

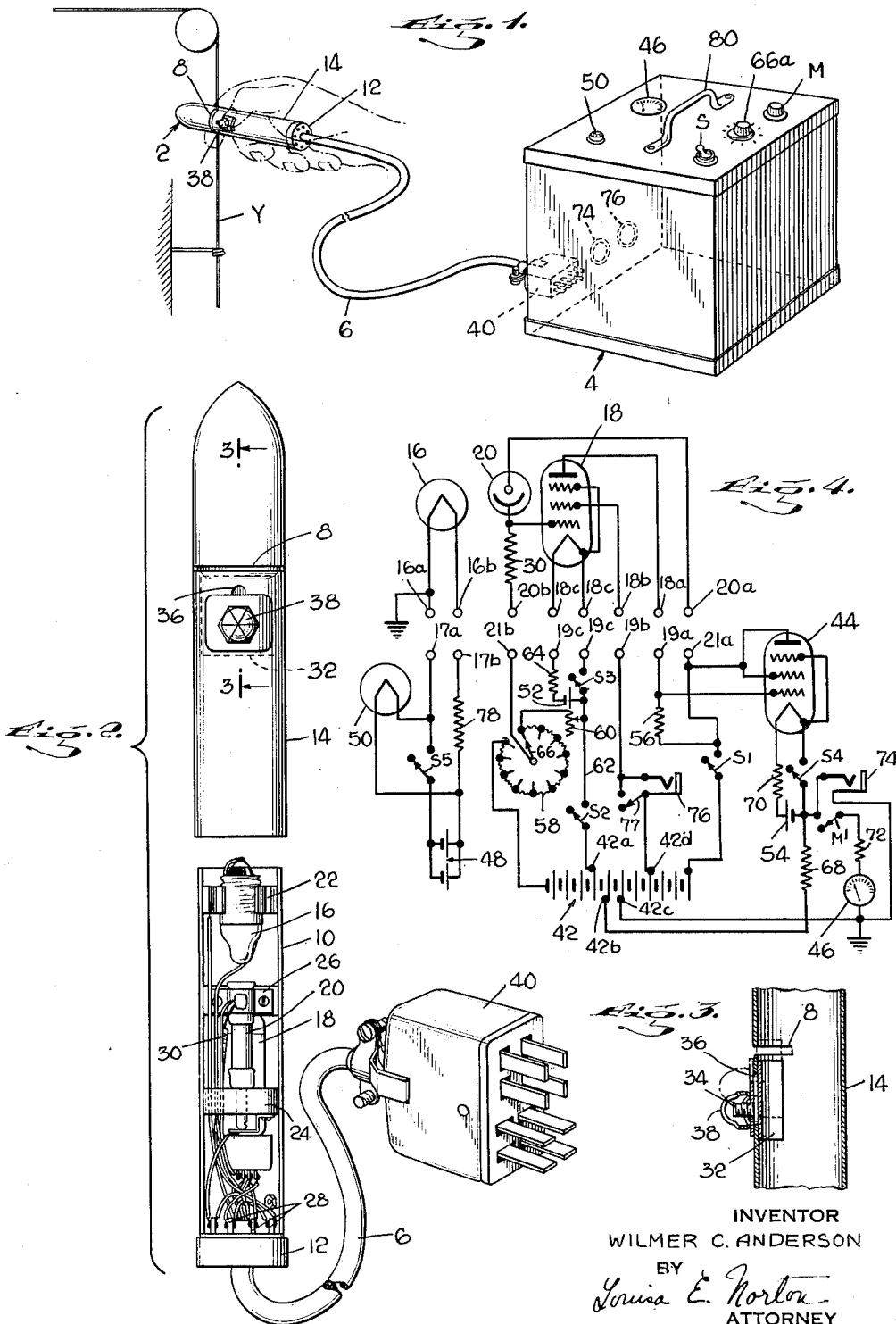
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UNIFORMITY METER FOR TEXTILE STRANDS

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UNIFORMITY METER FOR TEXTILE STRANDS

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The present invention relates to instruments for detecting and measuring variations in diameter of filamentary material such as yarn, wire or the like, and comprises a compact instrument of this character that is portable, simple of construction, convenient to use, sensitive and efficient in operation. Yarn uniformity meters heretofore in use are relatively large and expensive instruments. They include, in addition to the yarn diameter responsive elements, power driven winders and recording meters. When yarn uniformity is to be metered on such prior art instruments, the yarn must be unwound from a package and, unless discarded, wound on to a bobbin or the like, thus subjecting the yarn to an additional winding operation that may weaken or damage it.

