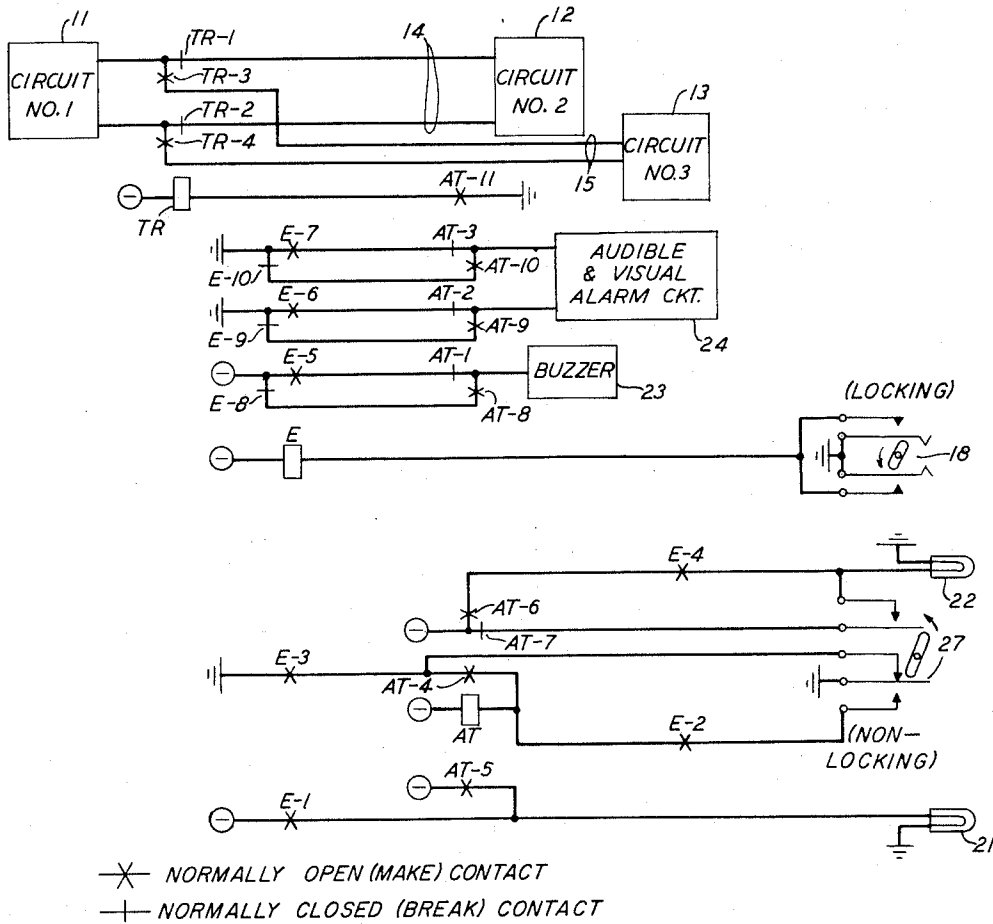


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EMERGENCY TRANSFER CIRCUIT

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EMERGENCY TRANSFER CIRCUIT

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This invention relates to a switching circuit and more particularly to an emergency transfer circuit.

In various types of systems, particularly in communication systems, it is often found desirable to provide arrangements whereby a circuit, or group of circuits, normally connected to one point may readily be switched to a second point or connection. Such arrangements may be desirable, for example, in program channel switching systems in connection with radio and television broadcasting. Also, in certain types of telephone systems it is desirable to provide such an arrangement whereby upon occurrence of an overload condition or other emergency, a group of lines or trunks normally connected over a first path may quickly be transferred to a second point over a second path.

In such situations as those mentioned above it is, of course, desirable that the switching or transfer means be capable of quick and uncomplicated operation. However, it is at the same time apparent that inadvertent and accidental operation must be guarded against so far as possible, in order that established communication channels may not be unnecessarily interrupted or that special conditions reserved for emergency situations not be activated in the absence of an actual emergency. In many instances it is equally important that, after the transfer operation has been completed, inadvertent or premature return of the circuits to their normal condition be guarded against.

Accordingly, it is an object of my invention to improve the arrangement and operation of transfer circuits.

