Dec. 11, 1956 E. BREUNING 2,774,061

TEXTILE THREAD BREAKAGE OR SLUBBING DETECTOR SYSTEM

Filed July 8, 1953

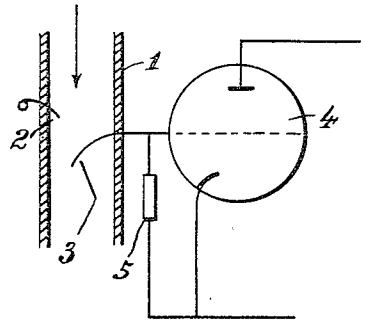


Fig. 1

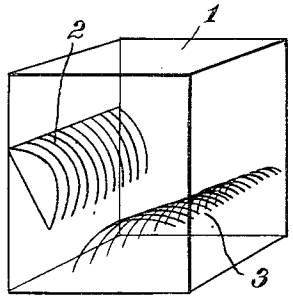


Fig. 2

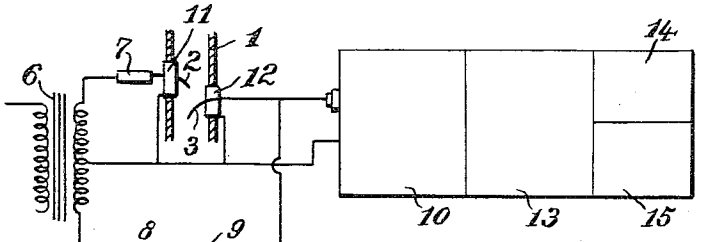


Fig. 3

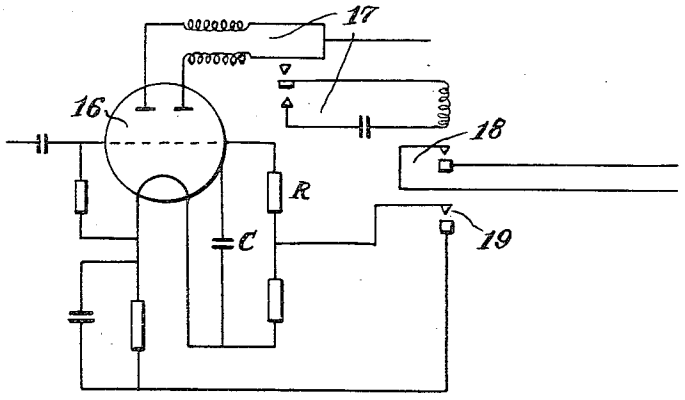


Fig. 4

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United States Patent Office 2,774,061 Patented Dec. 11, 1956

2,774,061

TEXTILE THREAD BREAKAGE OR SLUBBING DETECTOR SYSTEM

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Application July 8, 1953, Serial No. 381,052

10 Claims. (Cl. 340—259)

This invention relates to improvements in the supervision and control of production processes for materials of low electrical conductivity. It more particularly relates to a method and an apparatus for supervising and possibly controlling production processes for material of low electrical conductivity and in particular textiles.

It is known to continuously supervise a band of textile materials produced by a loom with respect to its moisture content by measuring its electric resistance and, if desired, using fluctuations in the resistance value to control the loom.

In this known process, the band of textile material is passed between two electrically conducting rollers acting as contact electrodes, positioned in a circuit as a portion of a Wheatstone bridge. Fluctuations in the resistance caused by the irregularities in the textile band are measured by the bridge instrument and may be utilized to control the loom.

Processes have also been suggested for supervising or controlling textile production processes with the use of contact electrodes. In these processes, the material only comes in contact with one or two contact electrodes when the same passes out of a path or carrier desired for the processing or working. This process permits supervision or control of the textile production process by actuating a warning or control device when, for example, detachment, tearing or breakage of a textile band or thread or of a slubbing being spun into thread occurs.

In all the prior known control or supervision processes utilizing contact electrodes, one of the electrodes is grounded. Since the resistance value of the materials being supervised as, for example, cottons, staple fibre, wool, etc., is relatively high, for example, about 10^{10} ohms, it is necessary to insulate the ungrounded electrode against ground with insulation having a resistance value at least equal to or greater than the materials being supervised. This necessitates very careful selection and maintenance of the insulation of the ungrounded electrode. Additionally, the operation of the contact electrodes for the supervision or control of the process requires the use of extremely high voltages.

One object of this invention is the electrical supervision and/or control of production processes for materials of low electrical conductivity such as textiles without the necessity of extremely high voltages and careful insulation of a grounded electrode. These and still further objects will become apparent from the following description read in conjunction with the drawing in which:

Fig. 1 diagrammatically shows an arrangement of a measuring electrode, a voltage carrying electrode and an amplifier for the measuring electrode in accordance with the invention,

Fig. 2 shows a perspective view of an embodiment of a measuring electrode and voltage carrying electrode in accordance with the invention,

Fig. 3 shows an embodiment of a circuit for effecting the invention and,

Fig. 4 shows a circuit arrangement for operating a signal and control device in accordance with the invention.

