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Catterall

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[54] **PREFERENCE LOCKOUT CIRCUIT FOR COMMON CONTROL SWITCHING SYSTEM**

[76] Inventor: **John Mason Catterall,** 1140 S. Yearling Rd., Columbus, Ohio 43227

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[58] **Field of Search** ..... 307/38, 113, 115, 134; 317/136; 246/132, 133; 340/147 LD

[56] **References Cited**

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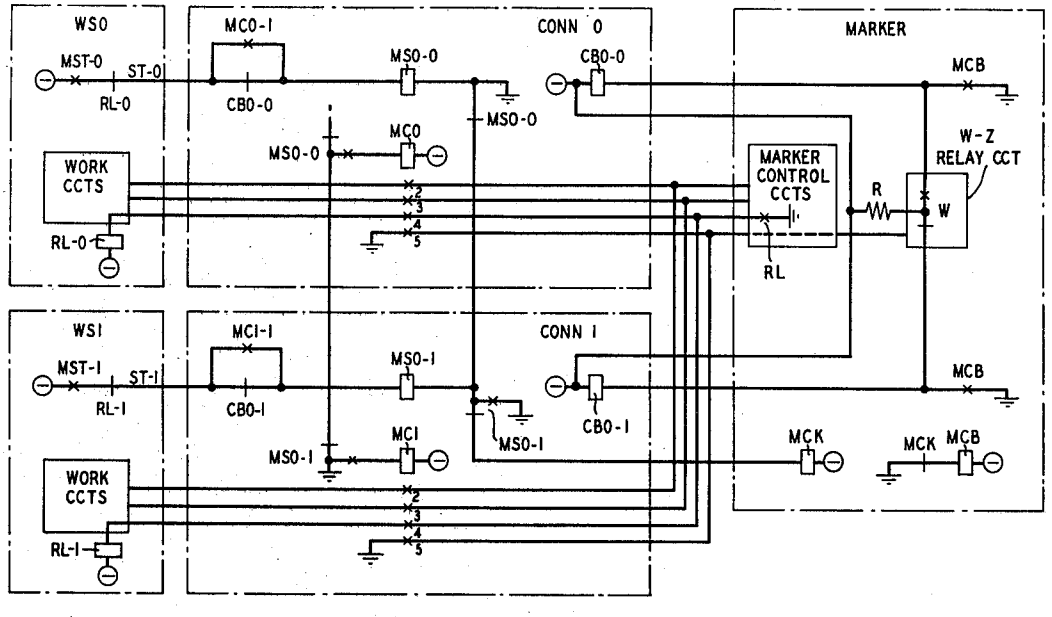
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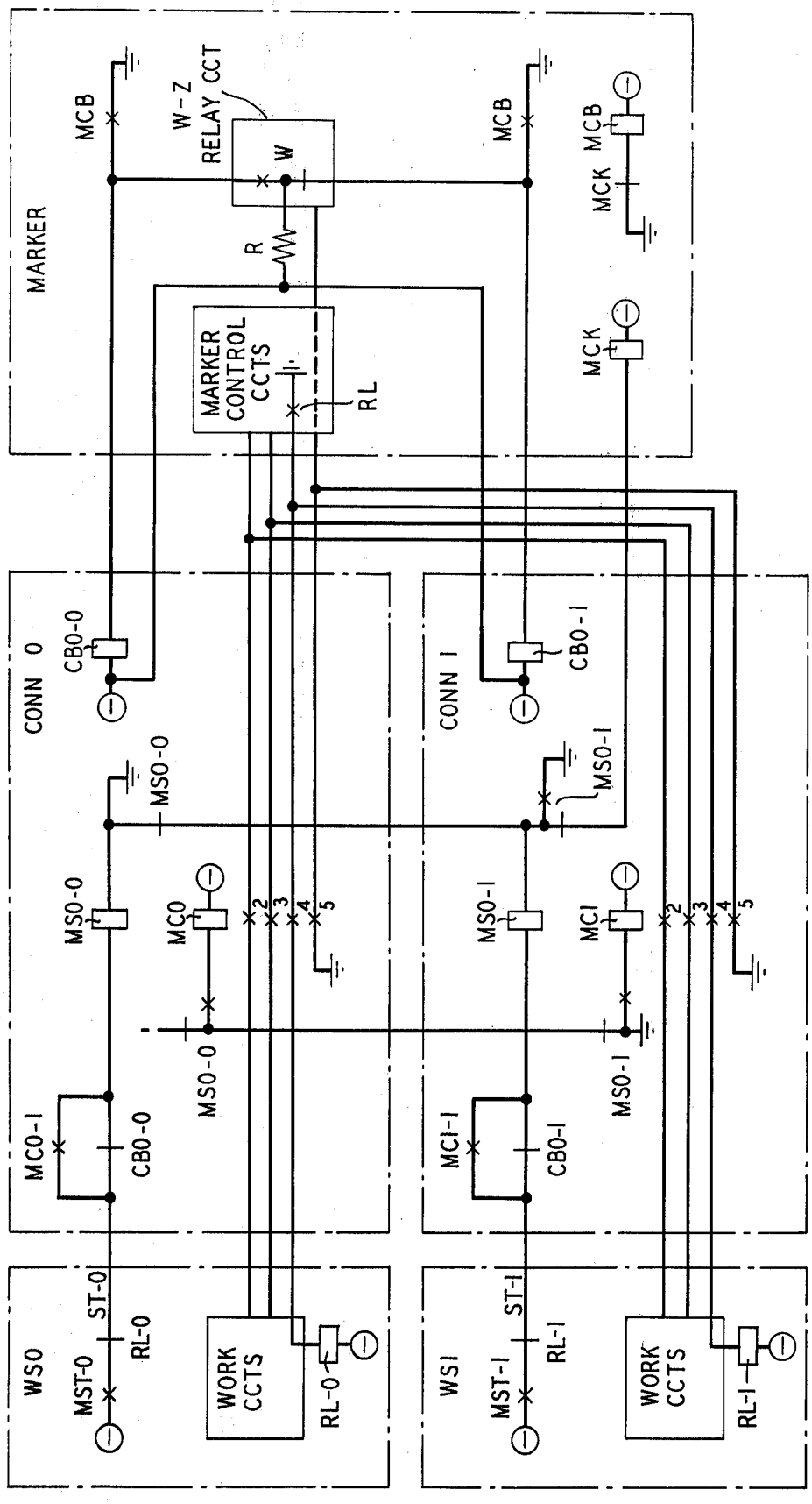
Attorney, Agent, or Firm—H. R. Popper

