May 20, 1941. E. A. KEELER 2,242,890

MEANS FOR INDICATING DEFECTS IN THREAD

Original Filed Dec. 29, 1936

FIG. 1.

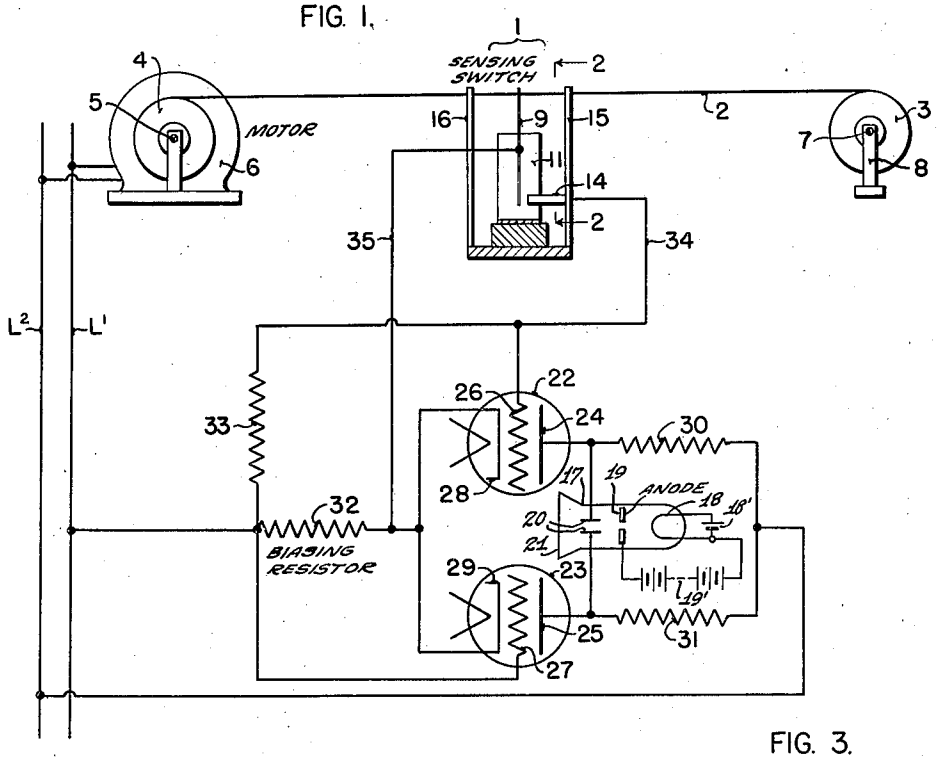


FIG. 2.

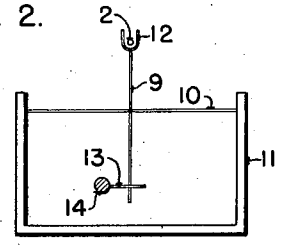
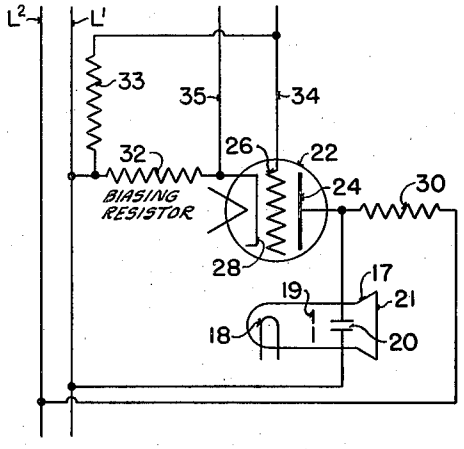


FIG. 3.



INVENTOR.
EARL A. KEELER
BY George H. Mueller
ATTORNEY.

