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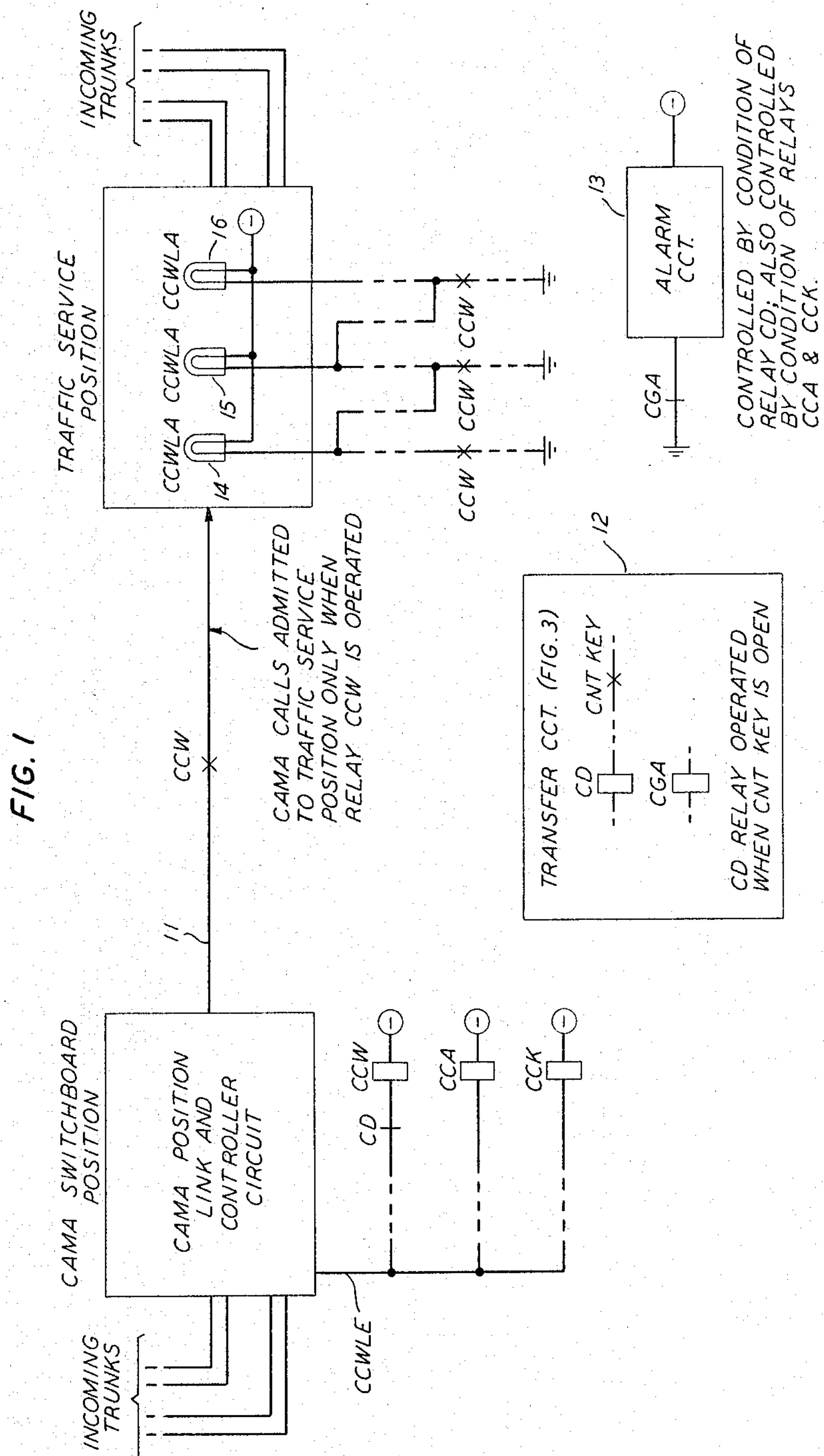
C. E. GERMANTON

