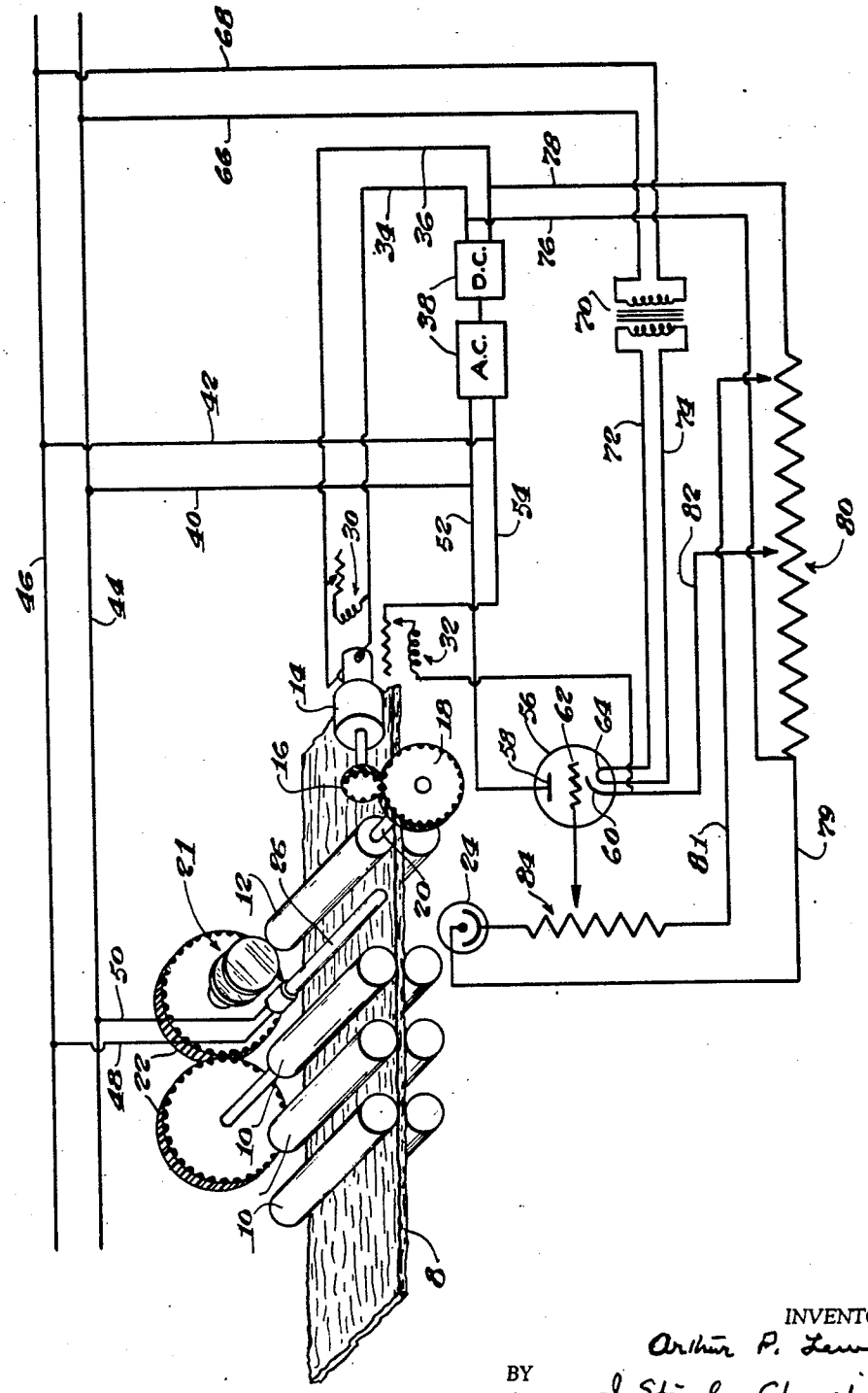
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APPARATUS FOR PRODUCING HIGHLY UNIFORM SLIVER

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APPARATUS FOR PRODUCING HIGHLY UNIFORM SLIVER

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4 Claims. (Cl. 19—70)

This invention relates to yarn production.

The object of the invention is to produce a yarn of more uniform size and strength than has been heretofore possible by producing a highly uniform sliver in a simple, practical and economical manner.

A further object of the invention is to provide novel and efficient apparatus for producing the present superior sliver.

In the accompanying drawing, the single figure is a perspective view illustrating diagrammatically the apparatus and control mechanism of a preferred embodiment of the invention.

Prior to the present invention, as far as I am aware, no one has succeeded in commercially producing a finished yarn of non-continuous fibers that does not vary in size and strength between wide limits. It is common to find in good yarns a size variation of as much as sixty percent (60%) in the same hank, when the same is checked in inch to inch measurement. Similarly, strength tests of the hank show large variations from average, varying in many instances fifty percent (50%) from the average.

