Oct. 24, 1950 R. S. SCHAAB ET AL 2,526,906

HEATING ROLLER

Filed Oct. 24, 1947 3 Sheets-Sheet 1

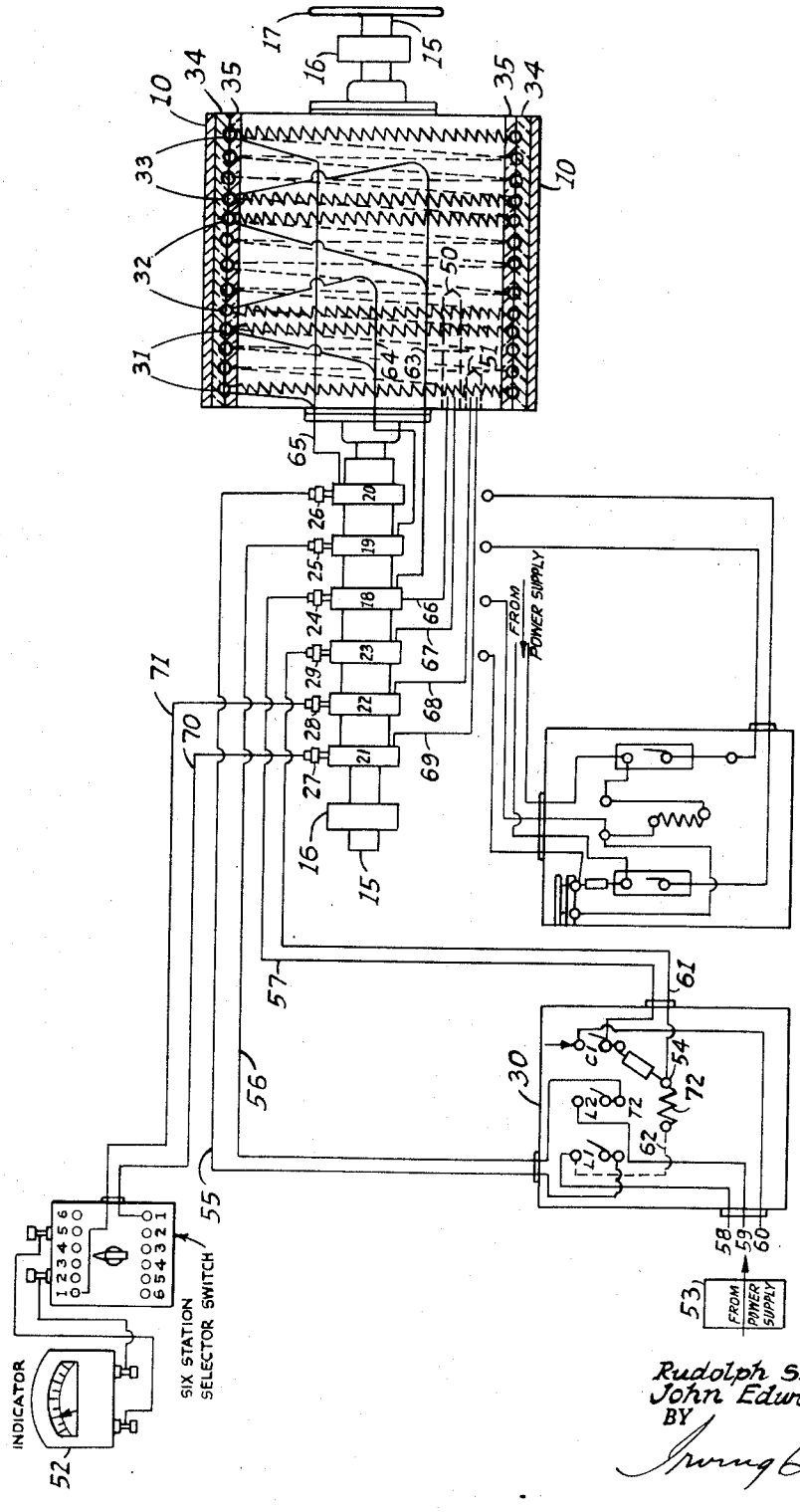


Fig. 1

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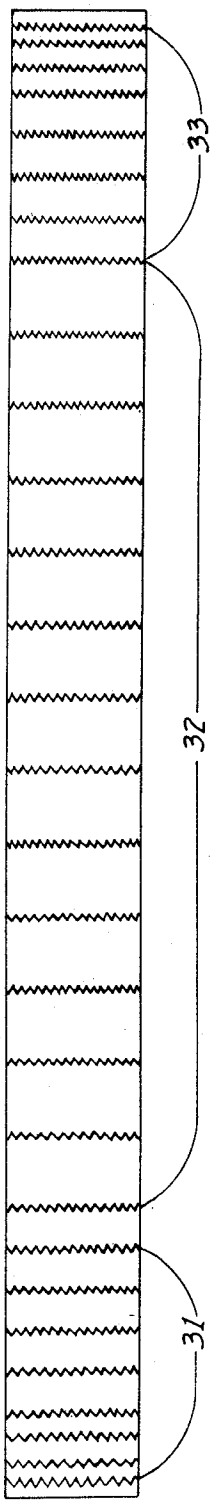


