April 2, 1963 E. VOSSEN ETAL 3,083,924

YARN FURNISHING DEVICE

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FIG. 1.

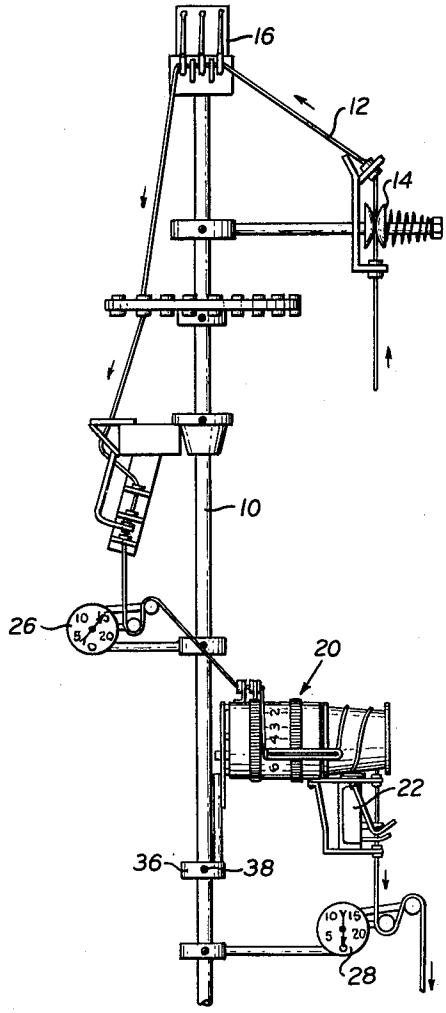



FIG. 2.

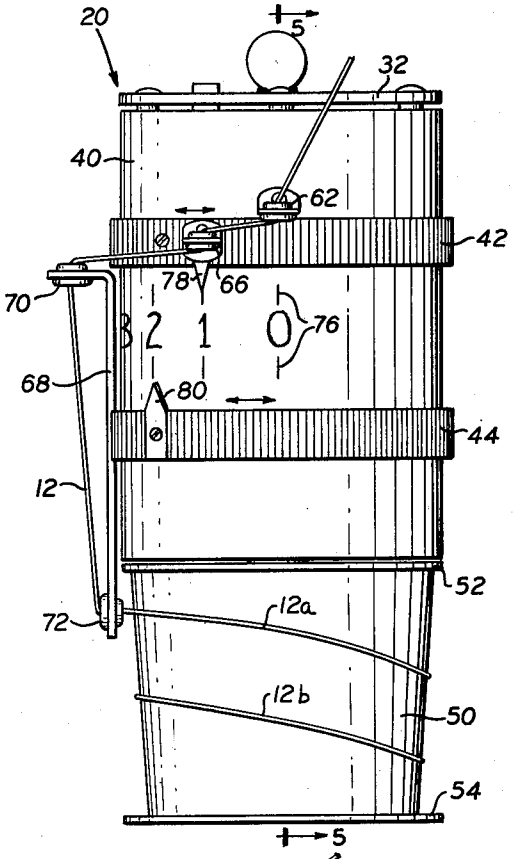



FIG. 3.

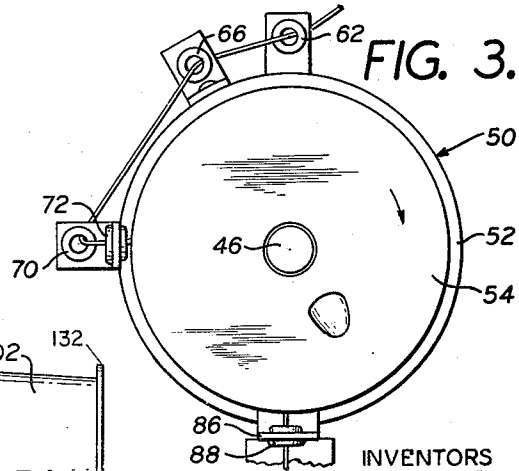
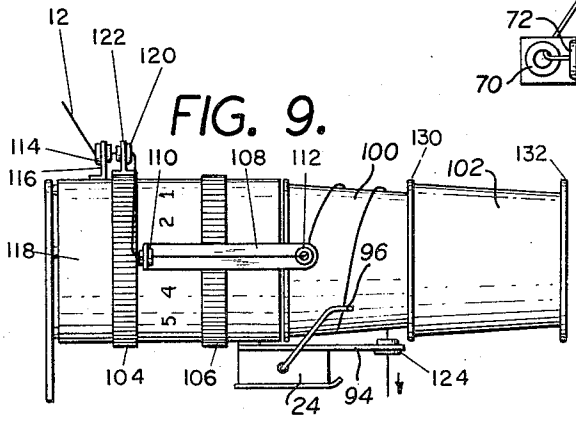



FIG. 9.




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FIG. 4.

