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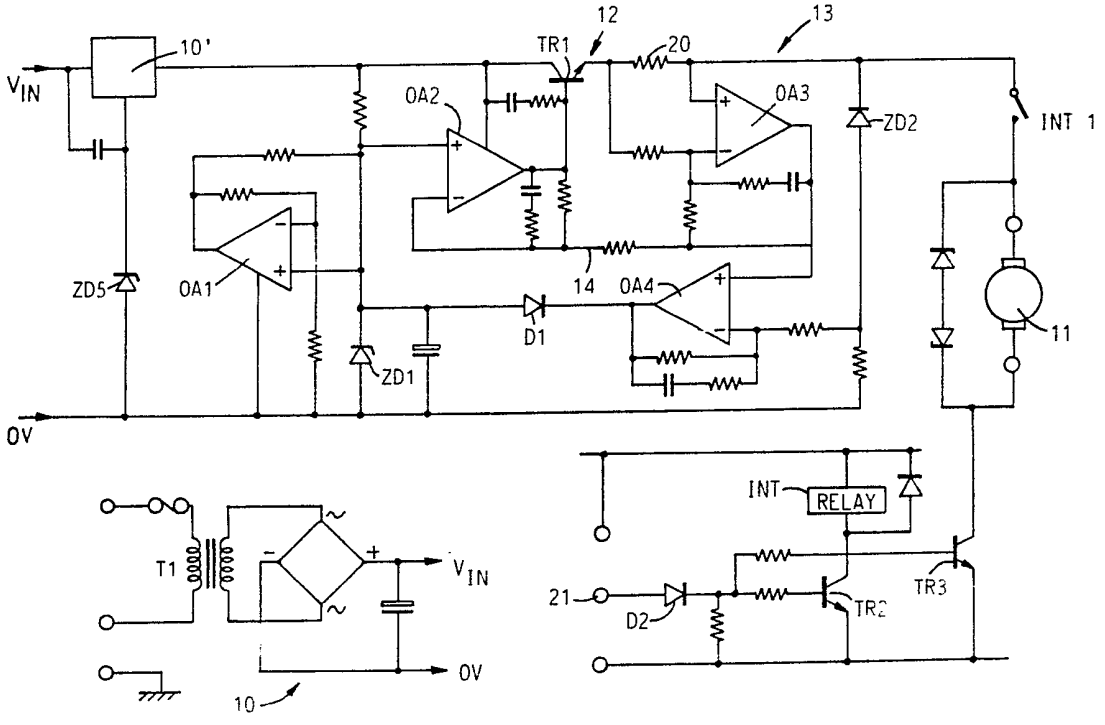
(54) Control of motor for tactile indicator at pedestrian road crossing

(57) A control system for a D.C. electric motor (11) provided to drive a rotary tactile indicator for use by blind persons, comprises an amplifier circuit (OA3, OA4, TR1) to limit and maintain the current supplied to the motor to a chosen maximum value so as to define and maintain a maximum torque which the motor can supply.

A further amplifier (OA1) stabilises the supply voltage to the motor in the "off load" condition.

The system controls the speed of the motor (1) to a chosen value under varying applied torque conditions. An interlock circuit (TR2, TR3, INT) couples operation of the motor (11) to other devices at a pedestrian crossing.