During yarn manufacture and in preparation for weaving or knitting, there are ordinarily a number of necessary operations in which yarn is transferred from one form of package to another. For example, after spinning, the yarn may be rewound from the spinning bobbins on to cones or cheeses for use as warp supply, or several ends may be doubled, or the yarn may be twisted or wound on quills for use as filling yarn. As during each stage of winding, the yarn is subjected to high tension and passes through or over guides, it is desirable to avoid, if possible, additional winding operations. It is also desirable, however, that the existence of irregularity sufficient to cause the yarn or resulting fabric to be rated sub-standard, be detected before the yarn has been woven into fabric, and preferably at an early stage in its processing. The construction of the new yarn uniformity meter of the present invention achieves these two objectives as it permits metering of the yarn at any stage without requiring an additional winding operation.

Briefly, the new device comprises a short, slotted tubular casing or head, less than one inch in diameter, within which a photo-electric cell, a light source and a subminiature electronic tube are compactly mounted and so disposed that yarn passing through the slot in the casing intercepts the light from the source falling on the sensitive element of the cell. A cabinet, circuit elements in which are adapted to be connected by a flexible cable to the elements within the tubular casing, is provided in conjunction with the head. The circuit elements in the cabinet include suitable batteries, an amplifying tube, switches and biasing and load resistors all as more fully hereinafter described. The cabinet.

which is provided with a suitable carrying handle, has the dial of an indicating meter, a pilot lamp and controlling switches, mounted in one wall thereof for convenient observation and ready manipulation by an operator.

For a better understanding of the invention, reference may be had to the accompanying drawing of which:

Fig. 1 is a perspective view of a yarn uniformity meter embodying the invention;

Fig. 2 is a view of the measuring head of the device of Fig. 1, the covering sheath being removed and illustrated separately;

Fig. 3 is an enlarged sectional view taken on line 3—3 of Fig. 2; and

Fig. 4 is a diagram of the circuit elements of the new uniformity meter.

As shown in Fig. 1, the new uniformity meter comprises a small bullet shaped head 2 and a portable cabinet 4 connected by a cable or cord 6 with the head 2. The cover or sheath of the head 2 has a transverse slot 8 near one end and yarn Y to be metered passes through this slot while the head is held by the hand of an operator. Because of the small size of the head 2 and the smoothly rounded shape of the end thereof, as hereinafter more fully described, the operator can insert the head into a relatively small space without disturbing the travel of the yarn or interfere with adjacent parts of machinery.

The head 2, as shown in Fig. 2, comprises a semi-cylindrical shell 10, a terminal disk 12 in which the end of the shell 10 is mounted and a cover or sheath 14 which fits snugly about the shell 10 and encloses the parts carried thereby. A miniature lamp 16 of the type having a built-in condensing lens, a subminiature electronic tube 18 and a photo-electric cell 20 are all carried by the shell 10, the lamp 16 being mounted on a clip 22 secured to the shell near one end thereof, and the tube 18 and cell 20 being mounted on brackets 24 and 26, respectively, with the light sensitive element of the cell positioned to be illuminated by light from lamp 16. The disk 12 has a central aperture for reception of the end of the cord 6 and has eight terminal pins 28 mounted thereon. The individual leads of the cable 6 are welded to these pins, as are the two leads from the lamp 16, four leads from the tube 18 and two leads from the photo-electric cell 20, a resistor 30 being included in one lead from the cell. The clip 22 for the lamp 16 and the bracket 26 for the cell 20 are so positioned that the slot 8, when the sheath 14 is slid over the shell 10, is located between the lamp and cell. Yarn pass-

ing through the slot will intercept the light beam to the light sensitive electrode of the cell. Preferably, to prevent the yarn from slipping out of the slot and to insure proper positioning of the yarn, masking means such as a curved plate member 32 is slidably mounted on the inner wall of the sheath 14 adjacent the slot by means of a bolt 34 which extends through a longitudinally extending slot 36 in the sheath and has a button 38 threaded thereon for manipulation by the thumb of an operator. The width of the plate 32 measured circumferentially of the sheath, is less than the length of the slot 8, also measured circumferentially of the sheath, so that, when the plate is moved by the operator into the position shown in dotted lines in Fig. 3, the opposed end edges of the slot and plate provide a guide passage for the yarn which insures that the yarn will travel between the lamp 16 and cell 20.

On the end of cable 6 is a terminal plug 40 having eight prongs connected through the cable with the terminal pins 28 and adapted to be inserted in a socket in the wall of cabinet 4.

Reference may now be had to Fig. 4 wherein the preferred circuit of the new uniformity meter is diagrammatically shown. The lamp 16 of the circuit within the head is connected across two terminals 16a and 16b, which may be considered as terminals of the plug 40. The anode of cell 20 is connected to a terminal 20a and the cathode is connected through the resistor 30 to a terminal 20b. The anode of tube 18 is connected to a terminal 18a, the screen grid of tube 18 to a terminal 18b, the heater across terminals 18c and the control grid to the cathode of cell 20. As shown in Fig. 2, one of the leads from the lamp 16 is connected to the clip 22 and hence is indicated conventionally in Fig. 4 as being grounded.

