

May 3, 1955

R. J. MARMORSTONE
ANNUNCIATOR AND ALARM SYSTEM

2,707,777

Filed Oct. 22, 1952

4 Sheets-Sheet 1

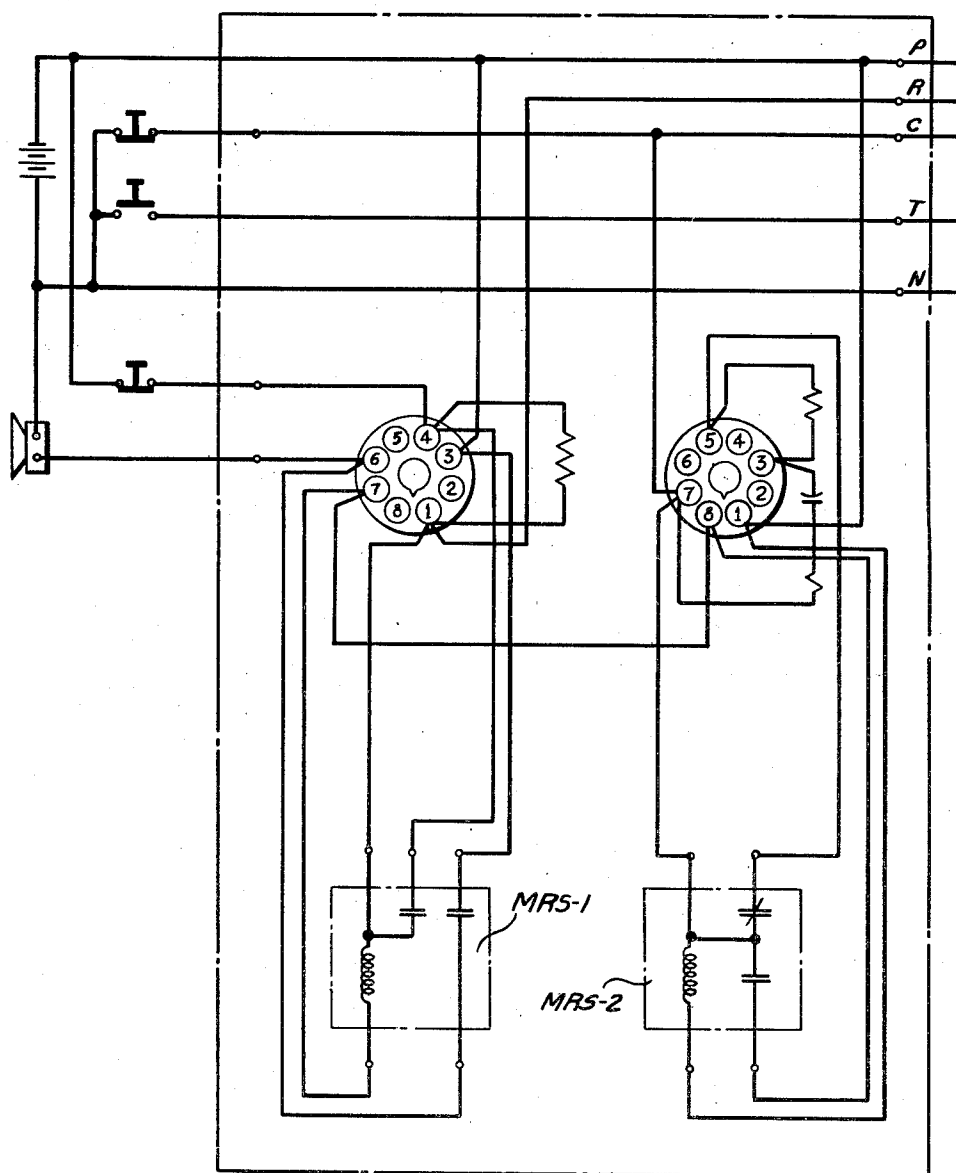


Fig. 1

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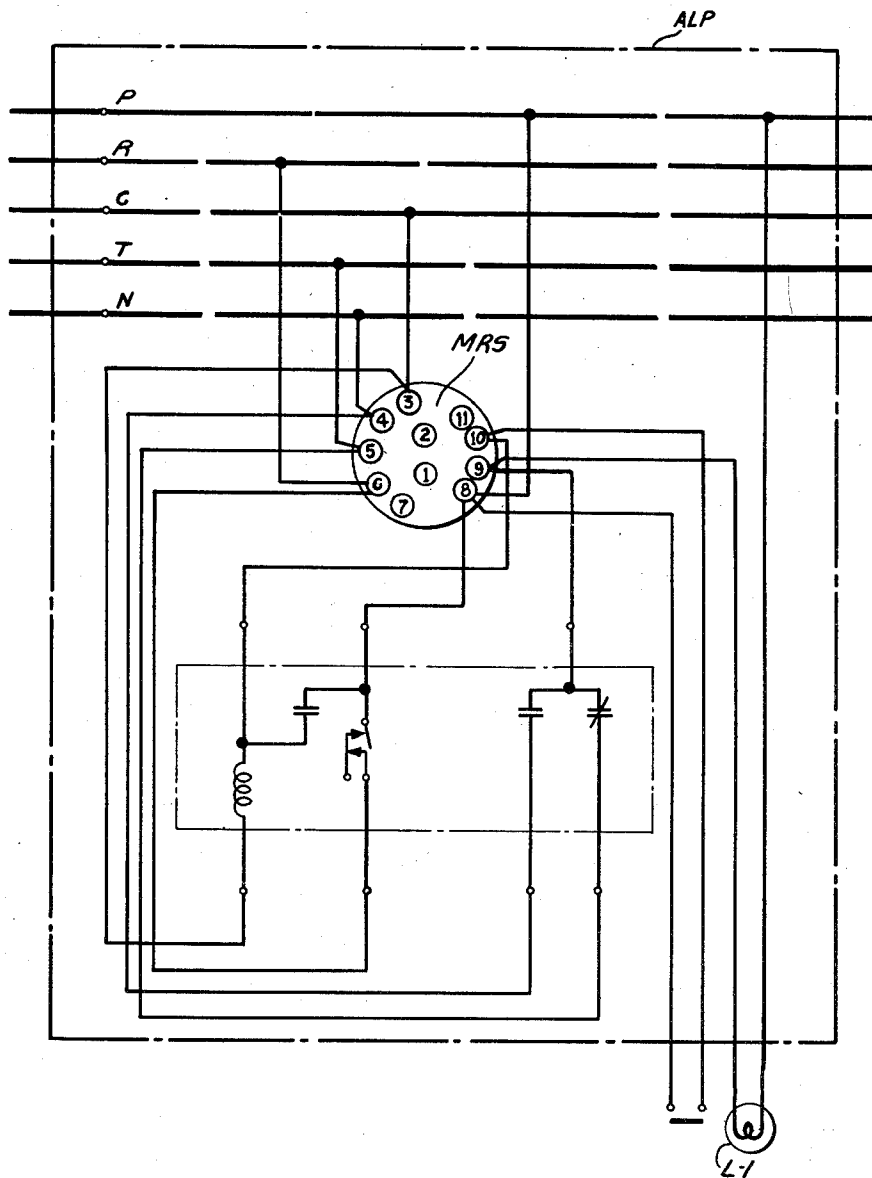
