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YARN TENSIONING APPARATUS

Filed May 26, 1966

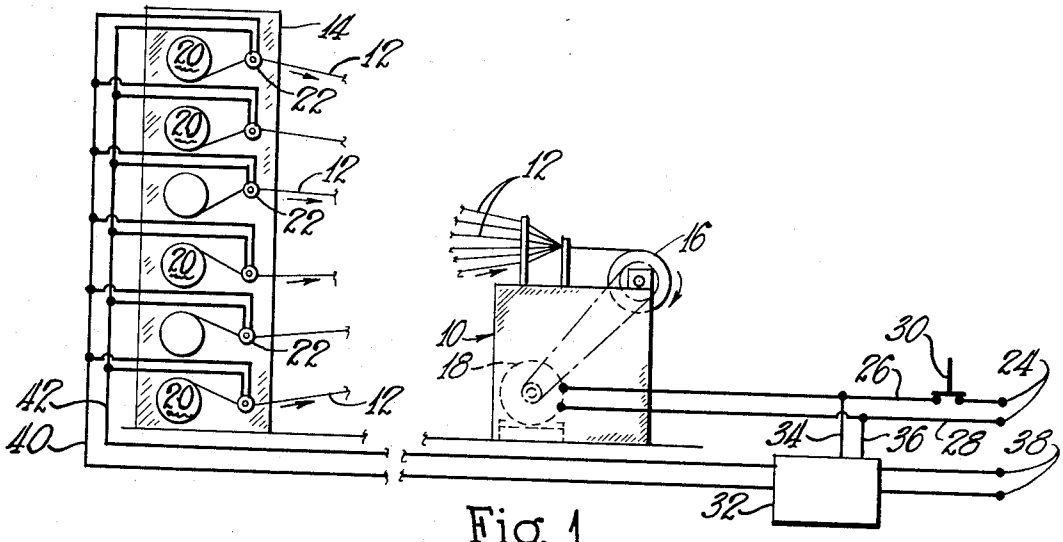


Fig. 1

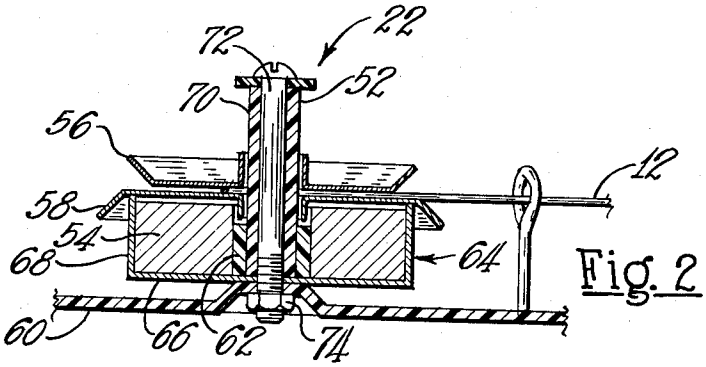


Fig. 2

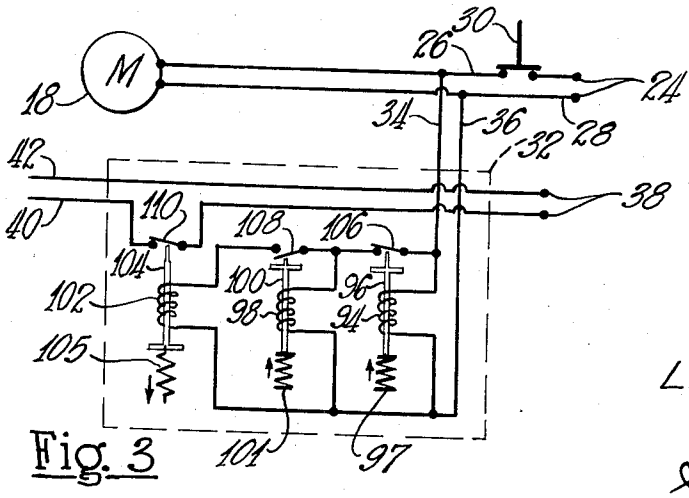


Fig. 3

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YARN TENSIONING APPARATUS

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ABSTRACT OF THE DISCLOSURE

A method for handling alignment of yarn advancing through a tensioning device including a squeezing zone of opposing members wherein the yarn advances with the members urged together followed by a subsequent interval during which the members are not urged together and the alignment of the yarn occurs and finally re-establishing the urged together relationship of the members with the yarn aligned between them.

