

Jan. 30, 1962

B. FRIED
YARN STORAGE AND FEEDING SYSTEM FOR
CIRCULAR KNITTING MACHINES

3,018,645

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2 Sheets-Sheet 1

FIG. 1

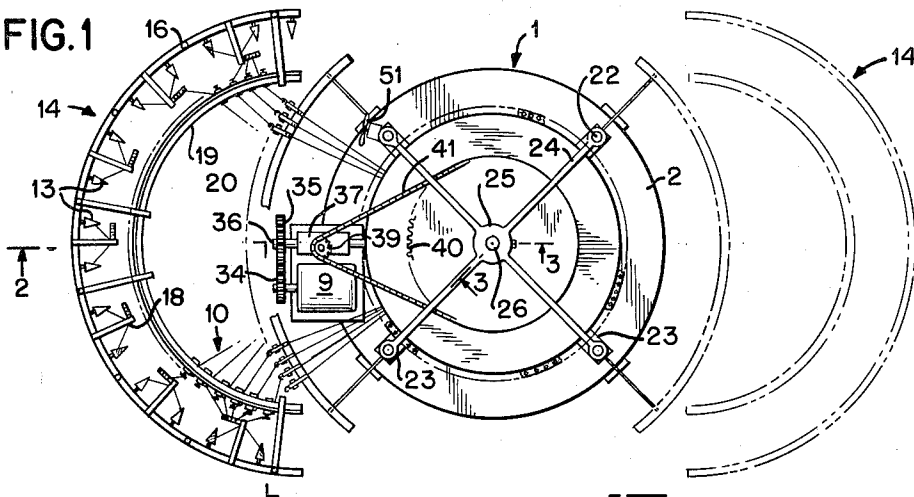


FIG. 2

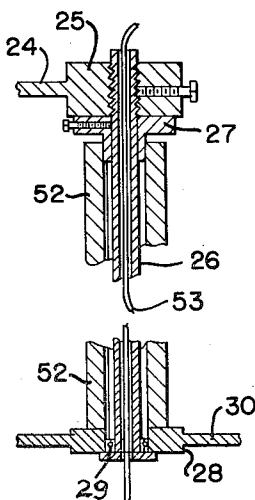
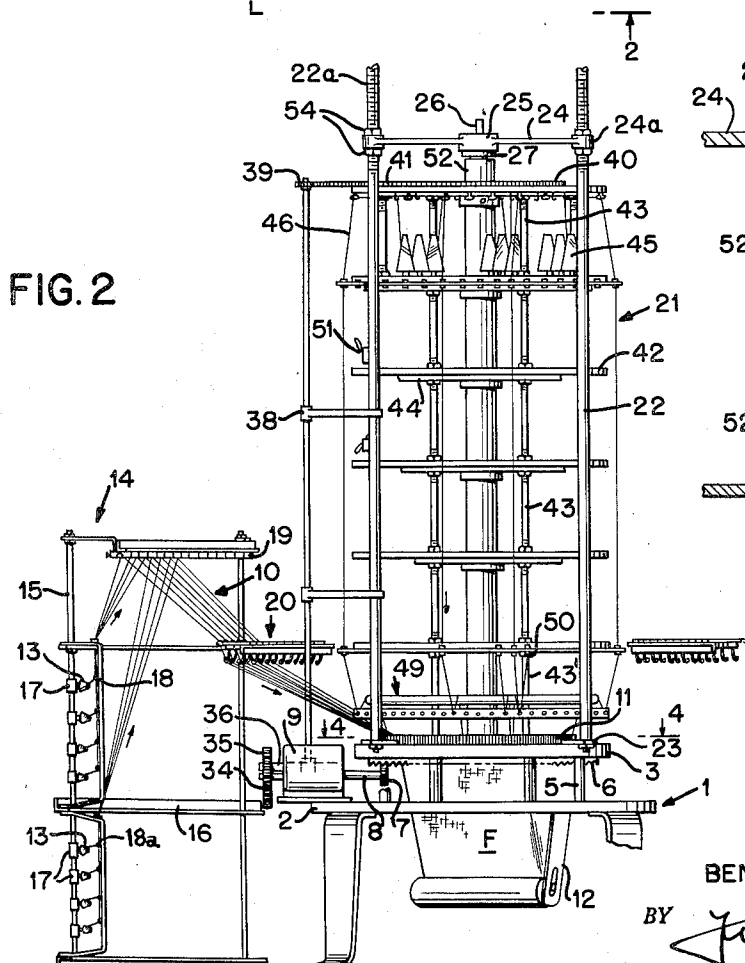


