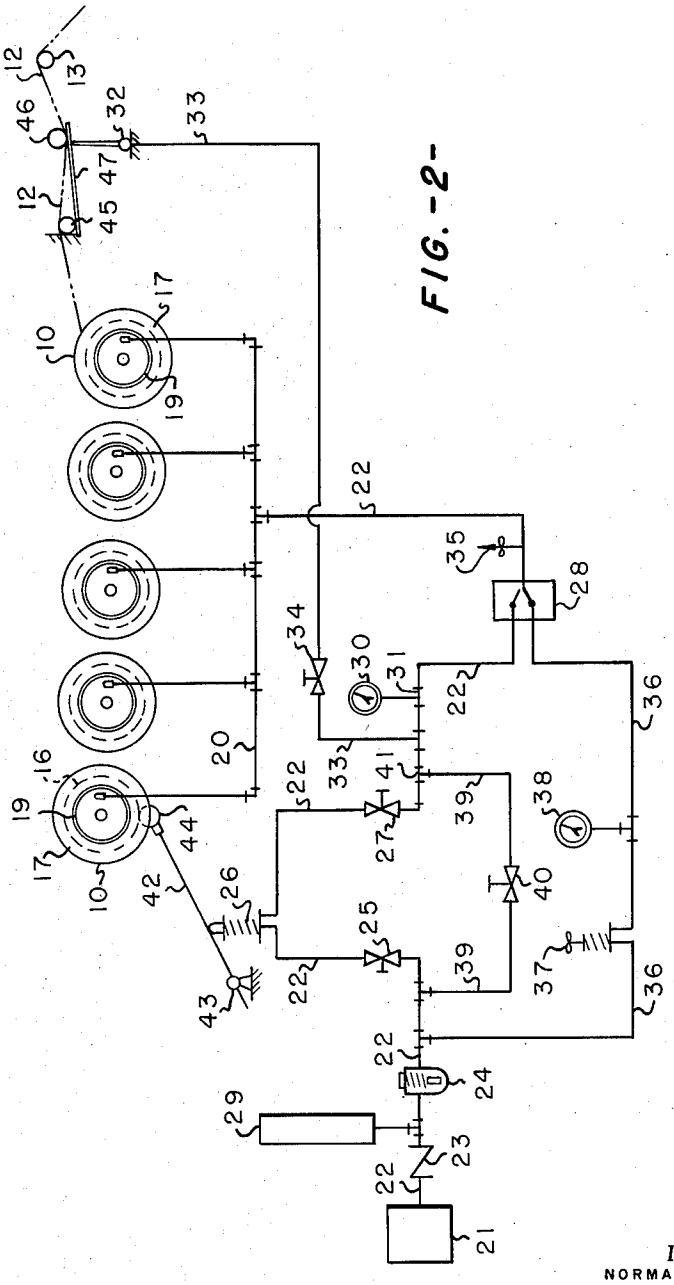


FIG. -2-

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BRAKE SYSTEM

Original Filed March 1, 1954 4 Sheets-Sheet 3

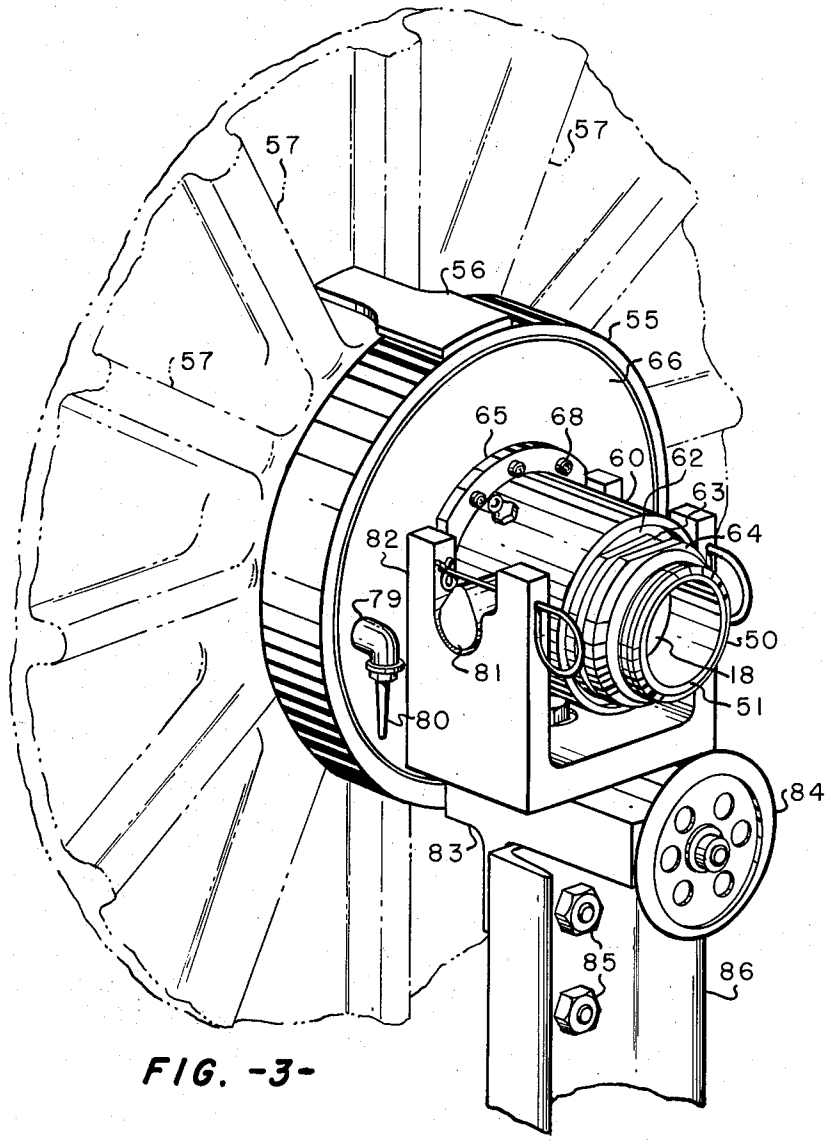