[57] **ABSTRACT**

A relay preference lockout circuit is disclosed for according one-at-a-time access to a plurality of circuits bidding for connection to a common circuit such as a marker. Each work circuit has a respective preference relay, the operating path for which is interruptible by another relay which can have its release time altered by a selectively switched-in shunt. Advantageously, the shunt is switched to different ones of these relays on each seizure of the common circuit.

12 Claims, 1 Drawing Figure




MARKER
MCB
W-Z RELAY CCT
W
R
MARKER CONTROL CCTS
RL
MCB
MCK
MCB
MCK
CONN 0
CB0-0
MS0-0
MS0-0
MC0
MS0-0
MC0-1
CB0-0
MS0-0
2
3
4
5
CONN 1
CB0-1
MS0-1
MS0-1
MC1
MS0-1
MC1-1
CB0-1
MS0-1
2
3
4
5
WS0
MST-0
ST-0
RL-0
WORK CCTS
RL-0
WS1
MST-1
ST-1
RL-1
WORK CCTS
RL-1

PREFERENCE LOCKOUT CIRCUIT FOR COMMON CONTROL SWITCHING SYSTEM

BACKGROUND OF THE INVENTION

This invention relates to preference lockout circuits and more particularly to preference lockout circuits in which the order of preference amongst circuits bidding for control to a common circuit may be altered.

In general, lockout circuits are employed to accord one-at-a-time access to a plurality of circuits bidding for connection to a common circuit. In telephone switching, for example, lockout arrangements are employed where a number of markers must bid for connection to a number group or where a number of registers or link frames must bid for connection to one of a group of markers. Aside from providing for one-at-a-time connection, lockout circuits are known in which the preference order amongst circuits bidding for access is changed after each usage to prevent perpetual lockout due to circuit trouble conditions.

In the well-known treatise on switching engineering entitled The Design of Switching Circuits by Keister, Ritchie, and Washburn, the subject of lockout circuits is dealt with at great length in Chapter 15. In section 15.4 there is a discussion and illustration of a circuit that permits the order of preference amongst circuits bidding for access to common circuits to be varied. In a normal preference lockout circuit, assignment of preference is fixed and is determined only by the relative positions of the preference relays. As disclosed at pp. 356–357, the preference may be reversed on alternate usages by employing a two-relay "walking circuit" or pulse divider which alternately shifts the direction over which the output provided by the chained transfer contacts of the preference is delivered to the work circuits. This arrangement requires that each preference relay include two sets of transfer contacts, one for each chain direction of output preference. In this prior art circuit if a number of preference relays are simultaneously operated only that relay which has its output transfer contacts situated closer to the source of the output signal in the chain path will be permitted to deliver the output signal to its work circuit.