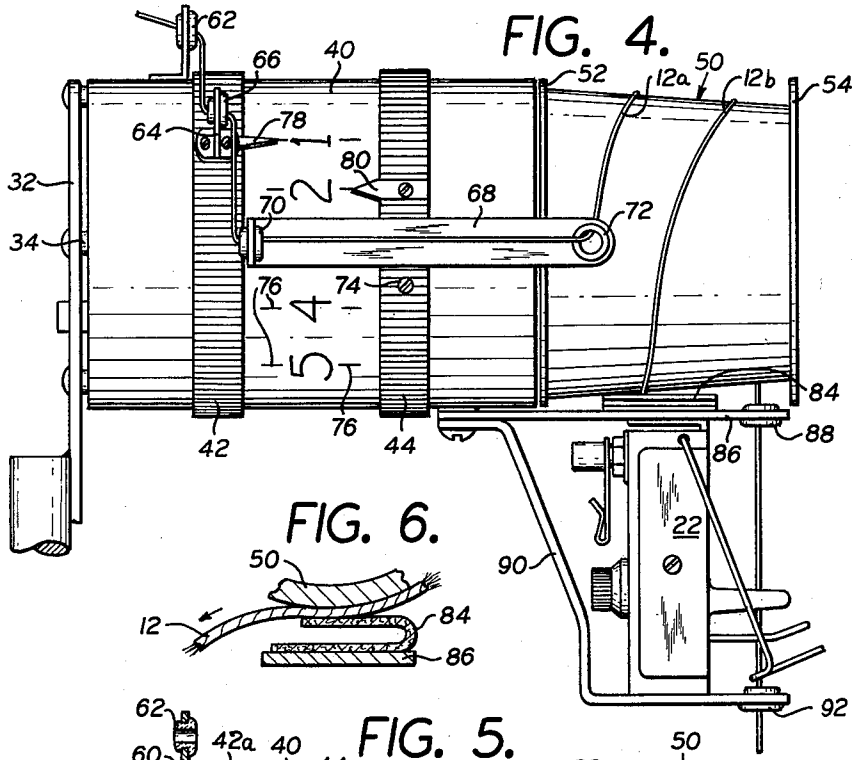



FIG. 6.




FIG. 5.

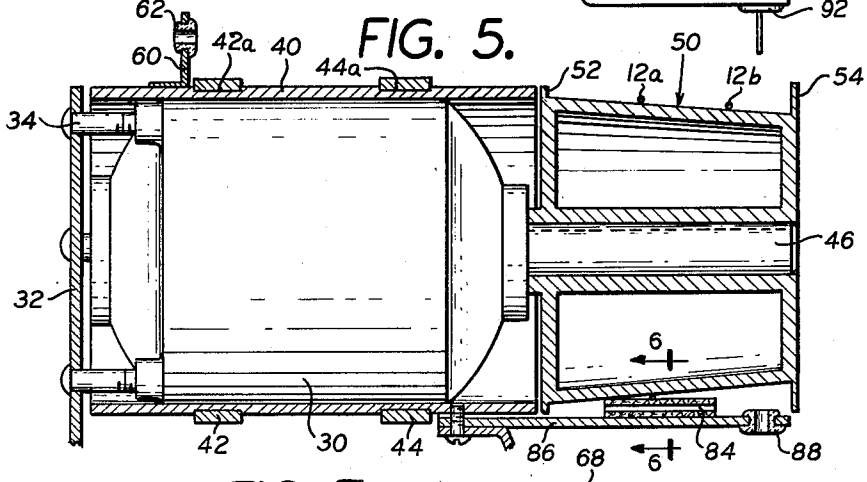



FIG. 7.

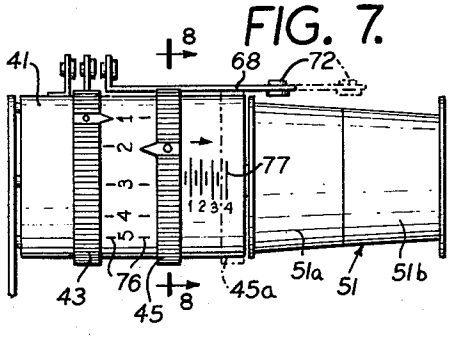
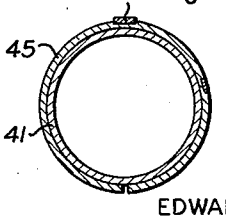



FIG. 8.