FIG. -3-

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BRAKE SYSTEM

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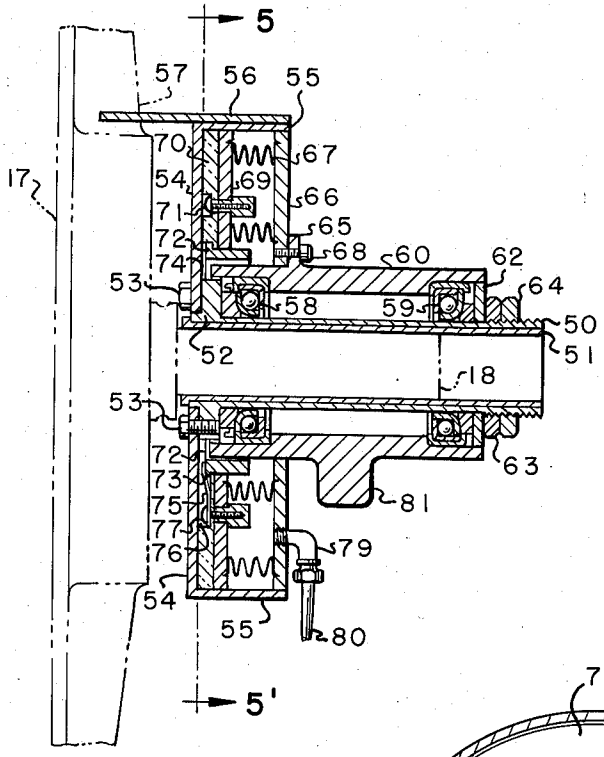