The circuit elements within the cabinet 4 comprise a source of energy, indicated as a battery 42, a pentode 44, a meter 46, a separate battery 48 for the lamp 16 and for a pilot lamp 50, and batteries 52 and 54 for the cathodes of tubes 18 and 44, respectively. The positive terminal of battery 42 is connected, through a switch S₁ to the anode and screen grid of tube 44 and to socket terminal 21a adapted for connection through terminal 20a when plug 40 is inserted in its socket with the anode of cell 20. The positive terminal of battery 42 is also connected through the switch S₁ and through a resistor 56 to the control grid of tube 44 and to a socket terminal 19a adapted for connection through plug terminal 18a with the anode of tube 18. The negative terminal of battery 42 is connected to one end of a resistor array 58 comprising ten series connected resistors, each of about 15 kilohms, the other end of the array being connected through a variable resistor 60 to a lead 62. Lead 62 is connected through a switch S₂ to a tap 42a on the battery 42 and to the energizing circuit for the cathode of tube 18, which latter comprises the battery 52, a resistor 64 and a switch S₃ connected to socket terminals 19c for connection through terminals 18c to the filament of tube 18. A rotary contact arm 66 associated with the resistor array 58 is connected to socket terminal 21b adapted for connection through terminal 20b and resistor 30 to the cathode of cell 20 and control grid of tube 18. A tap 42b on battery 42, at a point of potential slightly above that of tap 42a, is connected through a resistor 63 to the energizing circuit for the cathode of tube 44, that circuit comprising the battery 54, a resistor

70 and a control switch S₄. The meter 46 has one terminal connected to a tap 42c on the battery 42, which tap is grounded to the cabinet and is of a potential slightly above that of tap 42b, and its other terminal connected through a resistor 72 and a switch M₁ to the junction of resistor 68 and the energizing circuit for the cathode of tube 44. A tap 42d at a point on battery 42 of relatively high potential is adapted to be connected through terminals 19b and 18b with the screen grid of tube 18. Output jack terminals 74 are connected across the meter circuit to permit connection to amplifying and recording devices, if desired. For initial adjustment and for test purposes, normally shunted jack terminals 76 are provided in the line connecting tap 42d with terminal 19b. By opening the shunt switch 77, a test meter (not shown) may be plugged into jack terminal 76 and the screen current of tube 18 measured.

Battery 48, indicated as comprising two parallel connected cells, under control of a switch S₅ supplies energy to the lamps 16 and 50, a resistor 78 being included in the lead to the socket terminal 17b and the switch S₅ being in the common lead to the pilot lamp 50 and the terminal 17a.

Switches S₁, S₂, S₃, S₄ and S₅ are preferably mechanically connected together for conjoint operation as by the on-off switch S indicated in Fig. 1 whereas switch M₁ is individually controllable as by a knob M. Switch 77 may be and preferably is of the type that is automatically opened by the insertion of a jack into terminals 76. The position of arm 66 of the resistor array 58 is controlled by a rotary switch 66a on the top of the cabinet 4.

With the above described circuit, when the plug 40 is inserted in its socket and the switch S thrown to "on" position, the lamps 16 and 50 will be lighted, the anode of the cell 20 will be connected to the positive terminal of battery 42 and the cathode of the cell will be connected to the negative terminal of the battery through resistor 30 and some or all of the resistors of array 58, depending upon the position of arm 66. If no yarn is present in the slot 8, maximum current will flow through the cell and the potential applied to the control grid of tube 18 will be high enough to cause tube 18 to be energized with corresponding reduction in the potential of the control grid of tube 44. By proper initial adjustment of arm 66, and of the tap on resistor 60 if necessary, the current through meter 46 can be brought to zero under these conditions. Preferably, for initial adjustment or after replacement of a tube or of lamp 16, a test meter (not shown) of about 40 microampere capacity, is plugged into jack terminals 76 prior to closure of switch M and the circuit adjusted until the test meter reads about 28 microamperes screen current. Switch M is then closed and final adjustment made for no-yarn condition. The passage of yarn through the slot 8 reduces the illumination of the cathode of cell 20 and correspondingly reduces the current through the cell. The resulting change in potential of the control grid of tube 18 causes a reduction in current through that tube and an increase in potential of the control grid of tube 44. Thus the larger the diameter of the yarn, the greater the current through tube 44, as indicated by the meter 46. The meter scale may be, and preferably is, calibrated to read directly in terms of yarn diameter. As heretofore indicated, when a per-

manent record of yarn diameter variation is desired, a recorder of known type can be connected into the circuit at jack terminal 74 and the meter circuit opened at switch M₁.

