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CRIMPING OF YARN

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FIG. 1

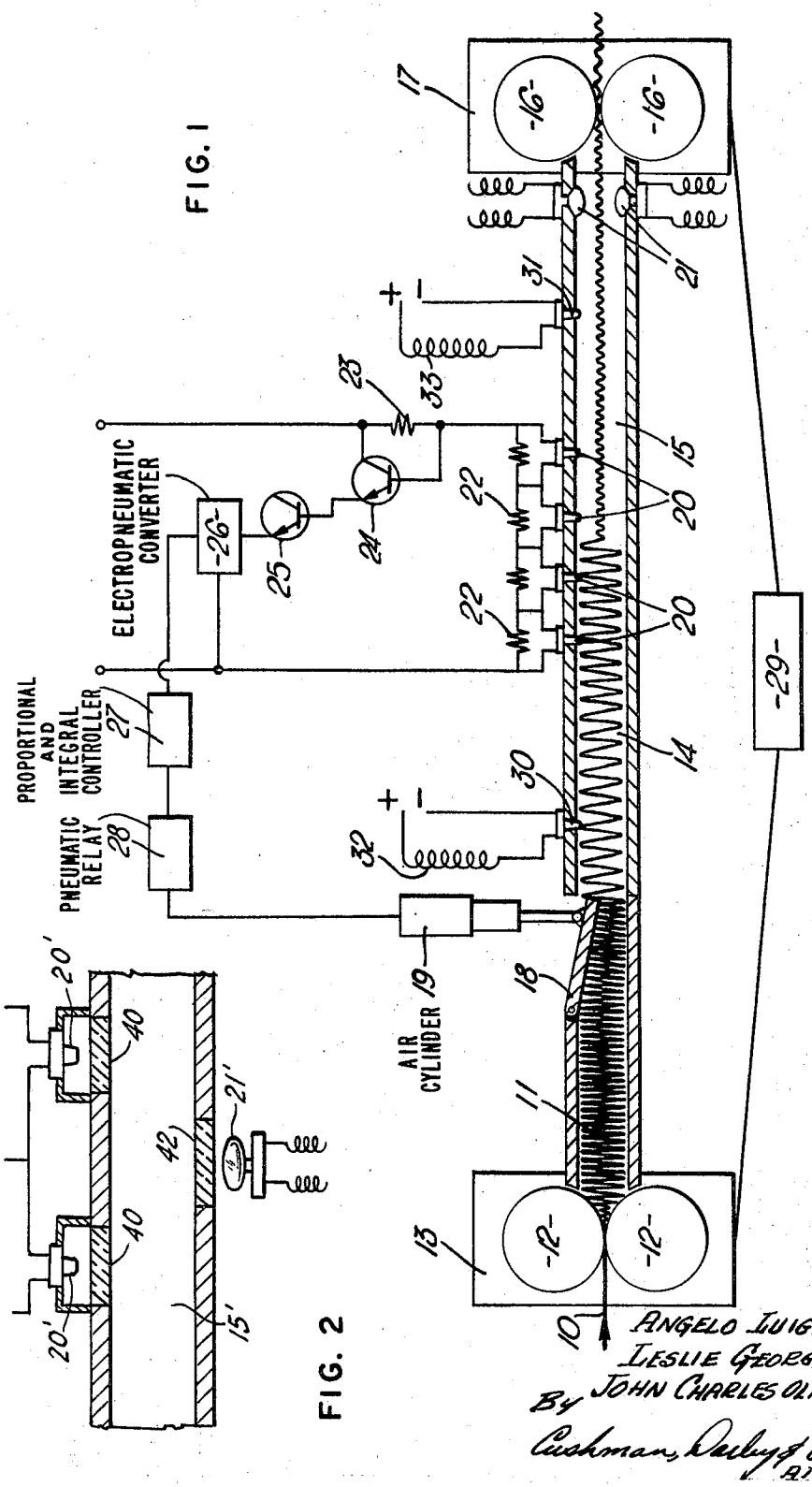

FIG. 2

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CRIMPING OF YARN

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ABSTRACT OF THE DISCLOSURE

Apparatus for controlling uniformity of crimp comprises a stuffer box having adjustable counterpressure means and contiguous therewith a detection chamber provided with photoelectric means for detecting the amount of crimped yarn therein, and means for adjusting the counterpressure means in response to any change in the amount of yarn in the detection chamber. In operation the apparatus varies backpressure exerted on the yarn as it enters the stuffer box in response to changes in crimp ratio in the yarn.

The present invention concerns improvements in or relating to the crimping of yarn by the so-called stuffer-box process. In this specification, "yarn" is used as the generic term to include any textile fibre or filament or assemblies of fibres or filaments and is not to be read as being restricted to fibres, filaments and assemblies of any particular size.

