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| [72] | Inventor | Richard F. Seyfried
Parma Heights, Ohio |
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| [73] | Assignee | Park-Ohio Industries, Inc.
Cleveland, Ohio |

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Primary Examiner—J. V. Truhe
Assistant Examiner—L. H. Bender
Attorney—Meyer, Tilberry and Body

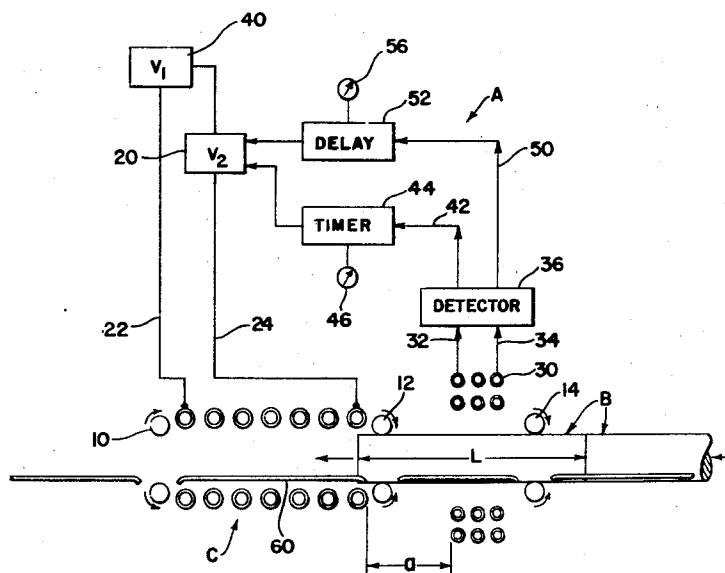
- [54] POWER CONTROL DEVICE FOR AN INDUCTOR**
5 Claims, 1 Drawing Fig.

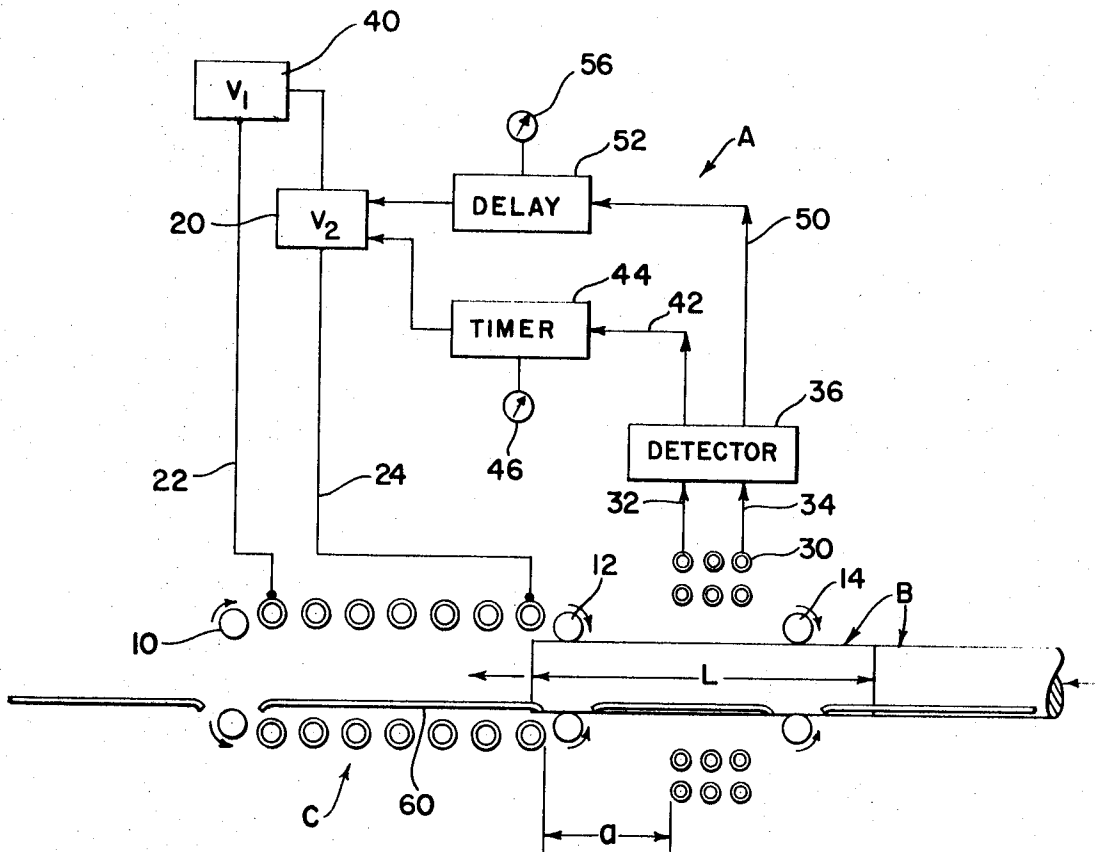
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ABSTRACT: A sensing coil is placed in advance of an inductor used to inductively heat an elongated workpiece and a low-level voltage below the heating voltage, is maintained on the inductor. As the workpiece passes through the sensing coil into the energized inductor, an induced voltage is created within the sensing coil. This induced voltage is used to increase the voltage across the inductor to the induction heating level. As the workpiece exits from the sensing coil, the voltage across the inductor is decreased again to its low level.





