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APPARATUS FOR WINDING YARN

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FIG. 1.

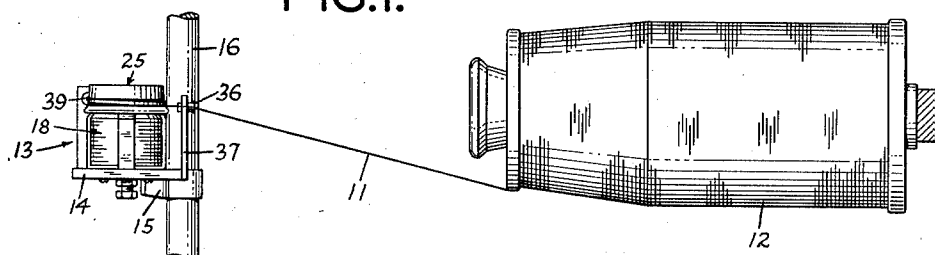


FIG. 2.

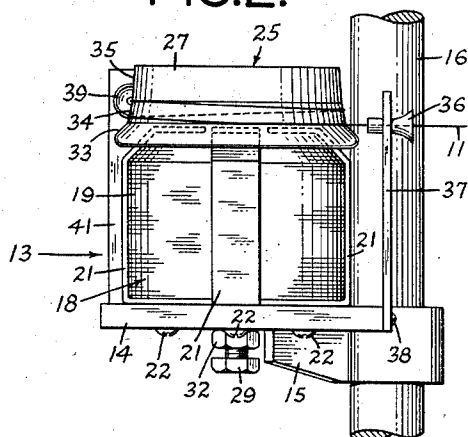


FIG. 3.

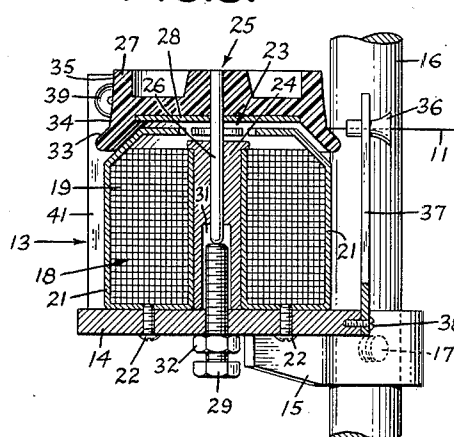


FIG. 5.

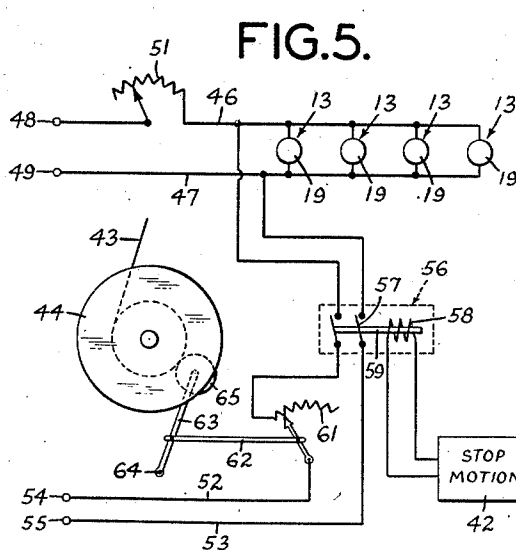
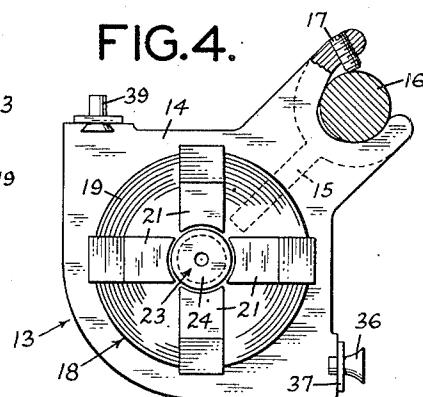


FIG. 4.



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APPARATUS FOR WINDING YARN

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6 Claims. (Cl. 28—51)

This invention relates to textile apparatus and relates more particularly to yarn tension devices for use in textile apparatus.

