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Birkin

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[54] **TRACK TO TRAIN COMMUNICATION SYSTEMS**

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[52] **U.S. Cl.** ..... **178/17.5,** 246/167 R, 340/47

[51] **Int. Cl.** **B61l 3/08**

[58] **Field of Search** ..... 178/43, 63, 49, 3, 17.5; 179/82, 5 R, 5 P, 18 BB, 90 BB; 340/47, 48, 173 SP, 263, 23, 24, 365 S, 172.5, 173 R; 246/187 C, 187 B, 63, 8, 167 R, 174, 175

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[57] **ABSTRACT**

A transmitter for use in signalling systems for example in track to train communication systems for transmitting information in digital code. The transmitter comprises a plurality of read-only memories each having a stored information content related to a respective state of a variable. Control means are responsive to the state of the variable for causing the output of the one of the read-only memories related to the prevailing state of the variable to be transmitted by the transmitter.

2 Claims, 2 Drawing Figures

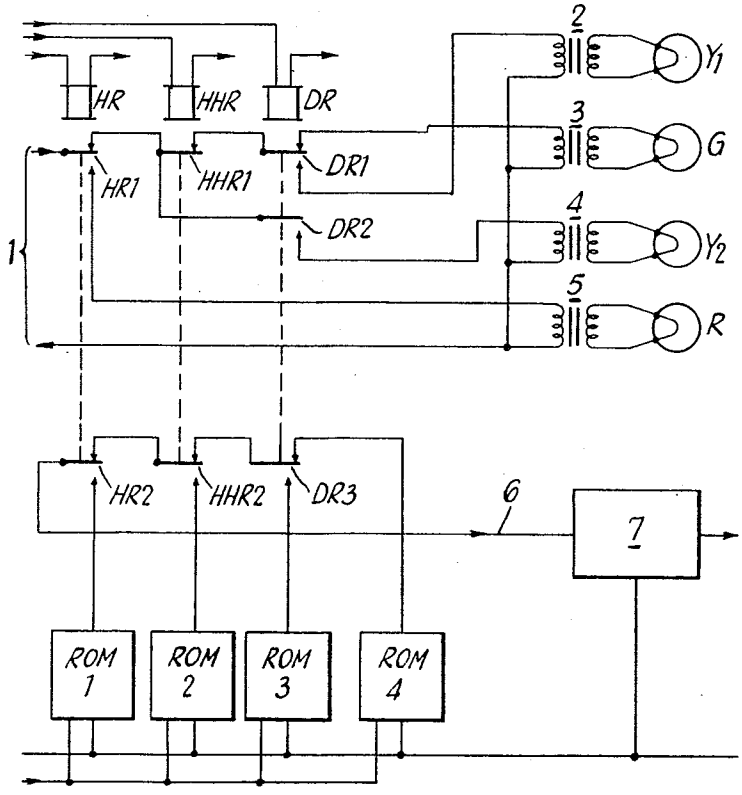
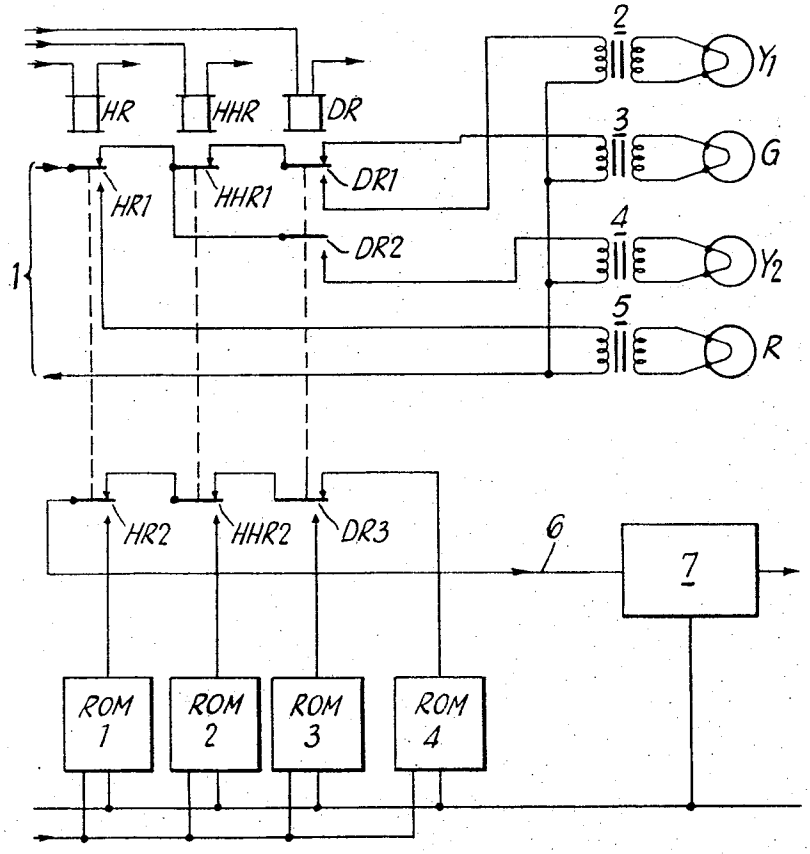


