

Nov. 16, 1943.

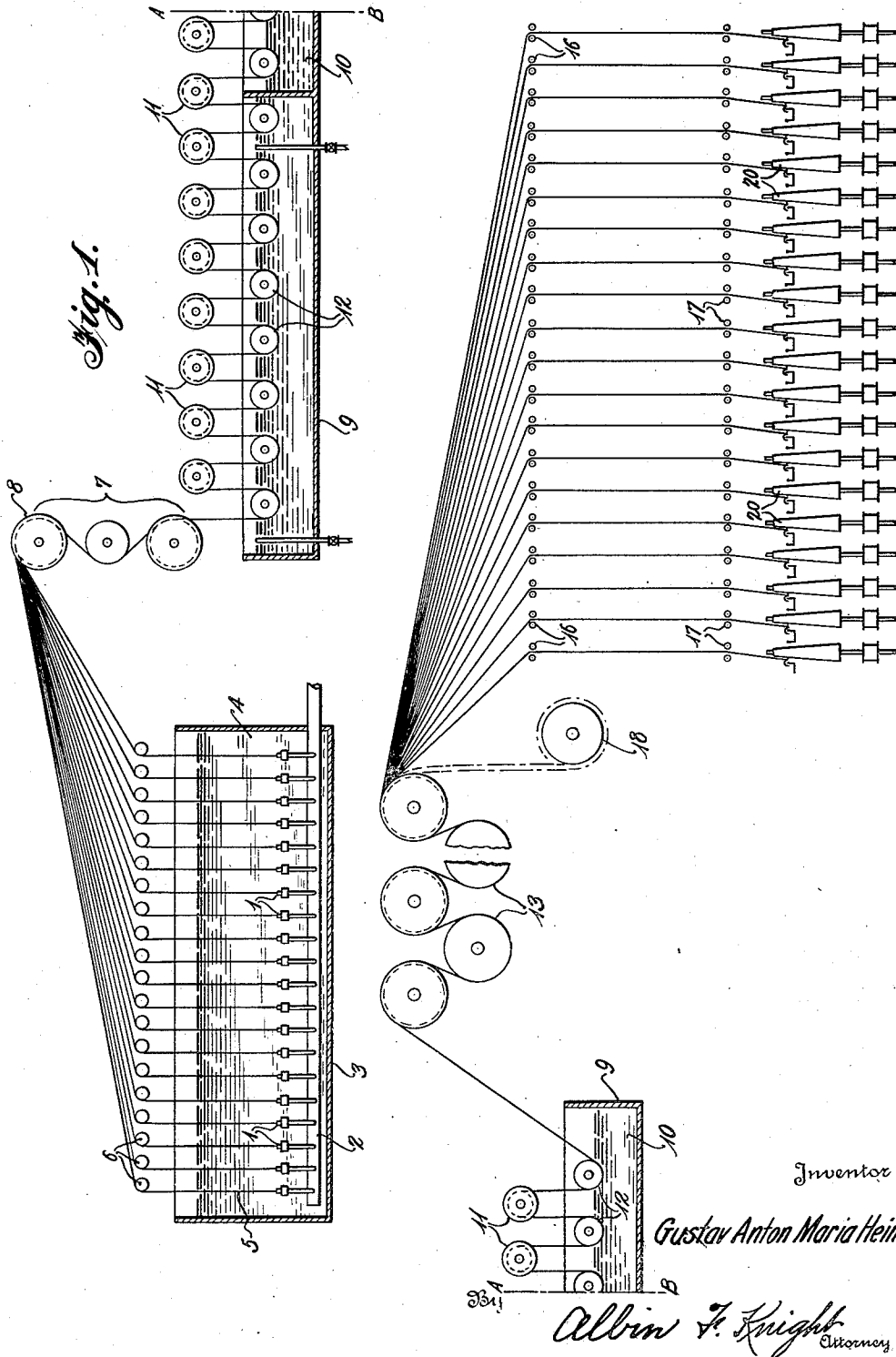
G. A. M. HEIM

2,334,325

CONTINUOUS SPINNING

Filed May 11, 1940

2 Sheets-Sheet 1



Nov. 16, 1943.