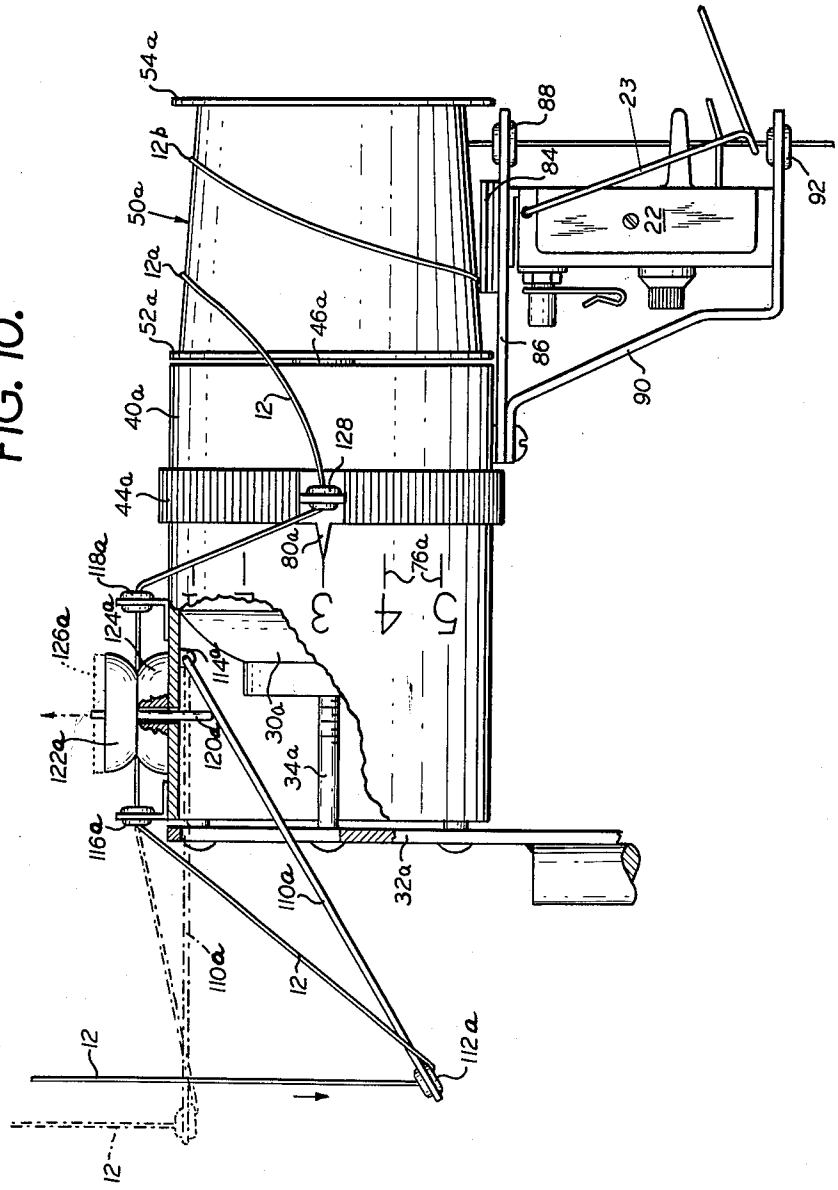

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FIG. 10.




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United States Patent Office

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3,083,924

# YARN FURNISHING DEVICE

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Filed Sept. 11, 1959, Ser. No. 839,411

3 Claims. (Cl. 242—47.12)

This invention relates to a yarn-furnishing device for knitting and other machines.

Although the present invention is applicable to many different kinds of needle machines, such as knitting machines, sewing machines and the like, it is also applicable to many other kinds of machines which employ yarn or thread for one purpose or another, such as looms, other weaving machines and yarn-winding machines. For purposes of illustration, however, the invention will herein be described solely in terms of its application to a knitting machine, for example, a circular or flat knitting machine. But this should not be construed as limiting the scope or application of the invention in any way whatsoever.

The problem of feeding yarn to the needles of knitting machines has long plagued the knitting and knitting machine industries. The yarn is neither fed nor drawn at a uniform, constant rate or with a uniform, constant force. The yarn cones from which the yarn is fed are themselves wound unevenly and irregularly and they provide variable resistance to the feeding operation. For example, as yarn is fed from a yarn cone the diameter of the yarn windings tends to diminish, and it will be understood that there are variations in the feed resistance of the yarn bearing direct reference to the diameter of the yarn windings. Furthermore, the windings are not always precisely positioned with respect to each other, and some windings are entangled or overlapped in ways that resist or interfere with the yarn-feeding operations. The yarn itself, especially the kind made of natural fibers, is most irregular in its cross-sectional dimensions and in its fibrous structure, and this alone militates against a uniform feed. Some types of synthetic yarns or textured yarns develop static electricity when rubbing against the porcelain guides. This static causes the yarn to stick to the porcelains, resulting in an abnormal drag which strains the needle and produces imperfections in the cloth.

There are many other reasons for an irregular flow or movement of yarn through a knitting machine. Obstructions of one kind or another, changes of direction of movement, resistance and tension elements and the like, all contribute in varying degrees to prevent the yarn from flowing uniformly through the machine. Moreover, the needles themselves draw the yarn in intermittent manner, alternately pulling and releasing the yarn.

In order to form a knitted article in which the stitches are all evenly made and the yarn between stitches is under uniform tension, it is essential that the yarn tension at the needle station be extremely sensitive to the needle demands. Since the needle demands are intermittent and alternately build up and diminish, it would not solve the problem to provide a yarn-furnishing wheel, as others have proposed, which delivers a uniform flow of yarn at a constant rate of speed. Mechanical furnishing wheels have been made and discarded because they would not supply instantly the demand curve which is always variable due to uneven tensions or drag.