FIG. 3

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2 Sheets-Sheet 2

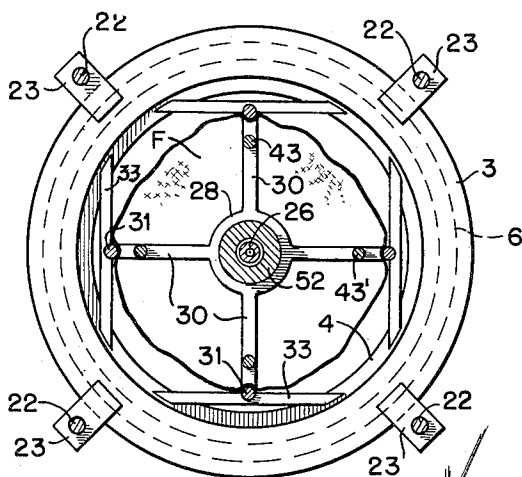


FIG. 4

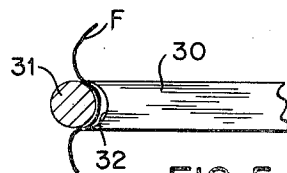


FIG. 5

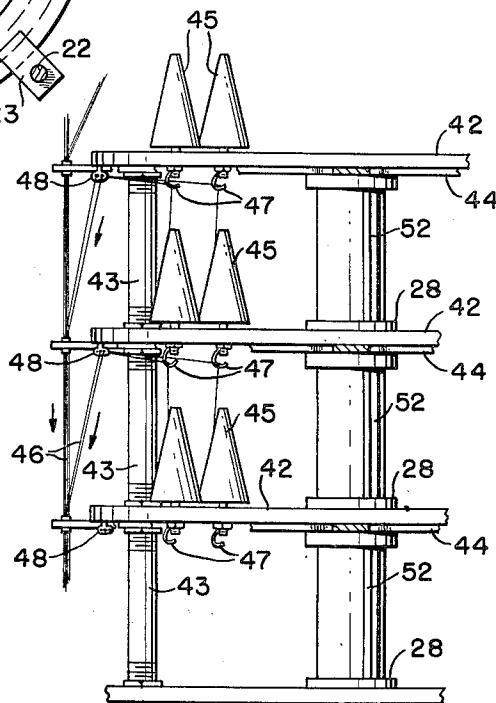


FIG. 6

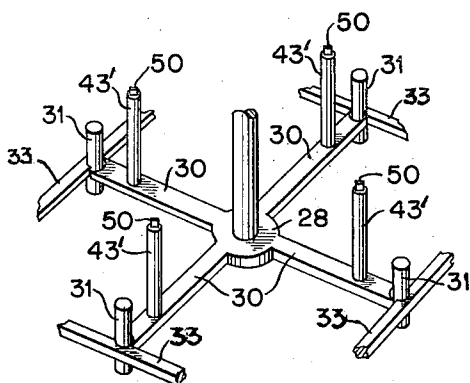


FIG. 7

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3,018,645

YARN STORAGE AND FEEDING SYSTEM FOR CIRCULAR KNITTING MACHINES

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15 Claims. (Cl. 66—125)

The present invention relates to an improved knitting system and more particularly to improvements in yarn storage and feeding means for revolving cylinder, sinker-top circular knitting machines. In one aspect, the invention is concerned with a super-structure for storing and feeding a multiplicity of wale yarns vertically downwardly to needles on the revolving cylinder.