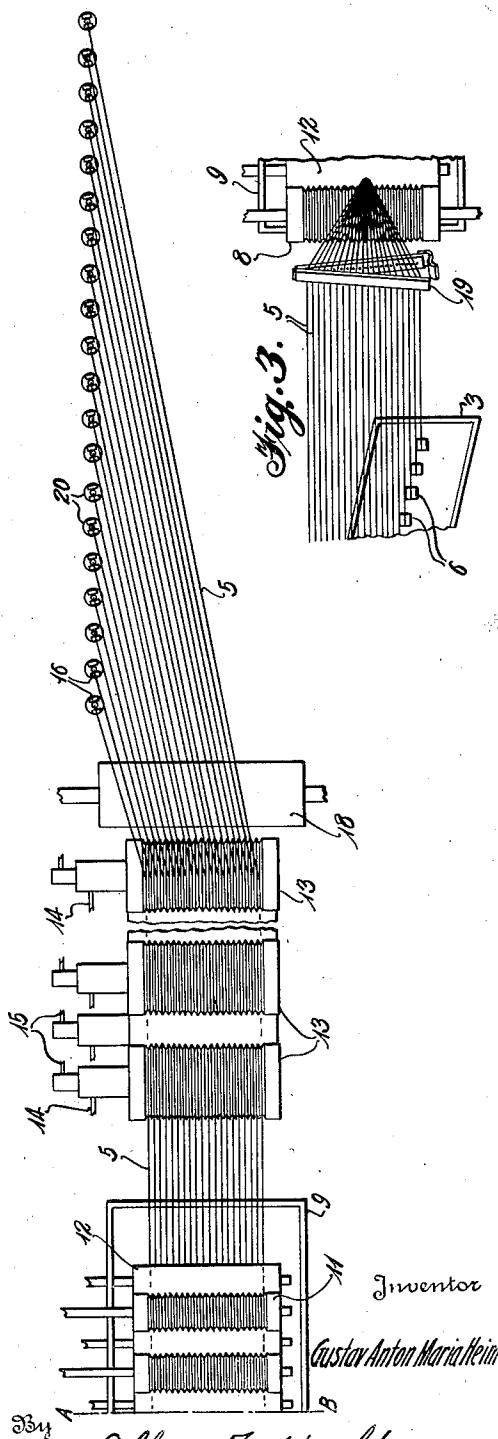
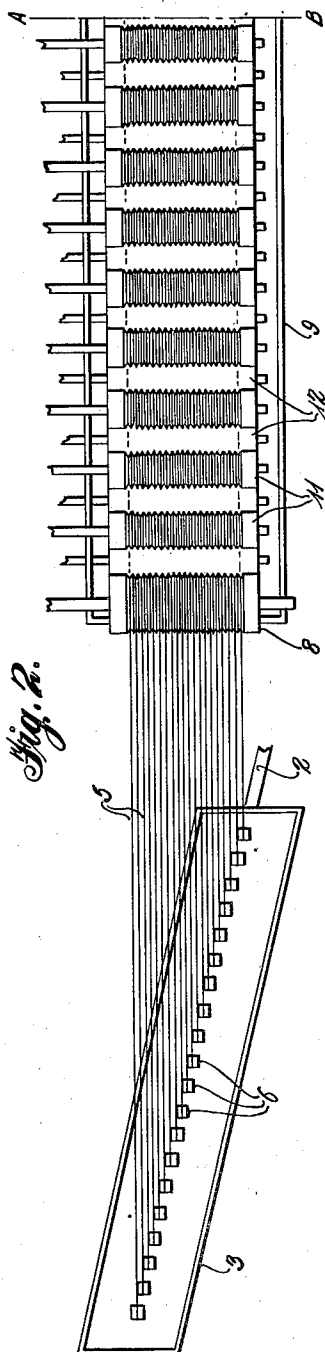
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2 Sheets-Sheet 2



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2,334,325

CONTINUOUS SPINNING

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Application May 11, 1940, Serial No. 334,659
In the Netherlands September 19, 1939

4 Claims. (Cl. 18—8)

The present invention relates to the manufacture of rayon and, more particularly, to a method and apparatus for the production of rayon according to the continuous spinning method.