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4 Sheets-Sheet 2

Fig. 2



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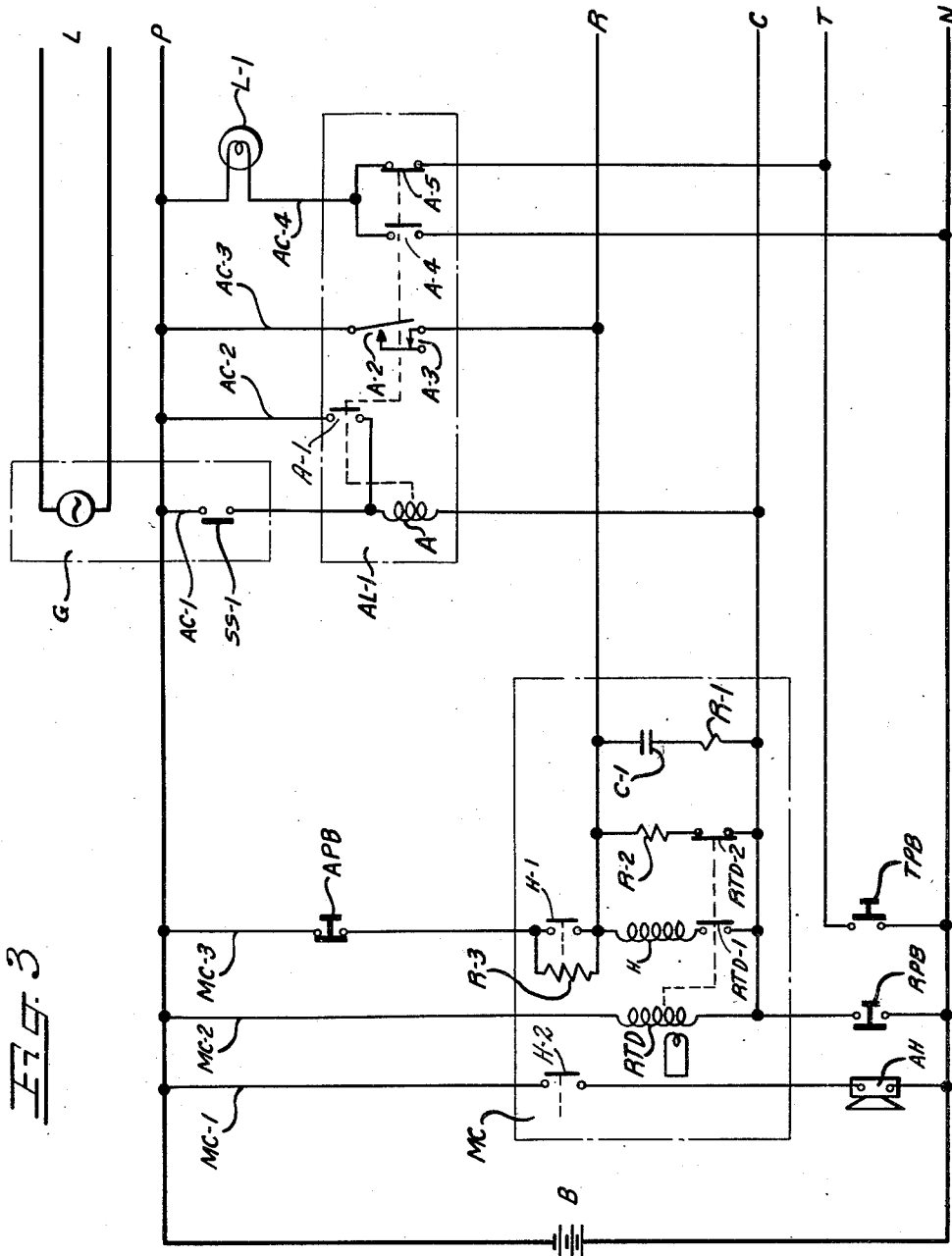
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4 Sheets-Sheet 3