Fig. 3

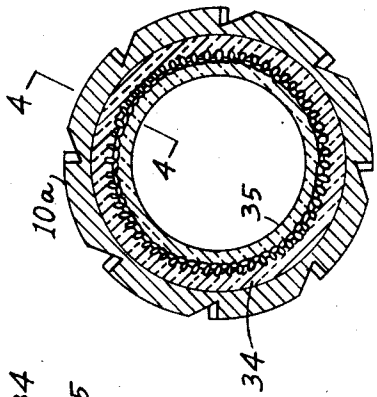


Fig. 2

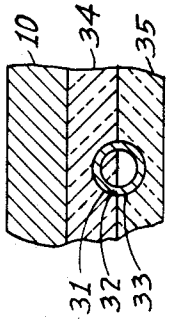


Fig. 4

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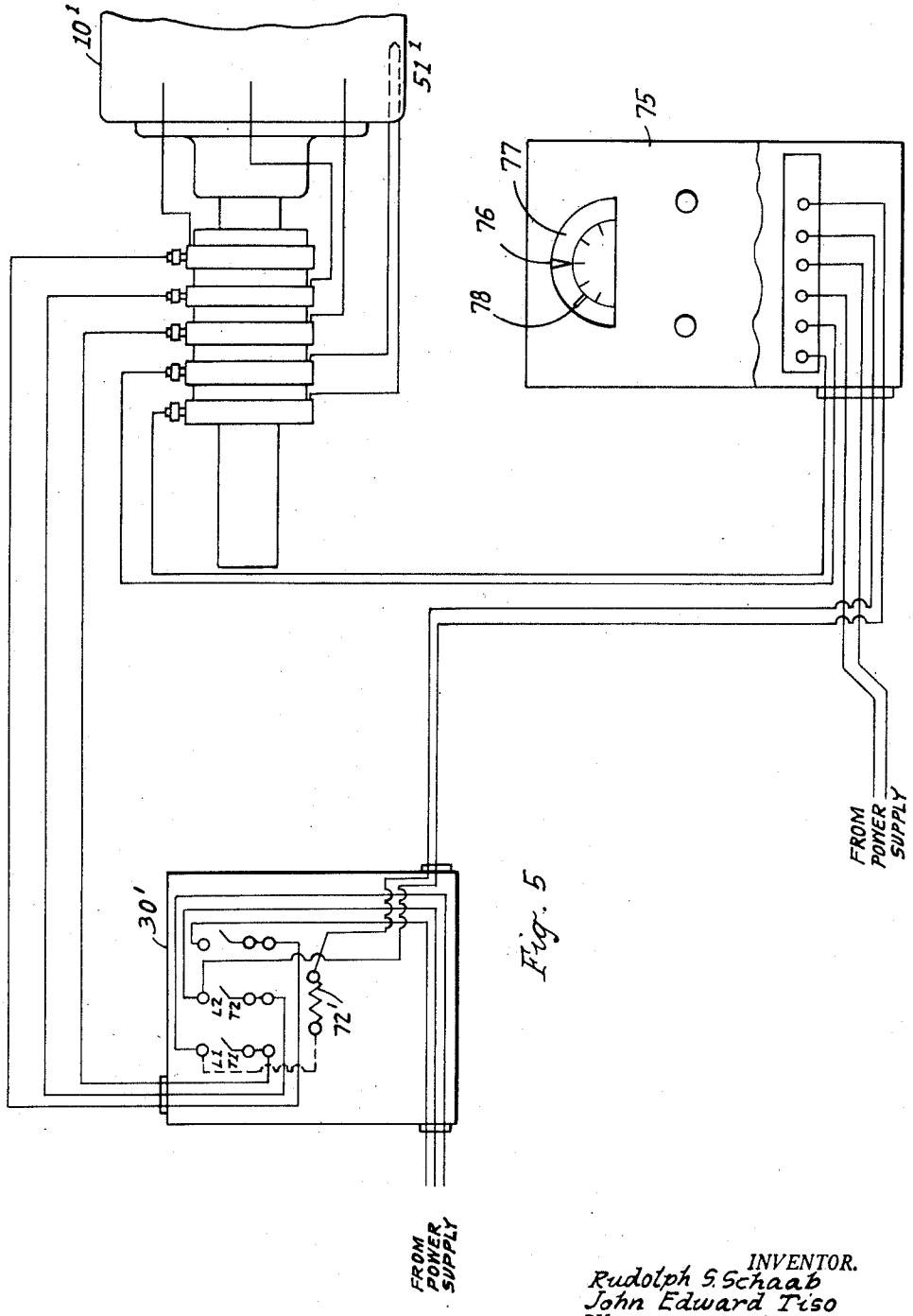