FIG. -4-

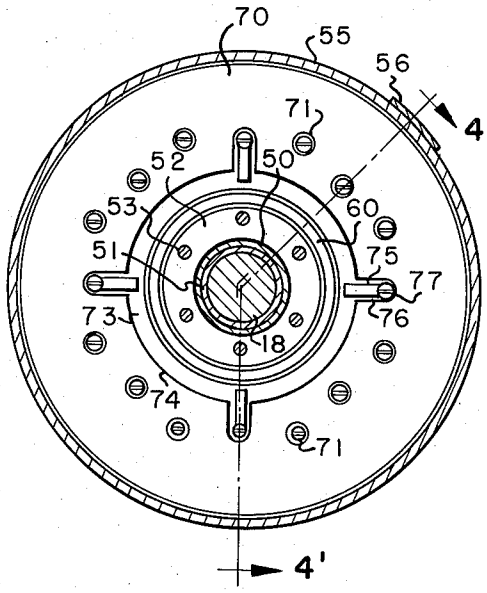


FIG. -5-

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2,964,826

BRAKE SYSTEM

Norman E. Klein, Pendleton, Charles D. Lucas, Clemson, and George A. Mobley, Spartanburg, S.C., assignors to Deering Milliken Research Corporation, Spartanburg, S.C., a corporation of Delaware

Original application Mar. 1, 1954, Ser. No. 413,132, now Patent No. 2,924,869, dated Feb. 16, 1960. Divided and this application July 3, 1959, Ser. No. 824,847

9 Claims. (Cl. 28—28)

This is a divisional applicaion of the copending application of Norman E. Klein, Charles D. Lucas, and George A. Mobley, Serial Number 413,132, filed March 1, 1954, now Patent No. 2,824,869.

This invention relates to brakes and braking systems and more particularly to braking systems suitable for use with textile beaming or slashing apparatus.

In beaming and slashing operations it is common practice to load a creel with a number of section beams each of which has been previously wound with a multitude of warp threads or ends. The ends from all of the section beams are combined to form a warp which is, at least in slashing operations, then treated with a liquid size, dried and wound on a warp beam. In all such beaming operations it is necessary that the section beams be braked in order to provide the proper tension in the warp and to prevent the warp from overrunning during such times as the apparatus is being brought to a stop. At present, braking action for the section beams is customarily provided by placing a weighted rope or band around one or both heads of each of the section beams in peripheral grooves provided for the purpose. In spite of numerous suggestions over a period of many years for replacing such brakes with a more precise system, rope brakes continue as the choice of most of the industry.

The disadvantages of weighted rope brakes are well recognized in the art. The brakes require constant attention since as the diameter of the yarn supply on each of the section beams decreases, it is necessary to decrease the braking action to maintain a constant tension in the warp and this means that an operator must be continually removing weights from the rope brakes on each of the section beams throughout the beaming operation. A second well recognized disadvantage of rope brakes is that the braking action is not decreased uniformly as the weights are removed, and one obtains a step wise reduction of braking action. A further serious disadvantage of the weighted rope brakes is that the ropes soon become frayed so that the braking action on various section beams is not uniform and, as a result, some section beams run out of yarn much sooner than others. As the yarn remaining after one beam is out cannot readily be employed in the preparation of a warp, this results in what is known to the trade as soft waste.

In spite of the fact that the disadvantages of rope brakes for beaming apparatus have been recognized for many years and many efforts have been made to replace the rope brakes, none of these efforts have met with any degree of commercial success. One reason that these efforts have not been successful is that conventional mechanical brakes in all instances possess measurable operating friction in the control system which results in objectional hysteresis characteristics. In other words, the amount of braking torque obtained wtih the application of a given force to the brake activating means varies with conventional mechanical brakes depending upon whether the selected value is approached from a smaller value or

from a larger value. A further reason why these efforts have been largely unsuccessful is that conventional brakes ordinarily do not have a linear response so that the amount of braking torque resulting from the application of the brake is not necessarily proportional to the amount of force applied to the brake activating means. A still further important reason why these efforts have generally met with failure is that there has not been available a braking system capable of evenly compensating for the different braking torques required as the diameter of the section beams is decreased and which is also integrated to achieve a substantially constant let-off tension in the warp.

According to this invention there is provided a brake suitable for use on section beams wherein two disk shaped braking surfaces are engaged in frictional contact by the expansion of a bellows due to internal fluid pressure and there is also provided a fluid braking system suitable for use with the new brake in beaming operations. The new system evenly and adequately compensates for the change in diameter of the yarn supply on the section beams and also detects and compensates for let-off tension variations in the warp, resulting in the warp being maintained under a substantially constant tension at all times.

It is a feature of the new braking system that it allows for the adjustment of minimum braking torque without allowing the warp to slacken on stopping of the beaming apparatus.