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ANNUNCIATOR AND ALARM SYSTEM

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4 Sheets-Sheet 4

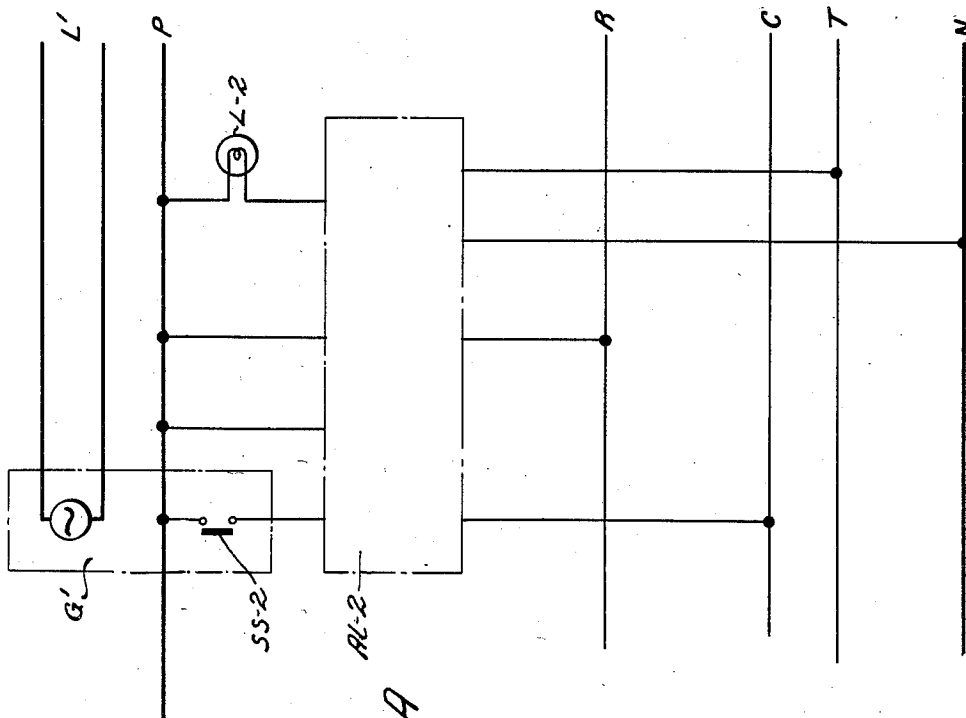


FIG. 3A

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ANNUNCIATOR AND ALARM SYSTEM

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Application October 22, 1952, Serial No. 316,186

17 Claims. (Cl. 340—213)

This invention relates to an electric alarm system for the protection of power plants and the like.

A common object of systems of this kind is, to provide a full and complete alarm announcement schedule with the simplest means possible. A complete schedule requires mainly: safe and instantaneous starting of audible and visual alarms, the former being plantwide and the latter being specific for the indication of the source of trouble; provisions for manual acknowledgment and extinction of the audible alarm; and provision for suitable extinction of the visual alarm. In the latter respect it is frequently required that the visual alarm should be extinguished by manually actuated reset means, rather than automatically, in order to facilitate logging of out of service time and manual restarting of machinery; and the present system makes such provision. In connection with such manual reset it is particularly important that tentative resetting should extinguish the alarm only if and when the off-normal condition responsible for the alarm has been corrected. This will avoid inadvertent, premature extinction of alarms. Simplicity is desired for the means carrying out these various functions, in order to enhance safety as well as economy. The new system is improved in these various respects.

A particular object and feature of the present system is that manual resetting of visual alarms as well as manual acknowledgment of audible alarms is provided in a pulse type system which heretofore allowed only automatic resetting. In other words the scope of application of such a system has been expanded.

Another particular feature of the present system is that the resetting is achieved in extremely simple, safe and inexpensive manner.

Still another particular feature of the present system is that extremely low drain of electric energy is involved, thereby economizing the battery supply which is preferably used as a power source for the alarm circuits of a power generating station; thereby again increasing the safety as well as the economy of the installation.

The new system utilizes improved circuits and wiring arrangements for annunciator circuits and for momentary electric pulse circuits, employed to trigger other circuits or at other times prevented from so doing. Basically and preferably the new system comprises:

A. A source of direct current for the alarm circuits.

B. A series of signal switches, one for each machine or element to be protected; these switches being normally open.

C. A series of signal relays, one for each signal switch, with a single relay coil and a relatively small number of relay switches; preferably these switches comprise one for the sealing in of the relay coil, another, of the make-before-break type, for the triggering of the master relay to be described presently, and a third, of the double throw type, to feed current to an alarm lamp either during alarm conditions (started automatically and terminated by manual reset) or during a test operation.