FIG. 1


HR
HHR
DR
HR1
HHR1
DR1
DR2
HR2
HHR2
DR3
1
2
3
4
5
6
7
Y1
G
Y2
R
ROM 1
ROM 2
ROM 3
ROM 4

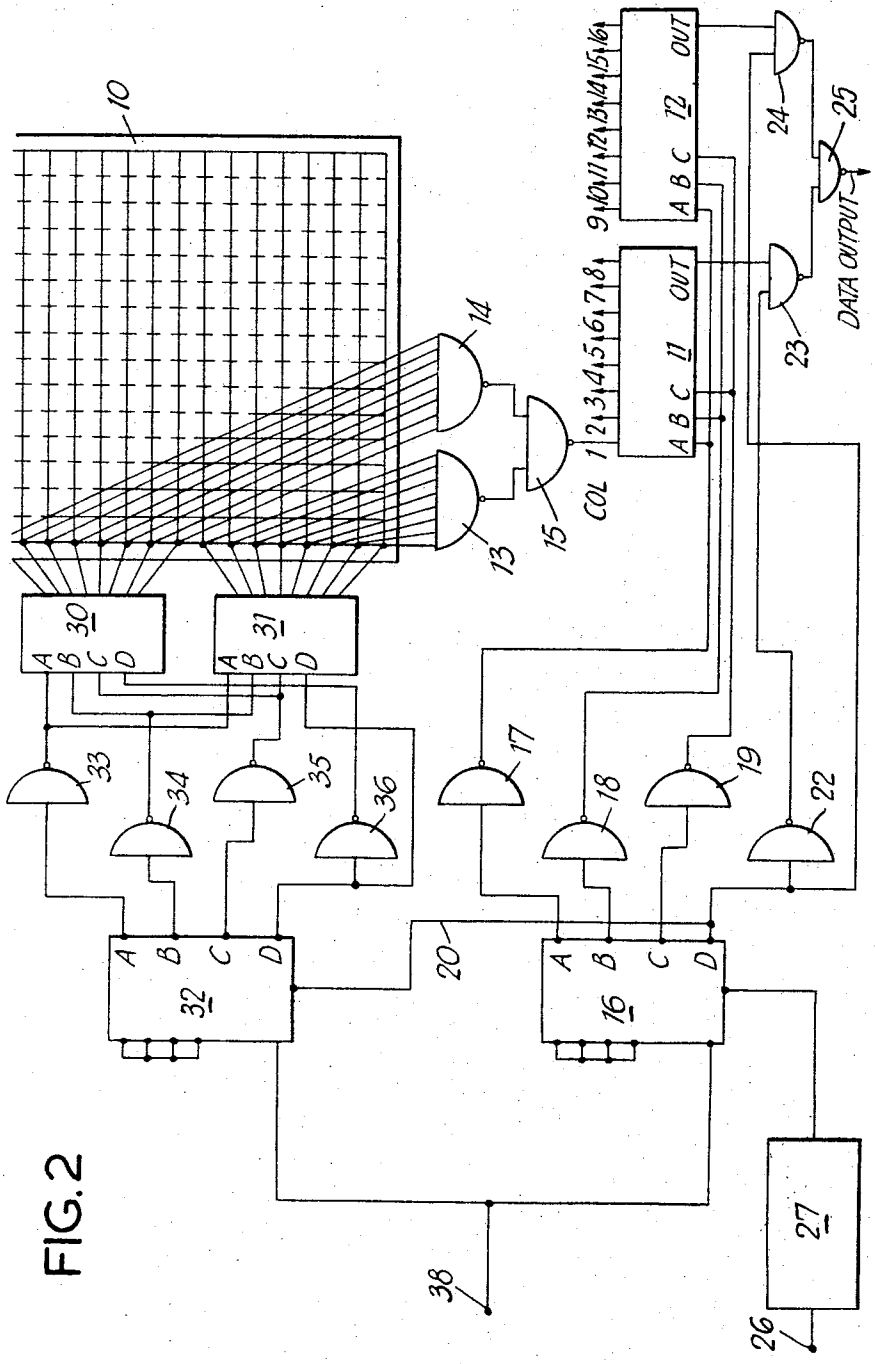

10
14
13
15
COL 1
2 3 4 5 6 7 8
A B C 11 OUT
9 10 11 12 13 14 15 16
A B C 12 OUT
24
25
DATA OUTPUT
23
30
31
A B C D
33
34
35
36
17
18
19
22
20
32
16
27
38
26

FIG. 2

TRACK TO TRAIN COMMUNICATION SYSTEMS

The present invention relates to transmitters for use in a signalling system in which information is transmitted in digital code.

The invention is more particularly, but not exclusively, applicable to track to train communication systems but also has application for example in telemetering systems.

In track-to-train communication systems, information in the form of a digital track telegram is conveyed from a trackside transmitter to a train in order to control the running of the train by giving command signals to the train driver or by automatically actuating the train control gear. The information may be relayed from the transmitter through conductors laid along the track and which become inductively coupled with aerial means on the train, the aerial means in turn feeding a decoding receiver on the train. The track telegram may have for example an information content which is used by equipment on the train to calculate the maximum permissible speed of the train for presentation to the train driver as a visual display.

Track telegrams have an information content, part of which is constant for the particular block section to which it is applicable. This constant information can be termed geographical information and for example comprises the distance to signals, gradient information and sections of the track in which speed restrictions are imposed. The remaining part of the information content of the track telegram is variable information related to the prevailing signal aspect which represents traffic conditions ahead of the train and dependent upon the track occupation by trains ahead. The information content of the track telegram will therefore vary in dependence upon the prevailing signal aspect ahead of the train.

At the present time there are normally four signal aspects, green, double yellow, yellow and red, although additional signal aspects may be used. The colour terminology for signal aspect has been used for convenience but it will be appreciated that, particularly in the case of automatic train control, the signal aspect may be represented by electric signals.