The word yarn as used in the present application includes strands, rovings, yarns, cords or any linear body.

There are many instances in textile operations involving traveling yarn where applying controlled tension simultaneously to a great number of yarns in an effective and reliable manner is essential. An example is beaming of warp yarns where a plurality of yarns supplied from individual serving packages mounted on a reel are pulled through suitable individual yarn tensioning devices onto a driven warp beam. Satisfactory beaming occurs only when each yarn has substantially identical tension continuously applied to it by its individual yarn tensioning device. Uneven tensioning of the yarns results in nonuniformly wound warping beams providing yarns of varying length on the same warp beam and dissimilar yarn loop tension between yarns on the beam. These conditions cannot be tolerated in subsequent yarn processing such as weaving.

While not all yarn tensioning devices are equally effective in providing even tension between a plurality of yarns being pulled to a collection package (e.g. warping beam), prior art "squeeze-type" devices have demonstrated their usefulness. Prior art "squeeze-type" tension devices usually comprise two independent members or discs rotatably mounted on a post. The yarn enters between the discs along an entrance path and turns on the post to exit the discs along a different path, generally from 45–135 degrees from its entrance path. Usually controlled tension is applied to the yarn through urging the discs together by weights, springs or electromagnetic force. Tension on the traveling yarn may be varied by changing the magnitude of the force urging the discs together. Further, once the yarns are threaded in proper alignment through the discs, continual disc pressure must be maintained, especially where there are long lengths of unsupported yarn such as in the beaming of warp yarns. If a positive squeeze is not maintained on the yarn by the yarn tensioning device, the weight of the yarn gives rise to yarn "run-out" from the serving packages which brings about undesirable slack in the yarn.

Because "squeeze-type" yarn tensioning devices, in particular electromagnetically operated "squeeze-type" yarn tensioning devices, often permit yarn to escape from between their discs during normal yarn processing, the full advantage of their use has not been possible in the beaming of warp yarns and other textile operations. Since there may be as high as 700–800 yarn ends requiring equal individual tensioning from serving packages on a single creel during beam, escaping yarn becomes a serious problem. Escaped yarn permits undesirable nonuniform yarn tensioning and frequently makes possible yarn entanglement with the apparatus on the creel to cause the yarn to break.

Re-creeling is repeatedly required to return the yarn to operating alignment between the discs. Under such re-creeling conditions an economical process is difficult to obtain.

An object of the invention is to provide a method and apparatus for tensioning a plurality of yarns with "squeeze-type" yarn tensioning devices which is substantially free from process interruptions caused by loss of yarn operating alignment with the devices.

Another object of the invention is to provide a method and apparatus for tensioning yarn which permits yarn to regain operating alignment with its "squeeze-type" yarn tensioning device when misalignment has occurred.

These and other objects are attained by interrupting the force urging together the members or discs of "squeeze-type yarn" tensioning devices at a predetermined time for a selected time interval while the yarn is traveling. During the time interval the discs are not urged together. The traveling yarn which has escaped from between the discs or somehow has become misaligned is permitted to move into proper alignment between the discs because the discs are not squeezed together. The force urging the discs together is re-established at the end of the selected time interval to maintain proper yarn alignment and yarn tension.

Other objects and advantages of the invention will become apparent as the invention is hereinafter described in more detail with reference made to the accompanying drawings in which:

FIGURE 1 is a schematic representation of yarn handling apparatus comprising a beaming machine, a creel including electromagnetically operated yarn tensioning units and an electrical delay device embodying the principles of the invention.