D. A master control unit, adapted to start an audible

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alarm by automatic triggering from any of the make-before-break switches and also adapted to provide, exclusively, for manual acknowledgment of the audible alarm and manual resetting of any of the visual alarms; the latter in a manner preventing undesirable retriggering while at the same time minimizing switch and circuit arrangement provided for this purpose.

The apparatus incorporating this system comprises simple panels or chassis units, incorporating the different elements A, B, C, etc., pointed out above and their interconnecting wiring and additionally facilitating standardization of such panels or chassis and the use of interchangeable relay elements and plug-in provisions for different annunciator systems.

The details in these various respects will be pointed out in the following specification and illustrated in the drawing appended hereto. The disclosure will be specific, for purposes of clear exposition. The scope of the invention is defined in the claims appended hereto.

In the drawing:

Figure 1 is a diagrammatic front view of the master control portion of the present invention.

Figure 2 is a similar view of a typical signal relay unit of the present invention and of parts directly connected therewith.

Figure 3 together with Figure 3A is a schematic view of the electric circuits of the present invention, showing such circuits at the start of an alarm.

The power plant to be protected comprises generators G, G' and power lines L, L' (Figures 3, 3A). The master chassis or master control unit MC for the protection of units G, G', L, L', and the like provides control circuits for the alarm horn or primary or audible annunciator AH. The various alarm relay units or signal relay units AL-1, AL-2, etc., controlled by signal switches SS-1, SS-2, etc. in the generators, lines, etc. provide control circuits for the respective secondary or visual annunciators or lamps L-1, L-2, etc. They also provide starting pulses for the master control.

The alarm wiring system, for the master unit MC and signal units AL-1, AL-2, etc., comprises basically a positive bus P and a negative bus N, connected respectively to positive and negative terminals of an electric battery B.

The primary annunciator or alarm horn AH is interposed on a first master control wire MC-1, shown as directly connected to the positive bus P at one end and to the negative bus N at the other end. A normally open horn relay switch H-2 is interposed on this wire, for the direct control of a horn circuit.

For this control, the master chassis MC provides a horn relay coil H, adapted to be triggered by any of the alarm relays AL-1, etc., subject to control by a reset time delay relay RTD in the master chassis MC. The latter relay is connected to the P bus and through a normally closed reset push-button RPB to the N bus. Opening and closing of the reset push button therefore deenergizes and re-energizes the time delay relay, respectively. The contacts of the time delay relay will, therefore, sometimes be referred to as the slave switch means or contacts.

Between the coil of the reset time delay relay RTD and the reset push-button RPB a reset control bus C is branched off from the second master control wire MC-2. This bus C cooperates with a pulse-transmitting bus R, which conducts pulses from any of the alarm relay units AL-1, etc. into the master chassis MC. Here such pulses are selectively used for the triggering of the horn relay coil H, with the aid of a capacitor or condenser CI. For this purpose there is interposed between the busses R and C, in the master chassis MC: (1) the horn relay coil H and (2) the energy-storing condenser CI in series

with a small resistor R-1. For reasons to be explained hereinafter there is also interposed, between the busses R and C, in the master chassis MC, (3) a resistor R-2 which has considerably greater resistance than does the condenser resistor R-1; the load units H and R-2 being in series, respectively, with the normally open and normally closed portions RTD-1 and RTD-2 of a double throw switch controlled by the reset time delay relay RTD.

This time delay relay is of the slow make, rapid break type, wherein energization usually requires about 80 milliseconds while de-energization may require about 15 or 20. The horn relay, by means of a pre-energizing resistor R-3, is of the rapid make type, using only a very few milliseconds for energization. (Standard relays such as A often require about 15 milliseconds for energization and about 7 for de-energization.)

The horn relay H can be energized from bus P either (1) from the pulse-conducting bus R or (2) through a normally open horn relay switch H-1, in parallel with resistor R-3 and in series with a normally closed acknowledgment push-button APB; these switches APB and H-1 being interposed on a third master control wire MC-3.

It will thus be seen that normally, (1) the reset time delay relay RTD is energized, the push-button RPB being normally closed; (2) the horn relay H is partly pre-energized through the resistor R-3, the acknowledgment button APB being normally closed and the relay switch RTD-1 being closed at all times during which the time delay relay RTD is energized; while (3) no current flows normally through the wire MC-1 and through the various wires connected with the alarm relays AL-1, etc. Of these, a usual installation may have several dozens or even hundreds or thousands. Their normal de-energization insures low drain of electric energy from battery B.

Each alarm relay AL-1, etc. comprises a single relay coil A, interposed in series with a signal switch such as SS-1, on a first alarm relay wire AC-1 connected between the positive bus P and the reset bus C. The signal switch SS-1 is normally open, as required in a low drain system.

A first alarm relay switch A-1 is provided in each relay AL-1, etc. on a wire AC-2, in parallel with the signal switch SS-1, between the coil A and the current supply of the signal switch, for seal-in purposes. Additionally, on a wire AC-3 in each relay AL-1, etc., there is an alarm relay switch A-2, A-3 of the make before break type to produce the required pulse for the triggering of the horn relay coil H. Finally the coil A controls a double throw switch A-4, A-5 in each relay AL-1, etc., for the direct control of the corresponding alarm lamp L-1, etc., disposed on a wire AC-4, in series with this double throw switch. Each of the several alarm relays AL-1, AL-2, etc. has the four supply wires AC-1, 2, 3 and 4, similarly connected; and each of the several alarm relays AL-1, etc. is connected to the other side of the system in the same manner as shown, that is, to the reset bus C on the other side of the coil A; to the pulse-transfer bus R on the other side of the make before break switch A-2, A-3; and to the negative bus N on the other side of the lamp control switch A-4.