It is a further feature of the braking system that the braking torque on all of the section beams is substantially the same thereby insuring that the beams will run out at substantially the same time with the elimination of soft waste.

It is a further advantage of the new braking system when applied to beaming apparatus that the tension in the warp is maintained substantially constant at all times irrespective of the diameter of the yarn supply on the section beams, thereby insuring that the warp will be wound on the warp beam at a constant tension.

Still another feature of the new braking system is that it provides means responsive to the diameter of the yarn supply and means responsive to the tension in the warp which are adapted to be employed in combination or individually to control the braking torque applied to the section beams.

A preferred embodiment of the invention will now be described with reference to the accompanying drawings in which:

Figure 1 is a fragmentary perspective view, showing principal parts in location, of a sizing apparatus employing the new brakes and braking system.

Figure 2 is a schematic diagram illustrating the new braking system.

Figure 3 is a view in perspective of the new brake as applied to a section beam.

Figure 4 is a sectional view of the new brake taken substantially along the line 4, 4′ in Figure 5.

Figure 5 is a section view of the new brake looking substantially along the line 5, 5′ in Figure 4.

Referring to the drawings in greater detail, there is illustrated in Figure 1 a conventional rayon slashing apparatus modified to employ the new brakes and braking system of this invention. Certain elements of the rayon slashing apparatus such as the creel and warp beam are not illustrated as they are conventional in design and form no part of the present invention.

A plurality of section beams 10 each of which has been previously wound with a multitude of yarn ends are arranged in two tiers and feed yarn ends to a comb 11. After passing through the comb 11, yarn ends from all of the section beams 10 are combined into a warp 12

which is drawn over a roller 13 and into a size box 14 where it is coated with a suitable sizing solution. The warp 12 is subsequently passed over drying rollers 15 and is eventually collected on a warp beam, not illustrated.

Each of the section beams 10 has a barrel section 16 on which the warp ends are wound and a head or flange 17 at each end of the barrel portion. Extending centrally from each of the heads 17 is a journal or gudgeon 18 on which the section beams are adapted to be journaled for rotation. Mounted around the gudgeon 18 on one end of each of the section beams 10 is a fluid activatable brake, generally indicated by the reference numeral 19, to be more specifically described in subsequent paragraphs.

Each of the brakes 19 is operatively connected to a header 20 which, as best shown in Figure 2, is connected to a pump 21 through a conduit 22 containing a check valve 23, a filter 24 to remove any suspended matter from the fluid, a valve 25, a controllable pressure regulator 26, a construction such as needle valve 27, and a two-way selector valve 28. An air reservoir 29 is operatively connected to conduit 22 between the check valve 23 and the filter 24 and serves the purpose of smoothing out fluctuations in pressure introduced by the operation of the pump 21 and also serves, in combination with the check valve 23, as a fail safe mechanism so that in the event of pump failure, the check valve 23 closes and the air reservoir 29 provides sufficient pressure to furnish braking action until the slashing apparatus can be brought to a stop.

A pressure indicator 30 is connected to conduit 22 by means of a connection 31 immediately preceding the two-way selector valve 28 and serves the purpose of measuring the pressure being supplied to brakes 19 during normal operation. An escape nozzle 32, which as will be subsequently explained acts as a secondary pressure regulating means, is connected to conduit 22 immediately preceding the connection 31 by means of a conduit 33 and a valve 34. A safety valve 35 is connected into conduit 22 at a point intermediate the selector valve 28 and the header 20 as a precautionary measure to prevent the pressure being applied to the brakes from rising above a safe value.

A by-pass 36 containing a pressure regulator 37 is connected to conduit 22 at a point intermediate the filter 24 and valve 25 and to the two-way selector valve 28. A pressure indicator 38 is provided for measuring the pressure of fluid in by-pass 36 between the pressure regulator 37 and the two-way selector valve 28. A second by-pass 39 containing valve 40 is operatively connected at one end to conduit 22 at a point intermediate the filter 24 and valve 25 and at the other end to a connection 41 immediately following the valve 27.