For a number of years, it has been the practice in the normal commercial production of multi-filament viscose rayon by the wet spinning process to extrude a viscose solution through spinnerets into a precipitating or coagulating bath and immediately thereafter to collect the filaments formed thereby as a package on a bobbin or in a centrifugal bucket. The package of wet thread is then removed from the bobbin or bucket and subjected to the necessary after-treatments such as washing, desulphurizing, bleaching, drying, twisting and finishing. This same general procedure has been utilized in the production of other types of rayon.

During each of the after-treating operations, it is customary to mechanically or manually handle the packages of yarn. Such handling is objectionable not only because of the expense involved and the damage to the thread, which is sometimes incurred but also because shrinkage differences are created in the packaged thread thereby for which certain compensations must be made. These various after-treating operations are expensive because not only do they require time and labor but each operation necessitates the use of a separate apparatus. Furthermore, the artificial thread produced by the so-called non-continuous or interrupted type of process is of a non-uniform character and is inferior in certain respects to the thread which is produced by the continuous spinning method.

The disadvantages present in the interrupted type of system have been recognized for a long time and the rayon industry has endeavored to overcome them and to achieve more efficient results in a more practical and simplified manner. In this connection, attempts have been made to conduct the entire spinning process continuously and to produce thereby a finished thread that is in condition for immediate fabrication. As a matter of fact, several different types of continuous spinning machines have been developed which do completely process the thread prior to its initial collection. However, the heretofore known continuous spinning machines have not proven entirely satisfactory as the thread, while being produced, is subjected to considerable friction and the equipment necessary is cumbersome, complicated and it takes up an excessive amount of space. Additionally,

such equipment is relatively expensive for individually treating the threads.

In order to provide a continuous system that is commercially practical, it is necessary to maintain a sufficiently large production to justify the use of a machine of the continuous spinning type. Normally, however, if a large number of rayon threads, each composed of a multiplicity of filaments are extruded and continuously processed on rollers, storage devices and the like, the threads, and therefore the filaments, being carried in parallel relationship cannot be maintained separate, as they become entangled and run together in the form of a cable. Consequently the individual filaments of such threads are not equally affected by the processing fluids and, therefore, uniform characteristics are not retained in the threads. Moreover, in attempting to separate cable of composite threads it has been found impossible to separate the threads into equal numbers of filaments.

Some of the systems which had been provided for the continuous and simultaneous production of rayon threads involves the use of conveyor belts over which the threads are spread. It was soon determined that by the use of such equipment the threads were improperly treated from a practical standpoint and the treating liquids caused the entanglement of the threads. In another type of system, it was attempted to maintain the threads separate during the passage thereof along their path of travel by means of hook-shaped guiding devices. However, it was found that such guiding hooks acted as friction devices and, therefore, damage of the filaments was effected either by the rupturing thereof or by the imparting of non-uniform characteristics to the thread.

The present invention contemplates the provision of a continuous spinning system for the manufacture of rayon threads wherein a plurality of threads are extruded, and simultaneously and continuously processed while being maintained separate, one from the other, together with provisions for the efficient initiation of the operation thereon.

A further object of the invention is the provision of a method of, and system for, the concurrent production of multi-filament threads including the continuous passing of the same through a plurality of treating baths under tension, but without substantial friction.

Additionally the present invention has as an object the provision of an apparatus and process by which a plurality of bundles of filaments are

continuously propelled side by side through a plurality of treating baths, stretched to the same extent and subjected to the respective baths in a uniform manner so as to avoid variations between the filaments being treated after the filament bundles have initially been threaded upon the apparatus in a composite bundle.

Other objects and advantages of this invention will be apparent from the following detailed description when considered in connection with the accompanying drawings, wherein;

Figure 1 represents a diagrammatic view in elevation of a continuous spinning machine constructed in accordance with this invention, showing the thread from the time it is extruded until it is collected,

Figure 2 is a diagrammatic plan view of the machine shown in Figure 1, and

Figure 3 is a detailed view illustrating the employment of a comb spreader bar for initiating the operation of the apparatus.