The switch A-5 serves to test the alarm lamp L-1 during the normal, de-energized condition of that lamp; it is interposed, for this purpose, between the lamp L-1 and a bus T, connected to the negative bus N through a normally open test push-button TPB.

Preferably the relays RTD, H and mainly the alarm relays AL-1, etc. are enclosed in hermetically sealed envelopes, filled with inert gas such as nitrogen at atmospheric pressure. This eliminates dangers due to hazardous or semi-hazardous atmospheres; particularly it prevents explosions of coal dust due to sparking and the like. The relay envelope or plug-in unit of each alarm relay AL-1, etc. has a multiple-prong plug in one end wall thereof; and the alarm relay panel ALP (Figure

2) has a series of multiple recess sockets MRS, matching the plugs. This arrangement facilitates the interchange, testing and maintenance of the entire panel.

The sockets MRS and the corresponding plugs are shown as providing certain recesses and plugs in addition to those utilized in the present system. This feature allows standardization of both panels and plug-in units, resulting in great savings both in original manufacture and safety testing and maintenance. Extra costs, for the extra prongs and recesses and their wiring, can be kept within insignificant limits.

The connection of the horn relay and reset time delay relay with the master chassis can be obtained by similar sockets MRS-1 and MRS-2, in the master chassis (Figure 1).

Basic operation

Normally, as mentioned, all signal switches SS-1, SS-2, etc. are open. Only one full load-energizing circuit is normally established: a reset relay circuit P, MC-2, RTD, RPB, N.

When any signal switch SS-1 closes, there is established in the corresponding relay AL-1, as shown in Figure 3, a signal circuit P, SS-1, A, C, RPB, N; an alarm relay seal-in circuit P, AC-2, A-1, A, C, RPB, N; an alarm lamp circuit P, L-1, AC-4, A-4, N and a momentary pulse circuit P, AC-3, A-2, A-3, R, CI, R-1, C, RPB, N for the triggering of the horn relay coil H. This latter circuit is channeled also, at least in part, through the horn relay coil H itself and through the closed switch RTD-1. The pulse circuit, produced in the make before break switch A-2, A-3, lasts about 1 to 1.5 milliseconds. Such duration is sufficient to charge the condenser CI to line voltage, and to commence full energization of the H relay coil, pre-energized through the resistor R-3.

Discharging of the condenser commences as soon as the pulse circuit has been terminated. The relay coil A is still energized, mainly through the seal-in circuit (the signal circuit may be reopened at once due to fluctuating conditions in the signal switch SS-1, or may be reopened later, without any effect upon the present circuit system which safeguards manual resetting). The alarm lamp circuit is still in effect, as is the reset relay circuit. In addition there is now established, by the energy discharged through the condenser, a horn relay trigger circuit CI, R, H, RTD-1, C, RPB, N, triggering the horn relay into fully energized condition.

Before the trigger circuit has been spent, it has snapped the H relay into fully energized condition, thereby closing the two normally open relay switches H-1 and H-2. This establishes a horn relay seal-in circuit P, MC-3, APB, H-1, H, RTD-1, C, RPB, N and a horn circuit P, MC-1, H-2, AH, N. The horn begins to sound.

It will be understood that the entire set of operations described up to here is performed within a very few milliseconds; it is practically instantaneous. As soon as the signal switch SS-1 closes a primary, general, plant alerting alarm is effected by the horn AH, while the exact trouble spot is indicated by the lamp L-1.

In order to avoid unnecessary disturbance of plant personnel, it is desirable to acknowledge or silence the alarm horn AH at the earliest opportunity, while keeping in effect the announcement of the lamp L-1. For this purpose, the acknowledgment push-button APB is provided. Momentary depression of this button breaks the horn relay seal-in circuit at APB, thereby de-energizing the horn relay coil H.

It is immaterial how long the acknowledgment push-button is depressed. As soon as it is depressed for the first time it de-energizes the horn relay as mentioned. Thereby it opens both horn relay switches H-1, H-2. Thus the horn seal-in circuit is now interrupted, either at H-1 alone or at this point and at APB. No other horn relay energizing circuit (except the mere pre-energizing circuit through the resistor R-3) is in effect, since alarm relays AL-1, etc. unaffected by the acknowledg-

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ment push-button APB, do not emit any pulses at this moment. Thus the arrangement shown safeguards the preferred plan, according to which any renewed or repeated sounding of the horn indicates a new and different source of alarm.

Such a new and different type of alarm may be originated by any of the alarm relays AL-2, etc. (Figure 3A), which are not energized and sealed in at the time. Fluctuations of the signal switch SS-1 of the first alarm relay AL-1, as mentioned, have no effect, due to the associated alarm coil seal-in circuit. Accordingly, opening of the signal switch SS-1 (which may be due to further fluctuation, or due to re-establishment of normal operating conditions) extinguishes the signal circuit of AL-1, but has no effect upon the now prevailing condition of the alarm devices L-1, AH. In other words, the present alarm system can be alarmed only automatically by a signal switch SS-1, etc., but can be de-alarmed and reset, in full or in part, only by manual switches APB, RPB.

