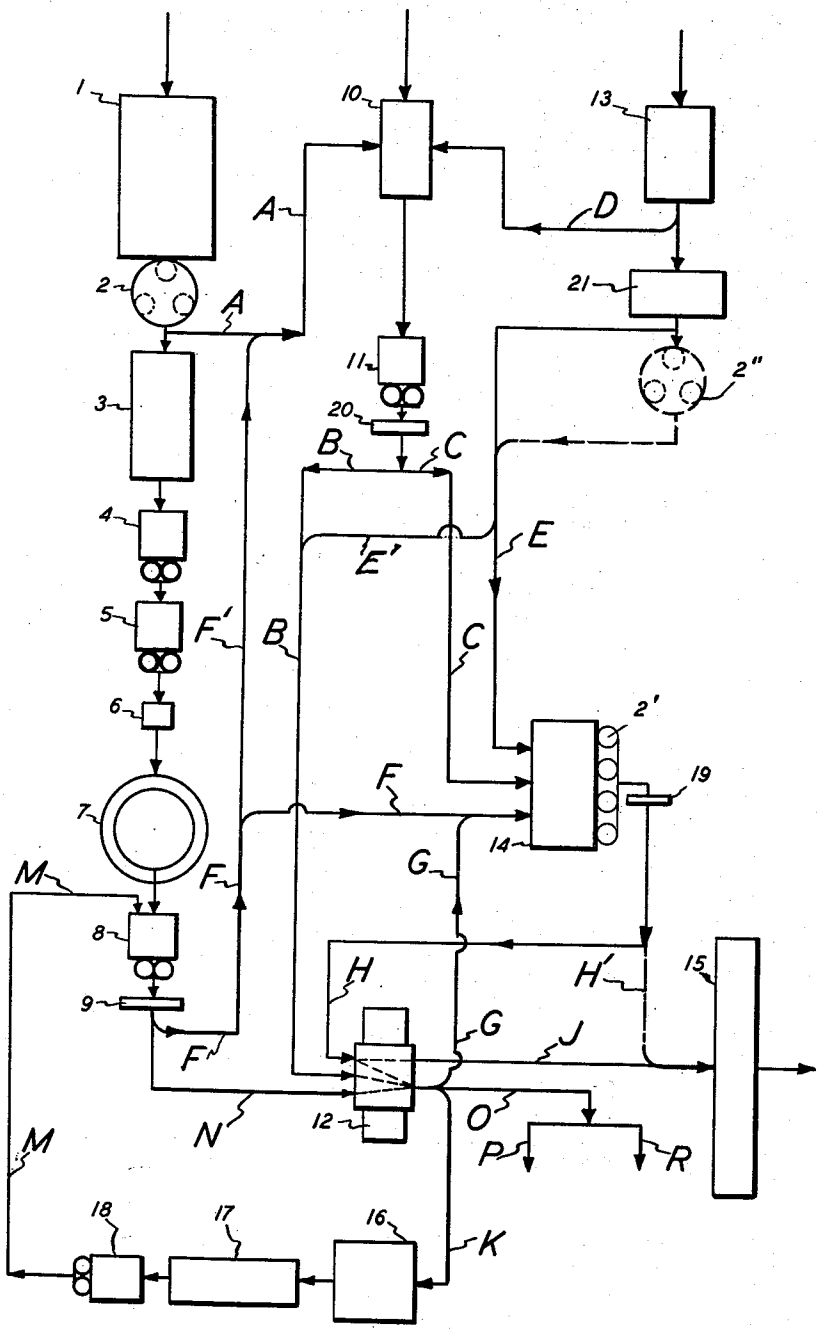
Jan. 6, 1959

R. C. WILKIE

2,867,077

PROCESS OF MAKING YARN

Filed Dec. 21, 1954



INVENTOR
ROBERT C. WILKIE
BY R. V. Lee
ATTORNEY

United States Patent Office 2,867,077
Patented Jan. 6, 1959

2,867,077

PROCESS OF MAKING YARN

Robert C. Wilkie, Andover, Mass., assignor to Pacific Mills, Lawrence, Mass., a corporation of Massachusetts

Application December 21, 1954, Serial No. 476,643

5 Claims. (Cl. 57—157)

This invention relates to a complete process of making yarn, either of all natural fiber or all synthetic fiber, or of blended combinations of natural and synthetic fiber.