It is accordingly the principal object of this invention to provide a yarn-furnishing device which is directly and instantaneously sensitive and responsive to the demands which are put upon it. Stated differently, the yarn-furnishing device herein described and claimed is sensitive to the needs and demands of the needles and instantaneously responds thereto by feeding just enough yarn to satisfy such needs and demands. As the demand for yarn ebbs and flows, so does the yarn feed, automatically and in the same proportions.



The essential principle of the device is that of the common winch, modified, however, in radical form. The yarn is wound around the winch element in the furnishing device, one end of the yarn being connected with the yarn source and the other end being connected with the needles. Tension is provided between the yarn source and the winch element. The needles provide their own tension. As the needles pull upon the yarn, such tension is developed in direct proportion to the need for yarn, and the yarn windings on the winch element are accordingly exposed to a pull at one end (exerted by the needles) and resistance to such pull at the opposite end (exerted by tensioning elements). The result is that the windings are caused to tighten upon the winch element and to be fed thereby.

An important feature of this invention is the taper of the winch element, commonly called a furnishing wheel. The furnishing wheel is formed in the general shape of a truncated cone. The yarn is fed from its source to the larger end of the furnishing wheel, and it is fed from the smaller end of said furnishing wheel to the needles. The taper acts upon the yarn to urge it down the taper from the larger to the smaller end. This prevents entanglement and overlapping of the yarn windings on the furnishing wheel. Furthermore, it distributes the wear on the furnishing wheel throughout its operative surface; otherwise the yarn would wear grooves into said furnishing wheel.

In the preferred form of this invention, each furnishing wheel is provided with a single yarn-engaging tapered surface and each such wheel is operated by a single electric motor. It will of course be understood that each furnishing wheel may be provided with a plurality of separately tapered yarn-engaging surfaces, each adapted to receive and feed a separate yarn end. Of course, it will also be understood that a single tapered yarn-engaging surface may be elongated to the extent necessary to accommodate a plurality of yarn ends, each being spaced from the others sufficiently to avoid overlapping and entanglement.

Another important feature of the invention is the provision of a furnishing wheel having a plurality of yarn-engaging surfaces for a single yarn end, adjustable guides being provided to direct the yarn to any of said surfaces. Each yarn-engaging surface is made of a different material or is otherwise treated to provide a different coefficient of friction. As will be understood, the greater the frictional coefficient, the more forcefully will the yarn be fed.

Still another important feature of the invention is the means with which it is provided to increase or decrease the number of turns or windings of the yarn around the furnishing wheel. It will be appreciated that the greater the number of windings, the stronger will be the action of the furnishing wheel upon the yarn; the fewer the number of windings, the less influence will the furnishing wheel have upon the yarn. In the present invention, adjusting means are provided for increasing or decreasing the number of windings upon the furnishing wheel, said means being so precise and so exact as to provide for fractional windings in addition to whole windings. For example, it may be found that a whole winding plus a fractional winding which extends but 15 degrees around the furnishing wheel would provide the precise feed required in a given installation. In another installation, one whole winding plus a 30-degree fraction of a second winding might provide better results. As each winding adjustment is set, it may be recorded for use on all of the other furnishing wheels in a given machine or it may be recorded for future use with the same yarn on the same machine as well as on other machines of like nature. By

way of illustration, a certain type of yarn intended for a specific use may require a given setting of the winding control means. The same setting may be utilized at different times and on different machines whenever the same yarn is employed for the same purpose.

A further feature of this invention, also of great importance, is the tension-adjusting means which adjusts the tension of the yarn between the furnishing wheel and the yarn source. Said tension-adjusting means functions independently of the winding control means and may be set to very precise limits. Calibrations are provided, and this is also true of the winding control means, so that each setting may be noted and recorded for use in connection with the furnishing wheels on the same machine or on other machines of like nature. As in the case of the winding control means, the settings may be recorded for future use in relation to the same yarn, used for the same purpose, as was the case with the original setting. In other words, the effort which a single setting requires need not be duplicated for each of the other furnishing wheels to which such setting would apply. A single setting for a single furnishing wheel using a certain yarn will suffice for all of the other furnishing wheels using the same yarn.

Another feature of the invention is the provision of gyroscopic action in the furnishing wheel. The furnishing wheel is provided with annular flanges at both ends, at least one of said flanges, the larger one at the smaller end of the furnishing wheel, functioning in the manner of a gyroscopic element or fly wheel. This tends to keep the furnishing wheel steady, even when abnormal tension or tugging action is applied to the yarn. Another advantage of the two annular flanges is that they help retain the yarn on the furnishing wheel under all normal and abnormal conditions of use.

Still another feature of the invention is the use of a pressure pad running substantially the full length of the furnishing wheel and tending to hold the yarn snugly against said furnishing wheel, thereby preventing the yarn from looping or bunching upon the furnishing wheel. This pressure pad applies only slight pressure to the yarn at or adjacent the point where the yarn leaves the furnishing wheel.

The invention is illustrated in the accompanying drawing, in which:

FIG. 1 is a side view of a single installation of a furnishing device made in accordance with this invention, said installation being typical of what would be encountered in a circular knitting machine, except for the two tension meters which are used to demonstrate the effectiveness of the invention.