3,301,965

TRANSFER CIRCUIT WITH ALARM FACILITIES

Filed Oct. 23, 1963

3 Sheets-Sheet 1



INVENTOR
C. E. GERMANTON
BY
F. R. McCorkewale
ATTORNEY

Jan. 31, 1967

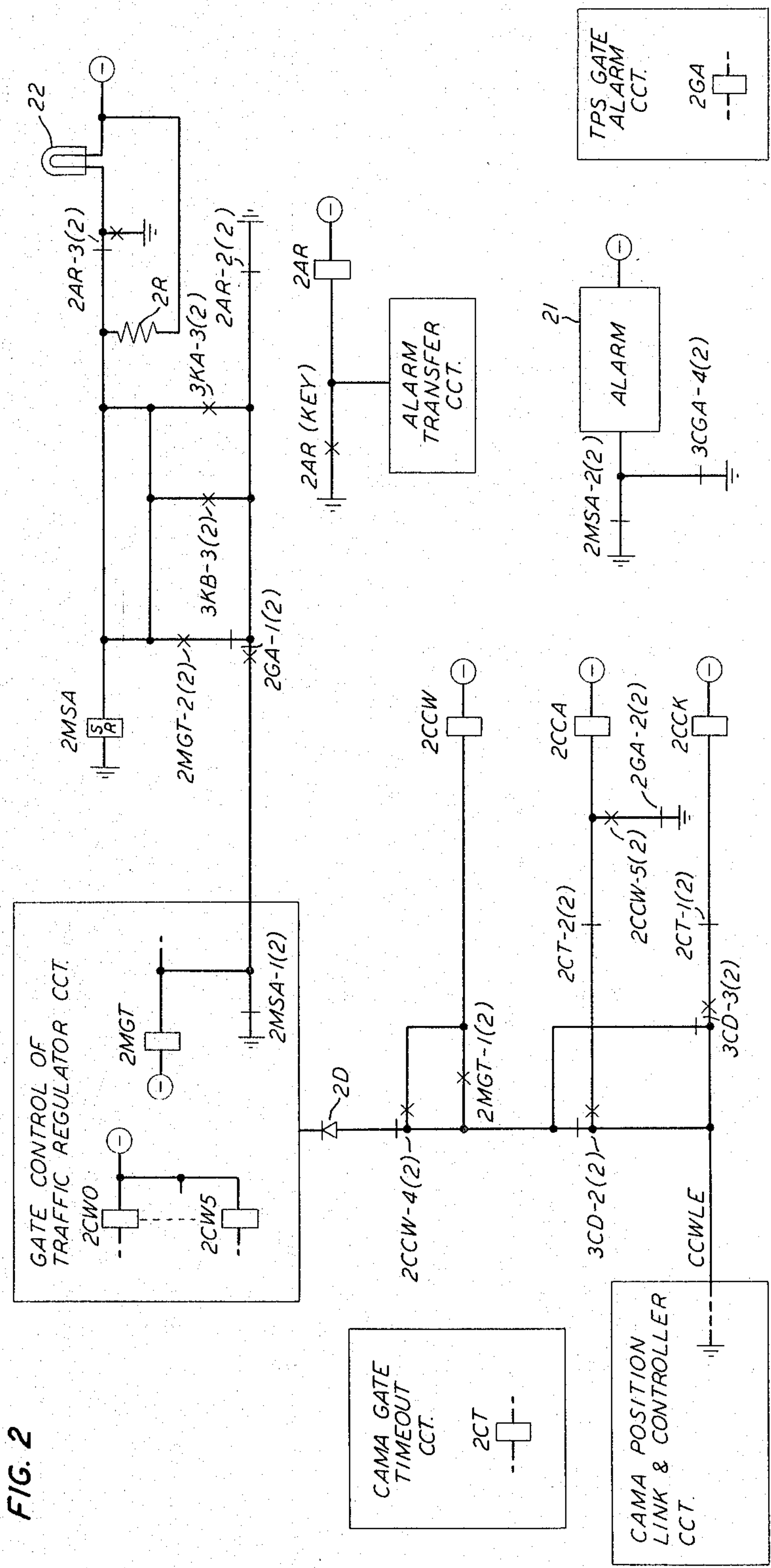
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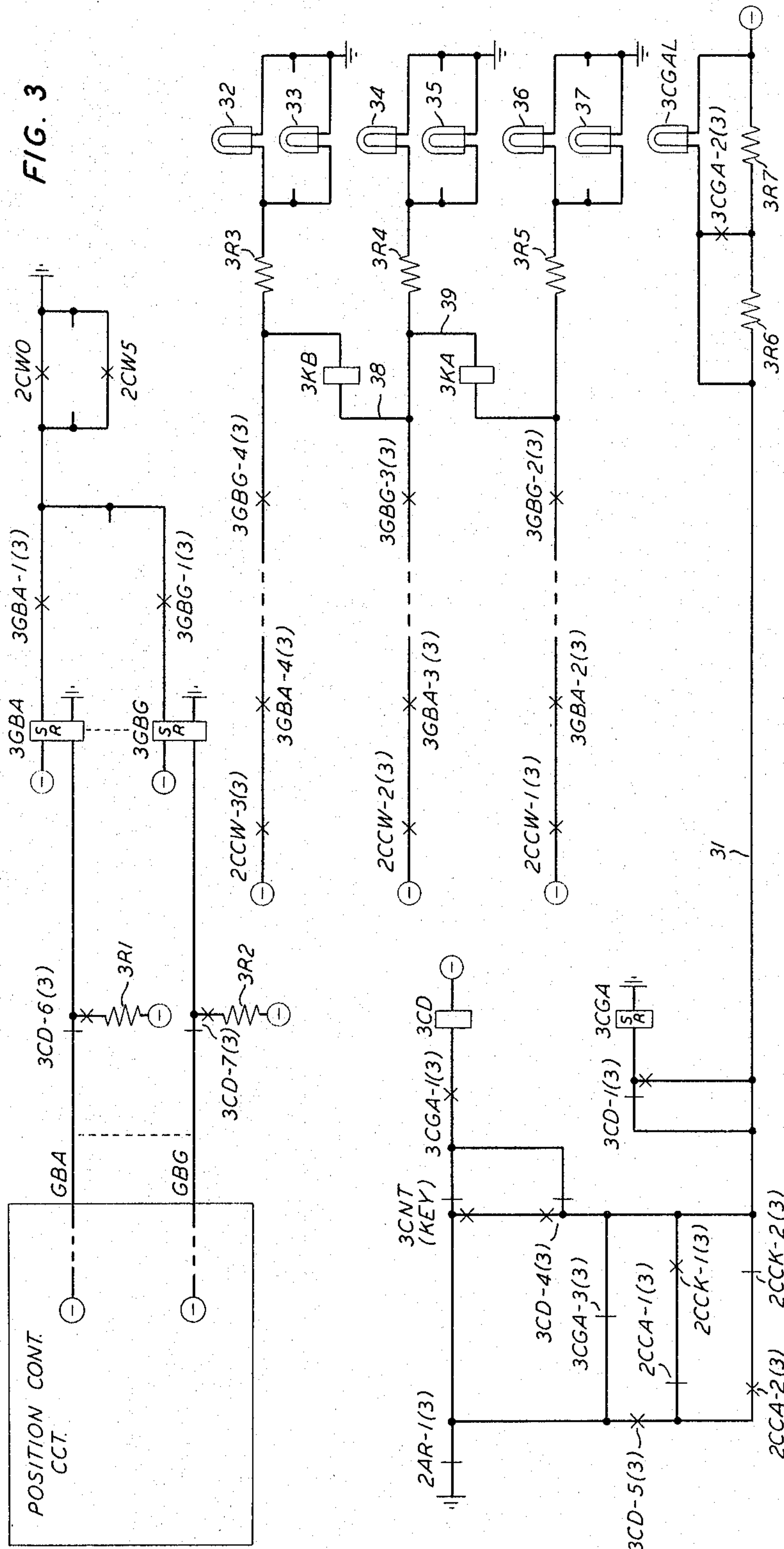
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3 Sheets-Sheet 3