Pattern wrap knitting machines incorporating a system of walewise patterning or vertical stripping are known. Patterned knitted goods on such and other machines have heretofore been produced on stationary cylinders although knitting machines with revolving cylinders are known.

It is one of the objects of my invention to knit patterned fabrics vertically on a multiple-feed circular knitting machine of the sinker-top, revolving cylinder type.

It is a concomitant object of this invention to provide an advantageous and novel attachment on an otherwise conventional circular knitting machine of this type, which permits the vertical feeding of wale yarns from a plurality of regular-sized yarn cones or tubes to needles on the revolving cylinder.

It is also an object of the invention to improve the knitting yarn storage means for such machines in the knitting of jersey-type and like knit goods.

In circular knitting machines with stationary cylinders, the yarn storage and feed means revolves about the cylinder during the knitting operation. In known arrangements of this type, the revolving stand holding the wale yarn supplies takes up so much room that little space remains for storing the supplies of any wale yarns, making it impossible to feed the latter yarns to the stationary knitting cylinder from regular sized yarn cones or tubes. Therefore, it has been necessary heretofore in vertical knitting to rewind the yarn from the regular cones or tubes, on which they are shipped to the knitting plant, into smaller packages which may be accommodated on a stand atop the knitting machine for feeding wale yarns to the stationary cylinder when walewise patterning was desired, for instance. Such rewinding of yarn is time-consuming, of course, but more importantly, these small packages of yarn used for vertical stripping are rapidly consumed, requiring frequent stopping of the knitting operation to replace the empty spools by full yarn packages, whereupon the knitting operation may be resumed until the yarn packages are depleted again, and so forth. This obviously is an exceedingly time-consuming operation, making such pattern wrap knitting exceedingly expensive.

As far as revolving cylinder type machines for knitting jersey-type cloth are concerned, the stationary knitting yarn storage means usually forms a super-structure mounted on the machine and carrying the yarn cones. The arrangement is such that it is difficult to reach the individual cones that are held inwardly of the stand periphery, the general crowding preventing ready access to all the cones. Thus, when one set of cones is depleted, the machine must be stopped, the empty cones are removed and full cones are placed on the stand for a new knitting cycle.

The yarn storage and feeding system of the present invention overcomes these and other disadvantages of the prior art by providing, first a stationary yarn storage means of considerable size and removed from the knitting machine so that an operator may freely walk around the

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storage means and have ready access to all yarn holders placed on the yarn storage means. Secondly, I have devised a novel means for storing and feeding wale yarns to a revolving cylinder knitting machine by mounting a multi-tiered superstructure on the machine, placing a multiplicity of yarn holders on the superstructure and driving the superstructure substantially synchronously with the revolving cylinder while vertically feeding wale yarns to the cylinder needles.

The above and other objects, advantages and features of the invention will become more apparent in the following detailed description of certain embodiments thereof, taken in conjunction with the accompanying drawing wherein—

FIG. 1 is a top view of a circular knitting machine with a yarn storage and feeding system according to the present invention;

FIG. 2 is a section along line 2—2 of FIG. 1;

FIG. 3 is a section along line 3—3 of FIG. 1 and showing the hub of the superstructure;

FIG. 4 is a section along line 4—4 of FIG. 2;

FIG. 5 shows a detail of a drive connection between the knitting cylinder and the superstructure;

FIG. 6 is an enlarged side view of a few tiers of the superstructure and a modified embodiment of a connection of the first tier with the revolving cylinder; and

FIG. 7 is a perspective view showing a detail of the lower portion of the superstructure.

Referring now to the drawing wherein like reference numerals in all figures designate like parts, there is shown a conventional revolving cylinder, sinker-top circular knitting machine generally indicated by arrow 1. Since such machines are quite well known and the machine itself forms no part of the present invention, only its major parts have been schematically indicated insofar as the structure constituting the invention cooperates with such parts.