While the aforementioned circuit operates satisfactorily, it would be advantageous in certain applications to be able to obtain a preference lockout arrangement in which operating preference was alternated on successive seizures without the need of requiring two sets of transfer contacts on each preference relay. More particularly, it would be desirable to obtain a preference lockout circuit wherein the actual operation of the preference relays themselves was alternated rather than merely the chain of their output contacts.

SUMMARY OF THE INVENTION

In one illustrative embodiment of my invention a plurality of conventional preference relays are provided for the circuits desiring to be connected to a common circuit. In addition, however, I provide in series with the operate winding of each such preference relay, a back contact of an alterable release time relay. The operation of any preference relay causes an operating path to be extended to all of the alterable release time relays. The operation of each alterable release time relay opens the operate path of all other preference relays to prevent their operation. Subsequent release of the operated preference relay opens the operating path for all of the alterable release time relays. The one of the alterable release time relays which has had its release time altered to be longer than that of the other alterable release time relays, as by the switching in of a resistance shunt across its operate winding, will remain operated after the others have released. The one of the alterable release time relays first to release restores the operating path to its associated preference relay which is now allowed to operate and also to lockout the operating paths for lower-ordered preference relays. The operated preference relay, via its output transfer chain, energizes its associated work circuit and locks out the work circuits of higher preference relays. When the alterable release time relay currently caused to have the slowest release does release and restore the operating path to its associated preference relay, that preference relay will not operate at all if it is of a lower-ordered preference and if operated because it is of higher-order preference will still have its output transfer chain cut off by the first preference relay to be re-operated.

DESCRIPTION OF THE DRAWING

The foregoing and other objects and features of my invention may become more apparent from a consideration of the drawing, the single FIGURE of which shows an illustrative embodiment of my invention in the environment of a crossbar switching system.

GENERAL DESCRIPTION

Referring now to the drawing, there is shown a pair of connectors CONN0 and CONN1 for connecting a respective pair of work circuits WS0, WS1 to the marker. Each work circuit has a work contact MST- (the winding for which is not shown) which contact applies an energizing signal to its respective start lead ST-0 or ST-1 to request access to the marker. In the prior art, each start lead ST- would be connected directly to an associated preference relay such as relay MS0 or MS1. In accordance with my invention, however, I insert in series with the operating path of each such preference relay the back contact CB0-0 or CB0-1 of a respective CB- relay, there being one such CB- relay in each connector for each marker to which the connector may obtain access.

To simplify the drawing, I have shown only one marker. It will be apparent, however, from a consideration of such crossbar disclosures as A. J. Busch U.S. Pat. No. 2,585,904, that a connector, such as an originating register marker connector, may bid for access to more than one marker. More particularly, in FIG. 123 of said Busch patent, there is shown a preference lockout circuit by means of which the connector is accorded access to a plurality of markers. Since such details are shown in the Busch patent or otherwise well known, they will not be repeated in the drawing.

Let it be assumed that only work circuit WS1 desires to obtain access to the marker. Its service requesting relay contact MST-1 will be operated applying ground to lead ST-1. The ground on lead ST-1 is continued over the back contact CB0-1 to the winding of relay MS0-1. Relay MS0-1 operates over this path and in operating, at the back contact MS0-1, of its right-most set of transfer contacts, prevents ground from being completed to the MS0-relay contacts of any other connector in the chain (not shown). The operation of the back contact of the right-hand set of transfer contacts of relay MS0-1 also causes marker relay MCK, which is

normally operated in an idle marker, to release. At the same time, the operation of the front contact of the left-hand set of transfer contacts of relay MS0-1 operates its associated connector relay MC1 and contacts 1 of relay MC1 lock the winding of relay MS0-1 to lead ST-1 independently of the path provided by the back contacts of relay CB0-1. Contacts 2 and 3 of relay MC1 connect through the internal circuitry of work circuit WS1 to the appropriate internal control circuitry of the marker, the details of both of which circuits are unimportant for purposes of understanding the present invention. Contact 4 of relay MC0-1 connects through a path for the subsequent operation of release relay RL-1 work circuit WS0 by the marker control circuits. Contact 5 of connector relay MC1 applies a seizure ground to marker seizure counting circuit W-Z. This seizure counting circuit is advantageously a conventional W-Z relay counting circuit which I include in the marker. Its purpose is to operate relay transfer contacts W on alternate seizures of the marker.