INVENTOR
RICHARD F. SEYFRIED

BY
Meyer, Tilberry & Body

ATTORNEYS

POWER CONTROL DEVICE FOR AN INDUCTOR

This invention relates to the art of induction heating and more particularly to a power control device for an induction heating installation. The invention is particularly applicable for use with a multiturn inductor used to heat an elongated workpiece being fed to the inductor by a series of rolls, and it will be described with particular reference thereto; however, it should be appreciated that the invention has much broader applications and may be used for various other induction heating installations, and may use a single turn indicator.

It is quite common to heat a series of elongated workpieces by passing them through an energized induction heating coil. Often the means for effecting movement through the coil is cycled when each workpiece is moved through the inductor. Consequently, the inductor may be energized in accordance with the cycling of the transfer device. In some instances, the workpieces are fed through the energized inductor by a series of feed rolls. When this happens, there is no accurate means for determining the time for energizing the heating coil. To overcome this problem, "air" switches and feelers have been used to detect the entrance of a workpiece into the heating coil. These devices have presented substantial maintenance difficulties and are not completely satisfactory.

The present invention overcomes the disadvantages of prior devices for energizing an induction heating coil upon the entrance of a workpiece therein. In accordance with the present invention, there is provided an improvement in an induction heating device for elongated workpieces. This improvement includes a multiturn sensing coil having an opening therethrough aligned with the opening of the inductor. The sensing coil is spaced only slightly from the inductor and a detector is provided on the sensing coil. A low-level voltage is maintained on the inductor so that an induced voltage is created within the sensing coil as the workpiece increases the mutual inductance between the inductor and coil by moving through the sensing coil and toward the inductor. This induced voltage is used to increase the voltage across the inductor to its heating level in an appropriate time to effect heating of the workpiece.

The object of the present invention is the provision of a device for detecting the entrance of a workpiece into a multiturn induction heating coil, which device is inexpensive, relatively maintenance free, maybe used with existing equipment, and is positive in operation.

This and other objects and advantages will become apparent from the following description used in connection with the accompanying drawing in which the FIGURE is a schematic representation of the preferred embodiment of the present invention.

Referring now to the single FIGURE, there is illustrated an induction heating apparatus A for heating an elongated workpiece B having a length L. This device includes a multiturn induction heating inductor C of the normal construction. A series of feed roll sets 10, 12, 14 are used to convey the elongated workpiece B through the internal passage of the inductor C. An appropriate power source, schematically represented at 20, is connected by leads 22, 24 with the inductor C to impose a heating voltage V_2 across the inductor when the power source is energized. The operation of this apparatus A is in accordance with normal practice. When the workpiece B is moved into the inductor, the power supply 20 is energized to inductively heat the workpiece for subsequent processing.

In accordance with the present invention, there is provided a sensing coil 30 spaced from the entrant end of inductor C a distance a . This distance a is substantially less than the length L of the workpiece B. Consequently, the workpiece B can af-

fect the mutual inductance between the inductor C and the sensing coil 30. The sensing coil is connected by leads 32, 34 with an appropriate detector 36 for detecting the level of induced voltage within the sensing coil. Means are provided for maintaining a low-level voltage across the inductor C at all times. This is schematically represented as a second power source 40 for maintaining a voltage V_1 across the inductor. Of course, only one power source can be used with appropriate relays and circuits for changing the level of the voltage across the inductor C.

In accordance with the invention, when the induced voltage within coil 30 reaches a preselected first value, a signal is transmitted through line 42 to the power source 20. This activates the power supply to establish a heating voltage V_2 across the inductor C. To control the timing of the starting cycle, an appropriate timer 44 is connected within line 42. This timer is adjustable by a schematically illustrated means 46 so that the time delay between detection and actual energization of the inductor C can be adjusted to control the heating pattern within the workpiece B. As the workpiece passes from the sensing coil 30, the mutual inductance decreases below a second preset value. This creates a signal within line 50 which deactivates the power supply 20 to again reestablish a low-level voltage V_1 across the inductor C. To control the delay in deactivating the high voltage V_2 , there is provided an appropriate time delay device 52 within line 50. The time delay device can be adjusted by an appropriate means illustrated as device 56.

The operation of the present invention, as schematically illustrated in the single FIGURE, is apparent from the above description. If a series of workpieces are driven successively through the inductor C it is maintained in an energized condition. Appropriate means can be provided for supporting the workpiece within the coil itself. This is schematically illustrated by the rails 60 in the FIGURE.

Having thus described my invention, I claim:

1. In a device for inductively heating an elongated workpiece having a length L, said device comprising an inductor having an internal passageway with an entrant end, means for feeding said elongated workpiece along a feed line extending through said passageway, and power means for energizing said inductor with a high-frequency induction heating current, the improvement comprising: a multiturn sensing coil having an opening therethrough, said opening being aligned with said passageway and said sensing coil surrounding said feed line, said sensing coil being spaced from said entrant end a distance a , substantially less than length L; means for detecting an increase in voltage induced into said sensing coil when said workpiece approaches said inductor; means for maintaining a low voltage on said inductor; first responsive means responsive to said detecting means for increasing the voltage applied to said inductor to a heating level, when said induced voltage exceeds a first preset amount, and second responsive means, responsive to said detecting means, for decreasing the voltage to said inductor to said low voltage when said induced voltage decreases below a second preset amount.

2. The improvement as defined in claim 1 including a means for delaying for a selected time said decrease of said voltage on said inductor when said induced voltage decreases below said second preset amount.

3. The improvement as defined in claim 1 including means for adjusting said time delay of said delaying means.

4. The improvement as defined in claim 1 including means for adjusting the response time of said first responsive means.

5. The improvement as defined in claim 1 including means for adjusting the response time of said second responsive means.