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SHORT-CIRCUIT CONTROL UNIT FOR THYRISTOR BRIDGE

The present invention concerns a short-circuit control unit for a thyristor bridge in mains-supplied thyristor drives where a motor is energized by one or several thyristor bridges.

5 Along with the development of semiconductor techniques, thyristor techniques have been ever more frequently adopted in motor control. This has afforded several advantages. There has however remained the drawback of the sensitivity of thyristor
10 systems as regards the fuses. In four-quadrant thyristor drives in particular, the risk of so-called internal short-circuit is present in the event of the thyristors misfiring. This is illustrated by Figure 1, where one possible short circuit path has been
15 indicated by arrows. In the event of short circuit, the fuses protecting the thyristors usually blow. Particularly in connection with lifts, such fuse trouble causes objectionable interruptions in the operation.

20 According to the invention there is provided a short-circuit thyristor protection circuit for use with a motor driven by at least one mains supplied thyristor bridge, comprising a current transformer for each bridge for detecting the current therein, a current
25 measuring circuit (VM) in which the current level in

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the bridge is converted into a signal representing the bridge current, a control unit (VE) which includes a comparator for comparing the signal from the current measuring circuit with a reference level, a transistor
5 (T1), connected to the ~~negative~~ output of said comparator so as to be controlled thereby to switch off the ignition pulses to the thyristors of the bridge in which the current level exceeds a predetermined threshold value, and an inductance or inductances in
10 series with the mains supply to limit the magnitude of a short circuit current surge.

By means of the invention, fuse blowing of the kind described due to a short circuit can no longer occur. The short circuit condition is detected by the
15 current measuring circuit, and the signal produced cuts off the ignition pulses to the thyristors, whereafter the magnitude of the current surge is limited by the series inductances to a value which is safe with respect to thyristors and fuses, and the
20 apparatus is immediately ready for operation as soon as the short circuit condition ceases to exist.

A protection circuit like this is simple, reliable in operation and advantageous.

The invention will now be described by way of
25 example with reference to the accompanying drawings, wherein

FIGURE 1 presents a thyristor bridge known in

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itself in the art,

FIGURE 2 shows the control unit of the invention, connected to a thyristor bridge,

FIGURE 3 displays the circuit diagram of the control circuit, and

FIGURE 4 shows the current intensity graph plotted over time.

In Figure 2 is seen an example of a motor drive where a D.C. motor is controlled by bridges S1 and S2. The current of the bridges is measured with current transformers 1, 2 and 3. The current intensity datum from the current transformers is converted into a signal corresponding to the motor current, by conventional rectifying technique in the block VM. The output voltage U_v of the block VM corresponds to the system's state of current. In Figure 3 is shown the operation amplifier op1, which serves as comparator detecting a short circuit condition. If the current datum U_v exceeds the measuring threshold, fixed by the resistors R1 and R2, the output of the amplifier turns negative and with the aid of transistor T1 disconnects the energy supply Is going to the ignition unit. This is a result of the physics of this phenomenon, which need not be more closely clarified in this connection. However, it may be noted that the magnitude of the current surge is determined by the inductance of the series choke L1. This choke cannot in actual practice

be one with iron core because after all the short circuit current peak is comparatively high and would saturate an iron core choke of normal size. The chokes with air core are so dimensioned that they will always
5 limit the short circuit current to be less than the surge current peak intensity I_{tsm} specified for the thyristor.

The ignition unit may be of conventional, commonly known design. The diode D1, resistor R3 and capacitor
10 C1 have the task to prolong the current measuring pulse. The duration of the cut-out period can be regulated by adjusting the capacitor C1. In general, short circuit is rare, and therefore the apparatus will continue its operation after the short circuit
15 condition has ceased to exist.

It is obvious to a person skilled in the art that various embodiments of the invention may vary within the scope of the claims stated below.



CLAIMS

1. A short circuit thyristor protection circuit for use with a motor driven by at least one mains supplied thyristor bridge, comprising a current transformer for each bridge for detecting the current therein, a
5 current measuring circuit (VM) in which the current level in the bridge is converted into a signal representing the bridge current, a control unit (VE) which includes a comparator for comparing the signal from the current measuring circuit with a reference
10 level, a transistor (T1) connected to the ~~negative~~ output of said comparator so as to be controlled thereby to switch off the ignition pulses to the thyristors of the bridge in which the current level exceeds a predetermined threshold value, and an
15 inductance or inductances in series with the mains supply to limit the magnitude of a short circuit current surge.

2. A short circuit protection circuit as claimed in claim 1, wherein the series chokes (L1) are inductance
20 coils with air core.

3. A short circuit protection circuit as claimed in claim 1, substantially as herein described with reference to Figures 2 and 3 of the accompanying drawings.