The pressure regulating means 26 is operated by a feeler arm 42 pivoted at one end from a suitable support 43 and having at the other end a contact for the yarn supply on beam 10 such as a small roller indicated by the reference numeral 44. The roller 44 is preferably made of a light weight material such as cork and is adapted to be held against the surface of the yarn supply on a selected one of the beams 10 by the tension spring in the regulator 26. As the diameter of the yarn supply on the section beam 10 decreases, a corresponding movement of the roller 44 and arm 42 allows pressure regulator 26 to close and decrease the pressure being supplied to brakes 19 by conduit 22.

After the warp 12 passes through comb 11 it is passed over a stationary rod 45 and then under a rod 46 which is resiliently mounted by virtue of leaf springs 47 only one of which is shown. The warp is then passed upwardly over roller 13 so that the rod member 46 is displaced upwardly as a result of the tension in the warp and as will be apparent to those skilled in the art, the degree of displacement of the rod 46 will be dependent on the tension in the warp 12. The nozzle 32 is positioned immediately below the spring member 47 so that the spring member acts as a variable closure for the nozzle.

In operation, the slashing apparatus is provided with full section beams, pump 21 is started to build up suitable operating pressure, and the selector valve 28 is positioned to open by-pass 36. Pressure regulator 37 is opened sufficiently to give approximately the correct braking pressure and the slasher is placed in operation. Pressure regulator 37 is then adjusted to give exactly the desired braking action as determined visually. The reading of pressure indicator 38 is noted and with the selector valve 28 still in the position to open by-pass 36, and with needle valve 27 wide open and valve 34 closed, pressure regulator 26 is adjusted to give a reading on pressure indicator 30 slightly in excess of that on pressure indicator 38. Valve 34 is then opened and nozzle 32 positioned with the respect to the spring member 47 so that the escape of fluid from nozzle 32 is appreciable but not excessive. As pressure regulator 26 will be trying diligently to compensate for the loss of fluid through nozzle 32, it will be found that the reading of pressure indicator 30 has fallen but slightly so that needle valve 27 is then closed sufficiently to give a reading on pressure indicator 30 identical to that on pressure indicator 38. The escape of fluid from nozzle 32 is then again checked to make certain it is satisfactory in volume and if necessary readjustment of nozzle 32 and needle valve 27 is made. When the escape of fluid from nozzle 32 is satisfactory and the reading of pressure indicator 30 is identical to that of pressure indicator 38, selector valve 28 is operated to close by-pass 36 and open conduit 22.

As has been previously explained, it is necessary that the braking action be decreased as the diameter of the yarn supply on the section beams decreases in order that the tension in the warp be maintained constant. It will be apparent from the above description that this is accomplished by pressure regulator 26 providing a decreased pressure on the fluid being supplied to brakes 19 by reason of the movement of arm 42 with decreasing yarn supply diameter. Pressure regulator 26 is, therefore, the primary pressure regulating means and the purpose of the escape nozzle 32 in ordinary operation is that of a secondary pressure regulating means responsive to warp tension. The escape of fluid from nozzle 32 not only smooths out small fluctuations in warp tension in normal operation but also reduces braking torque during starting and increases torque during stopping thereby preventing unnecessary stretching and overrunning of the warp. In other words, should the tension in warp 12 decrease slightly, the rod 46 is lowered as a result of the tension in spring members 47 thereby decreasing the volume of fluid escaping through nozzle 32 so that the fluid pressure being supplied to brakes 19 is equal to the pressure in conduit 22 between pressure regulator 26 and needle valve 27. On the other hand should the tension in warp 12 increase above the desired value, rod 46 and spring members 47 are raised vertically thereby allowing an increased escape of fluid from nozzle 32. Due to the constriction in conduit 22 furnished by valve 27, this results in a reduced fluid pressure being applied to the fluid activatable brakes 19, so that the tension in the warp is decreased.

It is a feature of the present braking system that it can be operated with either nozzle 32 or pressure regulator 36 serving as the sole pressure regulating means and this is advantageous in numerous instances. If for example pump 21 becomes defective so that it is incapable of furnishing sufficient fluid to operate the system when escape nozzle 32 is in operation, it may be desirable to operate the braking system solely by means of pressure regulator 26. On the other hand if the pressure regulator 26 should become defective in action,

one might desire to operate the system with escape nozzle 32 as the sole pressure regulating means.