FIG. 2 is an enlarged side view of said yarn-furnishing device.

FIG. 3 is an end view thereof.

FIG. 4 is another side view of of said yarn-furnishing device, showing it equipped with a yarn-break detector used for stop-motion purposes.

FIG. 5 is a longitudinal section through said yarn-furnishing device on the line 5—5 of FIG. 2.

FIG. 6 is a fragmentary sectional view on the line 6—6 of FIG. 5.

FIG. 7 is a side view of a modified form of yarn-furnishing device made in accordance with this invention, showing the furnishing wheel provided with two yarn-engaging surfaces, each having a different frictional coefficient.

FIG. 8 is a cross-section on the line 8—8 of FIG. 7.

FIG. 9 is a side view of another modified form of this invention, showing the yarn-furnishing device equipped with two independently tapered yarn-engaging surfaces on the furnishing wheel, each being adapted for use in association with a separate yarn end.

FIG. 10 is a side view, partly broken away and in vertical section, showing still another modified form of this invention in which a yarn tensioning device is used in connection with the yarn-furnishing device.



Referring now to the details of the invention as shown in the drawing, it will be seen that a vertical rod **10** is used as the supporting frame of the present device. This of course is purely illustrative, and vertical rod **10** may be viewed as comprising any suitable frame support which may be part of or secured to the frame of a knitting machine. Yarn **12** is drawn from a conventional source such as a spool, and it passes through a conventional spring-urged tension device **14**. The yarn then engages a yarn-defect detector **16**, which may be of conventional construction and connected to a conventional stop-motion device. The yarn also passes through a number of conventional guide members, such as porcelain eyes, and eventually it reaches the yarn-furnishing device **20** herein described and claimed. After it leaves said device, or while it is on said device, the yarn may engage another yarn-defect detector such as detector **22** shown in FIGS. 1 and 4 or detector **24** shown in FIG. 9. Following this, the yarn proceeds to one of the needles of the knitting machine.

FIG. 1 of the drawing shows two elements which are normally not incorporated into an installation of the character under discussion. These two elements are a pair of yarn-tension gauges **26** and **28** respectively which measure the tension of the yarn both before and after the yarn-furnishing device herein claimed acts upon it. The gauge readings in FIG. 1, although illustrative, are fairly typical. Before the yarn reaches the yarn-furnishing device, it takes a pull of approximately 15 grams to draw it through the various tension devices, guides, stop-motion devices and the like which are normally employed in a knitting machine. After it leaves the yarn-furnishing device, the yarn pulls or feeds with a virtually zero reading on the tension gauge.

Turning now specifically to the yarn-furnishing device **20**, it will be observed that it includes an electric motor **30** which is secured to a bracket **32** by means of bolts **34** or any other suitable means. Bracket **32** is secured to an adjustable support **36** such as a collar mounted on rod **10** and held in place thereon by means of set screw **38**. Adjustable support **36** may be raised or lowered on rod **10** or adjusted angularly thereon to support the yarn-furnishing device at any suitable position relative to the yarn feed and the needles.

Motor **30** is encased within a generally cylindrical housing **40**, on which are mounted two rings **42** and **44** respectively, for purposes shortly to be described. Mounted on motor shaft **46** is the furnishing wheel proper **50**. As is clearly shown in FIG. 5, said furnishing wheel is hollow and consequently light of weight, so that its inertial mass is relatively small and permits quick starting and stopping of the motor. This is extremely important, since it enables the machine to go into operation very quickly from an inoperative condition and also enables the stop-motion device to bring the machine to a stop immediately upon the detection of a defect in the yarn or knitted product. It will also be observed that a small annular flange **52** is formed at the larger end of furnishing wheel **50** (the end nearer the motor) and a second annular flange **54** is formed at the opposite or smaller end of the furnishing wheel (the end which is more remote from the motor). These two flanges tend to prevent the yarn from riding off the furnishing wheel. Flange **54** performs the additional function of a gyroscopic element or fly wheel and helps to steady the furnishing wheel under the intermittent tugs and pulls of the yarn.

As appears from the drawing and as has previously been mentioned, the furnishing wheel **50** is tapered to form a truncated cone, the larger end of the cone being adjacent the motor and the smaller end being removed from the motor. This orientation of the cone is not essential but it is preferred in view of the direction of feed of the yarn shortly to be described. Secured to motor housing **40** is a bracket **60** supporting a porcelain eye **62**. The yarn

is brought to the yarn-furnishing device under discussion through eye 62. It will now be seen that a second bracket 64 is secured to ring 42 and that a second eye 66 is provided on said second bracket. A third bracket 68 is secured to the second ring 44 and said third bracket is provided with a pair of eyes 70 and 72 respectively. The yarn passes from eye 62 through eye 66, thence through eye 70 and finally through eye 72 and it is then wound about the furnishing wheel in the form of windings 12*a* and 12*b* as illustrated in FIG. 4.