The supervision and possibly control of production processes for materials having low electrical conductivity as, for example, textiles is effected with a measuring electrode the potential of which is varied by galvanic contact with the material being supervised. This variation in potential is utilized, preferably, with the aid of electronic tubes for indication and, if desired, for the operation of control means. In direct contrast to the prior known processes, the material, in accordance with the inventions, effects an electrical connection between the measuring electrode and another electrode carrying voltage, and/or an electrical charge is produced on the measuring electrode by means of generation of electricity caused by the contact of the material with the electrode.

The instant invention, therefore, primarily differs from conventional electrical control processes in that the material being supervised does not form an electrical connection between a voltage carrying electrode and a grounded electrode, but forms an electrical connection between a voltage carrying electrode and a measuring electrode neither of which are grounded. The variations of the potential of the measuring electrode are used for measuring or control purposes.

Since a grounded electrode is not used in accordance with the invention, it is not necessary to insulate any of the electrodes used with an insulation having a resistance value as high as that of the materials being supervised, as, for example, textiles. Therefore, the apparatus used for effecting the invention may be substantially simpler than was conventionally required and necessitates considerably less attention, particularly since it is possible to dispense with the heavy insulation which is difficult to maintain under rough operating conditions. Considerable difficulties caused in conventional processes by the use of high voltages are also avoided in accordance with the invention.

It has further been found that with materials of extremely low conductivity, for example 10^{14} to 10^{18} ohms per cm., a utilizable variation of the potential of the measuring electrode will occur by mere contact with the material, i. e. if the material makes no connection between the voltage carrying electrode and the measuring electrode and merely contacts the measuring electrode generating a charge thereon. The process of the present invention is, therefore, well suited when production processes for materials of very low electrical conductivity, for example wool, perlon or dry cotton, are to be supervised.

According to a further development of the invention, the measuring electrode and preferably also the voltage-carrying electrode are surrounded by protective rings which are connected to ground. By this means, the requirements in respect of quality of the insulation of the electrode are still further reduced, as for example to 10^6 ohms.

In order to keep the degree of insulation of the measuring electrode and of the voltage carrying electrode low, it is further proposed, according to the invention, to bring the material to be worked up or undergoing processing into contact at least with the measuring electrode in the form of impulses, by means of suitable devices known per se. It is also convenient, according to the invention, to apply alternating voltage to the voltage carrying electrode.

These steps permit convenient amplification of the potential changes occurring at the measuring electrode.

The process of the invention can be further improved by balancing, by means of a compensating voltage of opposite polarity applied to the measuring electrode, dis-

turbing effects which are caused by inadequate insulation or the capacity between the voltage carrying electrode and the measuring electrode.

The invention will be explained in further detail with reference to the drawing and exemplified with reference to the supervision of thread breaks in spinning machines, for example flyers, the machine being automatically shut down in the event of thread or roving breakage. In spinning machines, it is customary to provide so-called thread suction devices. In the embodiments illustrated in the drawing, the measuring electrode and the electrode under voltage are disposed inside the pipeline of the thread suction device.

The voltage-carrying electrode **2** and the measuring electrode **3** are led in through the walls of the pipe **1** of a thread suction device in such manner that the two electrodes project into the pipe. It is immaterial in this arrangement whether the pipe **1** is made of metal or a non-conductor. In the case of a metal pipe, however, provision must be made for insulating the lead-in of the two electrodes through the wall from contact with the wall. The measuring electrode **3** is connected to the grid of the triode **4**.

The mode of operation of this arrangement, according to the invention, is as follows: If a break occurs on the roving to be spun, the roving is sucked into the thread suction device and passes into the pipe **1** in the direction of the arrow. As soon as the roving comes into galvanic contact with the voltage carrying electrode **2** and the measuring electrode **3**, the electric potential of the measuring electrode **3** is changed. This change of charge effects a change of charge of the grid of the triode **4**, whereby the anode current of **4** is varied. A suitable adjustment of the grid bias is maintained by means of the resistance **5**. This variation is used, preferably after further amplification in manner known per se, for supervising or disconnecting the driving unit of the spinning machine.

It has been found that an adequate change of charge of the measuring electrode **3** for supervisory or control purposes is already produced by the generation of contact electricity when the measuring electrode is merely touched by the broken roving or torn-off pieces of roving. The process of the present invention is, therefore, applicable even to materials of extremely low electrical conductivity.

In order to contact as far as possible all the pieces of roving passing into the pipe **1** and in order to avoid clogging, the voltage carrying electrode **2** and the measuring electrode **3**, as illustrated in Fig. 2, are constructed as rakes projecting into the pipe **1** and having prongs inclined in relation to the axis of the pipe.