In the particular embodiment of the invention illustrated in the drawing and hereinbefore described, the head 2 is about 1 inch in diameter and has an overall length of about 4 inches. The lamp 16 is one known in the trade as a Penlamp #222, the subminiature tube 18 is a CK505AX and the photo-electric cell is an 1P42. The grid resistor 30 has a value of 10 megohm.

The cabinet 4 is about 6 by 6 by 6 inches and is provided with a carrying handle 80. Pentode 44 is a CK506AX, battery 42 is a 36 volt battery with taps 42a, 42b, 42c and 42d at 6, 12, 13½ and 30 volts, respectively, above the negative terminal. Batteries 52, 54 and each cell of battery 43 are 1½ volt dry cells, and resistors 56, 60, 64, 68, 70, 72 and 78 are 1 meg. 50 k., 37 ohms, 51 k., 4 ohms, 56 k. and 1.4 ohms, respectively. Meter 46 has a range of from zero to 150 microamperes. Obviously various changes both in dimensions of the head and cabinet and in the specific circuit elements could be made if desired.

From the preceding description of the preferred embodiment of the invention, it will be apparent that the new yarn uniformity meter is a compact, practical device for ready determination of the diameter of traveling yarn. The small size and shape of the head and the light weight thereof make it convenient for handling by an operator and permit him to measure yarn diameter at practically any stage of its manufacture. For example, the head could be positioned to measure the drafted strand as it emerges from the draft rolls of a drafting mechanism and precedes to the ring spinner or it could be positioned to measure yarn drawn from a creel of a redraw or twister frame or of a warper.

The following is claimed:

1. A uniformity meter for a textile strand comprising in combination a tubular member having a transverse slot in the wall thereof for passage of a strand therethrough, a miniature lamp, a photo-electric cell, a subminiature electronic tube and a resistor all mounted within said member, said cell and said lamp being positioned at opposite sides of said slot and said cell being oriented so that light from said lamp illuminates the light sensitive electrode of the cell, a portable cabinet containing a meter, an amplifier and energizing means for said lamp, tube, cell and amplifier, means including a flexible cable and circuit connections within said element and within said cabinet for so electrically coupling the parts mounted within said member with the parts within said cabinet as to cause variations in the current passed by said cell due to variations in strand diameter to be amplified and the amplified currents to be indicated by said meter, said tubular member including a semi-cylindrical shell and an outer substantially bullet-shaped slotted sheath, said lamp, cell and subminiature tube being mounted on said shell.

2. The uniformity meter according to claim 1 including a plate member mounted on said sheath adjacent the slot therein and adapted to be

moved into a position preventing egress of a textile strand laterally from said slot, said plate member when in such position serving with the edges of the slot to guide a textile strand between the lamp and photo-electric cell.

3. A detecting head for a uniformity meter for textile strands comprising a photo-electric cell having an anode and a cathode, a miniature lamp having a built-in condensing lens, a resistor and a subminiature electronic tube having a cathode, a control grid and an anode all contained within a generally bullet-shaped casing of a maximum diameter of approximately one inch, said casing having a transverse slots in the wall thereof for passage of a textile strand therethrough and said cell and lamp being positioned within said casing at opposite sides of said slot, a plate member mounted on said casing adjacent said slot and movable across said slot to a position to prevent egress of a textile strand laterally from the slot, said plate member when in said position coacting with the edges of said slot to guide a textile strand between said lamp and said photoelectric cell and means for electrically connecting the lamp, the anode of said cell, the anode of said tube, the cathode of said tube and one end of said resistor to external leads, the other end of said resistor being connected to the cathode of said cell and to the control grid of said tube.

4. A detecting head for a uniformity meter for textile strands comprising an elongated cylindrical casing having a rounded closure at one end thereof, a removable terminal block closing the other end of said casing, said terminal block having a semicylindrical support attached thereto and extended into said casing, a lamp and photoelectric cell mounted in axially spaced relation on said support, said casing having a transverse strand receiving slot in the wall thereof positioned between said lamp and said photoelectric cell and means electrically connecting said lamp and said photoelectric cell through said terminal block to external sources of electrical potential.

5. A detecting head according to claim 4 wherein the casing has masking means movable across a portion of said slot to prevent egress of a strand therefrom and to guide the strand in a path between said lamp and said photoelectric cell.

6. A detecting head according to claim 5 in which the masking means comprises a curved plate supported for sliding movement along the inner surface of said casing across a portion of said slot and an actuating button extending externally of said casing whereby said sliding movement can be accomplished.

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