FIGURE 2 is a cross-sectional view of a "squeeze-type" yarn tensioning device employed with the yarn handling apparatus shown in FIGURE 1.

FIGURE 3 is a diagram of an electrical circuit for the delay shown in FIGURE 1 embodying the principles of the present invention.

Referring now in detail to the drawings, FIGURE 1 illustrates an example of a textile beaming operation incorporating electromagnetically operated "squeeze-type" yarn tensioning devices and employing a delay device embodying the principles of the present invention. A conventional beaming machine **10** draws a plurality of yarns **12** from a standard textile creel **14** onto a warp reel **16** which is rotated through suitable drive apparatus by a motor **18**.

The creel **14** is a frame supporting a plurality of bobbins or serving packages **20** which provide the yarns **12** which are wound in side by side relationship on the warp reel **16**. The creel **14** may be large enough to support hundreds of serving packages and may be 70–80 feet away from the beaming machine **10**. Associated with each serving package **20** is an electromagnetically operated "squeeze-type" yarn tensioning device **22**. The yarn **12** drawn from each serving package **20** proceeds through its associated tensioning device **22** on the yarn's way to the warp reel **16**.

Electrical current to the motor **18** is supplied from a suitable electrical source **24**, e.g. 220 volt AC, through leads **26** and **28**. Electrical power to the motor **18** is controlled by the beamer switch **30**.

A delay device **32** is connected in parallel across the electrical power leads to the motor **18**, leads **26** and **28**, by leads **34** and **36** positioned between the beamer switch **30** and the motor **18**. Operation of the delay device **32** is controlled simultaneously with the operation of the motor **18** by opening and closing the beamer switch **30**.

Electrical current is supplied to the electromagnetically operated "squeeze-type" yarn tensioning units **22** from a suitable electrical source **38** through leads **40** and **42**.

Delay device **22** is electrically interposed between the electrical source **38** and the yarn tensioning devices **22** along leads **40** and **42**.

FIGURE 2 shows, by way of example, an electromagnetically operated "squeeze-type" yarn tensioning device **22** capable of being employed in the process illustrated in FIGURE 1. The yarn tensioning unit **22** includes a post **52**, a coil **54** and annular discs **56** and **58** and is mounted on a support plate **60**.

The coil **54** is wound on a tubular member **62** made of nonmagnetic material, e.g. nylon, and having an inside diameter which allows the member **62** to slide down over the post **52**. The coil **54** is held in a cylindrical container **64** open at the upper end and having a circular bottom **66** and a tubular wall **68** extending upwardly generally the height of coil **54**. The bottom **66** has an opening through it positioned at its center.

The container **64** is securely positioned on support plate **60** by the upstanding post **52**, which comprises a sleeve **70** and a bolt **72**. The bolt **72** extends through the length of the sleeve **70**, and further, the threaded end of the bolt **72** extends through the center opening in the bottom **66** and a matched opening in the plate **60**. A nut **74** is screwed on the threaded end of the bolt tightly against the bottom of the plate **60**.

Annular discs **56** and **58** are freely rotatably mounted on post **52**. The lower annular disc **58** rests on tubular wall **68** across the upper end of the container **64** and has an outwardly and downwardly extending rim portion extending beyond the outside diameter of the container **64**. The disc **58** is usually fabricated of a non-magnetic material. The upper annular disc **56** is disposed on top of disc **58** and in the embodiment illustrated if FIGURE 2 is somewhat smaller in diameter. The disc **58** has an outwardly and upwardly extending rim portion, which when paired with the flat surface of disc **56** forms a circular furrow, within which a yarn which has escaped from between the discs may ride. Disc **56** is made of magnetic material, e.g. steel.