1

3,301,965

TRANSFER CIRCUIT WITH ALARM FACILITIES
Charles E. Germanton, Summit, N.J., assignor to Bell Telephone Laboratories Incorporated, New York, N.Y., a corporation of New York

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9 Claims. (Cl. 179—27)

This invention relates to a transfer circuit with alarm facilities and more particularly to such a transfer circuit for use in connection with telephone switchboards.

There is disclosed in the copending application of R. B. Curtis, Serial No. 318,275, filed October 23, 1963, entitled, Equipment for Operator Served Calls at an Intermediate Switching Center, a crossbar tandem telephone system for handling, particularly, customer dialed special toll calls such as person-to-person, collect, credit card and the like. Such calls are usually routed to assistance operators at special positions commonly referred to as traffic service positions. These special operators render such assistance as may be required in the completion of the call and the necessary accounting procedures involved.

The traffic service positions are frequently operated jointly with other types of switchboards in the same office, this being particularly true with regard to CAMA switchboards, that is switchboards at which centralized automatic message accounting (CAMA) calls are handled. The transfer circuit of the present invention is particularly adaptable to use at traffic service positions which are used jointly with other types of switchboards. In the instance of such joint use, the usual procedure is to normally exclude from the traffic service position all CAMA calls, leaving such calls for handling at the CAMA switchboard. However, on occasion, for example during night hours or other periods of light load, a transfer circuit may be actuated to admit CAMA calls to the traffic service position for handling at that point. For such purpose it is obvious that the transfer circuit should be efficient and reliable in its operation and that an indication should be given immediately of its failure to operate in the directed manner.

Accordingly, it is an object of the present invention to improve the operation of transfer circuits.

Another object of the invention is to transfer in a reliable and efficient manner calls from one type of switchboard to another.

Still another object of the invention is to facilitate the joint use of two different types of switchboard positions.

A more specific object of the invention is to provide an immediate indication of the failure of a transfer circuit to operate in the directed manner.