The object of this invention is to provide a transmitter in which digital encoding of information does not have to take place each time there is a change in the state of a variable such as signal aspect, controlling the information content. Since, in the case of track telegrams of track-to-train communication systems, digital encoding will normally include parity checking bits which have been permanently written in the track telegram, there will be permanent correlation between the information bits and parity checking bits for detecting errors. This follows from the fact that since the message is permanent, the parity bits will be permanent as well; thus avoiding possible errors in encoding.

According to this invention, a transmitter for use in signalling systems for transmitting information in digital code, comprises a plurality of read-only memories each having a stored information content related to a respective state of a variable, and control means respective to the state of the variable for causing the output of the one of the read-only memories related to the prevailing state of the variable to be transmitted by the transmitter.

By the term "read-only memory" is meant a permanent information store, that is to say a store whose information content is not updated during interrogation. One known form of "read-only" memory comprises a diode matrix, in which the information content is writen into the store by inserting diode pins at selected junctions, the presence of a diode at a junction representing say a '**0**' and the absence of a diode then representing a '**1**' in conventional binary code.

In order that the invention may be readily understood, a transmitter in accordance with the invention and as applied to a railway track-to-train communication system will now be described by way of example with reference to the accompanying drawings, in which:

FIG. **1** shows a circuit diagram of the transmitter and associated control equipment, and

FIG. **2** shows one of the read-only memories of the transmitter in more detail.

The system will be described as applied to one block section of a railway track having a set of four aspect visual signals. The object of the invention is to transmit a track telegram to the train concerning geographical features of the track in the block section which is fixed information and also signal aspect information which will inform the train of the prevailing signal aspect at the time the track telegram is transmitted. Thus, for example, if the track telegram is transmitting a telegram which in content will provide the train with a maximum permissible speed, this will be different for each signal aspect.