Patented May 20, 1941 2,242,890

UNITED STATES PATENT OFFICE

2,242,890

MEANS FOR INDICATING DEFECTS IN THREAD

Earl A. Keeler, Norristown, Pa., assignor to The Brown Instrument Company, Philadelphia, Pa., a corporation of Pennsylvania

Original application December 29, 1936, Serial No. 118,095. Divided and this application April 9, 1938, Serial No. 201,130

4 Claims. (Cl. 73—51)

This invention is directed to apparatus responsive to variations in a condition and including a space discharge device adapted to be actuated by variations in said condition.

The present invention is a division of my prior application Serial No. 118,095, filed Dec. 29, 1936, now issued into Patent 2,188,754, which discloses various arrangements for detecting defective filaments in a thread together with means actuated thereby for indicating and/or recording the number of such imperfections.

The various arrangements disclosed in my prior application were devised by me with the general object in view of providing simple and efficient means for detecting defective filaments in a single thread or in a plurality of threads together with means actuated thereby for indicating the presence and/or recording the number of such imperfections.

The apparatus claimed herein is an arrangement embodying my invention in which a cathode ray tube is employed for visually indicating the presence of defective filaments in a thread.

In the manufacture of fabrics from rayon or other threads the presence of defective filaments in the individual threads shows up in the finished material in the form of fuzzy ends. Heretofore in order to eliminate these fuzzy ends provisions have been made for the inspection by observation of a portion of the thread during transfer of the thread from spool to spool and rejection of any spools having an excessive number of defective filaments. This inspection operation is obviously expensive and, more important from the standpoint of producing quality material, is inadequate by virtue of the fact that only a small portion of the total output can practicably be inspected.

Moreover, visual inspection of the thread during transfer of the thread from spool to spool and detection of defective filaments is difficult as will be readily appreciated when it is understood that rayon threads which themselves are extremely small in diameter are made up from 40 to 100 or more of such filaments. By means of the arrangement claimed herein, the manual inspection operation referred to may be dispensed with and defective thread filaments may automatically be detected and indicated by readily distinguishable means. As a means for such automatic detection, I employ a delicate switch member arranged in the path of the thread which is actuated when engaged by the fuzz or defective filaments of the thread as the thread is transferred from one spool to another. Impacts of the moving fuzz projections on the delicate switch member, which has little inertia, result in the closure of a contact and thereby in energization of a suitable indicating means to be described. Thus an indication of the presence of defective filaments of the thread, which are difficult of detection by visual means alone, is had.

The various features of novelty which characterize my invention are pointed out with particularity in the claims annexed to and forming a part of this specification. For a better understanding of the invention, however, its advantages and specific objects obtained with its use, reference should be had to the accompanying drawing and descriptive matter in which I have illustrated and described the best form of my invention now known to me.

Of the drawing:

Fig. 1 is a more or less diagrammatical view illustrating one form of my invention;

Fig. 2 is an end elevation of the contacting switch member shown in Fig. 1, shown as viewed in the direction of the arrows 2—2 of Fig. 1; and

Fig. 3 illustrates a modification of the arrangement of Fig. 1.

Referring to Fig. 1, provision is made, as illustrated, for arranging a detector 1 in the path of the moving thread for detecting the presence of defective filaments in the thread. Normally in practice, the detector may desirably be arranged in the path of the thread as it is being unwound from a spindle on a spinning machine and wound on a bobbin immediately after the spinning operation. For clarity and definiteness of illustration, however, I have shown, in a more or less diagrammatic way, the thread 2 as being unwound from a spool 3 and reeled on a spool 4, the latter being mounted for rotation on a shaft 5 driven through suitable gearing, not shown, by a unidirectional electrical motor 6 energized for rotation from alternating current supply lines L^1 and L^2. The spool 3 is mounted for rotation on a shaft 7 which may be disposed on suitable brackets 8 in any convenient manner. Preferably both spools 3 and 4 are so mounted for rotation as to facilitate quick removal and replacement by other spools.