In accordance with a specific embodiment of the invention a transfer circuit for use at a traffic service position, or service position as it will also be termed below, includes a relay and a key, or switch, for controlling the condition of the relay. When the controlling key, or switch, is in normal, open, position, the relay is held operated and all CAMA calls are excluded from the position. When the key, or switch as it will also be termed below, is closed, however, the relay is released whereby to close certain paths over which CAMA calls are admitted to the traffic service position. Means are included to initiate an alarm in the event either opening or closing of the control key is not followed by proper response of the relay, that is, operation and release respectively. The alarm is also initiated in the event that, with the referred-to relay operated, certain other relays involved in a CAMA call fail to function properly.

A feature of the invention is means for shunting down and releasing a relay whereby to initiate an alarm, which

2

means is effective upon the instance of any one of a plurality of trouble conditions.

Another feature of the invention is means for initiating an alarm in the instance of a trouble condition resulting in out-of-step lighting of call-waiting signal lamps at the service position.

Yet another feature of the invention is the energization of a plurality of groups of lamps over a plurality of normally balanced transmission lines with included means responsive to an abnormal unbalanced condition of the lines for initiating an alarm.

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 in which:

FIG. 1 shows schematically the general over-all arrangement of one specific illustrative embodiment of the invention;

FIG. 2 shows particularly the alarm relay circuits and certain other relay circuits involved in CAMA calls; and

FIG. 3 shows particularly the transfer circuit and the parallel energizing paths of the CAMA call-waiting lamps.

Referring now to the drawing, and first to FIG. 1, there is shown in that figure in schematic fashion a CAMA switchboard position and a Traffic Service Position; it will be assumed that both positions are located in the same central office and that an operator is normally in attendance at each position. It will be assumed for purposes of description that the positions are located at a tandem switching center for interconnecting incoming trunks with outgoing circuits extending to called lines at a terminating office in the general manner disclosed in the copending application of R. B. Curtis referred to above. In order to avoid undue and unnecessary complication of the drawing the incoming trunk circuits and the outgoing circuits are not shown in detail in the drawing of the present application. Lines connecting the CAMA position to the TSP (traffic service position) are represented by the single lead 11, and, as indicated, CAMA calls can be passed over these lines to the TSP only when relay CCW (CAMA call waiting) is operated and the indicated "make" contact is closed. As further indicated the operate path of relay CCW includes as a series element a break contact of relay CD (CAMA day) from which it is apparent that relay CCW will operate only when relay CD is in released position. (The involved circuitry which is discussed in general terms only with reference to FIG. 1 will, of course, be described in detail subsequently with reference to FIGS. 2 and 3.)

Under normal conditions, therefore, that is with relay CCW nonoperated, CAMA calls are not admitted to the traffic service position (TSP) for handling at that point but must be handled at the CAMA position. (Requests for connection to the TSP signaled on lead CCWLE at this time result in operation of relay CCA and CCK as will be described subsequently in connection with the detailed description.) However, as pointed out above, it may be desirable on occasion to be able to transfer the CAMA calls to the TSP for handling, and the novel transfer circuit contemplated by the present invention is particularly adaptable to such use. The transfer circuit is indicated in FIG. 1 by the captioned rectangle 12 and is shown in detail in FIG. 3.

In order to transfer the CAMA calls to the traffic service position the CNT (control) key is closed whereby to release relay CD; the relay CD, released, operates relay CCW whereby to close line 11 for connection of the CAMA calls to the traffic service position.

In the event that, due to some circuit failure, relay CD does not release in response to operation of the CNT key, the transfer will not be affected and the CAMA calls probably will not be properly processed, since under normal procedures the CAMA position would be left unattended as soon as the intended transfer had been initiated at the TSP. It is very important, therefore, that some means be provided for indicating immediately any failure of relay CD to release following closure of the CNT key, and, similarly, to indicate a failure of relay CD to operate in response to opening the key. Alarm circuit 13, as will be apparent from subsequent detailed description, fulfills this function. Alarm circuit 13 also indicates any failure of relays CCA and CCK to function simultaneously at a particular point in the circuit operation.

"CAMA call-waiting" lamps (CCWLA) are provided at the TSP, lamps 14, 15 and 16 being shown in FIG. 1. These lamps are energized over respective separate paths each of which includes a make contact of relay CCW; as indicated schematically in FIG. 1 and as will be described in detail subsequently, the energizing paths are interconnected by shunt paths. These shunt paths are basic elements of novel means contemplated by my invention whereby alarm circuit 13 is actuated in the event of circuit trouble leading to out-of-step lighting of lamps 14, 15 and 16. This arrangement will be described in detail with reference to FIGS. 2 and 3.

In referring now to FIGS. 2 and 3 of the drawing for detailed disclosure of one specific embodiment of the invention, it should be first pointed out that the "detached contact" representation of relays is utilized wherein, generally speaking, the respective contacts are shown separated from the relay windings, suitable designations being provided to properly indicate the association between the respective contacts and the controlling windings. 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.