A more specific object of my invention is to guard against accidental or inadvertent operation of a transfer circuit.

A still further object of the invention is to guard against the accidental premature return to normal condition of a transfer circuit subsequent to its operation.

Yet another object of the invention is to alert attendants to the initiation of a transfer operation before the transfer has actually been completed.

In accordance with a specific embodiment of the invention, the switching arrangement includes two switches, a transfer switch and an alarm cutoff switch; a transfer can be effected only by operation in proper sequence of first, the transfer key which is a locking type key and, second, the alarm cutoff key which is a nonlocking type key. Operation of the transfer key alone partially prepares, but does not complete, the transfer; this operation causes the actuation of audible and visual "alerting" signals whereby, if the operation was accidental or inadvertent, the key can be immediately restored to non-operated condition. However, if it is desired to actually complete the transfer, the alarm cutoff key is operated, while the transfer key remains locked in operated position, this being effective to complete the transfer and discontinue the above-mentioned alarms. The actual transfer is effected by operation of a transfer relay. The arrangement is such that the guarding action is also effective, in a generally similar manner, after a transfer has been effected, to guard against an unintended and premature restoration of the circuit to its original condition.

A feature of the present invention is the provision of alerting alarms which are actuated following the initial key operation and before the transfer operation has actually been completed.

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A further feature of the invention is a novel combination of a locking key and a nonlocking key, each with associated circuitry, whereby to attain the desired multiple function guarding and transfer operations.

A still further feature of the invention is a novel locking circuit for a relay included in the transfer circuit which is an essential factor in the desired multiple function performance thereof.

A full understanding of the arrangement contemplated by the present invention as well as an appreciation of the various advantageous features thereof may be gained from consideration of the following detailed description in connection with the accompanying drawing which shows one specific illustrative embodiment of the invention in a circuit transfer arrangement.

The drawing utilizes the so-called "detached contact" representation of relays and relay contacts wherein, generally speaking, the contacts are shown separated from the relay windings, suitable designations being provided to properly indicate the association between the respective contacts and their control windings. This type of disclosure permits functional groups of circuitry to be shown separately, thereby facilitating an understanding of the operational features embodied in the system. Normally open, or "make," contacts are represented by an X with proper identifying designation, and normally closed, or "break," contacts are represented by a short, straight line with proper identifying designation.

Referring now to the drawing, "Circuit No. 1," "Circuit No. 2" and "Circuit No. 3" are indicated by respective boxes 11, 12 and 13. The terms are illustrative only, and are intended to comprehend single circuits or lines, or groups of circuits or lines, normally connected to other circuits, lines or terminals, and transferable on occasion to another circuit, line or terminal. Just by way of example, "Circuit No. 1" may represent a telephone switchboard, "Circuit No. 2" a group of automatic telephone lines and "Circuit No. 3" a group of manual telephone lines.

As shown, circuit No. 1 is normally connected through break contacts TR-1 and TR-2 of relay TR to line 14 and thence to circuit No. 2, while line 15, which leads to circuit No. 3 is normally "open" at make contacts TR-3 and TR-4 of the same relay. It will be assumed that on occasion, for example on occurrence of an overload or other emergency, it becomes desirable to transfer circuit No. 1 over line 15 for connection to circuit No. 3; as will be described in detail subsequently this transfer is effected when transfer relay TR operates.

Let it be assumed first that transfer key 18, a locking key, be operated, either through accident or inadvertence, or deliberately in order to initiate a transfer. Operation of key 18 completes an obvious path through its upper and lower make contacts for operation of relay E. (While key 18 is shown with twin contacts for more positive operation, it will be understood that only a single make contact may be provided.)

Relay E, operated, completes at its E-1 make contact an energizing path for lamp 21, which is assumed to be "green"; partially completes at its E-2 make contact an operating path for relay AT, partially completes at its E-3 make contact a holding path for relay AT and partially completes at its E-4 make contact an energizing path for lamp 22 which will be assumed to be "white." Also, relay E upon operating completes a path through its make contact E-5 and break contact AT-1 of relay AT for operation of buzzer 23 and respective paths through its make contact E-6 and break contact AT-2 of relay AT and through its make contact E-7 and break contact AT-3 of relay AT for energization of audible and visual alarm circuit 24.