Fig. 5

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UNITED STATES PATENT OFFICE

2,526,906

HEATING ROLLER

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Application October 24, 1947, Serial No. 783,066

4 Claims. (Cl. 219—19)

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This invention relates to electrical heating rollers or cylinders used with machines of various kinds where heat is required.

Broadly, it is an object of our invention to provide electrical heating coils to the interior of a roller.

More particularly, it is an object of our invention to provide various heating coils to the interior of rollers generally used in association with fur, textile and paper machines.

Another object of our invention is to provide a roller and shaft having a series of slip rings thereon which are in contact with a series of brushes for passing the current therethrough.

A further object is to provide heating units for rollers which will give a uniform and constant heat upon the surface of such rollers.

Still a further object is to provide an indication to show the operator at all times, including the period while the roller is rotating, the exact surface temperature of the roller.

A further object is to provide automatic means for raising and lowering the surface temperature of the roller.

For a fuller understanding of the nature and objects of our invention, reference is had to the following detailed description in connection with the accompanying drawings, in which:

Figure 1 is a diagrammatic view of the roller, indicator magnetic circuit breakers and wiring diagram.

Figure 2 is a vertical sectional view taken through the roller.

Figure 3 is a front elevation showing the resistance wire upon the ceramic sleeve **35**.

Figure 4 is an enlarged section taken through line **4—4** of Figure 2.

Figure 5 is a wiring diagram of the indicator controller unit.

Referring to the drawings, numeral **10** represents a roller having a working surface **10***a* used in connection with a machine. The roller **10** is mounted upon a shaft **15** which is revolvably retained upon bearings **16—16**. A drive wheel **17** is placed at one end of the shaft **15** for revolving shaft **15** and the roller **10**. On one portion of the shaft **15** there are slip rings **18, 19, 20, 21, 22** and **23** with a series of brushes **24, 25, 26, 27, 28** and **29** adapted to engage the slip rings **18** to **23**, inclusive, so that electrical circuits can be completed. To the brushes **24, 25** and **26** is brought the power supply. The brushes pass power to the slip rings **18, 19,** and **20**. There are wire leads **63, 64** and **65** from the slip rings **18, 19** and **20** to the heating elements **31, 32** and **33**. The heating

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element or resistance wires **31, 32** and **33** lie between a ceramic composition liner **34** preferably made of zircon iron cement, and an inner liner **35** preferably made of a composition of alumina or silica and having a helical circumferential groove around the outer surface thereof and the heating coils or elements **31, 32** and **33** rest within such helical groove. In the process of placing the coils **31, 32** and **33** within the helical groove, the coils are first placed within the helical groove and the zircon cement is then applied over the outside of the coils and the liner **35** so that the zircon cement will not fill the inside of the coil thus permitting room for expansion and contraction. The resistance wire or ribbon is installed as close as possible to the inside of the cylinder wall of roller **10** to assure proper electric insulation. The roller **10** acts as the housing for the inner liner **35** and liner **34**. Wires **63, 64** and **65** are terminated onto slip rings **18, 19** and **20**.