To further facilitate consideration of the specification in connection with the drawing the reference character of each major item of FIGS. 2 and 3 is preceded by a prefix indicating the figure of the drawing in which it appears; for example, the operating winding of relay 3CD appears in FIG. 3 (and corresponds to relay CD of FIG. 1). Further, each relay contact designation is followed by a digit in parentheses indicating the figure in which the particular contact appears, for example, the contact designation 2AR-1(3) of the No. 1 contact of the 2AR relay, which contact appears in FIG. 3 while the operating winding of the 2AR relay appears in FIG. 2. Further, it will be understood that relay 2CCW of FIG. 2 corresponds to relay CCW of FIG. 1, relay 2CCK of FIG. 2 corresponds to relay CCK of FIG. 1; key or switch 3CNT of FIG. 3 corresponds to key or switch CNT of FIG. 1; and so on.

Let us assume now for purposes of further description that control key 3CNT is in open, or released, position. Relay 3CD is held operated under these conditions from ground, break contact 2AR-1(3), the break contact of the control key 3CNT, make contact 3CGA-1(3), winding of relay 3CD to battery. (Relay 3CGA is normally held operated from battery, resistor 3R7, make contact 3CGA-2(3), lead 31, the make contact of transfer pair 3CD-1(3), winding of relay 3CGA to ground.)

With relay 3CD operated the operate path for relay 2CCW, which corresponds to relay CCW of FIG. 1, is held open at the break contact of transfer pair 3CD-2(2) of relay 3CD so that relay 2CCW cannot operate. As pointed out above with reference to FIG. 1, under this condition no CAMA calls are admitted to the TSP. CAMA requests signaled by connection of ground to lead CCWLE (FIG. 2) under this circuit condition cause simultaneous operation of relays 2CCK and 2CCA; relay

2CCK operating over a path through the make contact of transfer pair 3CD-3(2) of relay 3CD and break contact 2CT-1(2), and relay 2CCA operating through the make contact of transfer pair 3CD-2(2) of relay 3CD and break contact 2CT-2(2) of relay 2CT. Relay 2CCA, operated, causes operation of certain CAMA gate relays, with which the present disclosure is not immediately concerned, and relay 2CCK provides certain check or test operations in connection with operation of relay 2CCA.

It will be assumed now that control key 3CNT is closed whereby to activate the transfer circuit, it being desired at this time to admit CAMA calls to the TSP position. In the event the transfer circuit functions as directed, relay 3CD will release following operation of key 3CNT since its operate path is opened at the break contact of the key. Upon release of relay 3CD, CAMA call requests signaled by connection of ground to lead CCWLE (FIG. 2) will now operate relay 2CCW through the break contact of transfer pair 3CD-2(2) of relay 3CD, make contact 2MGT-1(2), winding of relay 2CCW to battery. (Relay 2MGT is operated at this time by normal gate control circuit functions with which the present circuit is not immediately concerned.) Relay 2CCW which, as previously pointed out above, corresponds to relay CCW of FIG. 1, upon operating closes paths for admission of CAMA calls to the traffic service position.

It is essential, of course, that any failure of relay 3CD to respond properly to the operation of control key or switch 3CNT be immediately brought to the attention of the TSP attendant since such a failure might well mean that the CAMA calls would not be processed. For purposes of further description, therefore, let us assume that, due to some functional failure, relay 3CD remains operated after key 3CNT has been closed. Under this condition a path for "shunting down" and releasing relay 3CGA is established from ground, break contact 2AR-1(3), the make contact of control key 3CNT, the make contact of transfer pair 3CD-4(3) of relay 3CD, to lead 31; this ground path shunts the battery previously applied to relay 3CGA and that relay releases; when relay 3CGA releases the shunt-down path is, in effect, locked in through break contact 3CGA-3(3). CAMA gate alarm lamp 3CGAL lights following release of relay 3CGA since it is then connected in shunt to both resistors 3R6 and 3R7 and sufficient current will traverse the path through the lamp to activate its filament.

Relay 3CGA, released, opens the operate path of relay 3CD at make contact 3CGA-1(3) whereby to release the relay in the event the operate path was held completed due to the trouble referred to; release of relay CD will result in admission of the CAMA calls to the TSP as above described. Relay 3CGA, released, also closes through its break contact 3CGA-4(2) an energizing path for alarm device 21 whereby to signal an audible and/or visual alarm. Alarm device 21 corresponds to alarm circuit 13 of FIG. 1.

When the trouble has been cleared, or when otherwise desired, relay 3CGA may be reoperated by momentary closing of the 2AR key whereby to operate relay 2AR and open the shunt-down path at break contact 2AR-1(3). Relay 3CGA, reoperated, extinguishes lamp 3CGAL and opens the energizing path of alarm device 21.