The use of stuffer-box crimpers in the production of crimped yarns is well known. Generally, uncrimped yarn is conveyed by delivery rollers into a chamber which is restricted at a suitable point by movable counterpressure means, for instance a flap or a plunger. The yarn is compressed inside the chamber until the internal pressure is sufficient to move the counterpressure means when crimped yarn exits the chamber and may then advance or be advanced to subsequent operating stages, a state of equilibrium upon which the crimping effect depends being produced between the pressure exerted by the yarn and the pressure exerted by the counterpressure means. In practice, the crimping effect may not be constant owing to various influences such as, for example, variations in denier, moisture content or frictional properties of the yarn fed to the crimper and it is often necessary to adjust the counterpressure means to maintain the crimping effect within tolerable limits.

It has been proposed to maintain the crimping effect within tolerable limits by drawing off crimped yarn from the crimper at a fixed rate whilst forming a quantity of slack yarn between the crimper and the draw off means, continuously weighing the quantity of slack yarn and adjusting the counterpressure means when necessary if the weight of slack yarn varies so as to maintain a substantially constant crimping effect. This method is based on the fact that an uncrimped length of yarn fed to the crimper is longer than its crimped length and if a yarn draw-off means is run continuously to take yarn from the crimper, it should run more slowly than the delivery means, the difference in speed being dependent upon the particular crimping effect. If the crimping effect is constant, there will always be the same amount of yarn between the crimper and the draw-off means and if the crimping effect varies then, providing the draw-off speed is constant, the amount of yarn between the crimper and the draw-off means will vary. Hence the counterpressure means can be adjusted to maintain a substantially constant crimping effect by detecting changes in the weight of slack yarn.

We have found a method for producing crimped yarn having a crimp within tolerable limits which has much smoother control and with which the yarn is less prone to tangles and breaks, and accordingly the invention comprises in one of its aspects a method for producing stuffer-box crimped yarn which comprises feeding yarn at a constant known rate into a stuffer-box crimper having adjustable counterpressure means, collecting a mass of crimped yarn from said crimper in a chamber and drawing-off yarn from said chamber at a fixed known rate, measuring the amount of yarn in said chamber by photoelectric means and adjusting the counterpressure means in response to any change in the amount of yarn in said chamber to maintain a crimping effect within tolerable limits.

In another of its aspect the invention comprises apparatus for producing stuffer-box crimped yarn which comprises a stuffer-box provided with adjustable counterpressure means and delivery means for feeding yarn into said stuffer-box at a known rate, a chamber situated so as to collect yarn exiting said stuffer-box, means for drawing-off crimped yarn from said chamber at a known rate, photoelectric means for measuring the amount of yarn in said chamber and means for adjusting said counterpressure means in response to any change in the amount of yarn in said chamber to maintain a crimping effect within tolerable limits.

The chamber should preferably have the same cross sectional dimensions as the stuffer-box, may be of any desired length and is preferably oriented so that yarn exiting the stuffer-box does not substantially change direction thus reducing the tendency for tangles and breakages to occur. The photoelectric means may comprise, for instance, one or more of photoelectric cells arranged in the chamber and illuminating means either at the opposite side of the chamber from the photoelectric cell or cells so that yarn can interpose between them or arranged say at one end of the chamber so as to illuminate the chamber with diffuse light. If the latter position is used inside of the chamber may be polished to assist in light distribution.

The cell or cells and/or the illuminating means may be situated inside the chamber, for example let into the walls of the chamber, or may be situated outside the chamber and able to detect the amount of yarn in the chamber through slots or holes or transparent means.

We have found that if a number of photoelectric cells, illuminated by direct or diffuse light, are arranged along the chamber and each shunted with a resistor, connected in series and arranged to give an electrical signal the signal can be made to be smoothly related to the amount of yarn in the chamber. The yarn in the tube transmits some light and the photoelectric cells therefore do not produce a sharp switching action thus giving rise to the smoothly related signal. This smoothly related signal is particularly useful for feeding to the counterpressure control means. The control means can comprise means for producing any desired control signal for example proportional or proportional plus integral control and means such as suitable electrical and/or mechanical and/or pneumatic and/or hydraulic relays for adjusting the counterpressure means according to the control signal.

The invention will now be described, by way of example, in greater detail with reference to the accompanying drawing which in no way limits the scope of the invention. FIG. 1 is a schematic part-sectional view of apparatus designed to produce crimped yarn having a crimp effect between tolerable limits, and FIG. 2 is a fragmentary view showing a modified photoelectric cell arrangement.