The visual signals referenced Y_1, G, Y_2 and R are illuminated from an alternating current power source **1** through transformers **2, 3, 4** and **5.** The selection of the signal to be illuminated is controlled by three relays or indicating means HR, HHR and DR, the energisation of which is controlled by trackside signalling equipment in known manner. In the circuit between the power source **1** and the signals, relay HR has contacts **HR1,** relay HHR has relay contacts HHR1 and relay DR has contacts DR1 and DR2. The position of these contacts is shown for the energised condition of the relays. With all three relays energised, visual signal G is illuminated to provide a green signal aspect. With relays HR and HHR energised and relay DR de-energised, signals y_1 and Y_2 are illuminated to provide a double-yellow signal aspect. With relay HR energised and relays HHR and DR de-energised, signal Y_2 is illuminated to provide a yellow signal aspect. With relay HR de-energised, signal R is illuminated to provide a red signal aspect.

The telegram transmitter comprises four read-only memories **ROM1, ROM2, ROM3** and **ROM4** connected through contacts **HR2, HHR2** and **DR3** of relays HR, HHR and DR to data output line **6** which via a modulator **7** feeds the track conductors or equivalent track circuit through which communication is established with a train in the block section. The position of contacts **HR2, HHR2** and **DR3** is shown for the energised condition of their associated relays. It will be seen therefore that for a green signal aspect read-only memory **ROM4** is connected to the data output line **6**; for a double yellow signal aspect, read-only memory **ROM3** is connected to the data output line **6**; for a yellow signal aspect, read-only memory **ROM2** is connected to the data output line **6**; and for a red signal aspect, read-only memory **ROM1** is connected to the

data output line **6.** Thus for each signal aspect, the contents of a respective one of the read-only memories ROM1 to ROM4 will be fed to the data output line **6** and will be continually and serially transmitted via the modulator **7** to the track circuit.

Read-only memories and systems for their interrogation are well known. However one form of read-only memory and its interrogating system will now be briefly described with reference to FIG. **2.**

The read-only memory produces a 256 bit binary sequence. The pattern is determined by the position of diode pins in a 16 + 16 matrix board **10.** Thus, depending upon the convention adopted, the presence of a diode pin at a junction will, say, represent a 0, and the absence of a diode pin will represent a 1.

The matrix is scanned electronically by placing a 0 on one of the horizontal rows while the other **15** rows are held at the 1 level. Each column is then selected in turn by an electronic switch to detect if there is a diode pin at the junction between the row with a 0 applied to it and the selected column. When all the columns have been examined, the next row is selected and the process repeated.

The column selector switch consists of two eight-way multiplexers **11** and **12.** Each multiplexer input is connected to each row of a respective column by means of a 16 input AND gate made from two eight input NAND gates **13** and **14** and a NOR gate **15.** The column to which each multiplexer is connected is determined by the states of the inputs A, B and C. Each multiplexer is made to scan its eight inputs by cycling the three inputs A, B and C with the outputs from the first three stages of a four stage ripple counter **16** via buffer gates **17, 18** and **19.** The fourth stage of the counter **16** is used to switch between the two multiplexers **11** and **12** using gates **22, 23, 24** and **25** and to drive the row selector via line **20.**

The ripple counter **16** and hence the multiplexers **11** and **12** change on negative going edges of clock input **26** which is shaped by a Schmitt trigger circuit **27.**

For row selection, a 0 is cycled around the **16** outputs of two binary to octal decoders **30** and **31** by a four stage ripple counter **32.** Each of the outputs of the decoders **30** and **31** is connected to a respective row of the matrix **10.** Buffer gates **33** to **36** are included between the counter **32** and the decoders **30** and **31** to prevent spurious signals generated by the decoders **30** and **31** from resetting the counter **32.**

The counters **16** and **32** are shown as having a synchronisation input **38,** but this is optional.

There are several other ways in which the read-only memories can be controlled so that the read-only memory related to the prevailing signal aspect is providing the track telegram: For example, the relay contacts HR2, HHR2 and DR3 may be provided in the respective clock inputs to the read-only memories or in the respective power supply leads to the read-only memories.

We claim:

1. In a track-to-train communication system for transmitting information to a train related to the control of the running of the train in dependence upon the prevailing one of a plurality of signal aspects,

signal indicating means controlled to one of a plurality of conditions to indicate a prevailing one of a plurality of signal aspects,

a transmitter, having an output, for transmitting said information in digital code and comprising a plurality of non-destruct read-only memories each having stored therein information related to a respective one of a plurality of signal apsects,

and control means responsive to said indicating means for causing information stored in the one of the read-only memories related to the prevailing signal aspect to be transmitted.

2. The system of claim **1** wherein all said read-only memories are simultaneously active and said control means comprises switching means for connecting the output of the one of the read-only memories related to the prevailing signal aspect to said output circuit of said transmitter.

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