CIRCUIT ARRANGEMENT TO SUPERVISE AN M-OUT-OF-N CODE

Filed June 22, 1966 2 Sheets-Sheet 1

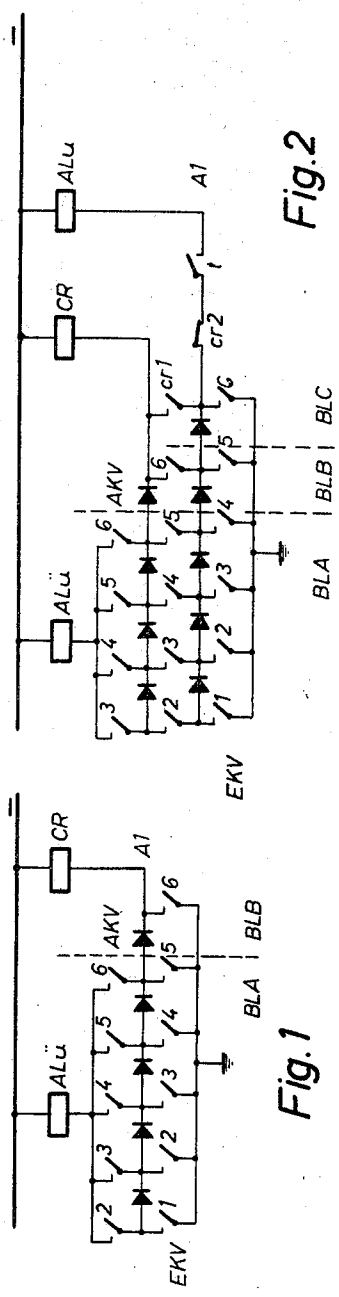

Fig.2

Fig.1

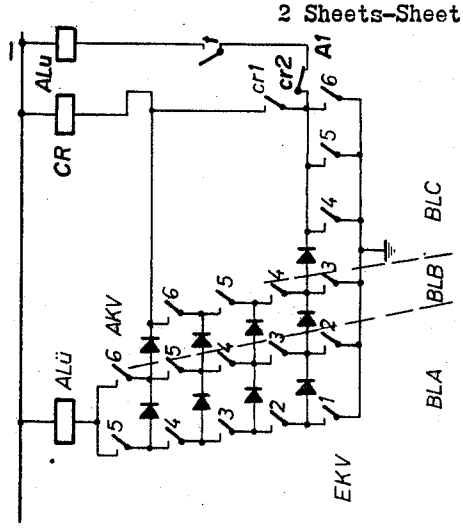

Fig.4

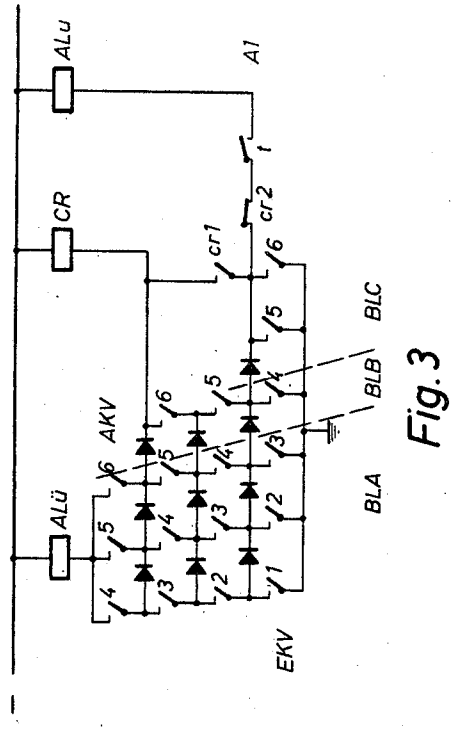

Fig.3

CIRCUIT ARRANGEMENT TO SUPERVISE AN M-OUT-OF-N CODE

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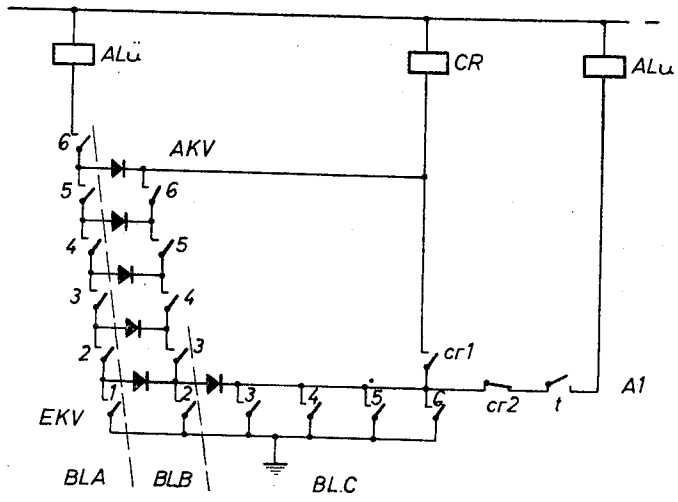

Fig.5

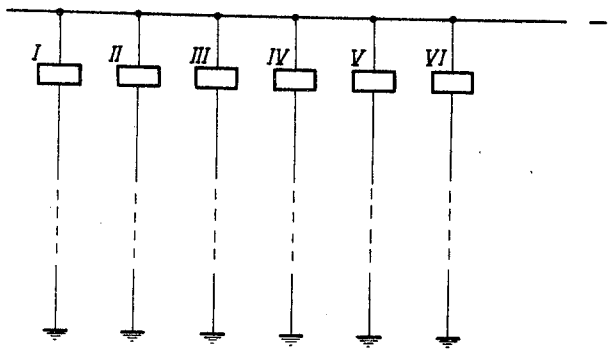

Fig.6

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3,496,537

CIRCUIT ARRANGEMENT TO SUPERVISE AN M-OUT-OF-N CODE

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U.S. Cl. 340—146.1
5 Claims

ABSTRACT OF THE DISCLOSURE

A circuit arrangement consisting only of make contacts and diodes is provided to check an *m*-out-of-*n* code.

The invention relates to a circuit arrangement to supervise an *m*-out-of-*n* code in which arrangement a code relay is provided for each of the *n*-code elements.

In supervising circuits known for checking coded information items contacting pyramids are shown, consisting of make- and break-contacts of the code relays, requiring a considerable expenditure of contacts.

It is a primary object of the invention to provide a circuit arrangement enabling code supervision with a minimum expenditure of contacts, but being generally applicable.

This and other objects are achieved by embodiments of the invention employing $(m+1)$ contact multiples, formed by the make-contacts of the code relays. In a preferred embodiment, the make-sides of all contacts, except those of the input contact multiple, are decoupled through rectifiers, and the make-sides of the input contact multiple are connected to the control potential and the output of the output contact multiple is connected with the control winding of an alarm relay.