As shown, the knitting machine is supported on a stand 2 which rests on the floor or any other desirable supporting surface. An annular support 3 is fixedly mounted on the stand by support rods 5 and carries the revolving knitting cylinder 4 with its annular gearing 6, which meshes with spur gear 7. Gear 7 is carried on the outer end of motor shaft 8 which is rotated by motor 9. In this manner, actuation of motor 9 causes the cylinder 4 to revolve in support 3. When yarns 10 are fed to needles 11 of the revolving cylinder, knitted fabric F is produced in a manner well known per se, as are all the parts of the revolving cylinder, sinker-top knitting machine heretofore described. As also well known, the knitted fabric is pulled through the knitting machine by cooperating nip rollers mounted below the knitting cylinder and is wound on a wind-up roll mounted on brackets 12 supported on the stand 2.

As shown in FIGS. 1 and 2, I have devised a knitting yarn storage stand separate and removed from the knitting machine itself, the stand being of considerable size to accommodate a large number of individual yarn cones or tubes and sufficient space being left between the machine and the stand to enable an operator to walk between the machine and the stand as well as outside the stand. This not only makes it possible to store an unusually large number of yarn holders on the stand but makes all of these individual yarn holders readily accessible to the operator.

It will be obvious to the skilled in the art that this arrangement increases manifold the number of different yarns which may be fed to the machine with great ease, thus enabling the knitting of jersey-type knit goods of great variety practically unobtainable with the crowded and relatively small yarn cone stands attached to the

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machine, as heretofore used. With a freely accessible yarn stand, which is spaced from the machine, different yarns, such as yarns of different colors or of different material, may be readily placed in any position on the stand, neither their placement or replacement causing any difficulty. This makes it possible to knit an inexhaustible number of different novelty goods economically and with hardly any increase in the labor cost.

Yarns like 55-denier acetate or rayon may be knit together with cotton in the same feeds on 64 feeds or 96 feeds, or even more, without having to reduce the number of feeds, and the spacing between the yarns, as a result of the stand, is sufficient to enable the cotton and fine filament yarns to feed properly without entanglement.

Equally, if not more, importantly, the depletion of any yarn cone does not necessitate stopping of the machine. Since every cone is readily accessible, the outer end of the yarn of a full cone may be readily tied to the inner end of the yarn of a cone about to be depleted, without ever stopping the knitting operation. Considering the fact that as many as 64 or more yarn cones may feed yarn to the machine knitting a jersey-type cloth, for instance, this feature alone may save as much as half an hour every two hours or so when the cones would normally be depleted, the machine would have to be stopped and the 64 cones would have to be replaced. In my operation, I simply tie new yarn supplies to those feeding yarn to the machine without the necessity of ever stopping the machine, except for taking off the rolls of finished knit goods.

In the illustrated embodiment, the knitting yarns 10 are fed to needles 11 of the revolving knitting cylinder from a desired number of cones 13 mounted on frameworks shown to consist of generally semi-circular, upright frames 14, one frame 14 being mounted on each of diametrically opposite sides of the machine 1 in the illustrated embodiment, as indicated in full lines at one side and in phantom lines on the other side, in FIG. 1. It will be quite obvious that neither the exact positioning or number or exact shape of the yarn stands are in any way critical. Clearly, for instance, the stands could be straight or polygonal, instead of being semi-circular, without in any way changing the principle of this feature. Also, the structure of the stand is of no importance, the illustrated frame comprising a plurality of uprights 15 interconnected by semi-circular transverse bars 16, either or both carrying cones 13. As shown in FIG. 2, the cones or some of the cones may be mounted on cone holders 17 which are pivotally supported on uprights 15 to permit the cones to be swung into different positions.

Brackets 18 are mounted on cross bars 16 and hold eyes 18a to guide the yarns from cones 13 to a semi-circular yarn guide 19 having a plurality of openings to permit the yarns to pass therethrough to a further yarn guide means 20, such yarn guide means being known per se and, therefore, not described or illustrated in detail.