The master control superintendent, who normally is in charge of the two manual switches, will usually depress the former, APB, at once, in order to protect the plant from disturbance and also to allow reception of new alerting signals originating elsewhere. He should depress the reset push-button RPB whenever his information or judgment so indicates. This latter task is facilitated, and tentative resetting allowed without adverse effect upon the overall safety of the alarm system, in the manner which will now be described in detail.

Resetting operations

The superintendent depresses the reset push-button RPB either before or after the reopening of the signal switch SS-1 which has caused the last alarm. I will first describe resetting after reopening of the signal switch.

Depression of the reset push-button RPB kills all MC and AL-1 circuits, fed by the alarm battery B. Previously the reset time delay relay RTD and at least one alarm relay AL-1 were energized. Both are now de-energized.

The resulting de-energization of the coil A causes a reversal of the make before break switch A-2, A-3. This tends to produce a second pulse P, AC-3, A-2, A-3, R, CI. In the absence of the present reset arrangement this pulse might tend to be completed through the quick operating H coil, in case of momentary operation of the RPB push-button; and this might re-energize the horn. However, this is avoided by the slow making but rapid breaking reset time delay relay RTD. The depression of the reset push button RPB has instantly reversed the previous position of the time delay relay switches RTD-1, 2 and established their normal positions. In other words, safely before pulling in can be completed even in the quick operating horn relay H, the path for any horn relay circuit has been broken at RTD-1.

The condenser CI, which has been charged again to a certain extent, discharges now through the resistor R-2 and the now closed switch RTD 2. In other words the opening pulse is prevented from triggering the horn relay. This is achieved by the same relay RTD which also serves to perform a basic function (reset) in the program.

As soon as the discharge through R-2 has taken place, which normally requires only a very insignificant time interval, normal condition of the alarm wiring system has been established or re-established. In this normal condition, as mentioned before, all circuits are dead, except the time delay relay circuit, which is re-established upon the release of the reset push-button RPB, and the partial or horn relay pre-energizing circuit. Particularly inactive are, the horn circuit, the lamp circuits of all alarm relays, and the signal and seal-in circuits of all alarm relays.

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Resetting prior to return to normal is safely avoided, even if the superintendent tentatively depresses the reset push-button at a time when the signal switch SS-1 is still closed. Momentarily, during such depression of the button, this establishes a position of the system with all circuits dead. Immediately upon the release of the button however the alarm relay coil A is energized again through the signal switch SS-1, sealing in again through the seal-in switch A-1, and re-establishing the lamp circuit through the switch A-4.

This operation involves also, a new pulse generated at A-2, A-3 and conducted through the bus R. This would theoretically tend to trigger the horn relay and restart the horn, which would be undesirable and confusing. Such an occurrence is therefore prevented. The same means which prevent triggering on the deenergizing pulse of the AL-1 relay have been found sufficient to prevent also the energizing pulse occasioned upon resetting prior to return to normal. In other words, the slow make quick break reset relay RTD has been de-energized at once during the momentary depression of the reset button RPB. Release of that button causes instantaneous arrival of the energizing pulse but only slow reversal of the switches RTD-1, RTD-2. Therefore the pulse in question is channeled through the resistor R-2 and switch RTD-2, and even the preenergizing of the horn relay H, through the resistor R-3, can start only a considerable number of milliseconds later.

It will thus be seen that a complete and fully informative alarm announcement program has been provided by means of extreme simplicity both in the alarm relays AL-1, etc. and the master chassis MC. Basically this has been done by a pulse storage triggering system involving the use of a standard coil A, a rapid make and standard break coil H, and a slow make and rapid break coil RTD; together with a pulse generating device of the make before break type, creating a pulse which is rapid as compared even with the quick operating characteristics of the H relay.

Testing of lamps

Testing of the lamps often is desirable, for maintenance of complete safety of an alarm system. Ordinarily it will be performed during the existence of normal conditions in all or most of the alarm relays AL-1, etc. However in the present system the test can be performed also while one or more of the alarm relays AL-1 and their corresponding lamps L-1 are energized. It will be noted that the special testing bus T allows this operation. It provides for a testing circuit P, AC-4, L-1, A-5, T, TPB, N. This circuit is established through all de-energized alarm relays AL-1, etc., whenever the test push-button TPB is depressed.

It will be understood that similar testing can also be applied to the horn AH and various other additions and modifications can be applied by persons skilled in the art, pursuant to a study of the foregoing disclosure.