Besides the small expenditure of contacts, one advantage of the invention arises from use of make-contacts. The use of make-contacts is especially valuable for circuitry techniques using reed contact relays. In a suitable embodiment, explained below, all supervising functions can be obtained, such as the indication of completeness and an alarm in case of excessive determination or incomplete determination of the code. The invention is in detail explained with the aid of the accompanying drawings.

The FIGS. 1 to 5 show examples for an *m*-out-of-6 code and FIG. 6 shows an arrangement of code relays.

The contact arrangements of FIGS. 1 to 5 are subdivided into blocks A, B, C.

Block A shows the contact arrangement as far as it serves to determine an excessive definition of the code. Each contact multiple contains $(n-m)$ contacts and starts, always staggered by one contact. For example, as illustrated in FIG. 3, in a 3-out-of-6 code the first multiple contains the three contacts **1**, **2**, **3**, the second multiple the contacts **2**, **3**, **4**, the third multiple the contacts **3**, **4**, **5**, and the last multiple $[(m+1)-te]$ the contacts **4**, **5**, **6**.

By adding the block B, an indication of code completeness is possible; the contact multiples are always formed by $[(n+1)-m]$ contacts, for example, the input contact multiple now contains the contacts **1**, **2**, **3**, and **4**; but the output contact multiple remains unchanged.

If the circuit arrangement is extended by the part shown in block C the incomplete definition of an *m*-out-of-*n* code is indicated.