The present trends in the textile industry require a system of making yarns that is simple, flexible and reducible to a minimum number of machines and processes and capable of producing quality yarns of any conceivable combination of fibers.

The present invention is the result of a long range development to create such a universal system. The system is composed of elements or individual processes some of which may be introduced into existing systems and certain advantages gained, but the optimum results are realized only in the correct combination of the several components.

The main object of this invention is to provide an economical system of producing first quality yarns composed of natural and/or synthetic fibers of all kinds, and varying combinations of the same. Another object is to provide a process that involves a minimum number of operating steps as compared with conventional methods.

An additional object is to provide a system wherein only one weight of roving is used to make a wide range of yarn sizes.

The drawing represents a diagrammatic flow sheet of the process of the invention, without showing the details of steps involved, or a scale layout.

In the drawing, **1**, **10** and **13** represent respectively a type of card used for wool, a Pacific Converter, Patent No. 2,438,469, and a type of card used for cotton. Preparation of the fibers to be supplied to these machines may be carried out according to conventional practice.

In the manufacture of yarns on the so-called worsted system, preferably the fiber, e. g., wool or man-made fibers, passes through the card **1** into a sliver can **2** of the type described in my prior Patents Nos. 2,478,960 and 2,598,738, which preferably are incorporated into a three-can self-doffing type of coiler of the type disclosed in the co-pending application of George Forsythe and Harold W. Russell filed May 31, 1952, Serial No. 291,016, now Patent No. 2,736,071 dated February 28, 1956. From the cans **2**, the sliver goes to the backwasher **3**, gill **4**, gill **5**, punch baller **6**, comb **7** (of the Noble type) and gill **8**. The gills **4** and **5** and comb **7** deliver the sliver to suitable cans or collecting means such as that of Patent No. 2,478,960 or Patent No. 2,598,738, as described above.

The collecting means, namely that of Patent No. 2,478,960, or Patent No. 2,598,738, is an important but not an essential part of the system. Besides the advantage of putting a very large number of yards in a can, the use of this collecting means makes it possible to produce a self-sustaining package of coiled sliver which is removable from the can. Thus only two cans are needed per gill head or coiler head and no more cans for transportation, storing or creeling in subsequent operations. The packages of sliver are removed from the can by

an electric hoist, and in the hoist cable a scale is incorporated for weighing the package while it is suspended as indicated at **9**. Operation **9** is not the conventional "weigh box" where several packages are put together to produce a required average weight. In my method, each package is weighed, and those which vary more than about 5% from a standard weight are removed to be reprocessed. I prefer, however, to hold the weight to within a tolerance of about ±1.6%. For one particular specification, for example, in a gross weight of 48 pounds, the packages are held to a tolerance of ±.75 pound or 1.56%. If a package is not within these limits, it is removed to be reprocessed to within the required limits, and no attempt is made to balance off-weight packages in regular production. This procedure is necessary in my system because the number of operations and doublings is reduced to a minimum in contrast to the conventional system employing many thousands of doublings which were depended upon to cover up or correct inherent faults in the processing.

The package produced by the above collecting means is accurately and symmetrically formed from top to bottom with coils arranged around a central hole running from top to bottom through the package. This physical structure of the package provides for the proper performance of the compressing and setting operation **12**, to which the package moves as shown by line N. In operation **12**, the package, which is roughly 60" in height, is reduced to a permanent size of 12 to 16" in height depending upon the immediate requirements, by apparatus and procedure described in my copending application Serial No. 208,562 filed January 30, 1951, now Patent No. 2,707,806 dated May 10, 1955. The compressed package supersedes the formerly used balled top. Although the sliver weight per unit of length is about the same as in balled top, the important difference is that the package contains four to six times as much sliver in the same volume of space as in the conventional ball of top.

From the setting operation **12**, the material passes along lines G, K or O as required. The line G leads to a high draft (12 to 25:1), high speed drawing frame **14** as disclosed in Patent No. 2,621,372 granted December 6, 1952 in which compressed packages totaling over 4,000 pounds may be placed in the drawing process at one time. This high speed drawing frame may deliver as much as 485 pounds per hour (at 100% efficiency), as contrasted, for example, with a widely used modern drawing frame, which at best would produce about 75 pounds per hour (also at 100% efficiency). Because of the ease of transportation of these compressed packages, the drawing frame **14** may be located some distance from the packaging operation **12**.