For a three phase system, 220 volts, a nichrome resistance wire is wound over a $\frac{3}{16}$'' mandrel. The two outside coils **31** and **33** are shorter than the center coil **32**. Coils **31** and **33** are wound around the diameter of the ceramic sleeve **35** starting at the ends towards the center. The spacing of the circular winding over the $\frac{3}{16}$'' mandrel is staggered to start with a spacing on the outside ends closer from radius to radius than the spacing towards the center of the roller; from the center towards the opposite end the spacing is decreased in the same manner. Instead of a wire, a ribbon can be substituted. Thus with the proper spacing of the resistance wire or ribbon, and the close proximity of the resistance wire or ribbon to the inner wall of the rotating cylinder, and a good heat conducting electric insulating agent between the resistance wire or ribbon and the wall of the cylinder, the heat created in the heating element assures an even and uniform temperature on the outside or working surface of the rotating cylinder.

A thermo-switch **50** is embedded at one end of the roller and close to the outer surface of said roller **10**. Thermo-switch **50** has two wires, **66** and **67**; wire **66** is connected to lead wire **63** from slip ring **18**; wire **67** is connected to slip ring **23**. From brush **29** the wire leads to one terminal of the magnet **54** of a magnetic switch box **30**, thus completing the circuit if thermo-switch **50** is in closed position. The other terminal **54** of the magnetic coil **72** is wired directly to the power supply through wire **62**. Instead of a thermo-switch, a thermo-couple **51** may be substituted

or both may be used as shown in Figure 1 where the thermo-couple operates the indicator **52** and the thermo-switch **50** operates the magnetic circuit breaker **30**. An indicator controller which reacts to the heat differential of a thermo-couple is employed to show visually through indication the actual heat of the working surface of the rotating cylinder while the cylinder is revolving and cuts in a magnetic circuit breaker to bring on the electric circuit to heat the resistance wire or ribbon. When the desired temperature is reached on the working surface of the rotating cylinder, the thermo-couple again activates the magnetic circuit breaker to cut off the electric supply, as shown in Figure 5. The magnetic switch **30** acts as the circuit breaker of the power line for the heating elements **31**, **32** and **33**. Wires **58**, **59** and **60** lead to the main power switch **53**, while wires **55**, **56** and **57** lead to the brushes **24**, **25** and **26**, respectively.

A thermo-couple **51** is embedded several inches on one end of the roller, close to the outer surface of roller **10**. One lead wire **69** is connected from thermo-couple **51** to slip ring **21** and the other lead wire **68** is connected to slip ring **22** from thermo-couple **51**. A lead wire **70** passes from brush **27** to heat indicator **52** and the other wire **71** is connected from brush **28** to indicator **52**, thus completing another circuit.

Thermo-switch **50** is activated through temperature changes which induces a circuit to open or close within the thermo-switch **50**. Thus at a predetermined degree of heat it can be accurately controlled to bring or shut off power to the operation of the magnetic switch **30**, thus bringing or shutting off power to the heating elements **31**, **32** and **33**.

In order to heat roller **10**, the main switch **53** is closed thus giving power to the magnetic coil **72** through lead wire **62** and lead wire **61** coming through closed thermo-switch **50**, thus closing magnetic switch **30** and closing wire circuits **58** to **55**, **59** to **56** and **60** to **57**. When the temperature of roller **10** rises above the degree set on the thermo-switch **50**, the magnetic switch **30** opens so that the circuit is broken shutting off the magnetic coil **54** which in turn breaks the power supply to the heating elements **31**, **32** and **33**.

Referring to Fig. 5 of the drawings, the circuit shown in this figure is very similar to the circuit shown in Fig. 1 except that the thermo-switch **50** has been eliminated. Therefore, only five slip rings have been shown on Fig. 5 instead of the six shown on Fig. 1. In addition, instead of the six station selector switch shown on Fig. 1 and the indicator **52** shown in association with the selector switch, an indicator controller unit **75** showing six terminals is used. The indicator **75** is actuated by a thermo-couple **51'**.