In textile operations involving travelling yarn, as in the winding of yarn from a source of supply onto a take-up package, it is desirable to maintain the yarn under controlled tension during the winding operation. Heretofore, the desired tension was applied to the yarn by devices of various types such as discs, whorls, gates, springs, etc. A common characteristic of all such prior yarn tension devices is that they depend upon the frictional rubbing of two surfaces, one of which may be the yarn itself, to develop tension in the yarn. These prior yarn tension devices are not wholly satisfactory since the rubbing causes wear on their friction surfaces necessitating periodic readjustment and replacement of said devices to maintain the yarn tension within narrow limits. In addition, where the prior yarn tension devices develop tension in the yarn through the rubbing of the yarn itself against a friction surface, the possibility is ever present that the rubbing will damage the yarn, particularly when the yarn is subjected to a large number of textile operations in each of which it passes through a yarn tension device.

In many textile operations, it is necessary to apply tension simultaneously to a great many ends of yarn. For example, in the beaming of a warp of yarns, a plurality of yarn packages are mounted in a creel, the ends of yarn from said yarn packages are passed through individual yarn tension devices and stop motions, and are then wound on a driven warp beam at a constant rate in a manner well known in the art. To obtain a satisfactory warp, the tension applied by the yarn tension devices to each of the ends of yarn must be substantially identical. When using prior yarn tension devices, as the friction surfaces thereof become worn, there was a tendency for the tension on the ends of yarn to change, leading to the production of imperfect warps. Furthermore, with prior yarn tension devices, when it was desired to change the tension applied to all of the ends of yarn at one time, as, for example, in beaming a different type or weight of yarn, it was necessary to adjust each of the yarn tension devices individually. This operation required a considerable amount of time and labor and often led to the production of defective warps where errors occurred in the setting of the yarn tension devices.

It is an important object of this invention to provide a yarn tension device which will be free from the foregoing and other disadvantages and which will be especially simple in construction and efficient in operation.

A further object of this invention is the provision of a yarn tension device in which the yarn tension is developed without the use of friction.

Another object of this invention is to provide yarn tension devices in which the tension on a number of ends of yarn passing through individual yarn tension devices may be changed by means of a single adjustment.

Other objects of this invention, together with certain details of construction and combinations of parts, will be apparent from the following detailed description and claims.

According to the present invention, there is provided a device for applying tension to a travelling yarn comprising a member movable by said yarn, such as a rotatable wheel around which the yarn is adapted to be trained, and magnetic means for applying a braking force to said wheel to develop tension in the yarn without the

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use of friction. The magnetic braking means comprises a magnet and an electric conductor spaced from and out of contact with the magnet and positioned in the magnetic field produced by said magnet. Either the magnet or the electric conductor is fastened to the rotatable wheel so that as the yarn causes said wheel to rotate, the electric conductor will be moved with respect to the magnetic field, generating an electric current therein. As is well known, the generation of an electric current in the conductor will tend to oppose the motion of said conductor with respect to the magnetic field, thereby applying a braking force to the wheel to develop tension in the yarn.

The magnet may comprise a coil through which an electric current is passed to produce a magnetic field, which coil may be provided with pole pieces of ferromagnetic material to concentrate the magnetic field. The electric conductor may be formed of any material that will carry an electric current, such as copper, aluminum or the like. To obtain the highest braking force in a yarn tension device of given size, the electric conductor is advantageously formed of a ferromagnetic material such as soft iron or the like so that the electric current generated therein will produce a strong magnetic field which will interact with the magnetic field of the magnet.

The magnitude of the braking force applied to the rotatable wheel and the tension developed in the yarn for a given yarn tension device and at a given yarn speed will depend upon the strength of the magnetic field with respect to which the electric conductor is moved. The strength of this magnetic field may be altered by adjusting the spacing between the magnet and the electric conductor, which adjustment may be used to match a plurality of yarn tension devices so that they will all produce substantially identical yarn tensions when operated under the same conditions. The strength of the magnetic field may also be altered by changing the strength of the magnet, which, in those cases where the magnet comprises a coil through which an electric current is passed, is readily effected by increasing or decreasing the value of this current. This permits the tension of the yarns passing through a plurality of yarn tension devices to be changed simultaneously by interconnecting the coils of said yarn tension devices and altering the value of the current flowing through all of said coils.