As an alternative, the material from operation **8** may follow the line F to the drawing operation **14** without being compressed. But then a charge of only about 1400 pounds is delivered at a time to the drawing frame which, although less than in my preferred procedure, is however greater than the use of conventional tops would allow.

The package as it comes from the setting operation **12** is admirably suited for large capacity dyeing or other liquid chemical treatment such as bleaching, tracer or identification tinting and the like. For such liquid treatment, such as dyeing, the material passes along line K to the liquid treating operation **16**, in which the packages are stacked on perforated hollow spindles passing through the central openings thereof and the spindles loaded with packages placed in a kettle, for example a Fredericks, Franklin or high pressure kettle, for liquid treatment by pumping of liquid through the packages, either from the hollow spindles or into the hollow spindles. After dyeing,

the packages move to a backwashing operation at **17**, gilling at **18** and back at M, to the gilling **8** and weighing **9**. It may be more convenient to have the operations following dyeing as a separate department through operation **14**, but the flow of material would be the same as for undyed material, with the possible exception of additional gilling for color blending. This procedure entirely supersedes the conventional "top dyeing" techniques as now practiced.

Another advantage of the compressed and set package from operation **12** is that the material can be placed in cartons and stored as at P or shipped as at R to distant points at great savings in space and transportation costs. In addition, the material is well protected from abuse in handling and storing, and can be stacked to any practical height with no flattening or package distortion in the lower layers as experienced in storing top.

The drawing device **14** is capable of reducing the sliver in one drafting operation to a size suitable for spinning, so it is in effect a roving frame. Preferably the device **14** delivers to sliver cans **2'** similar to the sliver cans **2** previously described. When so arranged, the device **14** delivers a plurality of ends, e. g., four ends to each of four cans, i. e. four ends per can. The ends are not twisted, so they may be used either as single roving, with one package serving four spindles, or as double roving, with one package serving two spindles. The roving as delivered from operation **14** is collected in the same sort of cans as after above operation **2** or **8**, except that four ends are handled together instead of one. The coiled material is weighed at **19** in the same manner as at **9**. The limits here are however about $\pm\frac{3}{4}$ pound in 25, i. e. $\pm 3\%$. I prefer, however, to hold the packages to within about $\pm\frac{1}{2}$ pound in 25 pounds, i. e. $\pm 2\%$, as by remaining within the narrower limits, both here and at operation **9**, the uniformity of the yarn is as good as that produced in any prior system. Packages which do not come within the limits are removed to be reprocessed.

The material then passes along line H to the compressing and setting process **12** where the 60" high package is reduced to a permanently set, compact package 12" or less in height. This package passes along line J to the spinning frame **15**. The package is in a form suitable for placing in the creel of the frame and weighs 25 pounds or more. This size package is obviously a great advantage either as single roving or double roving, in that the end pulls freely from the top of the package and there is avoided the tension applied to the roving as in the conventional roving where the roving package is revolved by the roving. Alternatively, the material from the weighing operation **19** may pass by line H^1 directly to the spinning frame **15**, without passing through the setting operation **12**, but of course with sacrifice of the advantages of this operation.

The spinning frame **15** employs the same principle of draft control as in the draft device **14**, as described in said Patent No. 2,621,372, and by using the tandem arrangement of drafting as described therein, drafts in excess of 600 may be achieved. An essential feature of my system is the ability to make use of heretofore unusable high drafts, in both operations **14** and **15**. Another indispensable feature in my system is the fact that the fiber control medium employed in operations **14** and **15** allows for successful handling of all lengths and types of fibers, except some of the very short fibers (sometimes called shoddy) used in the woolen system.

For a 100% vegetable fiber yarn, the material passes from the card **13** through a doubling device **21**, which need not employ draft, but serves the function of building up the normally light weight end from the card **13** into a size suitable to be handled on the drafting device **14**. The sliver therefrom flows along line E to operation **14**, preferably first being collected in sliver cans **2"** similar to the cans **2** described. Then from operation **14**, the fiber, preferably collected in sliver cans, goes to the weighing operation **19** and thence to the spinning frame **15** along line H^1, or along line H to the compressing and setting device **12**. From the compressing and setting device **12** it may go to dyeing **16**, storing P, shipping R or to the spinning frame **15**.