To operate the braking system with regulator 26 as the sole regulating means, a correct operating pressure is determined as explained above by by-pass 36 and pressure indicator 38. With valve 34 closed and valve 27 open, pressure regulator 26 is then adjusted so that pressure indicator 30 gives a reading identical to that of indicator 38. The selector valve 28 is then operated to close by-pass 36 and open conduit 22.

To operate the braking system with escape nozzle 32 as the sole pressure regulating means, a correct operating pressure is determined by means of by-pass 36 as above and with valve 25 closed and valves 34 and 40 open, nozzle 32 is positioned to give a pressure reading on indicator 30 equal to that on indicator 38. If the escape of fluid from nozzle 32 is excessive, valve 40 should be partially closed and nozzle 32 again adjusted to give a correct pressure reading on indicator 30. When the escape of fluid from nozzle 32 is satisfactory and the reading of pressure indicator 30 is identical to that of pressure indicator 38, selector valve 28 is operated to close by-pass 36 so that fluid pressure is then supplied to the brakes through by-pass 39, conduit 22 and header 20.

Reference will now be made to Figures 3, 4 and 5 of the drawings wherein the new fluid activatable brake is illustrated in greater detail. The reference numeral 50 designates a tubular sleeve adapted to be placed over a gudgeon 18 extending centrally from the head 17 of a section beam. As gudgeons of various section beams vary slightly in diameter, an adapter sleeve 51 is provided to eliminate needless play. Sleeve 50 is provided with an annular flange 52 near one end and attached to the flange 52 by any suitable means such as by bolts 53 is a centrally apertured, disk shaped member 54 having a wide peripheral annular flange 55. Secured to the flange member 55 for instance by welding is a lug member 56 adapted to engage any one of a number of ribs 57, with which the heads of section beams are conventionally provided, and thereby secure the disk member 54 and sleeve 50 for rotation with section beam 10.

Journaled about sleeve 50 and free to rotate with respect thereto by virtue of low friction bearings 58 and 59 is a cylindrical housing 60. The housing 60 is secured against lateral movement by a grease retainer ring 62 and lock nuts 63 and 64 threaded onto sleeve 50. The housing 60 is provided with a pair of opposed arcuate flanges 65 to which an end member 66 of a toroid shaped bellows 67 is attached by any suitable means such as by bolts 68. The opposite end member 69 of the toroid shaped bellows 67 serves as a brake shoe to which there is attached a section of brake lining material 70 by any suitable means such as by screws 71 having their heads recessed within the brake lining material. The braking surface of brake shoe member 69 is adapted to frictionally engage the inner surface of the disk member 54 which, of course, is machined to a high degree of smoothness to present a suitable braking surface and to eliminate unnecessary abrasion of the brake lining 70. The braking surfaces as well as the flexible part of bellows 67 are protected from external dirt and lint by means of flange 55 which serves as a protective cover.

Mounted through the brake shoe 69 in spaced relationship to the housing 60 is an inertia ring member 72 having an annular flange 73. The inner peripheral edge of brake lining 70 is provided with an annular recess 74 to receive the flange 73 which is maintained in sliding frictional contact with the brake lining 70 by means of a number of clip springs 75. The springs 75 are mounted in suitable recesses 76 in the brake lining material and are secured to the brake drum member 69 by screws 77.

The end member 66 of the bellows 67 is provided with an orifice 78 into which a suitable fitting 79 is threaded. The fitting 79 is connected by a suitable conduit 80 to header 20 (Figure 1) for the supply of a fluid under pressure.

The housing 60 is provided with a pair of trunnions 81 suitable for supporting the same in a trunnion box 82 quite similar to that with which creels are conventionally equipped. The trunnion box 82 is pivotally secured to a slide, not illustrated, but conventional in construction, which in turn is mounted in a housing 83 and is movable laterally in a conventional manner by rotation of the wheel 84. The housing 83 is in turn rigidly attached by any suitable means such as a bolt 85 to a convention creel standard 86.