Upon stopping the textile apparatus in connection with which the yarn tension device of the invention is employed, inertia causes the wheel to continue to rotate for a limited time. If this "override" is different from that of the other elements of the textile apparatus, it will introduce slack into the yarn or will subject the yarn to excessive tension. To avoid this possibility, means may be provided to change the braking force on the wheel when the textile apparatus is stopped so as to maintain a uniform tension on the yarn at all times.

The yarn tension device of this invention will now be described in specific connection with a warper. It is to be understood, however, that it may be applied in connection with other types of textile apparatus wherein it is desired to apply a controlled tension to a travelling yarn.

A preferred embodiment of this invention is shown in the accompanying drawing wherein,

Fig. 1 is a side elevational view of a portion of a creel to which the yarn tension device is applied.

Fig. 2 is a side elevational view of the yarn tension device,

Fig. 3 is a vertical cross-sectional view of the yarn tension device,

Fig. 4 is a plan view of the yarn tension device with certain parts omitted in the interest of clarity, and

Fig. 5 is a diagrammatic view showing the interconnections between a warper and a plurality of yarn tension devices.

Referring now to the drawing, the reference numeral 11 designates a yarn which is drawn from a bobbin 12 and passed over a yarn tension device, indicated generally by reference numeral 13, on its way to a warper which may be of the type shown in application Ser. No. 94,118, filed May 19, 1949, of Roughsedge et al., now Patent No. 2,663,067. The yarn tension device 13 is mounted on a

supporting plate 14 fastened to a bracket 15 that is clamped to an upright 16 by means of a set screw 17.

The yarn tension device 13 includes a magnet indicated generally by reference numeral 18, which comprises a coil 19 and pole pieces 21 of soft iron or other ferromagnetic material that are fastened to the plate 14 by means of screws 22. The pole pieces 21 are bent around the coil 19 and have an air-gap 23 separating the ends thereof, in which air-gap 23 a strong magnetic field is produced when an electric current flows through the windings of said coil.

Positioned centrally of the coil 19 is a sleeve-bearing 24 which is advantageously formed from porous sintered metal impregnated with a lubricant. Rotatably mounted in the bearing 24 is a wheel assembly, indicated generally by reference numeral 25, and comprising a shaft 26 of hardened steel that carries at its upper end, a wheel 27 and a soft iron disk 28. At its lower end, the shaft 26 is rounded and polished, and bears against the upper end of a hardened steel screw 29 that is in threaded engagement with the plate 14 and extends through said plate 14 and into a passageway 31 in the lower end of the sleeve-bearing 24. The screw 29 is provided with a lock-nut 32 to hold the same in any desired position.

The periphery of the wheel 27 is divided into three sections, a lower section 33 that is tapered at a relatively sharp angle, an intermediate section 34 that is tapered at a smaller angle than the lower section 33, and an upper section 35 that is tapered at a smaller angle than the intermediate section 34. The yarn 11 is directed onto the wheel 27 by means of a yarn guide such as a trumpet guide 36 which is supported on a standard 37 fastened to the plate 14 by means of a screw 38. After passing around the periphery of the wheel 27, the yarn 11 leaves said wheel and passes through a yarn guide such as a trumpet guide 39 which is supported on a standard 41 that is fastened to the plate 14 in any suitable manner. The trumpet guide 36 is positioned to direct the yarn 11 onto the intermediate section 34 of the wheel 27, and the trumpet guide 39 is positioned to remove the yarn 11 from the intermediate section 34 of the wheel 27 at a point higher than that at which it first contacts said wheel. Because of the upward inclination of the intermediate section 34, the yarn 11 tends to move upwardly on said section in passing around the periphery of the wheel 27 from the trumpet guide 36 to the trumpet guide 39 as shown in Fig. 2, thereby preventing the overlapping of two turns of yarn with possible damage to or breakage of said yarn.