The variations in uniformity and strength in the finished yarn are brought about by the inability to draft evenly, using prior methods and prior apparatus, and accordingly, it is the particular aim of the present invention to provide a novel apparatus by which drafting operations may be conducted and regulated in an efficient, rapid and practical manner to exert more drafting upon the thicker, heavier portions of a web or sliver and less drafting upon the lighter portions, to the end that in the finished sliver, a minimum of variations in size and strength may be present.

In studying short pieces of cotton sliver under the microscope, it has been noted that in the lightest samples, the fibers were nearly parallel, substantially free of immature and neppy cotton and the character of the fibers consequently permitted the draft rolls to work with greater effect, producing a section of reduced weight. On the contrary, the heavier weight samples were made up of a large portion of curly neppy fibers with long streamers from them which tended to nep. This reduced the ability to accept the action of the draft rolls, and as a result, a heavier weight section was produced. It has been found by careful laboratory experiments that the amount of light passing through a web or sliver and particularly in the condition in which it exists on reaching the final draft, is substantially proportional to its weight, the diffraction, thick edges and the usual departures from the uniform web seem to have no great bearing from the ratio of weight to light passed, when integrated over full width of the web.

In accordance with the present invention, the variations in the amount of light transmitted through a web or sliver being subjected to drafting, are utilized to control the speed of a drafting roll to which the web is fed, to the end that an increased draft may be exerted upon the heavier portions of the web and less draft upon the lighter portions of the web. While the invention may be applied at various stages in preparing the yarn wherever a drafting operation is being performed, nevertheless, it is preferred to expose the web to the action of a light beam during the passage of the web through the usual draw frame and prior to the passage thereof through the last pair of draw rolls. In practice, a source of light may be disposed upon one side of the web or sliver and in a position to cause the light beam to be transmitted therethrough, and a photo-electric cell or other light sensitive device may be disposed upon the opposite side of the web in a position to be acted upon by the light transmitted through the web. The variations in the amount of light thus transmitted through the web as heavier and lighter portions thereof pass through the light beam cause proportionate variations in the current passing through the photo-electric cell and these variations are, in accordance with the present invention, utilized to control the speed of the last draw rolls to the end that increased drafting may be exerted upon the heavier portions and less drafting upon the lighter portions of the web or sliver, it being understood that a web or sliver of sufficient weight is fed through the draw frame to produce a yarn of the desired weight.

Referring now to the drawing, I have illustrated a sufficient portion of a conventional draw frame to enable the present invention to be understood. The drafting is accomplished by the passage of the web or sliver 8 so that it advances to the right through successive sets of draw rolls 10 and in accordance with the present invention, the last pair of draw rolls 12, is arranged to be driven by a variable speed motor 14, herein shown as connected by spiral gears 16, 18 to the driving shaft 20 for the last pair of draw rolls. The last pair of draw rolls 12 is driven independently of the other pairs of draw rolls 10 and at various speeds relative thereto by the small motor 14. The remaining draw rolls 10 may and preferably

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will be of usual construction and driven in the usual manner; that is the back rolls 10 which first receive the sliver are driven at a constant speed, and the next pair of rolls are driven at a somewhat faster surface speed, while the pair of rolls 10 next to the final drafting rolls 12 are driven at a still higher surface speed. All three pairs of rolls 10 may be operated by the usual gears, not shown, and they are all driven through the gearing connection shown and designated by 22. The right hand gear 22 is driven at a constant speed by means, not shown, when the clutch 21 is manually shifted to connect the gear 22 to the source of power.

The arrangement is such that the sliver is successively attenuated or drafted by the action of the three pairs of rolls 10 as usual heretofore, but the speed of the final drafting rolls 12 is varied by the motor 14 to vary the drafting action of this pair of rolls upon the thicker and thinner portions, so that the gauge of the thick portions will be reduced sufficiently to form a highly uniform sliver which issues from the rolls 12.

The apparatus is provided with mechanism for controlling the speed of the drive for the final drafting rolls 12 herein shown as comprising a photo-electric cell 24 disposed on one side of the web or sliver 8 and the light source 26 on the other side. The photo-electric cell 24 and light source 26 are preferably disposed so as to pass the light beam through the web just prior to the operation of the final draft so that variations in the light thus transmitted through the web 8 may be utilized to control and regulate the speed of the final drafting operation. The usual reflectors and lenses (not shown) for the photo-electric cell are provided. Thus, when the web is heavier than the normal weight desired, less light will pass through the web and the speed of the final draft rolls is increased to thin out the heavy portion of the web or sliver. Conversely, in the event that the material is light in weight more light will pass through the web resulting in a decrease in the speed of rotation of the final draft rolls, and exerting relatively less, but a still positive draft on such portions.