In operation, the bellows 67 is expanded lengthwise by internal pressure above atmospheric by means of a fluid being admitted through conduit 80 and fitting 79. On the expansion of the bellows 67, the brake lining material 70 frictionally engages the smooth surface of rotating disk member 54. Since the brake lining 70 is not free to rotate because of its attachment to bellows 67 and housing 60, a braking torque is exerted on disk member 54 and since disk member 54 is secured for rotation with the section beam 10 by means of lug 56 bearing against rib 57 of the section beam head 17, the section beam is effectively braked. As will be apparent, the magnitude of the braking torque is dependent on the internal pressure in bellows 67 which can be effectively varied by changing the pressure on the fluid being supplied through conduit 80.

The brake lining 70 is secured against rotation only by virtue of its attachment to the free end of bellows 67 and since bellows 67 is not completely torsionally rigid, this introduces the likelihood of high frequency vibration of the brake shoe member 69. The inertia ring member 72 provides means for effectively damping the high frequency vibration which may possibly result because of this arrangement. While the inertia ring 72 does not prevent rotation of the brake shoe member 69, it momentarily discourages transient actions because of the inertia of the ring and the sliding frictional contact of the flange 73 with the brake lining 70 so that the brake shoe member 69 is effectively prevented from oscillating in a rotary manner.

Having thus described our invention, that which is claimed is:

1. A braking system for a rotatable strand let-off device comprising a variable action brake operatively connected to said strand let-off device, a diameter detecting device adapted to detect the diameter of a supply of strandular material on said rotatable let-off device and being connected in brake-controlling relation to said brake, and a strand tension detecting device adapted to detect the tension in strandular material proceeding from said rotatable let-off device and being operatively connected in brake-controlling relation to said brake.

2. A system according to claim 1 wherein said brake is a fluid actuated brake.

3. A system according to claim 1 wherein said diameter detecting device is a movable mechanical feeler disposed adjacent and in engaging relation to the surface of strandular material on said let-off device in the operation condition.

4. A system according to claim 1 wherein said brake is a fluid pressure responsive brake comprising an expandable bellows having a brake shoe element operatively movable thereby and adapted to brakingly engage a complementary brake surface synchronously movable with said let-off device.

5. The system according to claim 1 including a plurality of strand let-off devices, a corresponding plurality of brakes, each operatively associated in braking relation to a corresponding one of said let-off devices, said diameter detecting device and said tension detecting de-

vice being operatively connected in brake-controlling relation to each of said brakes and let-off devices.

6. A system according to claim 5 wherein each of said let-off devices is a section beam from which yarn is drawn to form a warp.

7. A system according to claim 6 wherein said section beams comprise a slashing apparatus creel.

8. A system according to claim 1 wherein said tension detecting device comprises a fluid bleeder valve and a bleeder valve restricting element movable to restrict the flow of fluid from said bleeder valve as a function of strand let-off tension.

9. A braking system for a slashing apparatus including a creel and a plurality of section beams from which yarn is drawn to form a warp, each of said beams including a head and gudgeon extending from said head, said braking system comprising a brake for each of said beams, said brakes including, in each instance, a sleeve to incase said gudgeon, a disk shaped brake member carried by said sleeve, a lug member on said brake member to engage one head of said beam and to secure said brake member for rotation with said beam, a cylindrical housing journaled about said sleeve, a toroid shaped bellows positioned about said sleeve and secured at one end to said housing, a centrally apertured, disk shaped brake shoe carried by the unsecured end of said bellows and circumscribing said sleeve in spaced relationship therewith, said brake shoe having a lined surface to frictionally engage said disk shaped brake member upon expansion of said bellows, and said lined surface having an annular recess, an inertia member positioned at least partially within said recess, a plurality of resilient retaining members secured to said brake shoe to retain said inertia member in sliding frictional contact with said lined surface, a pair of trunnions on said cylindrical housing to support the housing in said creel and to secure the same against rotation; means for supplying fluid under pressure to the bellows of each of said brakes, a feeler arm cooperating with one of said beams to measure the diameter of a yarn supply thereon, primary pressure regulating means cooperating with said feeler arm to decrease, with decreasing yarn supply diameter, the pressure at which said fluid is supplied to the bellows of each of said brakes, tension responsive means responsive to the tension in said warp, a secondary pressure regulating means cooperating with said tension responsive means to increase, with decreasing tension in said warp, the pressure at which said fluid is supplied to the bellows of each of said brakes, whereby said warp is retained under a substantially constant tension.

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