As the yarn 11 passes through the yarn tension device 13, it will cause the rotation of the wheel assembly 25, thereby moving the disk 28 with respect to the magnetic field produced in the air-gap 23 by the flow of an electric current through the windings of the coil 19. The movement of the disk 28 with respect to the magnetic field in the air-gap 23 will generate electric currents in said disk, which will tend to oppose the rotation of said disk and exert a braking force on the wheel assembly 25 to produce tension in the yarn 11. The magnitude of the braking force on the wheel assembly 25 and the tension in the yarn 11 will depend upon the strength of the magnetic field in the air-gap 23, which may be controlled by changing the value of the electric current flowing through the windings of the coil 19. The braking force on the wheel assembly 25 will also depend upon the spacing between the air-gap 23 and the disk 28, which spacing may be readily adjusted by turning the screw 29.

Fig. 5 shows diagrammatically the interconnections between yarn tension devices of this invention and a warper that is employed for beaming yarn. In this operation, ends of yarn are drawn from a plurality of yarn packages and, after passing through individual yarn tension devices 13 and, also individual stop motions indicated diagrammatically by reference numeral 42, are arranged to form a warp 43 that is wound onto a warp beam 44 rotated by means of a warper drive, indicated diagrammatically by reference numeral 45. The coils 19 of the yarn tension devices 13 are connected in parallel between leads 46 and 47 and a direct current is caused to flow through said coils by impressing a suitable voltage across the terminals 48 and 49. A rheostat 51 connected in series with the lead 46 permits the value of the current flowing through the coils 19 to be controlled over a wide range, so as to change the magnitude of the braking force

on the wheel assemblies 25 and the tension on the yarns forming the warp 43. To insure the production of a high quality warp, the screws 29 in the yarn tension devices 13 shown in Fig. 5 are adjusted so that the tension in the yarn 11 passing through each of said yarn tension devices will be substantially identical when the same voltage is applied to the coils 19 of all of said yarn tension devices.

When a yarn in the warp 43 breaks during the beaming operation, the stop motion 42 will act to shut off the warper drive 45, whereupon the inertia of the warp beam 44 will cause said warp beam to rotate for a limited period of time before it stops. To insure that the wheel assembly 25 will stop together with the warp beam 44, without overriding and without imposing excessive tensions on the yarns forming the warp 43, there is provided an auxiliary circuit for impressing a supplementary voltage on the coils 19 on the yarn tension devices 13. The auxiliary circuit comprises a pair of leads 52 and 53 that are connected to the leads 46 and 47, respectively, and upon which a suitable voltage is impressed through the terminals 54 and 55. A relay, indicated generally by reference numeral 56, and comprising a normally open double pole switch 57, a coil 58 and an actuating plunger 59, is connected in the leads 52 and 53 so that no supplementary voltage is applied to the yarn tension devices 13 from the terminals 54 and 55 when the warper drive 45 is operating. However, when the stop motion 42 shuts off the warper drive 45 it will also send a current through the coil 58, moving the plunger 59 to close the contacts of the switch 57, thereby impressing a supplementary voltage on the coils 19 of the yarn tension devices 13 from the terminals 54 and 55 to change the braking force on the wheel assemblies 25.

As the yarn builds up on the warp beam 44, the inertia of said beam will increase and it will rotate for a longer period of time after the stop motion 42 shuts off the warper drive 45. Simultaneously, the braking force applied to the wheel assemblies 25 when the stop motion 42 operates should be reduced to maintain the yarn tension uniform during this period. To this end, there is provided in the lead 52 a rheostat 61 that is operated by an actuating arm 62 fastened to a lever arm 63 pivotally mounted at 64 and carrying at its upper end a press roll 65 that bears against the winding on the warp beam 44. As the diameter of said winding increases, the motion of the press roll 65 will act, through the lever arm 63 and the actuating arm 62, to increase the resistance of that portion of the rheostat 61 which is in series with the lead 52, thereby decreasing the voltage that is impressed on the coils 19 of the yarn tension devices 13 from the terminals 54 and 55 when the contacts of the switch 57 are closed and reducing the braking force applied to the wheel assemblies 25.

It is to be understood that the foregoing detailed description is given merely by way of illustration and that many variations may be made therein without departing from the spirit of my invention.