The thermo-couple **51'** embedded adjacent the surface of roller **10'** actuates a relay within the indicator controller **75**. This relay operates the magnetic coil **72'** in the magnetic switch **30'**. The indicator controller **75** is set by a movable arrow **76** to the desired operating temperature for the roller **10'**. When the thermo-couple **51'** reaches the temperature set by the arrow **76**, an indicating hand **78** moves upon the dial **77** and when the indicating hand reaches the arrow **76** which has been preset to the desired temperature, the circuit is broken thus shutting off the current through the magnetic switch **30'**. When the temperature upon the surface of the roller **10'** drops below the temperature set by the arrow **76** upon the indicating controller, a contact

automatically closes, thus initiating the circuit again and closing the magnetic switch **30'** and thus raising the temperature of roller **10'** again to the desired predetermined temperature. This repeats itself from time to time thus maintaining practically a uniform temperature at the surface of the roller **10'**. By moving the arrow **76** to a lower or higher temperature, the heat at roller **10'** is greater or lesser depending upon the position of the arrow **76**.

It is obvious that a greater or lesser number of heating elements may be embedded in roller **10** depending upon the power supply and also on the temperature desired and also depending upon the length of the roller. It is also obvious that the parts may be rearranged without departing from the general spirit of the invention.

Instead of using a thermo-switch **50**, it is obvious that an indicating controller unit may be used in connection with a thermo-couple.

It is also obvious that additional wheels and discs may be added to the shaft to provide a greater or lesser degrees of heat, as desired. It is also obvious that various changes and modifications can be made in the details of construction without departing from the general spirit of the invention.

We claim:

1. A rotating cylinder having a working surface comprising an outer sleeve, an intermediate dielectric heat conducting material and an inner sleeve, said intermediate dielectric heat conducting material between said outer sleeve and said inner sleeve, means for heating said cylinder internally, said means comprising embedded resistance coils at each end of said cylinder and a central resistance coil, said coils laid in grooves in said inner sleeve surface, said coils embedded between said inner sleeve and said intermediate dielectric heat conducting material and within said cylinder, said end coils spaced closer at each outer end thereof, said end resistance coils being of a lesser length at each outside end than its opposite end to operate at a higher temperature at each end than at the center of said cylinder to compensate for the greater dissipation of heat at the ends of said cylinder than at the center to provide uniform and constant heat along the working surface of said cylinder and automatic means for controlling the flow of current to said resistance coils for raising or lowering the temperature along the working surface of said cylinder.

2. A rotating cylinder for a multiple phase circuit comprising an inner ceramic sleeve, a metal outer sleeve and an intermediate dielectric heat conducting material between said outer sleeve and said inner ceramic sleeve, grooves in said inner sleeve, resistance coils laid in said grooves in said inner sleeve, said coils embedded in said intermediate dielectric heat conducting material, said metal outer sleeve having a working surface, the outer surface of said intermediate material being in fixed contact with the inner surface of said outer sleeve.

3. A rotating cylinder comprising an inner ceramic sleeve, two end resistance coils, and a central resistance coil, an intermediate heat conducting material and a metal outer sleeve having a working surface, said resistance coils embedded between said inner sleeve and said intermediate material, the outer surface of said intermediate material being in fixed contact with the inner surface of said outer sleeve, said resistance coils wound around the outside of said

inner sleeve and spaced closer at each end of said cylinder than at the center thereof, said end resistance coils being of a lesser length than said central resistance coil to compensate for the greater dissipation of heat at the ends than at the center of said cylinder and automatic means for controlling the flow of current to said resistance coils for raising or lowering the temperature along the working surface of said cylinder.

4. A method of making a cylinder by winding a resistance wire around a mandrel producing three coils, then removing said coils from said mandrel, then graduating the distance of the turns of two of said coils from small to large, then winding said two coils around the outside of a ceramic sleeve with the small space between turns of said coils at the outer ends of said ceramic sleeve, then winding said third coil around the central portion of said ceramic sleeve, then covering said coils with a dielectric heat conducting material leaving an air space within said coils permitting expansion and contraction of said coils, said dielectric heat conducting material permitting rapid withdrawal of said heat from said coils, then encasing said heat conducting material within a metal cylinder, said heat

conducting material transmitting heat from said coils to the inside surface of said metal cylinder.

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