The release of marker relay MCK at its back contact completes an operating path to relay MCB. Relay MCB operates and at its make contacts completes operating paths to relay CB0-0 in connector CONN0 and to relay CB0-1 in connecter CONN1.

Since the winding of connector relay MS0-1 has locked to lead ST-1 over contact 1 of connector relay MC1, the operation of connector relay CB0-1 has no effect on the circuit at this time.

Had it been assumed that both circuits WS0 and WS1 had applied request-for-marker-access signals to their respective leads ST-0 and ST-1 at exactly the same instant, both relays MS0-0 and MS0-1 would operate. However, the left-hand transfer contacts of relays MS0-1 are in a higher preference position than the left-hand transfer contacts of relays MS0-0 and so only relay MC1 of connector CONN1 would receive operating ground and lock its associated preference relay MS0-1 to its lead ST-1. The service request signal on lead ST-0 remains so long as work circuit WS0 continues to request access to the marker. While circuit WS1 is being accorded marker access, however, the operation of the back contact of relay CB0-0 causes preference relay MS0-0 to be released.

When the work function is completed, marker control relay RL operates to operate work circuit relay RL-1 in WS1 through make contact 4 of relay MC1. Operation of back contacts of relay RL- in WS1 open the ST-1 lead allowing relay MS0-1 to release. The released make contact of the left-hand set of transfer contacts of relay MS0-1 releases relay MC-1 and the released back contact of the right-hand set of transfer contacts of relay MS0-1 restores the operating path to marker relay MCK. The re-operation of marker relay MCK at its back contact opens the operating path for relay MCB which releases all of its make contacts opening the operating path for both of relays CB0-0 and CB0-1.

Assuming that relay W is normal, the release of the MCB relay will cause relay CB0-0 to immediately release thereby restoring an operating path for relay MS0-0. Relay CB0-1 will not however release immediately as its winding is shunted down by the normal contact of relay W in series with resistor R and negative battery. The release of relay MCB, therefore, while opening the operating path to the winding of relay CBO-1 will not result in immediate release of relay CB0-1 since the resistance shunt prevents the immediate collapse of the magnetic field of the winding of relay CB0-1. This relay will release some time after relay CB0-0 releases. The signficance of the later release of this relay will presently be explained.

If it is now assumed that work circuits WS0 and WS1 had each operated its contacts MST-0 and MST-1 simultaneously only work circuit WS1 would, as mentioned before, have succeeded in obtaining access to the marker. Operations proceed as just described and when the marker completes its work functions it operates release relay RL-1 in work circuit WS1. Preference relay MS0-1 will now be released allowing marker relay MCK to reoperate opening the operating paths for relays CB0-0 and CB0-1. Relay CB0-0 immediately releases causing the operating path to relay MS0-0 to be restored quite promptly. However, relay CB0-1 is caused by the normal condition of transfer contacts W to be a slow release relay on this marker seizure and so the back contact of relay CB0-1 does not immediately restore the operating path to its associated relay MS0-1.

The prompt restoral of the operating path to relay MS0-0 allows this relay to operate and to operate its associated connector relay MC0. The back contact of the transfer contacts of relay MS0-0 removes operating ground from the winding of relay MS0-1 and so this relay is prevented from being re-operated when relay CB0-1 does finally release in the event that work circuit WS1 generates another service request. Accordingly, should work circuits WS0 and WS1 attempt to initiate simultaneous start signals to their respective preference relays, after work circuit WS1 had just been served by the marker, work circuit WS0 is now preferred, assuming that marker relay W was normal.

The operation of connector relay MC0 at its contact 5, however, applies a count pulse to the W-Z circuit which I provide in the marker causing transfer contacts W to operate. The shunting resistor R is now connected across the winding of relay CB0-0.

The marker will, in accordance with its usual operation, perform the circuit function requested by work circuit WS0 whereupon the marker will operate its contact RL, in turn operating relay RL-0 in work circuit WS0.

Let it now be assumed that work circuits WS0 and WS1 maintain their MST- contacts operated. The operation of relay RL-0 causes relay MS0-0 to release reoperating marker relay MCK and releasing marker relay MCB thereby opening the operate path for relays CB0-0 and CB0-1. This time, however, relay CB0-0 is configured as a slow release relay by the off-normal condition of relay W. Consequently, relay CB0-1 will restore first allowing relay MS0-1 to operate, to operate its associated connector relay MC1 and to lock to its ST-1 lead. Thus, with marker relay W off normal, work circuit WS1 is preferred on simultaneous seizures occurring just after work circuit WS0 had been served.