The resistor element connected in the operate path of relay 3CGA is in two separate sections, 3R6 and 3R7, either one or both sections being effectively included in the path depending upon the operated or released condition of the relay. This arrangement is such that the relay winding is soaked when the operate path is closed in order to realize the full release time capability of the relay, and that the resistor heating is limited during the time the relay is, in effect, locked in nonoperated position.

It is fully as important, of course, that the transfer circuit operate properly "in reverse," that is to release

5

relay CCW (FIG. 1) and restore the circuit to the non-admission condition, as it is that it operates properly under the conditions described above. The novel alarm arrangement contemplated operates effectively for both conditions of the transfer circuit. Let us assume, in order to examine this further, that the transfer circuit is now to be operated in reverse; relay 3CD being assumed to be released, control key 3CNT closed, and relay 3CGA reoperated following momentary operation of relay 2AR.

For proper functioning of the circuit, release of control key 3CNT should be followed by operation of relay 3CD over the path previously traced, that is from ground, break contact 2AR-1(3) of relay 2AR, the break contact of key 3CNT, make contact 3CGA-1(3), winding of relay 3CD to battery. Let us assume, however, for purposes of further description that, due to some circuit failure, relay 3CD remains released following release of key 3CNT. A path is then completed for shunting down and releasing relay 3CGA, traced from ground, break contact 2AR-1(3), break contact of key 3CNT, now in open or released position, the break contact of transfer pair 3CD-4(3) of relay 3CD, to lead 31; relay 3CGA releases, lights lamp 3CGAL and activates alarm device 21 as previously described.

As pointed out above, when relay 3CD is operated and CAMA calls are not admitted to the TSP, CAMA call requests signaled on lead CCWLE (FIG. 2) should result in simultaneous operation of relays 2CCK and 2CCA. The novel transfer circuit arrangement contemplated by the invention also provides for the initiation of an alarm if this simultaneous operation of the two relays does not occur. Let us assume, for example, that in response to the ground signal on lead CCWLE, relay 2CCK operates but relay 2CCA fails to operate. A path is then completed for shunting down and releasing relay 3CGA, traced from ground, break contact 2AR-1(3), make contact 3CD-5(3) of relay 3CD, break contact 2CCA-1(3), make contact 2CCK-1(3), to line 31; relay 3CGA releases, lights lamp 3CGAL and energizes alarm device 21 as before described.

It will be apparent that in the above instance had relay 2CCA operated and relay 2CCK failed to operate, the shunting path would then have been completed through make contact 2CCA-2(3) and break contact 2CCK-2(3). However, it will also be obvious that when relays 2CCA and 2CCK are both operated, or both released, then the shunt-down path is not completed and the alarm is not activated. An important feature in this novel and efficient arrangement is the provision of the two parallel legs or sections in the path leading to line 31, each of which legs or sections contains a break contact of one of the respective relays and a make contact of the other, the two contacts being connected as series elements in the respective leg.

It will be clear from the above description that the novel transfer and alarm circuit of the present invention provides the valuable advantage of dual action with regard to monitoring the response of relay 3CD to operation of the control key 3CNT. That is, it monitors both the response of the relay to closing of the key, when the relay should release, and to release or opening of the key, when the relay should reoperate. The over-all circuit arrangement is simple and uncomplicated since the basic circuit path is the same for both monitoring functions; a novel arrangement of two alternate shunt portions in the basic path, one of which portions includes as series elements make contacts of the control key and of relay 3CD and the other of which includes break contacts of the same two elements is a principal factor in attaining the dual capability of the circuit. Additionally, the circuit, without undue complication of the basic arrangement, provides means for indicating a failure of relays 2CCK and 2CCA to operate properly during the time relay 3CD is operated; a novel arrangement of alternate

6

shunt legs or sections in the basic path, each including a make contact of one relay and a break contact of the other, is an important factor in attaining this additional function.

As pointed out above in connection with the discussion of FIG. 1, a number of "CAMA call-waiting" lamps are provided at the traffic service position; six of these lamps, 32 to 37, are shown in FIG. 3. While all of the lamps could, of course, be energized over a single line, it is preferable for circuit reasons, particularly in order to prevent fuse overloading, that they be separated into groups of equal number and that each group be energized over a separate line. In the illustrative embodiment of the invention the lamps are divided into three groups. Since the lamps are to be energized only when all circuit groups, as represented by the 3GBA-3GBG relays, are busy, make contacts of each of these relays are included as series elements in each energizing line. A make contact of the 2CCW relay is also included in each line so it follows that the lamps are lighted by the 2CCW relay, operated, when all positions are busy and all 3GBA-3GBG relays operated. Having separated the lamps into different groups and provided a corresponding number of separate energizing lines, it is important, of course, that each line be affected the same when the 3GBA-3GBG relays are all operated, that is that each line be completely cut-through when all the group-busy relays are operated. The novel circuit arrangement contemplated by my invention which is described below provides immediate indication of discontinuity of any of the lines and also provides compensating means whereby to prevent out-of-step lighting of the CAMA call-waiting lamps.