With the above-described knitting yarn feeding arrangement, the knitting cylinder need not be stopped while new yarn cones are brought into operation and a single operator will be able to supervise a number of machines, the yarn storage means being readily accessible from all sides so that yarn cones may be replaced and yarn lengths stored on different holders may be tied together without difficulty. In this manner, considerable economies may be achieved in knitting jersey-type cloth and many types of knitted fabrics may be produced with great ease.

However, this knitting yarn storage and feeding system will be of particular advantage in the production of patterned knit goods with walewise patterning or vertical stripping and, for this purpose, I have provided the illustrated superstructure 21 for storing and feeding wale yarns to needles 11 of the revolving knitting cylinder 4.

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The suspension support for the entire structure is provided by a fixed support frame including four uprights 22 bolted to lugs 23 which are mounted on annular support 3. Added stability may be provided, if desired, by providing threaded extensions 22a on each upright and connecting these extensions to the ceiling, for instance. Four radial cross bars 24 extend from hub 25 to uprights 22, being mounted thereon by any suitable means, such as bushings 24a. The fixed hub 25 and the bars 24 constitute means for supporting the fixed shaft 26 whose upper end is threaded into the hub.

Fixed shaft 26 extends vertically downwardly from hub 25 into a first rotatable hub 28 centered within or somewhat below the revolving knitting cylinder 4, see FIG. 4. Four radial bars 30 extend from hub 28 in a plane generally intersecting and toward the revolving cylinder. As best shown in the enlarged top view of FIG. 5, the ends of bars 30 are concavely recessed to form substantially semi-circular grooves 32. The knitting cylinder has attached thereto chordal bars 33 which carry vertical studs 31 of substantially convex or circular cross section. Studs 31 are sufficiently spaced from the grooves 32 of cross bars 30 to permit knitted fabric F to pass through the interspace, as shown in FIGS. 4 and 5. However, they are close enough to the cross bars to engage their end grooves.

In this manner, rotation of the cylinder will cause synchronous rotation of first hub 28, studs 31 being mounted in fixed relationship with the cylinder and taking along bars 30 by the inter-engagement of the studs with grooves 32, the bars 30 being securely attached to or integral with hub 28. Obviously, the herein illustrated structure constitutes only one specific embodiment of a synchronous driving connection between the revolving cylinder and the rotary hub means of the superstructure, many variations and modifications thereof being possible.

An alternative or additional synchronous driving connection for the superstructure is shown in FIGS. 1 and 2. As illustrated, motor shaft 8 may have a short outward extension carrying gear 34 which meshes with gear 35 keyed to shaft 36. Shaft 36 is journaled in a gear box 37 housing a bevel gearing to translate the rotation of horizontal shaft 36 into synchronous rotation of vertical shaft 38. The end of shaft 38 carries sprocket wheel 39 forming part of a sprocket-and-chain drive including sprocket wheel 40 and chain 41. Sprocket wheel 40 forms a second rotary hub and is fixedly connected to the superstructure 21, elements 34-41 constituting a synchronous driving connection means between the revolving cylinder and the second hub of the superstructure 21, rotation of the cylinder by actuation of motor 9 causing synchronous rotation of the superstructure. The illustrated sprocket-and-chain drive could obviously be replaced by a gear drive and like driving means.

A plurality of superposed yarn cone support platforms 42 are fixedly mounted on the support rods 43 which are fixed to cross bars 30 and thus support and drive the entire superstructure. A rotary hub or pipe 52 surrounds fixed shaft 26 and rotates freely with the superstructure on brass bearing 27 and ball bearings 29. The several tiers of superstructure 21 carry the desired numbers of yarn cones for storing and feeding wale yarns to the needles 11 of the revolving knitting cylinder. If desired, each platform may carry a metal web 44 on its two faces, each web having four radially extending spokes similar to the structure 30 shown in FIG. 4. The radial spokes of two superposed webs, one on the upper face of a lower platform and the other on the underside of the next higher platform, are in alignment and are provided with aligned tapped holes to enable the rods 43 to be carried therein with their screw-threaded ends. In this manner, the entire superstructure 21 constitutes a rigid and integral wale yarn storage and feeding means.