It will now be understood that rings 42 and 44 are adjusting rings, ring 42 being a yarn tension adjusting ring and ring 44 being a winding control or adjusting ring. Both rings are adapted to move angularly about the longitudinal axis of the motor housing but they are not free to move axially thereof. As shown in FIG. 5, an annular channel 42*a* is formed in the motor housing to receive ring 42 and a second channel 44*a* is formed around the motor housing to receive ring 44. The rings are free to move angularly in said channels but they are clearly prevented by the side walls of said channels from moving axially of the motor housing. Set screws 74 are provided in the two rings to lock them in place once they have been set to any selected angular position.

In the setting or adjustment of the present device, the yarn is threaded through the several eyes as best shown in FIG. 4 and it is then wound about the furnishing wheel to the extent deemed desirable. For example, as shown in FIG. 4, two windings are provided, although only one of the windings, winding 12*b*, is complete, winding 12*a* extending only partly around the furnishing wheel. It will be observed that calibrations 76 are formed on the motor housing between the two rings. An indicator 78 is provided on ring 42 and a second indicator 80 is provided on ring 44 in connection with said calibrations. For example, indicator 80 on ring 44 is situated opposite the calibration designated "2" while indicator 78 points to the calibration designated "1." Ring 44 may be moved to any other angular position on the motor housing, in one direction or the other, to either increase or decrease the size of the partial yarn winding 12*a*. As has previously been noted, the greater the number of windings on the furnishing wheel, the greater the influence will the furnishing wheel have upon the yarn.

Let it be assumed that experience has shown that the setting of ring 44 with its pointer 80 opposite calibration "2" is most suitable for a particular installation and in connection with a certain type of yarn used for a given purpose. The ring would then be fixed in that position by means of its set screw 74. It is now desired to adjust the tension of the yarn before the yarn is fed to the furnishing wheel. This may be done by adjusting the angular position of ring 42. Bearing in mind that eyes 62 and 70 are now fixed in position relative to each other and relative to the motor housing, it will be understood that adjusting the angular position of ring 42 causes eye 66 to be shifted relative to eyes 62 and 70. The extent to which eye 66 causes the yarn to change its direction of movement relative to eyes 62 and 70 will determine the tension which will be applied to the yarn as it passes from eye 62 through eye 66 and thence to and through eye 70. As shown in FIG. 4 pointer 78 opposite calibration "1" indicates that the illustrated position has been found best suited for a particular installation, a particular yarn, and a particular yarn product. A set screw 74 may be used to lock ring 42 in said position.

It will be observed that each of the two adjustments shown in the drawing may be actuated independently of the other, although to some extent each modifies the other. However, each may be set as a separate and independent element and in accordance with settings previously tried and found appropriate to a particular job. For example, a single setting of both adjustments on a single yarn-furnishing device may be applied to all of the other yarn-furnishing devices on the same or similar machines.



A setting found suitable for a given job in connection with a certain production run may be used time and again in connection with subsequent production runs relating to the same job.

To help prevent the yarn windings from forming loops and bunching up upon the furnishing wheel, a pressure pad 84 is provided on a bracket 86 secured to the motor housing. An eye 88 is provided on bracket 86 and it is through said eye that the yarn leaves the furnishing wheel and proceeds through a detector 22 (if such detector is used) and then to the needles of the machine. Pressure pad 84 may be made of leather or any other relatively yieldable material and it exerts but a slight pressure upon the yarn as it leaves the furnishing wheel. This is just enough to prevent looping and bunching of the yarn.

Yarn defect detector 22 is of conventional construction and may be supported by means of bracket 90 on the motor housing. This bracket is also provided with an eye 92 through which the yarn passes on its way to the needles. If desired, another yarn detector 24 may be mounted by means of bracket 94 on the motor housing. The probe or feeler 96 of said detector would rest upon one of the yarn windings on the furnishing wheel. Detector 24 may be set by conventional means to be sensitive to either of two conditions which may arise: either the yarn may break and the probe would then move into contact with the furnishing wheel, or the yarn may overlap or bunch up and thereby cause the probe to move outwardly away from the furnishing wheel. In either case, the detector could be arranged by conventional means to actuate the stop-motion mechanism and thereby to stop the knitting machine.

The foregoing describes a preferred form of the invention and it will be understood that modifications and variations may be incorporated therein within the basic principles and scope of the invention. Speaking generally, what is provided here is a motor driven, conically tapered furnishing wheel to which the yarn is fed under adjusted, controlled tension and from which the yarn is delivered to the knitting machine needles. In a typical case, the furnishing wheel would be rotated at a speed of approximately 5,000 r.p.m. which would be far in excess of the speed of movement of the yarn. More precisely, the surface speed of the furnishing wheel far exceeds the linear speed of the yarn. There is, consequently, considerable slippable between the yarn and the furnishing wheel. When the knitting machine needles make no demand upon the yarn, the slippage increases to the point where the furnishing wheel has no effect upon the yarn. As the knitting machine needles begin to pull upon the yarn, the slippage between the yarn and the furnishing wheel decreases and yarn is fed to meet the demands of the needles. Although theoretically an r.p.m. of 5,000 is much in excess of what is needed, as a practical matter it affords considerable advantages. For example, it permits the use of a relatively small, inexpensive motor whose torque is sufficient at such high rates of speed to meet the needs of the mechanism. Furthermore, when the motor and furnishing wheel operate at such speeds, a gyroscopic effect is set up enabling the furnishing wheel to resist the intermittent and irregular tugs and pulls which it experiences and which would otherwise interfere with its smooth, normal operation.