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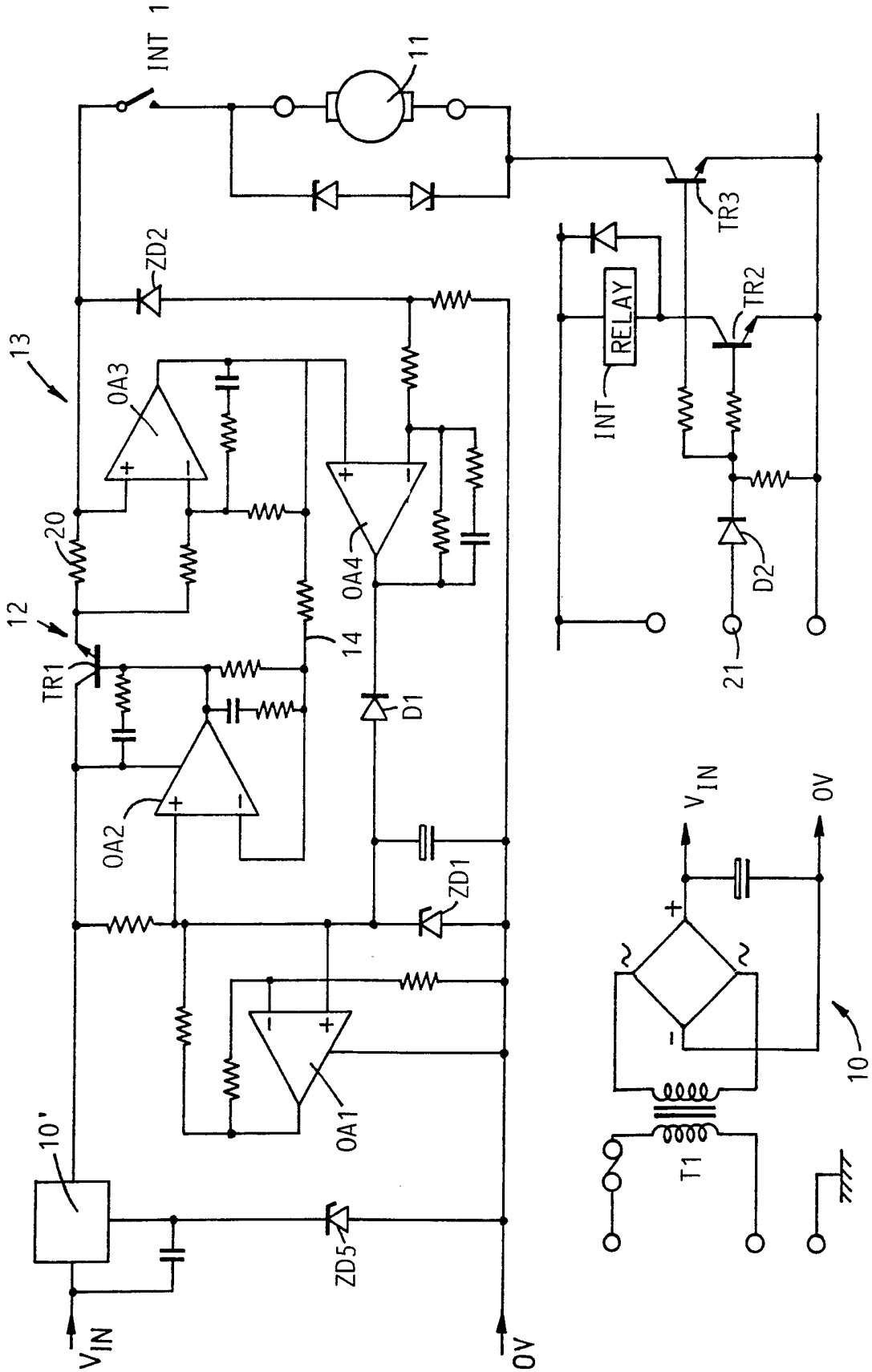
INT 1
11
ZD2
13
OA3
20
12
TR1
OA4
14
D1
OA2
ZD1
OA1
10'
ZD5
V_{IN}
0V
TR3
RELAY
TR2
INT
D2
21
V_{IN}
0V
10
T1

IMPROVEMENTS IN OR RELATING TO TACTILE INDICATORS FOR USE ON PEDESTRIAN ROAD CROSSINGS

This invention relates to a tactile pedestrian rotary indicator with electronic control of speed and torque, for use, at a pedestrian road crossing by blind pedestrians, to establish whether it is safe for them to cross.

It is well known that visually handicapped pedestrians have difficulty in determining a safe crossing period at complex traffic signal controlled pedestrian crossings. At simple installations an audible indicator is effective but where more than one crossing exists in a limited area dangerous ambiguities may result. The Department of Transport have, therefore, issued a specification (MCE 0157) describing a tactile indicator which can be installed in the existing pedestrian push button boxes. This tactile indicator comprises a small electric motor which rotates a knurled cone projecting from the bottom of the push button box to indicate safe crossing conditions. For safety reasons both the speed of rotation of the cone and its torque are required to be controlled. This has hitherto been achieved by mechanical means which have proved both bulky and expensive.

It is an object of the present invention to provide an electronic means of controlling the motor so that the requirements of MCE 0157 are met in a more cost effective manner, and with a device which will also fit more easily into existing designs of push button box.

Accordingly the present invention provides a control system for a D.C. electric motor provided to drive a rotary tactile indicator for use by blind persons, comprising means to limit and maintain the current supplied to the motor to a chosen maximum value thus to define and maintain a maximum torque which the motor can supply.

Preferably the control system includes means for sensing the current flowing through the motor and for increasing the applied voltage across the motor in response to an increase in motor current.

Preferably the control system includes means to stabilise the supply voltage to the motor in the "off load" condition.

The invention also provides a tactile indicator suitable for use at pedestrian road crossings by blind people including an electric motor arranged to drive a rotary indicator which may be touched by a blind person, when it is safe to cross the crossing, and including such a control system.

In order to promote a fuller understanding of the above and other aspects of the present invention, an embodiment will now be described by way of example only with reference to the accompanying drawing which shows a schematic circuit diagram of an embodiment of the invention.

For a given D.C. motor running under a given torque, the rotational speed of the output shaft has a substantially linear relationship with the applied voltage. The "off-load" speed of the tactile cone can thus be quite accurately controlled by stabilising the applied voltage against

variations in the supply voltage which can be as much as 3:1. However, the speed of a D.C. motor is also related by an inverse linear law to the applied torque. In order that excessive speed variations are avoided over the normal range of torque loads, the motor used would normally be rated for much higher loads than those anticipated. This approach is both expensive and wasteful of the limited available space in the push button box. By monitoring the motor current, which is also linearly related to the motor torque, it is possible, with this embodiment, to apply a compensatory feedback by increasing the applied voltage and thus the current as the load increases.