The operation of an electromagnetically operated "squeeze-type" yarn tensioning device is well known. When the coil **54** is energized by current supplied from the electrical source **38**, the resulting magnetic lines of force emitted from the coil **54** pass through a path comprising the upper annular disc **56** and provide a force tending to draw the disc **56** towards the coil **54**. The force further urges the upper annular disc **56** towards the lower annular disc **58**; hence, when the coil **54** is energized, the discs are urged together into a frictional engagement with the yarn **12** when the yarn **12** is proceeding in proper alignment between them. The amount of pressure and thereby the amount of tension applied to the yarn **12** depends upon the force urging the discs **58** and **56** together and may be varied by regulating the amount of current supplied to the coil **54**.

In operation the yarn **12** is drawn from the serving package **20** along a path running between the discs **56** and **58** of yarn tensioning devices **22**. The path the yarn takes while between the discs may be straight or bent by turning the yarn **12** on the post **52**. If the yarn **12** is turned on the post **52**, the exit path of the yarn is in a direction different from its entrance path to the discs from serving package **20**. While in practice the yarn **12** is bent one-quarter of a turn on the post **52**, the turn may be greatly varied. In any case the principles of the present invention are applicable.

FIGURE 3 illustrates an example of an electrical circuit for the delay device **22** which embodies the principles of the present invention. The circuit comprises control coils or electromagnets **94**, **98**, and **102** and their associated spring biased armatures **96**, **100**, and **104** respectively and pneumatic timing unit switches **106** and **108**.

When energized the circuit operates as a relay to open pneumatic timing unit switch **110** at a predetermined time after beamer machine start-up. The switch **110** is located in the lead **42** supplying electrical current to the coil **54** of the tension units **22**, opening the switch **110** interrupts electrical current to the coils **54**.

As shown in FIGURE 3, the electrical source **24**, also supplying current to the beaming machine **10** through leads **26** and **28** as described hereinabove, supplies electrical current to the leads **34** and **36**. While the armature **96** is pressed by the compression spring **97** to maintain the pneumatic timing unit switch **106** open, a solenoid force established by current flowing through the control coil **94** pulls the armature **96** to the control coil **94** and away from the switch **106**, freeing the pneumatic timing unit switch **106** so that it may operate. The switch is set to close at a predetermined time after withdrawal of the armature **96** by means of suitable pneumatic apparatus (not shown) well known in the art. When pneumatic timing unit switch **106** closes, coil **98** is immediately energized, establishing lines of force which pull the armature **100** away from the pneumatic timing unit switch **108**, which is maintained closed by the armature **100** positioned by compression spring **101** and timed to open by appropriate pneumatic apparatus (not shown) when the switch **108** is freed. In the case of switch **108**, it is closed only long enough to permit the control coil **102** to become energized, pulling the armature **104** to itself by solenoid force. Here, however, the armature **104** and the coil **102** are in reverse position with respect to the armatures **96** and **100** and their respective control coils. When the coil **102** is energized, the armature **104** is thrust to open the normaly closed switch **110**. Because switch **108** is closed only momentarily, the control coil **102** is only transitorily energized. While the armature **104** moves under the solenoid force of the energized control coil **102** to open switch **110**, it is immediately returned to its initial position out of contact with the switch **110** by tension spring **105**. The switch **110** is timed to close at a selected time after opening by appropriate pneumatic apparatus (not shown).

While switch **110** is open, all electrical current to the coils **54** of yarn tensioning devices **22** is stopped. Yarn continues to travel to the beamer reel **16** illustrated in FIGURE 1; however, the tensioning discs **56** and **58** are free from any electromagnetic force urging them together. After the selected time interval, pneumatic timing unit switch **10** closes to re-establish electrical current to the coils **54**. Because pneumatic timing unit switch **108** is initially closed, current passes almost instantaneously to the coil **102** after pneumatic timing unit switch **106** is closed, and consequently the period of time which the pneumatic timing unit switch **106** is open after beamer machine start-up is essentially the delay period after the start-up of beaming machine **10** before electrical current to the coils **54** is interrupted. After the pulse of current to the coil **102**, the switch **108** is opened and the coil **102** is de-energized and the armature **104** is swiftly returned to its initial position by tension spring **105**. The time interval for closing switch **106** may be changed by adjusting the pneumatic timing apparatus to suit the machinery and process employed. In practice 7–8 seconds has been found an adequate delay before closing switch **106** when conventional beamer machines are employed. This delay allows the beamer machine to attain a predetermined desired speed.