A modification of the furnishing device above described is shown in FIG. 7. It will there be seen that rings 43 and 45, corresponding to rings 42 and 44 above mentioned, are split spring rings. This is best shown in FIG. 8. These rings are mounted on a cylindrical housing 41 for motor 30 and they may be moved both angularly around the motor housing and axially thereof. This is done manually with the aid of suitable calibrations and indicators. Calibrations 76 correspond to those shown in FIG. 4. Calibrations 77 relate to the axial movement or adjust-

ment of the rings and especially ring 45. It will be observed that the furnishing wheel 51 in FIG. 7 has two surfaces 51*a* and 51*b* of different frictional coefficient. These surfaces may be made of different materials, for example, stainless steel and aluminum. They may also be made of the same material but treated differently. By way of illustration, one portion may be more highly polished than the other, the slippage coefficient being proportional to the extent to which the yarn contacting surfaces are polished. When it is desired to run the yarn around furnishing wheel section 51*a*, ring 45 is placed in its FIG. 7 position. Bracket 68 which it supports will hold eye 72 in proper location relative to said furnishing wheel section 51*a*. Should it be desired to run the yarn around furnishing wheel section 51*b*, ring 45 is moved to its dotted line position as indicated by the reference numeral 45*a*. This will relocate eye 72 and move it opposite furnishing wheel section 51*b*. The yarn will now be directed around said furnishing wheel section.

FIG. 9 illustrates another modification of the invention. In this device two furnishing wheels 100 and 102 are provided on the same motor, these two furnishing wheels being identical in shape and construction both to each other and to furnishing wheel 50 above described. In this form of the invention the large end of furnishing wheel 102 abuts the small end of furnishing wheel 100, the tapers of both wheels being oriented in the same direction. This is not an essential aspect of the use of two furnishing wheels. If desired, the large ends may be brought into abutment, the tapers running in opposite directions.

When two furnishing wheels are used, as in FIG. 9, two rings 104 and 106 are provided, corresponding to rings 42 and 44 or 43 and 45. An elongated bracket 108 is secured to ring 106 and this bracket of course corresponds to bracket 68 above mentioned. It will be understood that this bracket may be elongated to cooperate with both furnishing wheels and in such case it would be provided with a suitable number of eyes properly situated to feed yarn to both furnishing wheels. However, for purposes of clarity, bracket 108 is shown provided with eyes situated for feeding yarn to only one of said furnishing wheels but, as above indicated, it will be clearly understood that this is not intended to limit the invention in any way whatsoever and that extending the length of bracket 108 and providing it with a second set of eyes will enable it to feed yarn to the second of the two furnishing wheels. Alternatively, it will be understood that two such brackets 108 may be employed, one being adapted to cooperate with one of said furnishing wheels and the other being adapted to cooperate with the other furnishing wheel. In either case, eyes should be provided to feed the yarn to the furnishing wheels in the manner shown in the drawing.

Bracket 108 is shown to be provided with an eye 110 at its back end and a second eye 112 at its forward end. The yarn is brought down to the furnishing device by conventional means above indicated and it then passes through an eye 114 carried by a bracket 116 fixed to the motor housing 118. The yarn then passes through an eye 120 on bracket 122 fixed to ring 104. The yarn is then threaded through eyes 110 and 112 on bracket 108 and it will be observed that the yarn is thereafter wound about the first furnishing wheel 100. After it leaves said furnishing wheel, it passes through an eye 124 on bracket 94 of detector 24. This detector is supported by the motor housing 118 and it will be noted that the yarn probe or filler 96 is situated for engagement with one of the yarn windings on furnishing wheel 100. Furnishing wheel 102 is shown to be free of yarn and this will indicate that either of the yarn furnishing wheels may be used independently of the other. It will also be understood, as above mentioned, that both furnishing wheels may be used simultaneously and in such case there would be two yarn detectors, both having probes in contact with windings on the two wheels. It should also be understood that gyroscopic action may be had from the two flanges or flywheels 130 and 132 connected, respectively, to furnishing wheels 100 and 102, or such gyroscopic action may be had from either of said flanges or flywheels.

Turning now to FIG. 10, it will be observed that a yarn-furnishing device is shown substantially like that of FIG. 2 but there are substantial differences which improve the performance of the device. Motor 30*a* is shown to be supported on bracket 32*a* by means of bolts 34*a*. Motor 30*a* is provided with a motor housing 40*a* on which a ring 44*a* is rotatably mounted. Secured to the motor shaft 46*a* is a tapered furnishing wheel 50*a* corresponding to furnishing wheel 50 above mentioned. At the back end of furnishing wheel 50*a* is an annular flange 52*a* and at its forward end—namely, its smaller end—is a second annular flange 54*a* which serves as a flywheel for the gyroscopic effect above mentioned. Inscribed or otherwise formed upon the motor housing are calibrations 76*a* and it will be seen that a pointer 80*a* on ring 44*a* serves as an indicator relative to said calibrations.