The operation of the motor 14 to effect the desired change in speed of rotation of the final draft rolls 12 is automatically controlled by means of the control system illustrated in the single figure. The variable speed motor 14 comprises a direct current motor having two field windings 30, 32. One of the field windings 30 is energized through lines 34, 36 from a motor generator set indicated generally at 38 to drive the motor 14. As herein shown, alternating current is supplied to the motor generator set through conductors 40, 42 from the main supply lines 44, 46. The second field winding 32 is arranged to increase or decrease the speed of rotation of the motor 14 in accordance with the variation in the light passing through the web 8 onto the light sensitive device 24.

The light source 26 is indicated as an incandescent lamp suitably mounted above the web and may be supplied with energy from a suitable source such as from the main supply lines 44, 46 through conductors 48, 50. The circuit to the second field winding 32 includes the leads 52, 54 from the conductors 40, 42 connected to the main supply line, and a thermionic valve 56 such as a Thyratron tube having an anode 58, cathode 60, a grid element 62 and a heater 64. The Thyratron tube operates as a rectifier and amplifier to provide pulsating direct current to the second field winding 32 in known manner. The heating element 64 in the tube may be supplied with energy from the main supply lines 44, 46 through conductors 66, 68, a transformer 70 and conductors 72, 74, as clearly illustrated in the drawing.

The photo-electric cell 24 is connected to the direct current leads 76, 78 from the motor generator set 38 and the circuit includes leads 79, 81 from a voltage divider 80 arranged to provide suitable polarity and voltage, the latter also being connected to the cathode 60 through line 82. In operation, the photo-electric current traverses the resistance 84, and as is well-known, the grid potential of the thermionic valve is changed to vary the amount of energy permitted to pass through the tube 56 to the second field winding 32 of the motor 14 thus controlling the speed thereof as described.

From the description thus far it will be observed that by the present invention the excessive variations in strength and size which have heretofore characterized the commercial yarns, may be substantially reduced and inasmuch as most yarn is commercially sold on a basis of strength and fineness or uniformity tests, it will be apparent that the commercial value of a yarn may be substantially increased. The present apparatus is rapid in operation to effect the correction in the sliver being subjected to the drafting operation before the sliver has passed through the last drafting rolls, thus enabling maximum correction to be made.

The term "sliver" as used in the specification and claims is to be construed as meaning a web of greater width than thickness and which is thin enough to permit an appreciable amount of light to pass therethrough and which is formed of non-continuous fibers.

While the preferred apparatus for practicing the present invention has been illustrated and described, it will be understood that the invention may be embodied in other forms within the scope of the following claims.

Having thus described the invention, what is claimed is:

1. In apparatus for the production of sliver of highly uniform weight, two pairs of drafting rolls spaced apart and through which the web being drafted is caused to pass, a source of light disposed on one side of the web between said pairs of drafting rolls, a light sensitive device disposed upon the opposite side of the web and in a position to be acted upon by the light transmitted through the web, and electrical means controlled by said light sensitive device for increasing and decreasing the speed of one pair of drafting rolls nearly instantaneously through a wide range in accordance with the amount of light transmitted through the fibrous web.

2. In apparatus for the production of sliver of highly uniform weight, pairs of drafting rolls spaced near enough together to draft the fibers of a web, driving mechanism for the rolls including an independent variable speed drive for one of the pairs, a source of light disposed at one side of the web between the pair of rolls operated by said variable speed drive and another pair of said rolls, a light sensitive device disposed upon the opposite side of the web in position to be acted upon by the light transmitted through the web, and electrical means controlled by said light sensitive device and adapted to control said variable speed drive so as to change its speed nearly instantaneously through a wide range to vary the drafting

of the fibers in accordance with the amount of light transmitted between these particular fibers.

3. In apparatus for the production of a cotton sliver of highly uniform weight, pairs of drafting rolls spaced near enough together to draft the fibers of a cotton web, driving mechanism for the rolls including an independent variable speed motor for one of the pairs, a source of light disposed at one side of the web between the pair of rolls operated by said variable speed motor and another pair of said rolls, a light sensitive device disposed upon the opposite side of the web in position to be acted upon by the light transmitted through the web, and electrical means controlled by said light sensitive device and adapted to control said variable speed motor so as to change its speed nearly instantaneously through a wide range to vary the drafting of the fibers in accordance with the amount of light transmitted between these particular fibers.

4. In apparatus for the production of a sliver of highly uniform weight, pairs of drafting rolls spaced near enough together to draft the fibers of a web, driving mechanism for the rolls including an independent variable speed drive for one of the pairs, light sensitive electrical scanning means adapted to determine the thickness of the web and positioned to scan the width of the web as it travels between the pair of rolls operated by said variable speed drive and another pair of said rolls, and means actuated by said scanning means and adapted to control said variable speed drive so as to change its speed nearly instantaneously through a wide range to vary the drafting of the fibers in accordance with the thickness of the web formed of these particular fibers as determined by the scanning means.

ARTHUR P. LEWIS.