The detector 1 is a delicate switch mechanism including a contact arm 9 pivoted intermediate its ends for rotation on a light suspension wire 10, which may be of phosphor bronze or other suitable material, and disposed in the path of the thread. As best seen in Fig. 2, wire 10 is suspended between opposite arms of a U-shaped member 11 at the upper ends thereof. The arm

9 is provided at its upper end with a bifurcated portion or stirrup 12 which is so arranged that one arm of the stirrup is disposed on either side of the thread. The arms of stirrup 12 are separated by a distance slightly greater than the normal diameter of the thread so that any projecting portions of the latter resulting from defective filaments will engage one or the other or both of said arms. The other end of the arm 9, normally maintained in the position of Fig. 1 due to the torsion of wire 10, is adapted when engaged by defective filaments to engage a relatively fixed flexible contact element 13 disposed at right angles to the arm 9 and securely fastened at one end to a stationary rod member 14 which may be mounted in any suitable manner as for example on the rod 15. As defective filaments strike the stirrup 12 and rotate the arm 9 into engagement with the flexible contact 13, the suspension wire 10 sets up a resisting torque to thereby return the arm 9 to its normal position when the fuzz projections on the thread have passed on. The thread is guided into the stirrup 12 by guide rods 15 and 16 having saddle portions at their upper end for guiding the thread. The resiliency of contact 13 permits movement of the arm 9 to any position which may be taken by the latter. This is important to prevent injury to the thread or detector in the event that a knot or other unusually large projection from the thread engages the stirrup 12.

When the contacting arm 9 is rotated into engagement with the flexible contact 13, a circuit including the contacts will be completed for operating a cathode ray tube 17 for indicating the presence of the defective filaments in the thread which caused the movement of arm 9 into engagement with contact 13. The cathode ray tube 17 employed is comprised of the usual elements; a cathode 18, an anode 19 having a small aperture in the center thereof to permit a stream of electrons to pass through, a pair of deflecting plates 20 and a fluorescent screen 21. A suitable direct current potential is maintained on the anode by a battery 19' and current is supplied for heating the filament by a battery 18'. A continual stream of electrons passes from the cathode 18 to the anode 19 some of which pass through the small opening or aperture in the anode and due to their high velocity normally travel in a straight line through the deflecting plates 20 to the screen 21 the latter becoming luminescent at the point at which the electrons strike. When an alternating current voltage is applied to the deflecting plates 20 the electron stream will be deflected first in one direction and then the other at the frequency of the applied alternating current voltage resulting in a luminescent line appearing on the screen 21. According to my invention I apply an alternating voltage to the deflecting plates 20 whenever defective thread filaments strike the stirrup 12 and thereby bring the arm 9 into engagement with the flexible contact 13.

The means by which the alternating current voltage is applied to the deflecting plates 20, as illustrated by Fig. 1, include two heater type three-electrode electronic tubes 22 and 23 including the usual anodes 24 and 25, grids 26 and 27 and cathodes 28 and 29, respectively. The anode to cathode resistances of valves 22 and 23 are connected in opposite arms of a Wheatstone bridge network, the two remaining arms of the bridge consisting of equal resistances 30 and 31, the latter being connected to the alternating current supply line L^2. The cathodes 28 and 29 are connected through a grid biasing resistor 32 to the alternating current supply line L^1. The deflecting plates 20 of the cathode ray tube are connected between the anodes 24 and 25 on which equal potentials are maintained when the bridge is balanced so that normally both of the deflecting plates are at the same potential and the electronic stream is permitted to pass through them undisturbed. The grids 26 and 27 are connected to the alternating current supply line L^1, the grid 26 being connected thereto through a one-megohm resistor 33. The grid 26 is connected also to the flexible contact 13 by a conductor 34 and the contacting arm 9 is connected by a conductor 35 to the cathodes 28 and 29. The resistor 32 provides a negative bias for both grids 26 and 27 so that both tubes 22 and 23 normally are equally conductive. Upon engagement of the arm 9 with the flexible contact 13 resulting from defective thread filaments striking the stirrup 12, however, the grid 26 is connected directly to the cathode 28 and the potential thereon is raised to that of the cathode potential whereupon the resistance of tube 22 to the flow of anode current decreases and the bridge becomes unbalanced. Since the current supplied to the bridge by the supply lines L^1 and L^2 is alternating, the currents conducted by the tubes 22 and 23 will be pulsating and bridge unbalance will result in an alternating voltage being applied to the deflecting plates 20. This alternating voltage on the plates 20 deflects the cathode ray stream in a manner hereinbefore described and a luminescent straight line appears on the fluorescent screen 21. Such visual indication is had each time that defective thread filaments strike the stirrup 12 of the delicate switch mechanism 1.