Alternatively the sliver from the doubling device **21** may go directly, as indicated at E', to the compressing and setting apparatus **12**. From the setting operation the material may be processed as heretofore described. Man-made fibers, or blends of various fibers including wool, may be processed as just described for 100% vegetable fibers.

For 100% synthetic yarns, the material goes through the converter **10**, Patent No. 2,438,469, where the material is converted from continuous filament to staple sliver of any desired fiber length. From there the sliver (preferably in sliver coils as heretofore described) goes to gill **11** and weighing operation **20**, which perform the same functions as gill **8** and weighing **9**. The material then goes (preferably in sliver coils as heretofore described) via line C to the drawing frame **14** to be processed as described, i. e., through weighing **19** and to spinning frame **15** or to setting and compressing operation **12** and then to dyeing **16**, storing P, shipping R, or spinning **15**. As an alternative, the material may go from the weighing operation **20** via line B to the setting and compressing device **12** and thereafter follow the same route as described above.

In the production of a yarn composed of blends of any of the above mentioned fibers, the synthetic fibers are started in the form of tow and are first fed to the converter **10**. Any percentage of fibers may be added from operation **2** over line A and introduced into the converter beyond the fracturing rolls thereof as described in Patent No. 2,636,222, granted April 28, 1953. If a combed sliver of animal fiber is required, the material is taken from operation **9** over lines F, F^1 and A. Likewise, vegetable fibers may be taken from operation **13** over line D to the converter, and blended with the synthetic fibers. Varying percentages of all types of fibers may meet at the converter **10** and then be further processed into yarn as described above.

Cross-dyed effects may be obtained by first blending different fibers by my process, as described above, and then dyeing. Any of the various mentioned types of fibers may be separately dyed and then blended by operations **17**, **18**, **8**, **14** and **12** and then formed into yarn.

To illustrate the accuracy with which a yarn may be made according to my preferred method, assume the material from operation **8** weights 3 ounces per 5 yards or 10,500 grains per 40 yards. The total weight of the package at **9** is 48 ponnds, with a tolerance of ± 0.75 pound, or a net weight of 43 pounds, with a tolerance of $\pm .672$ pound.

Standard=43 pounds$\times$7000 grains/pound=301,000 grains

Maximum=(43+.672) (7000)=305,704 grains

Minimum=(43−.672) (7000)=296,296 grains

Standard sliver weight $\begin{cases} =10{,}500 \text{ grains/40 yards} \\ =262.5 \text{ grains/yard} \end{cases}$

$$\therefore \frac{301{,}000}{262.5} = 1{,}147 \text{ yards}$$

$$\text{Maximum weight} = \frac{305{,}704}{1{,}147} =$$

266.5 grs./yd.=10,660 grs./40 yards

$$\text{Minium weight} = \frac{296{,}296}{1{,}147} =$$

258.3 grs./yd.=10,332 grs./40 yards

Then at operation **14:**

Maximum weight delivered=$\frac{2\times10,660}{12}$=

1,778 grains/40 yards

Minimum weight delivered=

$\frac{2\times10,332}{12}$=1,722 grains/40 yds.

Standard weight delivered=

$\frac{2\times10,500}{12}$=1,750 grains/40 yards

Spinning operation 15

Using single roving for 1/24s Worsted Count

Standard $\frac{1,750}{84}$=20.83 grains/40 yards=1/24s

Maximum $\frac{1,778}{84}$=21.18 grains/40 yards=1/23.6s

Minimum$\frac{1,722}{84}$=20.06 grains/40 yards=1/24.3s

If for some reason the material delivered from operation **14** shows a variation in weight per unit length, said variation is held to ±0.5 in 25 pounds.