I claim:

1. An electric alarm system comprising a source of current; first and second main lines connected thereto; a series of alarm relays and a single master relay unit between said main lines; an alert unit associated with the master relay unit; an alert circuit from one main line through the master relay unit and alert unit to the other main line; a control relay coil of the slow make rapid break type in the master relay unit; a control circuit from one main line through the control relay coil to the other main line; a reset push-button interposed in the last mentioned circuit; a control bus branched off from the last mentioned circuit between the coil and the push-button; an alert relay in the master relay unit; an alert relay circuit from one main line through the alert relay coil to the control bus; an acknowledgment switch interposed on the alert relay circuit; a pulse-transmitter bus connected to the alert relay circuit between the acknowledgment switch and the coil; a condenser and a shunt both connected

between the control bus and the pulse-transmitter bus in parallel with the alert relay coil; a pair of normally open switches controlled by the alert relay and interposed respectively in the alert circuit and on the alert relay circuit between the line and the pulse-transmitter bus; a normally open switch in series with the alert relay coil between the control and pulse-transmitter busses and controlled by the control relay; a normally closed switch in the shunt, controlled by the control relay, and an alarm circuit system in each alarm relay comprising a signal circuit from one of the main lines through the alarm relay, to the control bus; an alarm relay coil and a normally open signal switch in the signal circuit; an alarm seal-in switch and circuit for the last mentioned relay coil; a make before break switch operable by the last mentioned relay coil, and a circuit, including the make before break switch, from the last mentioned main line to the pulse-transmitter bus.

2. An alarm system as described in claim 1 additionally comprising a pre-energizing resistor for the alert relay coil, shunted around the switch controlled by and in circuit with said coil.

3. An alarm system as described in claim 2 wherein said shunt comprises a resistor having considerably less resistance than said pre-energizing resistor.

4. An alarm system as described in claim 3 wherein the circuit comprising said condenser comprises a resistor having considerably less resistance than the resistor in said shunt.

5. An electric alarm system comprising a source of current; a series of signal circuits connected to said source; a signal switch and an alarm actuator in each signal circuit; an alarm seal-in switch and circuit for each actuator; a series of make before break switches operable respectively by said actuators; a condenser adapted to be charged by electric energy from the source through any of the make before break switches; an alert actuator circuit; an alert actuator therein adapted to be triggered by the discharge of the condenser; a seal-in switch and circuit for the alert actuator; a manually controllable switch in the seal-in circuit for the alert actuator; a shunt alternate condenser discharge circuit around the alert actuator; respective control switches interposed in the alert actuator and shunt circuits; a control relay to operate the control switches into opposite conditions, one switch being closed while the other is open; a control circuit including said control relay; and reset switch means for actuating said control relay, the latter being operated upon actuation of said reset switch means to a position which operates the control switches to prevent operation of the alert actuator.

6. An alarm system as described in claim 5 wherein the control relay has a slow make rapid break coil, the control switch interposed on the alert actuator circuit is normally open but closed while the control relay is energized, and the control switch interposed on the shunt circuit is normally closed but open while the control relay is energized.

7. An alarm system as described in claim 6 additionally comprising a pre-energizing resistor shunted around the seal-in switch for the alert actuator and adapted to effect pulling in of the alert actuator within a time interval which is rapid as compared with the operations and reversals of the alarm actuators.

8. An alarm system as described in claim 7 additionally comprising a small resistor in series with the condenser to provide loading of the condenser within a short but definite fraction of the time interval during which the make before break switch of any alarm relay is closed.

9. An alarm system as described in claim 8 wherein the condenser, resistors and other elements are arranged to energize the alert actuator in less than 7 milliseconds, each alarm actuator in about 15 milliseconds and the control relay in about 80 milliseconds and to de-energize

the alert actuator and each alarm actuator in about 7 milliseconds and the control relay in about 15 to 20 milliseconds.

10. An alarm system comprising a series of alarm annunciator units for giving an indication of the condition of associated variables, control means for each alarm annunciator unit to effect operation thereof, an alert annunciator, a self-holding, impulse-operable circuit to effect operation of the alert annunciator, an impulse-transmitter for each annunciator unit operable in response to the operation of the associated control means during abnormal and normal operation thereof to effect operation of the alert annunciator substantially together with the operation of the associated alarm annunciator unit, reset control means for actuating said annunciator units to clear fault indications thereof, said reset control means including a momentarily operable manual reset switch and slave switch means operable in response to said momentarily operable reset switch means by moving from a normal position to a position which prevents the operation of said alert annunciator by the impulse transmitters, said slave switch means being slow to operate upon the release or return of said momentarily operable reset switch to its normal position, said slow operation being such that the impulses generated by said impulse transmitters terminate before said slave switch returns to its normal position to prevent operation of the alert annunciator when the reset switch is released, and alert acknowledgment circuit means operable only upon said impulse-operable circuit to deenergize the alert annunciator.

11. An alarm system comprising a series of alarm annunciator units for giving an indication of the condition of associated variables, control means for each alarm annunciator unit to effect operation thereof, an alert annunciator, a self-holding, impulse-operable circuit to effect operation of the alert annunciator, an impulse-transmitter for each annunciator unit operable in response to the operation of the associated control means during abnormal and normal operation thereof to effect operation of the alert annunciator substantially together with the operation of the associated alarm annunciator unit, reset control means for actuating said annunciator units to clear fault indications thereof, said reset control means including a momentarily operable manual reset switch and slave switch means operable in response to said momentarily operable reset switch means by moving from a normal position to a position which prevents the operation of said alert annunciator by the impulse transmitters, and said slave switch means being slow to operate upon the release or return of said momentarily operable reset switch to its normal position, said slow operation being such that the impulses generated by said impulse transmitters terminate before such slave switch returns to its normal position to prevent operation of the alert annunciator when the reset switch is closed.