If desired, the tube 23 and resistor 31 may be dispensed with and the plate 20 which is connected to this side of the bridge may be connected directly to the supply line L^1, as illustrated, more or less diagrammatically, in Fig. 3. An alternating voltage will then be continuously applied to the deflecting plates 20 resulting in the appearance of a luminous line on the fluorescent screen 21, but the length of this line will be varied when the contacting arm 9 engages the flexible contact 13 to thereby indicate the presence of thread imperfections.

While in accordance with the provisions of the statutes, I have illustrated and described the best form of embodiment of my invention now known to me, it will be apparent to those skilled in the art that changes may be made in the form of the apparatus disclosed without departing from the spirit of my invention as set forth in the appended claims, and that certain features of my invention may sometimes be used to advantage without a corresponding use of other features.

Having now described my invention, what I claim as new and desire to secure by Letters Patent is:

1. In apparatus for detecting defective filaments in a thread, a normally balanced Wheatstone bridge comprising a pair of electronic valves in two opposite arms thereof and similar resistances in the remaining arms, the said electronic valves each comprising an anode, grid and a cathode, a source of alternating current voltage for said bridge, a cathode ray tube comprising a fluorescent screen, anode, cathode, and a

pair of deflecting plates, said deflecting plates being connected across the balancing connections of said bridge, a source of direct current voltage for said cathode ray tube, detecting means disposed in cooperative relation with said thread adapted to detect said defective filaments, and means for relatively moving said thread and detecting means adapted under control of said defective filaments to vary the flow of anode current through one of said electronic valves.

2. In measuring apparatus, a normally balanced Wheatstone bridge comprising a pair of electronic valves in two opposite arms thereof and similar resistances in the remaining arms, the said electronic valves each comprising an anode, grid and a cathode, a source of alternating current voltage for said bridge, a cathode ray tube comprising a fluorescent screen, anode, cathode, and a pair of deflecting plates, said deflecting plates being connected across the balancing connections of said bridge, a source of direct current voltage for said cathode ray tube, detecting means disposed in cooperative relation with a variable to be measured, and means under control of said detecting means adapted to vary the flow of anode current through one of said electronic valves.

3. In detecting apparatus, a normally balanced Wheatstone bridge comprising a pair of electronic valves in two opposite arms thereof and similar resistances in the remaining arms, the said electronic valves each comprising an anode, grid and a cathode, a source of alternating current voltage for said bridge, a cathode ray tube including an anode and a cathode for producing an electron stream, and a pair of deflecting plates controlling the direction of said stream, said deflecting plates being connected across the balancing connections of said bridge, a source of direct current voltage for said cathode ray tube, detecting means adapted to detect a variable to be detected, and means controlled by said detecting means to vary the flow of anode current through one of said electronic valves to thereby vary the potential impressed upon said deflecting plates and thereby to vary the direction of said electron stream.

4. Apparatus for detecting defective filaments in a thread comprising a bridge circuit having a pair of electronic valves in two opposite arms, a source of alternating voltage for said bridge, a detector disposed in operative relation with said thread and responsive to defective filaments in the latter to control the relative conductivities of said valves and thereby the state of balance of the said bridge circuit, and a cathode ray tube having a ray deflecting means connected to the unbalanced terminals of said bridge circuit to indicate the state of balance of the latter.

EARL A. KEELER.