In the circuit arrangement illustrated in Fig. 3, the alternating voltage of the transformer **6** of about 300 v. is supplied to the voltage carrying electrode **2** as charge voltage. One end of the secondary winding of the transformer **6** is connected to the voltage carrying electrode **2** through the protective resistance **7** of about 1 M ohms.

The measuring electrode **3** is connected to the high resistance control input of an alternating current amplifier **10**, while the middle tapping of the transformer **6** is connected to the ground connection of the alternating current amplifier **10**.

The other end of the secondary winding of the transformer **6** is connected to the measuring electrode **3** through the resistance **8** of about 1 M ohms, and through the condenser **9**, the capacity of which is substantially equal to that between the measuring electrode **3** and the voltage carrying electrode **2**. Any undesirable alternating voltage influences on the measuring electrode **3** caused by the voltage carrying electrode **2** are thereby compensated.

In order to be able to keep the requirements of quality of the insulation of the voltage carrying electrode **2** and of the measuring electrode **3** against one another at a value easily obtainable in practice, both the aforesaid electrodes are surrounded by grounded protective rings **11** and **12** of conducting material.

If, in contrast to the circuit arrangement shown in Fig. 3, the voltage carrying electrode **2** is connected to direct voltage, the alternating voltage amplifier produces by way of differentiation an insensitivity of the arrangement against defective insulation of the electrodes **2** and **3**.

A rectifier **13** with signalling device **14** and control device **15** is connected in rear of the alternating current amplifier **10** and effects the stoppage of the flyer drive unit.

Fig. 4 shows a particularly convenient circuit arrangement according to the further development of the invention, wherein a double anode triode **16** having only one cathode is used. One triode system works as a rectifier, while the other determines the magnitude of a compensation current for the polarized relay **17**. In the normal way, the anode currents of the two systems are equal in magnitude, but when the grid of the rectifier system undergoes a change of potential, its anode current is reduced.

The polarized relay **17** responds and through the relay **18** operates the signal and control device connected in rear thereof, thereby releasing the relay of the drive device and thereby bringing the latter to rest. Through a separate contact **19** of the relay **18**, a negative potential is imposed on the grid of the second triode system with the time constant of the condenser C and resistance R and effects a reduction of the anode current of that system. The armature of the polarized relay **17** thus reverses again after an adjustable period of time and brings the arrangement back into the position of readiness, so that after the roving break, for example, has been repaired, the relay of the drive unit can be connected again.

In order to reduce cost, according to the invention, a plurality of input stages of production points of a machine to be supervised are advantageously connected together to one utilization stage. Only one amplifier or rectifier is then needed for all the stages connected together.

Thus, for example, if the device, in accordance with the invention is used on a spinning machine on which a large number of threads which run parallelly are simultaneously spun on a flyer, each of the threads may pass through a device provided with a voltage carrying and measuring electrode as shown in Fig. 1 and all these voltage carrying and measuring electrode arrangements may be parallelly connected to the alternating current amplifier **10**, the rectifier **13**, the signaling device **14** and the control device **15**, as shown in Fig. 3. Thus, when any of the individual threads break and contact the electrodes of the arrangement with which it is associated,, it will automatically actuate the control and signal device which, for example, may effect the stopping of the machine. The arrangement is such that the contacting of the electrodes of any of the measuring and voltage carrying electrode arrangements connected to **10** will effect this actuation.

In the claims the term "supervision" will be used to generically define the supervision and/or control of the production processes.

I claim:

1. Apparatus for the supervision of production processes for material of low electrical conductivities such as textiles which comprises an ungrounded measuring electrode, an ungrounded voltage carrying electrode positioned in spaced relationship to said measuring electrode, said electrodes being positioned to be bridged for contact with material of low electric conductivity passing a predetermined area in a production process, means for supplying sufficient voltage to said voltage carrying electrode to allow current to pass through material of low conductivity such as textiles from the voltage carrying electrode to the measuring electrode when both electrodes are contacted by a piece of such material.

2. Apparatus according to claim 1 including an electronic valve positioned for control actuation by said

measuring electrode and having the output thereof connected to said supervising means.

3. Apparatus according to claim 2 in which said electronic valve is a vacuum tube having the grid thereof connected to said measuring electrode and the anode-cathode circuit connected to said supervising means.

4. Apparatus according to claim 1 including a grounded protective ring of conductive material surrounding said measuring electrode.

5. Apparatus according to claim 4 including a grounded protective ring of conductive material surrounding said voltage carrying electrode.

6. Apparatus according to claim 1 including means for returning the apparatus to condition of response readiness a predetermined period after response.

7. Apparatus according to claim 1 in which said electrodes have multiple parallel rake-like prongs.

8. Apparatus according to claim 7 in which the prongs of each electrode are inclined in relation to the prongs of the other electrode.

9. Apparatus according to claim 8 in which said electrodes are at least partially positioned in the pipe line of a thread suction device of a spinning machine.

10. Apparatus according to claim 1 which includes a plurality of ungrounded measuring electrodes, voltage carrying electrode arrangements connected to said means for supervising the production process.

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