The input contact multiple now contains always one contact of each code relay.

FIG. 1 shows the supervision of a 1-out-of-6 code. The

input contact multiple is connected to the control potential (in the example, ground potential) with the make-sides of the contacts **1** to **6** and the supervising relay CR is connected with the output A1. The incomplete definition in the special case of a 1-out-of-*m* code is possible only with a time supervising circuit, not shown on the drawing. If a code element is given, the corresponding code relay (e.g. III), shown in FIG. 6, is energized and its contacts, e.g. **3**, are closed. The alarm relay AL*u* cannot be energized, because both contacts **3** of the input and output contact multiple, respectively, are decoupled via a rectifier. In case of an excessive code definition, if, for example, two code relays are energized, e.g. II and IV, the rectifier inserted between the contacts **2** and **4** is operated in the conductive direction and the alarm relay AL*u* responds, relay CR is energized simultaneously. If its response in case of an excessive definition of the code should be prevented it is only necessary to insert into the control circuit of relay CR a break-contact of the alarm relay AL*u*. An extended supervising facility is shown in the FIGS. 2 to 5. The number of contact multiples is increased in compliance with the formation law $(m+1)$.

The input contact multiple EKV contains, in all the illustrated circuit arrangements, 6 contacts (corresponding in the general case of *n* contacts). This means that a contact from each of the 6 code relays (in the general case N code relays) is present in the input contact-multiple. At the output A1 of the contact multiple EKV an alarm relay AL*u* is connected via a break-contact *cr***2** of relay CR and a make-contact *t* of a conventional time supervising circuit, not shown on the drawing, in contrast to the circuit arrangement for the 1-out-of-6 code. If less than *m* code elements are given (but never less than 1 code element), the relay CR which is connected to the output of the *m*-th contact multiple is not energized and, after a predetermined period, the alarm relay AL*u* is excited.

If *m* code elements exist relay CR responds, thereby indicating the completeness of the code; the relay CR is held energized via an intrinsic make-contact, arranged between the outputs of the first (EKV) and the *m*-th contact multiple, until the last code element has been read out, i.e. as long as a code relay is still energized. Processes may depend from this measure which are not in direct connection with the idea of the invention. The excessive code definition is supervised in the way described for FIG. 1.

In the input contact multiple the rectifiers are superfluous in cases where no connections to the following contact multiple exist.

While the principles of the invention have been described above in connection with specific apparatus and applications, it is to be understood that this description is made only by way of example and not as a limitation on the scope of the invention.

What is claimed is:

1. A circuit for supervising an *m*-out-of-*n* code, where *m* and *n* are integers, comprising

N code relays where N=*n*,

$(m+1)$ contact multiples, including an input contact multiple and an output contact multiple formed by make contacts of said code relays,

means, including rectifier decoupling means, connected to interconnect contacts of adjacent contact multiples and to allow current flow in one direction through closed contacts,

means connecting make-sides of the contacts of the input contact multiple to a control potential,

an alarm relay, and

means connecting the outputs of the output contact multiple with the control winding of the alarm relay.

2. A circuit for supervising an m-out-of-n code substantially as claimed in claim **1**, in which

each contact multiple includes $(n-m)$ make-contacts,

the input contact multiple starts with a contact of the first code relay, and

the output contact multiple ends with a contact of the nth code relay, and the contacts of the first code relay and of the nth code relay occur once for each relay.

3. A circuit for supervising an m-out-of-n code substantially as claimed in claim **1**, in which

the first through the mth contact multiples include $(n+1-m)$ make contacts, and

the m-th contact multiple connects through an output terminal to a switching means.

4. A circuit arrangement for supervising an m-out-of-n code substantially as claimed in claim **3**, including

a second alarm relay,

the input contact multiple including n make-contacts of the code relays, and

means connecting said n make-contacts via a break-contact of said switching means and via a make-contact of the time supervising circuit to the alarm relay.

5. A circuit arrangement for supervising an m-out-of-n code substantially as claimed in claim **4**, in which

the switching means, once operated, remains energized via contacts of the input contact multiple and via a make contact of said switching means until the code relays are released.

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