CONCLUSION

Accordingly, I have disclosed a preference lockout circuit wherein preference is changed by means of an alterable time release relay controlling the operation of a work circuit preference relay when in competition with other work circuits and which alterable release relays selectively override the normal operating preference after the marker has been served to prevent mo-

nopolization of the marker by the "preferred" preference relay. In the drawing I have shown only one marker but it will be apparent that additional markers can be served by providing additional connectors having CB- relays similar to those shown and whose back contacts are chained into operation by additional CB0- make contacts (not shown). Further and other modifications will become apparent to those of skill in the art without, however, departing from the spirit and scope of this invention.

What is claimed is:

1. A preference lockout circuit for according any of a plurality of work circuits access to a common control circuit including a preference relay respective to each work circuit and contacts controlled by each operated preference relay for normally defining the order of operating preference of said relays, the improvement comprising

control means in circuit with each said preference relay for temporarily interrupting the operating path thereto, and

means for selectively altering the timing of said control means.

2. A preference lockout circuit according to claim **1** wherein said control means includes contact means operable to interrupt said preference relay operating path and releasable to restore said operating path and wherein said selectively altering means includes means for modifying the release time of said control means.

3. A preference lockout circuit according to claim **1** wherein said selectively altering means includes counting means energized after one of said preference relays has operated.

4. A preference lockout circuit according to claim **3** wherein said counting means includes a W–Z relay circuit controlled by said common control means each time one of said work circuits is accorded access to said common control circuit, said control means includes relays, and said altering means further includes means controlled by said W–Z relay circuit for selectively switching in a resistance shunt across the winding of one of said control means relays.

5. A preference lockout circuit, comprising

a plurality of preference relays each having an operate winding adapted to respond to a service request,

a plurality of release relays each having a respective contact means for interrupting the operating path of an associated one of said preference relays,

means for permitting one of said preference relays to lock,

means for operating all of said release relays when any of said preference relays is operated,

means for removing the service request for the operated one of said preference relays,

means responsive to all of said preference relays in the released condition for interrupting the operating path to all of said release relays, and

means for selectively changing the release times of said release relays.

6. A preference lockout circuit according to claim **5** wherein each said preference relay has associated therewith a respective connector relay, wherein each said preference relay has a pair of transfer contacts, means connecting each said pair of transfer contacts in a chain for completing a connector relay winding operating path to said connector relays in a given order of preference, and wherein said means permitting said one of said preference relays to lock includes a contact of one of said connector relays.

7. A preference lockout circuit according to claim **6** wherein said means for selectively changing said release times includes means for selectively switching in a resistance shunt across the winding of one of said release relays.

8. A preference lockout arrangement comprising a plurality of preference relays each adapted to be energized to indicate a request for connection to a common circuit by a respective work circuit, means for temporarily interrupting the operating paths to said relays, and means including the selective release of said temporarily interrupting means for recompleting the operating path to one of said preference relays before an operating path is recompleted to the other of said preference relays.

9. A preference lockout arrangement according to claim **8** wherein said temporarily interrupting means includes control relay means individual to each of said preference relays and wherein said recompleting means includes means for selectively applying a circuit to cause one of said control relay means to become a slower release relay means than the other of said control relay means.

10. A preference lockout arrangement according to claim **8** wherein said temporarily interrupting means includes means operative when said respective work circuit is connected to said common circuit and wherein said recompleting means includes means for applying said slower release circuit means to a different one of said control relay means when said common circuit is disconnected from said respective work circuit.

11. A preference lockout circuit for according one-at-a-time access between a common control circuit and a plurality of work circuits comprising

a plurality of preference relays some of which are capable of being simultaneously energized by their respective work circuits,

a connector relay associated with each preference relay,

means normally connecting the connector relays to be operated in a given order of preference by the operation of said preference relays, and

means operative upon the release of said common circuit by the highest preference one of said connector relays for preventing reoperating of the preference relay associated with said work circuit which has just received access to said common circuit.

12. A preference lockout circuit according to claim **11** wherein said operative means includes a plurality of release relay means each having a contact in circuit with a respective one of said preference relays,

means for normally operating said release relay means during the time one of said work circuits is accorded access to said control circuit, and

means for selectively causing one of said release relays to be released more slowly than the other of said release relays when said one work circuit is released from said common circuit.

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