It will be obvious that this superstructure, particularly

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when fully loaded with yarn cones 45, is fairly heavy. Therefore, when motor 9 is stopped to discontinue rotation of cylinder 4 and first hub 28, the forces of inertia will cause a certain backlash which, under some circumstances, may be objectionable.

As shown, the vertical stripping yarns 46 are fed from cones 45 over hooks 47 through eyes 48 and over a suitable yarn guide and equalizing means 49 to the needles 11. If the backlash of the superstructure on stoppage of motor 9 is appreciable, this will increase the wear on the entire machine.

In the embodiment of the invention illustrated in FIGS. 2 and 7, this is avoided in the following manner. Rods 43 are fixedly attached to cross bars 30, for instance by screwing their threaded ends into tapped holes in the cross bars. However, the upper ends of rods 43, instead of being fixedly attached to a web on the underside of the first platform, carry anti-friction bearings, for instance rollers 50, which merely glidably engage and support the underside of the lowest platform. In this manner, there is no fixed connection between the bars 30 driven by cylinder 4 and the yarn cone support platforms fixedly interconnected by rods 43, which form a portion of the superstructure driven by gear means 34-41.

In this embodiment, therefore, both synchronous driving connections are required, the lowest portion of the superstructure being driven by the cylinder directly and the upper portion being driven by the gearing 34-41. In the embodiment of FIG. 6, wherein the lowest platform, too, is fixedly connected to the cross bars 30, one or the other illustrated driving means for the superstructure may be omitted, if desired.

While specific means have been shown to illustrate suitable synchronous driving connections between the superstructure 21 and the revolving cylinder 4, it will be obvious to the skilled in the art that many variations and modifications of such means may be devised without departing from the spirit and scope of this invention, the only essential thing being that the superstructure and the cylinder rotate in more or less synchronous motion.

For the purpose of clearing away yarn sludge and accumulating dirt, suitable suction means, such as fans 51, are mounted on uprights 22 at each tier of the superstructure. Also, I have found it advantageous to provide a light source, such as an electric bulb within the tubularly knitted fabric F below the knitting cylinder to be able to observe the fabric as it comes off the cylinder. For this purpose, I make the shaft 26 hollow and guide therein an electric cable or wire 53 supplying electric current to the light source (not shown).

The operation of the illustrated machine is obvious from the above description of its structure. Jersey-type fabrics may be knitted on the revolving cylinder in the conventional manner by feeding knitting yarns 10 to the knitting needles 11, the only difference being the spatial arrangement of the knitting yarn storage and feeding means, as shown at 14.

If it is desired to knit plain fabrics, it is possible either to discontinue the yarn feed from the superstructure or to disconnect the superstructure drive by lifting the entire structure on threaded extensions 22a by turning nuts 54. In this manner, the cross bars 30 will become disengaged from studs 31.

When it is desired, on the other hand, to produce patterned knit goods with vertical stripping, the superstructure is synchronously driven with the revolving knitting cylinder to feed suitable wale yarns to needles 11.

While certain specific embodiments of the invention have been described and illustrated, it will be obvious that many modifications or variations may occur to the skilled in the art, particularly after benefiting from the present teaching, without departing from the spirit and scope of this invention as defined in the appended claims.

What I claim is:

1. In combination with a circular knitting machine hav-

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ing a revolving cylinder with knitting needles: a wale yarn storage and feeding system comprising a rotatable superstructure mounted above said revolving knitting cylinder, said superstructure including means for supporting yarn holders, means connecting the cylinder and the superstructure for substantially synchronously driving the superstructure with the revolving cylinder, and means positioned peripherally of said yarn holder supporting means for guiding yarn outside said superstructure from said holders to selected ones of said knitting needles.