Referring to the drawing in more detail this shows uncrimped yarn **10** being fed into the compression zone **11** of a stuffer-box of rectangular cross-section by a pair of nip rolls **12** driven at a constant but adjustable known rate through a motor and gearbox shown generally as **13**. Crimped yarn is forced from the compression zone **11** to form a mass **14** in a chamber **15** of rectangular cross-section and is drawn off at a fixed but adjustable known rate, dependant on the feed rate and the crimping effect desired, from the chamber by a pair of nip rolls **16** driven through a motor and a gearbox shown generally as **17**. The counterpressure means for the compression zone **11** is provided by a pivoted flap **18** in a side wall of the compression zone **11** which is acted upon by an air pressure cylinder and piston **19** and the counterpressure may be adjusted by regulation of the air supply to the cylinder. Yarn builds up in the compression zone **11** until the pressure in that zone is sufficient to move flap **18** when crimped yarn is forced from the compression zone **11** into chamber **15**, a state of equilibrium, upon which the crimping effect depends, being eventually produced between the pressure exerted by the yarn and the pressure exerted by the counterpressure means. The crimped yarn forms a mass **14**, the initial amount of which is predetermined and is drawn-off at a fixed rate by rolls **16**. The amount of yarn is sensed by an arrangement of photoresistive cells **20** which project into the chamber **15** and are illuminated by diffuse light from the bulbs **21** which are supplied with power from a source not shown. By positioning the photoresistive cells so that they project into the chamber, their surfaces can be wiped clean, by yarn passing through the chamber, of deposits, such as yarn finish, which could interfere with the light impinging on the cells and, by using diffuse light to illuminate the photoresistive cells, false operation of the system, caused by yarn being withdrawn from the chamber interrupting light impinging on the cells, can be prevented. The photoresistive cells **20** are shunted with resistances **22** in order to obtain the desired form of electrical signal/yarn level characteristic and the cell arrangement is connected to a counterpressure control circuit fed with a 12 volt D.C. supply and consisting of resistor **23**, transistors **24** and **25** which are connected to form a Darlington pair, an electropneumatic convertor **26**, a proportional and integral controller **27** and a pneumatic relay **28**. An amplified signal related to the amount of yarn in the chamber is fed to the controller **27** and the controller adjusts the counterpressure means accordingly by activating cylinder **19** so as to keep the crimping effect within tolerable limits. The speeds of nip rolls **12** and **16** can optionally be measured by speed transducers (not shown) the outputs of which may be fed to an indicating device **29** which indicates the ratio of the speeds. Photocells **30** and **31** operate alarm circuits should the tube empty or fill by operating logic circuitry (not shown) by means of Reed relays **32** and **33**.

In the modification shown in FIG. 2 the photoresistive cells **20'** are located outside the walls of the chamber **15'** and the walls of the latter are provided with transparent means **40**. Illumination is provided by a bulb **21'** disposed outside the chamber and adjacent transparent means **42** on the side of the chamber opposite the cells **20'**.

What we claim is:

1. Apparatus for producing stuffer-box crimped yarn which comprises a stuffer-box provided with adjustable counterpressure means and delivery means for feeding yarn into the stuffer-box at a known rate, a chamber situated so as to collect yarn exiting said stuffer-box, means for drawing off crimped yarn from said chamber at a known rate, photoelectric means for measuring the amount of yarn in said chamber, said photoelectric means including illuminating means illuminating the interior of said chamber and a plurality of photoelectric cell means arranged along the chamber and connected in series to a source of electricity so as to give a signal which is substantially smoothly related to the amount of yarn in said chamber, and control means responsive to said photoelectric means for adjusting said counterpressure means in response to any change in the amount of yarn in said chamber to maintain a crimping effect within tolerable limits.

2. Apparatus as claimed in claim **1** in which the photoelectric cell means is housed in the walls of the chamber.

3. Apparatus as claimed in claim **2** in which the photoelectric cell means projects into the interior of the chamber.

4. Apparatus as claimed in claim **1** in which the photoelectric cell means is situated outside the walls of the chamber and the walls are provided with light transmitting means.

5. Apparatus as claimed in claim **1** in which the illuminating means is situated at the end of the chamber from which the yarn is advanced.

6. Apparatus as claimed in claim **1** in which the illuminating means is situated opposite and across the chamber from the photoelectric cell means.

7. Apparatus as claimed in claim **1** in which the illuminating means is housed in the walls of the chamber.

8. Apparatus as claimed in claim **1** in which the illuminating means projects into the interior of the chamber.

9. Apparatus as claimed in claim **1** in which each photoelectric cell is shunted by being connected in parallel with a resistor.

10. Apparatus as claimed in claim **1** in which the photoelectric cell means comprises four cells.

11. Apparatus as claimed in claim **1** in which the control means includes a proportional controller and a relay connected in series with said photoelectric means.

12. Apparatus as claimed in claim **1** in which the control means includes a proportional plus integral controller and a relay connected in series with said photoelectric means.

13. Apparatus as claimed in claim **1** in which the counterpressure means is a pivoted flap.

14. Apparatus as claimed in claim **1** in which the means for adjusting the counterpressure means is pneumatic means.

15. Apparatus as claimed in claim **1** in which the stuffer box and the chamber are contiguously arranged.

16. Apparatus as claimed in claim **15** in which the stuffer box and the chamber are arranged in abutting relationship along a common axis.

17. Apparatus as in claim **1** including an additional photoelectric cell disposed upstream of and downstream of said series-connected photoelectric cells and including an alarm circuit electrically connected to each said additional cells, said additional cells being responsive to emptying or filling of said chamber to activate one of said alarm circuits.

18. Apparatus as in claim **1** wherein the illuminating means is situated outside the walls of the chamber and the walls are provided with light transmitting means.

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