Now in referring to the drawings, the numeral 1 indicates a series of spinnerets connected to a feed line 2 and positioned within a spinning tank 3, which spinning tank contains a coagulating bath 4. Freshly coagulated threads 5 emerging from the spinnerets 1 are passed over freely rotatable rollers 6 and directed to a draw-off assembly indicated at 7. This draw-off assembly 7 consists of three driven rollers which are positioned vertically, one above the other. Thus, as the threads 5 are propelled around the rollers, as indicated in Figure 1, substantially no slippage takes place. The upper and lower rollers of assembly 7 are provided with circumferential grooves 8. The number of these grooves corresponds to the number of threads being spun, each groove thereby accommodating a single thread. These grooves 8 keep the threads separated as they are being propelled therearound. In order to assure complete separation of the threads, the grooves should be spaced apart from 3 to 5 mm. and should be approximately $1\frac{1}{2}$ mm. in depth with slightly rounded contours.

After the threads have been propelled around the rollers of the assembly 7, they are conducted through a series of treating baths arranged within a tank 9, which is divided into a number of compartments 10. Each of these compartments accommodates an individual treating bath. The thread is passed in and out of each treating bath a number of times by means of a series of driven rollers 11, located above that particular bath, and a corresponding series of freely rotatable rollers 12, which are either partially or completely submerged in the bath. As shown in Figure 1, the thread is propelled from the lowermost roller of the assembly 7 to the first freely rotatable roller in the series of rollers 12 in the bath and thence, alternately and in sequence, around driven rollers 11 and freely rotatable rollers 12. The driven rollers 11 are provided with grooves corresponding in number, size, and shape to those constructed in the uppermost and lowermost roller of the assembly 7.

As the threads are passed through the several treating baths, they are subjected to the treatments required for the particular use to which the threads are to be put. For example, in the manufacture of viscose rayon, threads may be subjected successively to a treatment with a dilute acid solution, hot water, desulphurizing bath, cold water, and a finishing agent, etc. The proper amount of stretching may be effected during the path of travel of the threads by in-

creasing the peripheral speeds of succeeding rollers. It is usually desirable to stretch the threads from about 40% to 80% in the first bath and impart additional stretch in succeeding baths, or at least the threads may be maintained under tension by very small increases in peripheral speeds of the succeeding rollers.

After the threads have been given the desired processing treatments, they are passed to a drying assembly 13, consisting of a plurality of driven rollers which are heated from the interior by means of any suitable heating medium such as hot water or steam supplied through inlet ducts 14 and outlet ducts 15. If it is necessary, one or more of the rollers in the drying assembly 13 may also be provided with circumferential grooves similar to those on the processing and stretching rollers.

After the threads have been dried, they are passed through guides 16 and 17 rotatably positioned on a twisting machine whereupon they are finally twisted and collected in a form suitable for marketing.

In initiating the spinning operation, the threads are bunched together and carried around the rollers of the draw-off assembly and the processing rollers in the form of a cable consisting of a multiplicity of parallel filaments. This cable, after passing through the drying assembly, is collected on an auxiliary roller 18.

After the spinning operation has commenced and the threads passed around each of the rollers in the system as a composite bundle, they may be separated by means of a comb device indicated at 19 in Figure 3. This comb device consists of a number of teeth corresponding to the number of threads being spun and to the number of grooves in each of the rollers. This device may be manually or mechanically operated and acts to separate the threads prior to their contact with the first roller of the assembly 7, and thereafter it is used in front of each of the succeeding grooved rollers. A comb device may be employed that is carried automatically by the threads themselves around each of the grooved rollers. After the threads have been separated, each one being positioned in its corresponding groove, they are then threaded up to their respective twisting spindles 20.

The number of processing rollers depend upon the speed of the machine, on the total denier, the elementary denier of the finished threads and on the number of treatments required. For example, a viscose thread of 275 denier with 120 filaments, is spun at a speed of 60 meters per minute (take-up speed), and eight sets of rollers are employed having a diameter of 75 mm. The axes of the submerged series of rollers are 50 mm. below the surface of the treating liquid.