2. In combination with a circular knitting machine having a revolving cylinder with knitting needles: a wale yarn storage and feeding system comprising a fixed shaft coaxial with said cylinder and extending upwardly therefrom, means upwardly spaced from said cylinder and firmly supporting the fixed shaft in suspension above said cylinder, hub means supported by and rotatably mounted on said fixed shaft, a plurality of superposed support means for yarn holders, means for connecting the hub means with the yarn holder support means whereby a rigid yarn supporting superstructure is formed, means connecting the cylinder and the hub means for substantially synchronously driving the superstructure with the revolving cylinder about the fixed shaft, and means positioned peripherally of said yarn holder support means for guiding yarn from said holders outside said superstructure to selected ones of said knitting needles.

3. In combination with a circular knitting machine having a revolving cylinder with knitting needles: a wale yarn storage and feeding system comprising a fixed shaft coaxial with said cylinder and extending upwardly therefrom, means upwardly spaced from said cylinder and firmly supporting the fixed shaft in suspension above said cylinder, hub means supported by and rotatably mounted on said fixed shaft, said hub means including a plurality of radially extending bars extending in a horizontal plane intersecting the revolving knitting cylinder, a plurality of superposed support means for yarn holders, means for connecting the hub means with the yarn holder support means whereby a rigid yarn supporting superstructure is formed, said means including a plurality of rods fixedly connecting the radial bars with the support means, means fixedly connected to the inside of the cylinder, said means engaging the ends of said bars but being sufficiently spaced therefrom to permit fabric knitted on the cylinder to pass downwardly through the space between the ends of the radial bars and the bar engaging means, said bars and bar engaging means constituting means connecting the cylinder and the hub means for substantially synchronously driving the superstructure with the revolving cylinder about the fixed shaft, and means positioned peripherally of said yarn support means for guiding yarn from said holders outside said superstructure to selected ones of said knitting needles.

4. The combination of claim 3, wherein said radial bar ends have concave grooves and said bar engaging means include convex studs of a surface configuration substantially complementary to the concave grooves, the convex studs extending into the concave grooves but being spaced from the groove wall.

5. In combination with a circular knitting machine having a revolving cylinder with knitting needles: a wale yarn storage and feeding system comprising a fixed shaft coaxial with said cylinder and extending upwardly therefrom, a fixed support frame surrounding said shaft, means spaced upwardly from said cylinder and mounted on said support frame for supporting the fixed shaft in suspension above said cylinder, hub means supported by and rotatably mounted on said fixed shaft, a plurality of superposed platform means for supporting yarn holders, said platform means extending toward said support frame, means for rigidly interconnecting the platform means and at least one platform means with the hub means whereby a rigid rotatable yarn supporting superstructure is formed within said fixed support frame, means connecting the cylinder

and the hub means for substantially synchronously driving the superstructure with the revolving cylinder about the fixed shaft, and means positioned peripherally of said yarn holder supporting means for guiding yarn from said holders outside said superstructure to selected ones of said knitting needles.

6. In combination with a circular knitting machine having a revolving cylinder with knitting needles: a wale yarn storage and feeding system comprising a fixed shaft coaxial with said cylinder and extending upwardly therefrom, a fixed support frame surrounding said shaft, means spaced upwardly from said cylinder and mounted on said support frame for supporting the fixed shaft in suspension above said cylinder, hub means supported by and rotatably mounted on said fixed shaft, said hub means including a plurality of radially extending bars extending in a horizontal plane intersecting the revolving knitting cylinder and having ends with concave grooves, convex studs of a surface configuration substantially complementary to the concave grooves and means fixedly mounting said studs on the inside of said cylinder in engaging registry with said grooves but sufficiently spaced therefrom to permit fabric knitted on the cylinder to pass downwardly through the space between the groove walls and the studs, a plurality of superposed platform means for supporting yarn holders, said platform means extending toward said support frame, means for rigidly interconnecting the platform means and at least one platform means with the hub means whereby a rigid rotatable yarn supporting superstructure is formed within said fixed support frame, said bars and studs constituting means for substantially synchronously driving the superstructure with the revolving cylinder about the fixed shaft, and means positioned peripherally of said yarn supporting means for guiding yarn from said holders outside said superstructure to selected ones of said knitting needles.