Only two of the relays in the 3GB (group busy) series are shown in the drawing, that is the 3GBA and 3GBG; the omission of the intervening five relays in the series is indicated by dotted lines and it will be understood that the arrangement and function of the intervening relays are similar to that of those shown. Relay 3GBA operates, following operation of relay 3CD, from battery, resistor 3R1, the make contact of transfer pair 3CD-6(3) of relay 3CD, operating winding of relay 3GBA to ground, and, upon operating, locks to ground through its make contact 3GBA-1(3) and a make contact of an operated relay in the group 2CW0 to 2CW5. Relay 3GBG, similarly, operates, following operation of relay 3CD, from battery, resistor 3R2, the make contact of transfer pair 3CD-7(3) of relay 3CD, the operating winding of relay 3GBG to ground, and upon operating locks to ground through its make contact 3GBG-1(3) and a make contact of an operated relay in the group 2CW0-2CW5.

The three lines for energizing the CAMA call-waiting lamps 32 to 37 are connected to ground at the position through respective resistors 3R3, 3R4 and 3R5, and each outer line is, in effect, balanced electrically against the center line so that when each line is completely cut through, that is when all 3GBA-3GBG contacts are closed, there is no significant current flow through the operate path of either relay 3KA or 3KB and neither relay will operate. In the event of contact failure, however, the line continuity will be interrupted and unbalance will result; this will result in current flow in the shunting path through the 3KA and/or 3KB relay which will operate. (If the upper outer line is interrupted, relay 3KB will operate; if the lower outer line is interrupted relay 3KA will operate; and if the center line is interrupted both relays 3KA and 3KB will operate.) In more detail, assuming that contact 3GBA-4(3) of relay 3GBA fails to close, the upper outer line will be opened and the transmission balance between it and the center line will be upset. Current will continue to flow through the center line to light lamps 34 and 35 and will now also traverse the shunting path through line 38 and the operate winding of relay 3KB, and will pass through resistor 3R3 to light lamps 32 and 33 normally controlled

over the upper outer line. The "in-step" lighting of the group of CAMA call-waiting lamps is preserved, therefore, in spite of the interruption of the upper outer energizing line. However, an alarm indication of the trouble is initiated as described below. Since the balance between the lower outer line and the center line is not upset, lamps 34, 35, 36 and 37 are lighted over their normal paths and relay 3KA remains released.

Relay 2MSA (miscellaneous alarm) is normally held operated from battery, resistor 2R, winding of relay 2MSA to ground. However, upon operation of relay 3KB, as just described, a shunt-down path to ground is closed through make contact 3KB-3(2) and break contact 2AR-2(2), and relay 2MSA releases. (Relay 2MSA is slow to release and will hold over if only a momentary short circuit is applied across its winding.) Relay 2MSA, upon releasing, closes an operate path through its break contact 2MSA-1(2) for operating main gate relay 2MGT; the shunt-down path is now maintained through make contact 2MGT-2(2) and the break contact of transfer pair 2GA-1(2) to the ground on break contact 2AR-2(2). (Relay 2GA is released at this time through the normal functioning of the TSP Gate Alarm Circuit not shown in detail.) Also, relay 2MSA, released, closes at its break contact 2MSA-2(2) an energizing path for alarm 21 which operates as an indication of the contact failure in the line referred to. During the time the shunting path to ground is maintained, miscellaneous alarm lamp 22 is lighted over an energizing path through the break contact of transfer pair 2AR-3(2).

After the trouble has been cleared and relay 3KB released, the alarm device 21 may be deactivated and the 2MSA relay circuit restored to normal by momentarily closing key 2AR whereby to operate relay 2AR. Relay 2AR, operated, opens the shunt path to ground at its break contact 2AR-2(2) and relay 2MSA reoperates over its normal operate path from battery, resistor 2R, winding of relay 2MSA to ground; relay 2MSA, operated, releases relay 2MGT. During the short interval relay 2AR is operated, lamp 22 is maintained lighted through the make contact of transfer pair 2AR-3(2) of relay 2AR; when the relay releases the lamp is extinguished.