In the preferred embodiment of the invention, the threads are maintained under tension throughout the manufacturing process. If, however, complete shrinkage is desired, the threads may be caused to pass through a heated zone under no tension in lieu of passing them over drying rollers under tension. If partial shrinkage is desired, the threads may be dried under tension on heated rollers until the moisture content has decreased to about 40 or 30% and they may then be allowed to dry in warm air with the tension removed.

Various modifications may be made in the spinning system without departing from the spirit thereof. For example, instead of submerging the freely rotatable rollers in treating baths,

sprays may be employed for impinging the treating fluid on the said rollers and thereby subjecting the threads passing therearound to an action similar to that of a bath. It may be desirable to positively drive the series of rollers located within the baths in a manner similar to the series of rollers located above the baths. Moreover, the rollers rotating in the baths may be grooved in order to assure more complete separation of the threads. Instead of employing a driven roller for each of the rollers rotating within the baths, one driven roller may be employed for pairs of rollers rotating within the baths.

Having now described the invention in its preferred embodiment, it is to be understood that the scope thereof is to be limited only by the appended claims.

What is claimed is:

1. Apparatus for the simultaneous continuous production of a plurality of rayon threads comprising, a spin bath container, a plurality of spinnerets, a series of pairs of vertically spaced horizontally disposed parallel thread supporting rollers, each of said rollers being provided with a plurality of circumferential guide grooves for accommodating simultaneously a plurality of threads, a plurality of treating bath containers each underlying at least several of said pairs of rollers, each of the pairs of rollers being so positioned with respect to the respective bath containers that one roller thereof is received within the container, the plurality of spinnerets being adapted to produce simultaneously a number of threads corresponding to the number of grooves on each roller and being disposed adjacent one another in a line which is at such an angle to a vertical plane in which any one of the axes of said rollers lies that lines drawn from the ends of said line to respective outermost grooves on said rollers are substantially parallel, and the spinning bath container having walls lying substantially parallel with the line of spinnerets and substantially co-extensive in length therewith, and separate means for collecting each of the threads after the delivery thereof from the rollers.

2. The method of producing rayon which comprises extruding a cellulosic solution to form a plurality of bundles of filaments, initially directing the bundles of filaments together to form a composite bundle, propelling the composite bundle of filaments over a series of rollers having wide contacting surfaces such as to accommodate a plurality of the original bundles in parallel spaced relation, thereafter effecting the progres-

sion of the point of combining of the original bundles into the composite bundle through the series of rollers thereby to cause the original bundles to pass in parallel relation through the rollers up to a point of temporary collection, severing each of said bundles adjacent the temporary collection point and delivering the end of each bundle to a separate collecting device.

3. The method of producing rayon by the wet spinning process which comprises extruding a cellulosic solution to form a plurality of bundles of filaments, conducting each bundle of filaments produced through a coagulating bath, passing each bundle of filaments over a freely rotatable roller, directing the bundles of filaments together to form a composite bundle, propelling the composite bundle around a series of driven rollers having wide contacting surfaces such as to accommodate a plurality of the separate bundles, subjecting the composite bundle to treatments while in contact with said driven rollers, temporarily collecting the composite bundle, thereafter directing the separate bundles as they are passed from the freely rotatable roller to and over the series of driven rollers in their separate form up to the point of temporary collection, severing each of said bundles at the point of temporary collection, delivering the end of each bundle to a collecting device continuing the operation and subjecting succeeding portions of each of the bundles to treating liquids in contact with the driven rollers.

4. The method of producing rayon by the wet spinning process which comprises extruding a cellulosic solution through a series of spinnerets, conducting each bundle of filaments produced through a coagulating bath, passing each bundle of filaments over a freely rotatable roller and then combining the bundles to form a composite bundle, directing the composite filament bundle around a series of driven rollers provided for normally handling a plurality of separate bundles, temporarily collecting the composite bundle, thereafter engaging the spaced individual bundles near the point of passage over the freely rotatable rollers by a comb spreader bar and propelling the bar through the series of rollers to a point adjacent the temporary collecting device by the bundles of filaments, removing the comb spreader bar from the bundles, severing each of the bundles near the point of temporary collection and effecting the independent collection of the individual bundles.

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