Indication of the operated condition of transfer key

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18 is now supplied at various locations by the lighting of lamp 21, by the sounding of buzzer 23 and by the actuation of the audible and visual alarm circuit 24. The actual transfer operation has not yet taken place and, obviously, if transfer key 18 has been operated accidentally or through inadvertence or misunderstanding, persons now alerted to the situation by the above referred to alarms can take steps to have the transfer key restored to normal, unoperated position. Assuming, on the other hand, that a transfer is actually desired, alarm cutoff key 27 (nonlocking) is momentarily closed, or operated, while transfer key 18 is still locked in operated position.

When key 27 is closed an obvious operating path for relay AT is completed through make contact E-2 of relay E and the lower make contact of key 27; relay AT upon operating locks over a holding path to ground through its own make contact AT-4 and make contact E-3 of relay E. (It is noted that when key 27 restores to normal position another holding ground for relay AT is then found on the break contact of key 27.)

Relay AT, operated, completes at its AT-5 make contact a shunt path for energizing lamp 21 (already lighted when relay E operated) and completes at its AT-6 make contact the path previously partially set up at make contact E-4 of relay E for energizing lamp 22. (Lamp 22 was lighted through break contact AT-7 of relay AT and the upper make contact of key 27 when key 27 was first closed and before relay AT operated.) Relay AT upon operating also interrupts at its AT-1 break contact the operating path for buzzer 23, which is silenced, and also interrupts at its break contacts AT-2 and AT-3 the energizing path for the audible and visual alarm circuit 24 and these alarms are thereby deactivated. A shunt path for subsequent operation of buzzer 23 is partially established at make contact AT-8 of relay AT, and shunt paths for subsequent reactivation of audible and visual alarm circuit 24 are partially completed at make contacts AT-9 and AT-10 of the same relay.

Relay AT, operated, also completes at its AT-11 make contact an obvious operating path for transfer relay TR; transfer relay TR operates and interrupts at its break contacts TR-1 and TR-2 the connection of circuit No. 1 over line 14 to circuit No. 2 and at the same time completes at its make contacts TR-3 and TR-4 a transfer connection of circuit No. 1 over line 15 to circuit No. 3.

The desired transfer has now been achieved by a simple operation in proper sequence of first, the locking key 18 and second, the nonlocking key 27 which need be closed only long enough to lock up relay AT. The alerting alarms are silenced but both the "white" lamp 22 and the "green" lamp 21 remain lighted.

Return of the system to its original condition will of course become desirable in due course, but in most instances it is essential here again that a premature or accidental switching operation be guarded against; this desirable feature is provided by the novel arrangement of the present invention. Let us assume first that transfer key 18 is moved to nonoperated, or open, position either accidentally or in a deliberate step in retransferring the connection of circuit No. 1 to circuit No. 2.

When key 18 is opened the path over which relay E was operated, and held, is interrupted and relay E thereupon releases; the resulting action is similar to that described above following the first operation of the key. The path for operation of buzzer 23 is completed at break contact E-8 of relay E (having been partially set up by operation of relay AT) and the paths for energizing audible and visual alarm circuit 24 are completed at break contacts E-9 and E-10 of relay E (having also been partially set up by operation of relay AT). The office attendants are thus alerted to the change in condition of key 18 as before. Lamp 22 is dark as its energizing path is opened at make contact E-4 of relay E

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but lamp 21 remains energized over the shunt path through make contact AT-5 of relay AT.

Relay AT remains operated since, while the path to holding ground through make contact E-3 of relay E is now interrupted, the alternate holding path to ground on the break contact of key 27 prevails. Since relay AT holds operated over this alternate holding path, relay TR also holds operated and the transferred connection is held. As before, the attendants, alerted by the alarms, may restore key 18 to closed position if there be indication of faulty procedure.

Now, if a retransfer or restoral to the original connection actually be desired, key 27 is moved to operated or closed position; this interrupts at the break contact of the key the path over which relay AT was held following release of relay E, and relay AT thereupon releases. Relay AT, released, interrupts at its AT-11 make contact the path over which relay TR operated and was held, and relay TR thereupon releases.