A further safety requirement of this equipment is that the tactile indicator should cease rotation if the load torque exceeds a specified limit. In order to achieve this the embodiment of the invention monitors the motor current, limiting it and therefore the torque to a safe maximum level by reducing the applied voltage appropriately.

Since the required rotational speed of the tactile indicator is very low (60 r.p.m.), it will normally be necessary for a gear box to be used so that the motor can be run at a reasonable speed. In this case all torque and speed controls will be scaled accordingly.

In the drawing a power supply unit 10 which is arranged to be connected to the A.C. mains, provides a D.C. supply to a motor 11 which is arranged to drive the tactile indicator

(not shown). The supply 10 includes a voltage stabiliser circuit 10' in the positive rail to the remainder of the circuit.

Interposed between the motor 11 and the power supply unit 10, are a motor supply voltage regulator 12 and a motor current sensor 13. The motor supply voltage regulator 12 which comprises transistor TR1, operational amplifier OA1 and zener diode ZD1, is arranged to stabilise the supply voltage to the motor 11, so that it runs at a desired constant speed in the "off-load" condition. The voltage regulator operates in known manner per se with the zener diode ZD1 providing the stabilising element.

The current sensor 13 which comprises operational amplifier OA3 and a measuring resistor 20 is arranged so that the inputs of the operational amplifier sense the voltage drop across the resistor 20, and thus the current flowing to the motor, and give an output along the feedback line 14. The feedback line 14 is connected to the negative input of operational amplifier OA2 which is interposed between the operational amplifier OA1 and TR1 of the voltage regulator 12. Thus the drop in voltage across the resistor 20 is utilised to provide a control feedback to the voltage regulator thus to control the current flowing through the motor 11. If the current increases, indicating that the motor is being closed down by a user touching the indicator, then the supply voltage is increased to compensate.

The output of operational amplifier OA3 is also connected to the positive input of operational amplifier OA4. The negative input to this operational amplifier is supplied with a reference voltage established by zener diode ZD2. The output of this operational amplifier is connected by way of a diode D1 to the positive input of operational amplifier OA1. Thus operational amplifier OA4 monitors the level of the feedback correction provided by operational amplifier OA3, and when this exceeds a predetermined level as set by zener diode ZD2 and which corresponds to a desired maximum torque to be available at the motor 11, it will drag down the reference voltage set by zener diode ZD1 thus reducing the voltage applied to the motor 11 to limit the available torque.

In order that the operation of the motor 11 may be interlocked with other items associated with a pedestrian crossing, two interlock means are provided. The first of these is a pair of relay contacts INT1 on the relay INT controlled by a transistor TR2 in response a signal on input 21. The second interlock is provided by transistor TR3 also controlled by an input signal on the input 21. It can be seen that either of these interlocks may be used to inhibit the operation of the motor 11 in chosen circumstances.

CLAIMS:

1. A control system for a D.C. electric motor provided to drive a rotary tactile indicator for use by blind persons, comprising means to limit and maintain the current supplied to the motor to a chosen maximum value thus to define and maintain a maximum torque which the motor can supply.

2. A control system as claimed in Claim 1, comprising means for sensing the current flowing through the motor and for increasing the applied voltage across the motor in response to an increase in motor current.

3. A control system as claimed in Claim 1 or 2, comprising means to stabilise the supply voltage to the motor in the "off load" condition of the motor.

4. A control system as claimed in Claim 1, 2 or 3, comprising means to control the speed of said motor to a chosen value under varying applied torque conditions.

5. A control system as claimed in Claims 3 or 4, in which said means for stabilising the supply voltage to the motor comprises a first operational amplifier the positive input of which is connected to a stabilised voltage source and the output of which is connected to the base of a transistor connected in series in the supply line to the motor.

6. A control system as claimed in Claim 5, in which said means to sense the current flowing through the motor comprises a second operational amplifier connected with its

inputs responsive to the voltage drop across a fixed value resistor in series in the supply line to the motor and with its output connected by a feedback line to the negative input of a third operational amplifier the positive input of which is connected to the output of the first operational amplifier and the output of which is connected to said base of said transistor.

7. A control system as claimed in Claim 5, in which said means for limiting torque comprises a fourth operational amplifier the negative input of which is connected to a further stabilised voltage source, the positive input of which is connected to said feedback line, and the output of which is connected to the positive input of said first operational amplifier.

8. A control system as claimed in any preceding Claim, comprising interlock means in series with the motor whereby the operation of the motor may be interlocked with the operation of other items.

9. A tactile indicator for use at a pedestrian crossing including a D.C. electric motor arranged to drive a rotary indicator and a control system for that motor as claimed in any one of the preceding Claims.

10. A control system for a D.C. electric motor substantially as herein described with reference to the accompanying drawing.

11. A tactile indicator substantially as herein described with reference to the accompanying drawing.

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