12. An alarm system as described in claim 5 wherein the control relay operates slowly in the direction which actuates the control switches in a direction which renders the alert actuator operative, so that the condenser discharges through the shunt circuit and by-passes the alert actuator before the control switches have reversed their positions, and the control relay operates rapidly in the opposite direction to render the alert actuator inoperative immediately upon actuation of said reset switch means.

13. An alarm system as described in claim 12 wherein the control switch interposed in the alert actuator circuit is closed while the control relay is energized, said control relay being normally energized and being arranged to be deenergized by the actuation of said reset switch means, the control switch interposed in the shunt circuit being open while the control relay is energized, a pre-energizing resistor shunted around the seal-in switch for the alert actuator to reduce the voltage on the alert actuator below the value which would actuate the same, and adapted to effect actuation of the alert actuator within a time inter-

val which is rapid as compared with the operation of the alarm actuators.

14. An annunciator system for indicating the normal and abnormal conditions of a variable, comprising condition signalling means providing respective signals indicating the normal and abnormal condition of the variable, first condition responsive control circuit means including relay and circuit means for actuating the condition signalling means to its normal and abnormal signalling indications, said circuit means including means for holding the relay in its abnormal position, which in turn holds the signalling means in its abnormal signalling condition, alarm signalling means for giving an alert when said variable becomes abnormal, second control circuit means normally responsive to the actuation of said first control circuit means to both its normal and abnormal condition for actuating said alarm signalling means, manually operable reset switch means for momentarily actuating said relay to its non-holding position, and means responsive to the operation of said reset switch means for preventing the operation of said alarm signalling means during the resetting operation.

15. In an annunciator system for indicating the normal and abnormal conditions of a number of variables and which includes condition signalling means for each variable providing respective signals indicating the normal and abnormal condition of the associated variables, respective first condition responsive control circuit means for said variables each including relay and associated circuit means for actuating the associated condition signalling means to its normal and abnormal signalling indications, each of said circuit means including a holding circuit for holding the associated relay in its abnormal position which in turn holds the signalling means in its abnormal signalling condition, common alarm signalling means for said variables for giving an alert alarm when a variable becomes abnormal, second control circuit means common to all of said variables which is normally responsive to the actuation of any of said first control circuit means to both their normal and abnormal conditions, for actuating said common alarm signalling means, manually reset switch means for momentarily actuating said relays to their non-holding positions, and means responsive to the operation of said reset switch means for preventing the operation of said alarm signalling means during the resetting operation.

16. An annunciator system for indicating the normal and abnormal conditions of a number of variables, comprising respective condition indicating apparatus for indicating the normal and abnormal conditions of associated variables, respective relay circuit means for controlling the operation of said condition indicating apparatus and each including a condition responsive relay having a set of holding contacts connected in a holding circuit therefor, a set of make before break contacts which are momentarily closed as the relay is energized and the relay is de-energized, and a set of contacts arranged in a circuit for controlling the operation of the associated condition indicating apparatus, a common alert actuator means for initiating an alarm when any variable becomes abnormal, means connecting all make before break contacts to a common circuit with said alert actuator means, the arrange-

ment being such that an energizing impulse for effecting the energization of the alert actuator means is generated each time said make before break contacts are momentarily closed, a manually operable reset control switch adapted to be momentarily actuated, said reset control switch arranged when momentarily actuated to operate all condition responsive relays not already so operated to their normal condition indicating positions and so to break their holding circuits, a control relay operated by said reset control switch, said control relay having a set of contacts in circuit with said alert actuator means, said last-mentioned set of contacts rapidly operating to prevent the energization of said alert actuator means immediately upon actuation of said reset control switch and being slow operating in the opposite direction of actuation thereof, the latter set of contacts maintaining their position which prevents energization of said alert actuator means until after the generation and termination of the energizing impulse due to the momentary closing of said make before break contacts caused by the release of the reset switch, so that momentary actuation and release of the reset control switch will not result in an alert.

17. In an annunciator system for indicating the normal and abnormal conditions of a number of variables, and which includes condition indicating apparatus for indicating the normal and abnormal condition of an associated variable, relay circuit means for controlling the operation of said condition indicating apparatus and including a condition responsive relay having a set of holding contacts connected in a holding circuit therefor, a set of contacts which initiate an energizing impulse when the relay is energized and when it is deenergized, and a set of contacts arranged in a circuit for controlling the operation of the condition indicating apparatus, alert actuator means for initiating an alarm when the variable becomes abnormal, and means for coupling each energizing impulse to the circuit which includes said alert actuator means for energizing the same, the improvement comprising a manually operable reset control switch adapted to be momentarily actuated, said reset control switch arranged to operate said condition response relay to its normal condition indicating position and so to break its holding circuit, a relay operated by said reset control switch, said relay having a set of contacts in circuit with said alert actuator means, said last-mentioned set of contacts rapidly operating to prevent the energization of said alert actuator means immediately upon actuation of said reset control switch and being slow operating in the opposite direction of actuation thereof, the latter set of contacts maintaining their positions which prevent energization of said alert actuator means until after the termination of the energizing impulse caused by the release of the reset switch, whereby momentary actuation and release of the reset control switch will not result in an alert.

References Cited in the file of this patent

UNITED STATES PATENTS

2,278,939	Muehter	Apr. 7, 1942
2,493,548	Proctor	Jan. 3, 1950
2,501,793	Sperry	Mar. 28, 1950
2,600,132	Seaton	June 10, 1952