In the event a contact in the lower outer line had failed to close, for example, make contact 3GBG-2(3), the transmission balance between it and the center line would be interrupted. Current will continue to flow through the center line to light lamps 34 and 35 in the normal manner, and will now also traverse the shunt path through line 39 and the operate winding of relay 3KA, the break contact of transfer pair 3KB-1(3) of relay 3KB and through resistor 3R5 to light lamps 36 and 37 which are normally controlled over the lower outer line. The "in-step" lighting of the lamps is maintained, therefore, in spite of the interruption in the continuity of the line. Operation of relay 3KB causes an alarm to be initiated in the manner described above with reference to relay 3KB; in this instance the shunt-down path is first completed through make contact 3KB-3(2).

In the event a contact in the center line fails to close, for example contact 3GBG-3(3), then current will pass from the upper outer line through the winding of relay 3KB operating that relay as previously described and, similarly, current will pass from the lower outer path through the winding of relay 3KA, operating that relay also; the two currents combined will pass through resistor 3R4 to light lamps 34 and 35. Lamps 32 and 33 will be lighted over the upper outer lead in the normal manner and lamps 36 and 37 will be lighted over the lower outer lead in the normal manner.

With relays 3KA and 3KB both operated, alarm 21 will be activated as described above, dual paths now being provided for completing the shunt-down path through

make contact 3KB-3(2) of relay 3KB and 3KA-3(2) of relay 3KA, respectively.

It is to be understood that the above-described arrangements are illustrative of the application of the principles of the invention. Numerous other arrangements may be devised by those skilled in the art without departure from the spirit and scope of the invention.

What is claimed is:

1. In a tandem switching center for interconnecting incoming trunks with outgoing circuits extending to called lines at a terminating office, a service position, a switchboard position, means for connecting said incoming trunks to said positions, a line connecting said switchboard position and said service position, a transfer circuit at said service position, said transfer circuit including a relay and a control switch operable between open and closed position, means effective when said switch is in open position for operating said relay and effective when said switch is in closed position for releasing said relay, means effective when said relay is in operated position for opening said line whereby to prevent the connection of calls thereover from said switchboard position to said service position, a second relay, said second relay being normally operated, means effective both when said first-mentioned relay remains released following opening of said switch and when said first-mentioned relay remains operated following closure of said switch for releasing said second relay, an alarm, and means effective upon release of said second relay for operating said alarm.

2. In a tandem switching center for interconnecting incoming trunks with outgoing circuits, the combination defined by claim 1 wherein said means for opening said line includes a third relay, a make contact of said third relay connected in said line, and a break contact of said first-mentioned relay connected in the operate path of said third relay.

3. In a tandem switching center for interconnecting incoming trunks with outgoing circuits, the combination defined by claim 1 wherein said releasing means for said second relay includes a shunt path to ground for short circuiting the normal operate path of said second relay.

4. In a tandem switching center for interconnecting incoming trunks with outgoing circuits, the combination defined by claim 3 wherein said shunt path to ground includes two parallel branch sections, the first of which includes a make contact of said control switch and a make contact of said first-mentioned relay and the second of which includes a break contact of said control switch and a break contact of said first-mentioned relay.

5. In a tandem switching center for interconnecting incoming trunks with outgoing circuits, the combination defined by claim 4 further comprising a fourth and a fifth relay, means for simultaneously operating said fourth and fifth relays, and additional means effective when said fourth and said fifth relays are in respectively different conditions for releasing said second relay.

6. In a tandem switching center for interconnecting incoming trunks with outgoing circuits, the combination defined by claim 5 wherein said additional means is effective only when said first-mentioned relay is in operated condition.

7. In a tandem switching center for interconnecting incoming trunks with outgoing circuits, the combination defined by claim 6 wherein said shunt path to ground includes two additional parallel branch sections, one of which said additional branch sections includes a make contact of said fourth relay and a break contact of said fifth relay, and the other of which additional branch sections includes a break contact of said fourth relay and a make contact of said fifth relay.

8. In a tandem switching center for interconnecting incoming trunks with outgoing circuits extending to called lines at a terminating office, a service position, a switchboard position, means for connecting said incom-

9

ing trunks to said positions, a line connecting said switch-board position and said service position, a plurality of groups of lamps at said service position, a separate energizing line for each of said groups, said energizing lines normally being mutually balanced electrically whereby each respective group of lamps is energized solely over its respective line, means effective upon interruption of the continuity of one of said energizing lines with consequent upsetting of the balance between it and the adjacent energizing line for completing a shunt path whereby to energize the group of lamps normally associated with said interrupted line over the respective adjacent line.

9. In a tandem switching center for interconnecting incoming trunks with outgoing circuits extending to called lines at a terminating office, the combination de-

10

finer by claim 8 wherein said shunt path includes a relay, means for operating said relay upon completion of said shunt path, an alarm, and means effective upon operation of said relay for activating said alarm.

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15 KATHLEEN H. CLAFFY, *Primary Examiner*.

L. A. WRIGHT, *Assistant Examiner*.