A conventional yarn breakage detector 22 may be secured to the motor housing by means of brackets 86 and 90, respectively. Upper and lower eyes 88 and 92 are provided on said brackets to conduct the yarn 12 from the furnishing wheel to the needles of the knitting machine. As is clearly shown in FIG. 10, the yarn feeler or probe 23 is positioned for engagement with the yarn at a suitable point between the two eyes 88 and 92. It will also be noted that a pressure pad 84, made of leather or other suitable material, is secured to bracket 86 for engagement with one of the yarn windings 12*b* on the furnishing wheel. The reference numeral 12*a* is intended to represent a prior winding or convolution of said yarn.

The yarn furnishing device shown in FIG. 10 is provided with a yarn tension control device on the motor housing 40*a*. This tension control device includes a vertical pin 120*a* which is slidably supported on the motor housing for axial movement in either direction. Two pressure discs 122*a* and 124*a* are mounted on said pin, pressure disc 122*a* being fixed to the upper end of said pin and pressure disc 124*a* resting against the motor housing. Pressure disc 122*a* is vertically movable with pin 120*a* relative to pressure disc 124*a*, as the dotted lines 126*a* clearly indicate. In the preferred form of this invention pressure disc 122*a* is merely gravity-urged toward pressure disc 124*a* but it will be understood that it may also be spring-urged with substantially the same results.

Yarn 12 passes between the two pressure discs for frictional engagement therewith in the usual manner. Guiding the yarn are eyes 116*a* and 118*a* supported by means of suitable brackets on the motor housing on opposite sides of the two pressure discs.

It will also be observed that a tension arm 110*a* is pivotally supported by means of bracket 114*a* on the motor housing. This tension arm is swingable between its solid line and interrupted line positions indicated in FIG. 10. Yarn 12 passes downwardly through eye 112*a* at the free end of said tension arm and then upwardly to eye 116*a* above-mentioned. It will now be seen that the lower end of slidable pin 120*a* bears against tension arm 110*a* a spaced distance from bracket 114*a*. When increased yarn tension is encountered, the tension arm 110*a* will compensate therefor by swinging upwardly in the direction of its interrupted line position. This will have the effect of elevating slidable pin 120*a* and pressure disc 122*a* which is secured thereto. This will relieve the pressure of said pressure disc 122*a* upon the yarn and permit the yarn to move freely between eyes 116*a* and 118*a*. When the tension on the yarn diminishes, tension arm 110*a* will drop, thereby permitting pin 120*a* and pressure disc 122*a* to move back to their original positions as indicated by the solid lines in FIG. 10. The yarn will once again be subjected to frictional engagement between the two pressure discs 122*a* and 124*a*.

In the operation of the machine, tension regulating arm **110***a* may vibrate or oscillate to compensate for and control fluctuations in tension in the yarn. It has been found that the combination of a tension regulating device, of which the showing in FIG. 10 is merely illustrative, and a yarn-furnishing wheel as herein described and claimed, produces a very effective and efficient yarn-furnishing device which controls the flow and feed of yarn to the knitting machine needles in optimum manner.

The foregoing is illustrative of preferred forms of this invention and it will be understood that these forms may be modified and other forms may be provided within the basic principles of the invention and the broad scope of the claims.

What is claimed is:

1. A yarn-furnishing device, comprising a motor, a motor housing therefor, a generally conically tapered furnishing wheel driven by said motor, yarn guiding means adapted to guide yarn to the larger end of said furnishing wheel, and a yarn guide member which is adapted to receive the yarn from the smaller end of said furnishing wheel, the yarn being spirally wound around the furnishing wheel from the point where it is brought to said furnishing wheel to the point where it leaves said furnishing wheel, said yarn guiding means including first, second and third yarn guides, the first yarn guide being fixed relative to the furnishing wheel, the third yarn guide being angularly adjustable about the longitudinal axis of the furnishing wheel to vary the number of spiral windings of yarn thereon, the second yarn guide being laterally adjustable between and relative to said first and third yarn guides to apply and vary tension upon the yarn as it is guided to the furnishing wheel, said first yarn guide being fixed to said motor housing, a pair of axially spaced ring being also mounted on said motor housing, coaxially with said furnishing wheel, said second and third yarn guides being fixed to said pair of rings, each of said rings being angularly adjustable independently of each other about said motor housing.



2. A yarn-furnishing device in accordance with claim 1, wherein each of the rings is a split spring ring which is adapted to tensionally and frictionally engage the motor housing for setting in any adjusted position thereon.

3. A yarn-furnishing device in accordance with claim 1, wherein annular channels are formed in said motor housing in axially spaced relation, said channels being coaxial with each other and with the furnishing wheel, said axially spaced rings being respectively mounted within said channels to prevent axial movement of said rings relative to each other and relative to the furnishing wheel while permitting angular movement of said rings about the axis of the furnishing wheel.

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