Having described my invention, what I desire to secure by Patents Patent is:

1. In apparatus for winding yarn including a take-up element on which the yarn is wound, the combination with electrically-operated means for halting the operation of said apparatus, of a device for applying tension to yarn moving through said apparatus, said device comprising means including a coil for producing a magnetic field when electrical current is caused to flow through said coil, means for impressing a voltage on said coil for causing tension to be applied to the yarn, means for changing the voltage impressed on said coil when said means for halting the operation of said apparatus is actuated, and means for varying the change in voltage impressed on said coil whereby the tension applied to the yarn is altered, said latter means including a rheostat and an arm actuated by the windings of said take-up element for operating said rheostat.

2. In apparatus for winding yarn including a take-up element on which the yarn is wound, the combination with electrically-operated means for halting the operation of said apparatus, of a device for applying tension to yarn moving through said apparatus, said device comprising means including a coil for producing a magnetic field when electrical current is caused to flow through said coil, means for impressing a voltage on said coil for causing tension to be applied to the yarn, a separate cir-

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cuit for changing the voltage impressed on said coil when said means for halting the operation of said apparatus is actuated, and means for varying the change in voltage impressed on said coil whereby the tension applied to the yarn is altered, said latter means including a rheostat and an arm actuated by the windings of said take-up element for operating said rheostat.

3. In apparatus for winding yarn, the combination with electrically-operated means for halting the operation of said apparatus, of a device for applying tension to yarn moving through said apparatus, said device comprising a rotatable wheel around which the yarn is trained, a coil for producing a magnetic field when electrical current is caused to flow through said coil and an electrical conductor movable relative to said coil on rotation of said wheel by the travelling yarn to apply a braking force to said wheel whereby tension is applied to the yarn, means for impressing a voltage on said coil, means for changing the voltage impressed on said coil when said means for halting the operation of said apparatus is actuated, and means for varying the change in voltage impressed on said coil.

4. In apparatus for winding yarn including a take-up element on which the yarn is wound, the combination with electrically-operated means for halting the operation of said apparatus, of a device for applying tension to yarn moving through said apparatus, said device comprising a rotatable wheel around which the yarn is trained, a coil for producing a magnetic field when electrical current is caused to flow through said coil and an electrical conductor movable relative to said coil on rotation of said wheel by the travelling yarn to apply a braking force to said wheel whereby tension is applied to the yarn, means for impressing a voltage on said coil, means for changing the voltage impressed on said coil when said means for halting the operation of said apparatus is actuated, and means for varying the change in voltage impressed on said coil in proportion to the windings on said take-up element.

5. In apparatus for winding yarn including a take-up element on which the yarn is wound, the combination with electrically-operated means for halting the operation of said apparatus, of a device for applying tension to yarn moving through said apparatus, said device comprising a rotatable wheel around which the yarn is trained, a coil for producing a magnetic field when electrical current is caused to flow through said coil and an electrical conductor movable relative to said coil on rotation of said wheel by the travelling yarn to apply a braking force to said wheel whereby tension is applied to the yarn, means for impressing a voltage on said coil, means for changing the voltage impressed on said coil when said means for halting the operation of said apparatus is ac-

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tuated, and means for varying the change in voltage impressed on said coil, said latter means including a rheostat and means actuated by the windings on said take-up element for operating said rheostat.

6. In apparatus for winding yarn including a take-up element on which the yarn is wound, the combination with electrically-operated means for halting the operation of said apparatus, of a device for applying tension to yarn moving through said apparatus, said device comprising a rotatable wheel having a tapered periphery around which the yarn is trained for at least one turn, a coil for producing a magnetic field when electrical current is caused to flow through said coil and an electrical conductor movable relative to said coil on rotation of said wheel by the travelling yarn to apply a braking force to said wheel whereby tension is applied to the yarn, means for impressing a voltage on said coil, means for changing the voltage impressed on said coil when said means for halting the operation of said apparatus is actuated, means for varying the change in voltage impressed on said coil, said latter means including a rheostat and an arm actuated by the windings on said take-up element for operating said rheostat, means for guiding the yarn onto the periphery of the wheel at one point where the wheel has a given diameter, and means for guiding the yarn from the periphery of the wheel at a point where the wheel has a smaller diameter whereby the turns of yarn around the periphery of the wheel will not overlap.

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