7. The combination of claim 6, further comprising means on said fixed support frame for moving said fixed shaft supporting means upwardly whereby the grooved bar ends may be disengaged from said studs.

8. The combination of claim 5, further comprising suction means associated with each platform means for removing yarn sludge.

9. In combination with a circular knitting machine having a revolving cylinder with knitting needles: a wale yarn storage and feeding system comprising a fixed shaft coaxial with said cylinder and extending upwardly therefrom; a fixed support frame surrounding said shaft; means spaced upwardly from said cylinder and mounted on said support frame for supporting the fixed shaft in suspension above said cylinder; hub means supported by and rotatably mounted on said fixed shaft, said hub means including a first hub with a plurality of radially extending bars extending in a horizontal plane intersecting the revolving knitting cylinder, a second hub below said suspension support means for the fixed shaft and a hollow shaft between the first and second hubs; studs fixedly mounted on the inside of said cylinder in engaging registry with the ends of said radial bars but sufficiently spaced therefrom to permit fabric knitted on the cylinder to pass downwardly through the space between the bar ends and the studs; a plurality of superposed platforms extending from the hollow shaft toward said support frame and supporting yarn holders; vertical rods fixedly interconnecting the platforms and at least one of said hubs with an adjacent one of said platforms whereby a rigid rotatable yarn supporting superstructure is formed within said fixed sup-

port frame; means connecting the cylinder with the second hub for substantially synchronously driving the superstructure with the revolving cylinder about the fixed shaft, and means for guiding yarn from said holders to selected ones of said knitting needles.

10. The combination of claim 9, wherein said vertical rods include rods fixedly interconnecting said second hub with the uppermost of said platforms and the radial bars of the first hub with the lowermost of said platforms.

11. The combination of claim 9, wherein said vertical rods include rods fixedly interconnecting said second hub with the uppermost of said platforms and further comprising support rods for the lowermost of said platforms, said support rods being fixedly attached to the radial bars of the first hub and glidably supporting said lowermost platform.

12. In combination with a circular knitting machine having a revolving cylinder with knitting needles: a fixed knitting yarn holder storage stand supported independently of and at a distance from the knitting machine so as to be readily accessible from all sides, means on said stand for supporting a plurality of yarn holders and means for guiding yarn from said holders to said knitting needles.

13. The combination of claim 12, wherein said stand consists of a framework and said yarn holder support means includes yarn supports pivotally mounted on the framework.

14. In combination with a circular knitting machine having a revolving cylinder with knitting needles: a fixed knitting yarn holder storage stand supported independently of and at a distance from the knitting machine so as to be readily accessible from all sides, means on said stand for supporting a plurality of yarn holders, means for guiding yarn from said holders to said knitting needles, and a wale yarn storage and feeding system comprising a rotatable superstructure mounted above said revolving knitting cylinder, said superstructure including means for supporting wale yarn holders, means connecting the cylinder and the superstructure for substantially synchronously driving the superstructure with the revolving cylinder, and means positioned peripherally of said wale yarn holder supporting means for guiding wale yarns outside said superstructure from the latter holders to selected ones of said knitting needles.

15. In combination with a circular knitting machine having a revolving cylinder with knitting needles: a fixed knitting yarn holder storage stand supported independently of and at a distance from the knitting machine so as to be readily accessible from all sides, means on said stand for supporting a plurality of yarn holders and means for guiding yarn from said holders to said knitting needles, groups of two of said yarn holders being associated with a single one of said yarn guiding means whereby yarn may first be fed from one of said two holders to said yarn guiding means and as the yarn nears exhaustion at said one holder the yarn from the other one of said two holders may be tied to the yarn of the one holder to continue the yarn feed to the yarn guiding means without interruption.

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