While in practice 7–8 seconds after start-up of a beamer machine has been found adequate before interrupting current to the coils of electromagnetically operated yarn tensioning devices, this time may be varied. The important thing is that the yarn be traveling so that the yarn will pull itself back between the discs when they (the discs) are in a relaxed or non-urged together condition. Machinery which hastens the yarn to speed requires less delay after process start-up before electrical

current to the coils of the yarn tensioning devices **22** is interrupted.

In practice 3–4 seconds has been found adequate time to permit the yarn **12**, which has escaped from between the yarn tension discs **56** and **58**, to be captured in proper operating alignment between the discs. Thus, in practice switch **110** is timed to close 3–4 seconds after being opened. This time may be varied.

While an electromagnetically operated yarn tensioning devices have been illustrated, the principles of the present application are applicable to handling of traveling yarn where any "squeeze-type" yarn tensioning device, e.g. spring or weight biased discs, is employed.

It can be seen that the invention described provides as effective method for handling a plurality of traveling yarns in textile operations where "squeeze-type" yarn tensioning devices are employed which is substantially free from interruptions cause by the yarn losing operating alignment from between the members or discs of the tensioning devices.

In view of the foregoing it will be recognized that while a particular example of a delay arrangement providing a predetermined interruption of electrical power to the coils of electromagnectically operated yarn tensioning device for a selected time interval has been made many modifications thereto, in addition to other arrangements, may be employed to gain the same predetermined interruption of the force urging together the discs of "squeeze-type" yarn tensioning devices for a selected time interval and, therefore, it is not the intent to limit the invention to specific embodiments.

I claim:

1. A method for handling alignment of traveling yarn advanced from a source through a squeezing zone including opposing members from which said yarn has become misaligned comprising the steps of

advancing said yarn from rest while a force is applied urging said members together,

releasing said force for a time so that said members are not urged together, said advancing yarn realigining itself between said members during interruption of said force, and

applying said force again to urge said members together, said yarn continuing to advance without interruption.

2. In a textile operation where yarn is tensioned by advancing said yarn between a pair of members capable of being urged together, a method for handling alignment of said traveling yarn comprising the steps of

advancing said yarn from rest to a predetermined speed while a force is applied to said members urging said members together,

interrupting said force for a time to said members when said yarn reaches said predetermined speed so that said members are not urged together, said yarn when out of alignment becoming realigned during said time, and

re-establishing said force to said members after said time to again establish the desired tension in said yarn.

3. In a textile beaming operation where a plurality of yarns are tensioned by advancing each of said yarns between a pair of rotatably mounted discs capable of being urged together, a method of handling alignment of said traveling yarn comprising the steps of

advancing said yarn from rest while a force is applied to said discs urging said discs together,

interrupting said force for a period to said discs at a predetermined time after commencement of yarn travel so that said discs are not urged together, said yarn when out of alignment between said discs during the interruption of said force pulling itself into alignment between said discs, and

re-establishing said force to said discs after the interruption to again establish the desired tension in said yarn.

4. A method of handling traveling yarn recited in claim **3** where said force applied to said discs is electromagnetic.

5. In a textile beaming operation where yarn is tensioned by advancing said yarn along a path running between a pair of discs rotatably mounted on a post and said yarn is turned on said post to leave said discs at a different path from its path of entrance, a method of handling alignment of said traveling yarn comprising steps of

advancing said yarn from rest to a predetermined speed with a force applied to said discs urging said discs together,

interrupting said force for a time to said discs so that said discs are not urged together, said yarn when out of alignment between said discs during the interruption of said force pulling itself into alignment between said discs, and

re-establishing said force to said discs after said time to again establish the desired tension in said yarn.

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