Relay TR, released, interrupts at its make contacts TR-3 and TR-4 the transfer connection of circuit No. 1 over line 15 to circuit No. 3 and restores at its break contacts TR-1 and TR-2 the original connection of circuit No. 1 over line 14 to circuit No. 2.

When relay AT released, the energizing path last established for buzzer 23 was interrupted at make contact AT-8 while, at the same time, the energizing paths for the audible and visual alarm circuit 24 were interrupted at make contacts AT-9 and AT-10. Lamp 21 is now dark as the alternate energizing path is open at make contact AT-5 of relay AT. The circuits are now in normal condition and the alarms are inactive.

The novel arrangement contemplated by the invention provides for readily testing the lamps, 21 and 22, on a routine basis without actually effecting a circuit transfer. For example, with key 27 normal, operation of transfer key 18 should result in lamp 21 lighting assuming the lamp and associated line are in proper operating condition. Similarly, after key 18 has been restored, operation of key 27 should light lamp 22 if the lamp and associated line are in proper operating condition.

It will be apparent from the above description that the novel arrangement contemplated by the invention provides an easily and quickly executed circuit transfer and restoral and yet includes adequate warning if either the transfer or restoral is initiated accidentally or through mistake. An essential element in the "two-way" function of the arrangement is the dual holding path for the AT relay, which path is completed through a make contact of the E relay, while relay E is operated, or through a break contact of the nonlocking key after relay E has released. Through provision of this novel locking path the desired guarding action on the restoral step is attained whereby such restoral occurs only upon the release of the transfer key followed by opening of the alarm cutoff key. By virtue of the novel arrangement contemplated, proper sequential operation of the two keys is required either for transfer operation or restoral; operation of the nonlocking key 27 first, that is before operation of the locking key 18, is ineffective either to set up the transfer operation or the restoral operation.

While a specific embodiment of the invention has been selected for detailed disclosure, the invention is not, of course, limited in its application to the embodiment disclosed. The embodiment which has been described should be taken as illustrative rather than restrictive thereof.

What is claimed is:

1. In a switching system, a first line, a second line, a circuit normally connected to said first line, a first relay effective upon operation to transfer said circuit from said first line to said second line, and means for controlling the operation and release of said first relay, said controlling means including a second relay operation of which is effective to cause operation of said first relay, a locking

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key and a nonlocking key, a third relay operated by operation of said locking key, means including a first contact of said third relay effected only by sequential operation of said locking key followed by operation of said nonlocking key for operating said second relay, means effective upon operation of said second relay for holding said second relay operated, and means including a second contact of said third relay effected only by release of said locking key followed by operation of said nonlocking key for releasing said second relay.

2. In a switching system, a first line, a second line, a circuit normally connected to said first line, a first relay effective upon operation to transfer said circuit from said first line to said second line, and means for controlling the operation and release of said first relay, said controlling means including a second relay operation of which is effective to cause operation of said first relay, a locking key and a nonlocking key, a third relay operated by operation of said locking key, means effected only by sequential operation of said locking key followed by operation of said nonlocking key for operating said second relay, means effective upon operation of said second relay for holding said second relay operated, and means jointly under control of said third relay and said nonlocking key for releasing said second relay.

3. In a switching system, the combination defined by claim 2 further characterized in that said last-mentioned means includes two circuits to ground connected in series with the operating winding of said second relay, one of said circuits being completed through a make contact of

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said third relay and the other of said circuits being completed through a break contact of said nonlocking key.

4. In a switching system, a first line, a second line, a circuit normally connected to said first line, a first relay effective upon operation to transfer said circuit from said first line to said second line, and means for controlling the operation and release of said first relay, said controlling means including a second relay operation of which is effective to cause operation of said first relay, a locking key and a nonlocking key, a third relay operated by operation of said locking key, means effected only by sequential operation of said locking key followed by operation of said nonlocking key for operating said second relay, and a holding circuit for said second relay completed upon operation of said second relay through two parallel branches, one branch completed through a make contact of said third relay and the second branch completed through a break contact of said nonlocking key whereby release of said second relay can be effected only by sequential release of said locking key followed by operation of said nonlocking key.

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