Standard=25×7000=175,000 grains
Maximum=25.5×7000=178,600 grains
Minimum=24.5×7000=171,400 grains
Standard weight delivered from operation **14**=1750 grs./40 yards

$\frac{175,000}{1,750}$=100 units of 40 yards

∴maximum weight=$\frac{178,600}{100}$=1,786 grs./40 yards

Minimum weight=$\frac{171,400}{100}$=1,714 grs./40 yards

At spinning operation 15

For standard of 1/24s

Maximum=$\frac{1,786}{84}$=21.3 grs./40 yards=1/23.5s

Minimum=$\frac{1,714}{84}$=20.4 grs./40 yards=1/24.5s

It can be readily seen that by checking the weights at two points as above described, the yarn counts are kept well within the limits of any known system, regardless of the number of operations used in it, despite the small number of operations in my system.

Whenever reference is made herein to the Pacific Converter, as described in my Patent No. 2,438,469, it will be understood that the Converter may include the improvements disclosed in my copending application Serial No. 286,316, filed May 6, 1952, now Patent No. 2,706,834 dated April 26, 1955.

The present application is a continuation-in-part of my prior application Serial No. 291,043, filed May 31, 1952, now abandoned.

I claim:

1. The process of making yarn which comprises forming fibers into sliver, collecting the sliver into masses of coils each arranged around a central opening, compressing and setting the coiled masses into packages about 20 to 26% of their original height without substantial increase in their diameter, reducing the sliver in one drafting operation to the condition of untwisted substantially constant weight roving, coiling said roving in masses of coils each arranged around a central opening with a plurality of ends in each mass, compressing and setting the coiled masses into packages about 20% to 26% of their original height without substantial increase in their diameter, and spinning said roving into yarn with a draft of about 25 to 600, as required to produce the yarn count desired.

2. The process of making yarn which comprises forming fibers into sliver, collecting the sliver into masses of coils each arranged around a central opening, compressing and setting the coiled masses into packages about 20 to 26% of their original height without substantial increase in their diameter, dyeing the packages, reducing the sliver in one drafting operation to the condition of untwisted substantially constant weight roving, coiling said roving in masses of coils each arranged around a central opening with a plurality of ends in each mass, compressing and setting the coiled masses into packages about 20% to 26% of their original height without substantial increase in their diameter, and spinning said roving into yarn with a draft of about 25 to 600, as required to produce the yarn count desired.

3. The process of making yarn which comprises blending natural and synthetic fibers of varied lengths and forming the blended fibers into sliver, collecting the sliver into masses of coils each arranged around a central opening, compressing and setting the coiled masses into packages about 20 to 26% of their original height without substantial increase in their diameter, reducing the sliver in one drafting operation to the condition of untwisted substantially constant weight roving, coiling said roving in masses of coils each arranged around a central opening with a plurality of ends in each mass, compressing and setting the coiled masses into packages about 20% to 26% of their original height without substantial increase in their diameter, and spinning said roving into yarn with a draft of about 25 to 600, as required to produce the yarn count desired.

4. The process of making yarn which comprises blending natural and synthetic fibers of varied lengths and forming the blended fibers into sliver, collecting the sliver into masses of coils each arranged around a central opening, compressing and setting the coiled masses into packages about 20 to 26% of their original height without substantial increase in their diameter, dyeing the packages, reducing the sliver in one drafting operation to the condition of untwisted substantially constant weight roving, coiling said roving in masses of coils each arranged around a central opening with a plurality of ends in each mass, compressing and setting the coiled masses into packages about 20% to 26% of their original height without substantial increase in their diameter, and spinning said roving into yarn with a draft of about 25 to 600, as required to produce the yarn count desired.

5. The process of making yarn which comprises forming fibers into sliver, collecting the sliver into masses of coils each arranged around a central opening, compressing and setting the coiled masses into packages about 20 to 26% of their original height without substantial increase in their diameter, dyeing the packages, reducing the sliver in one drafting operation to the condition of untwisted substantially constant weight roving, coiling said roving in masses of coils each arranged around a central opening with a plurality of ends in each mass, and spinning said roving into yarn with a draft of about 25 to 600, as required to produce the yarn count desired.

References Cited in the file of this patent

UNITED STATES PATENTS

687,573	Phillips	Nov. 26, 1901
2,181,777	Asbelle	Nov. 28, 1939
2,228,963	McGinnis	Jan. 14, 1941
2,478,960	Wilkie	Aug. 16, 1949
2,621,372	Wilkie	Dec. 12, 1952
2,707,806	Wilkie	May 10, 1955

FOREIGN PATENTS

402,314	Great Britain	Nov. 30, 1933