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3,447,145 5/1969 Schumann..... 340/213.1
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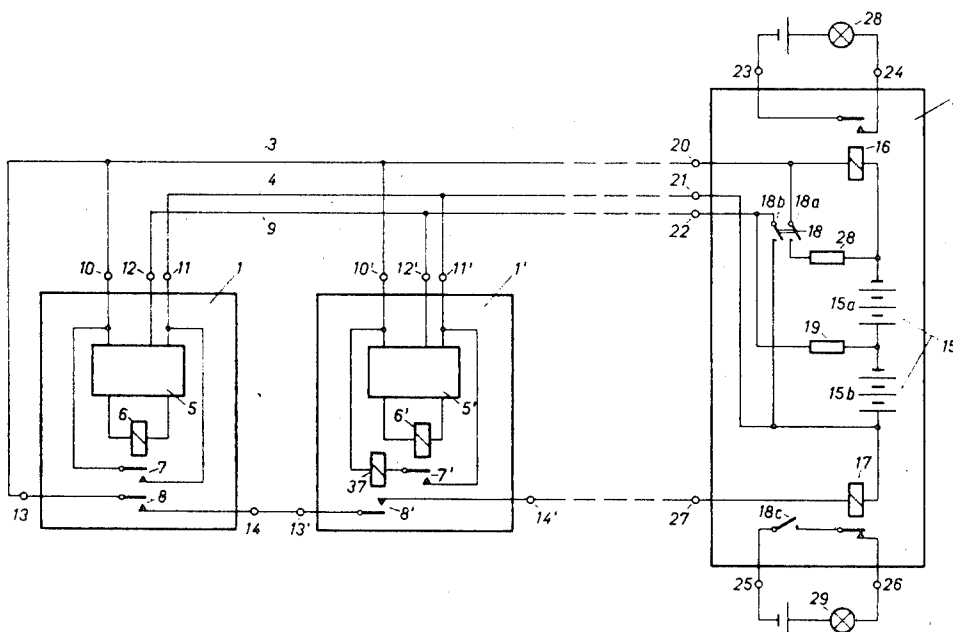
[54] **TEST OF PARALLEL ALARM UNITS**
7 Claims, 3 Drawing Figs.

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[56] **References Cited**
UNITED STATES PATENTS

2,847,662	8/1958	Lindgren.....	340/227.1
3,235,858	2/1966	Mader.....	340/214
3,530,450	9/1970	Walshard et al.	340/214
2,639,418	5/1953	Sundstrom et al.	340/228
2,895,125	7/1959	Watts.....	340/227
3,128,457	4/1964	Culbertson.....	340/213.1

ABSTRACT: An improved signal installation of a plurality of alarm units is disclosed, the signal installation enabling the operational readiness of each alarm unit to be checked in a simple and reliable manner. The basic signal installation itself comprises a plurality of individual alarm units, each alarm unit being connected in parallel preferably across a pair of supply conductors leading to some central monitoring station. Each alarm unit is preferably of the type wherein, at the occurrence of an alarm condition, an electrical contact is closed therein essentially shorting the supply conductors. For purposes of checking the operational readiness of the plurality of alarm units, alarm conditions are electrically simulated at each alarm unit. When each alarm unit responds to the checking operation, and additional electrical contact associated with each alarm is closed. The additional or checking electrical contacts are connected in a separate series circuit leading back to the central monitoring station. If all alarms of the plurality of alarm units have properly responded to the checking operation, then the separate series circuit comprising all the additional electrical contacts will be completed. Should one of the plurality of alarm units fail to respond, then its associated additional electrical contact would remain in an open condition thus breaking the series circuit triggering an indicator at the central station.



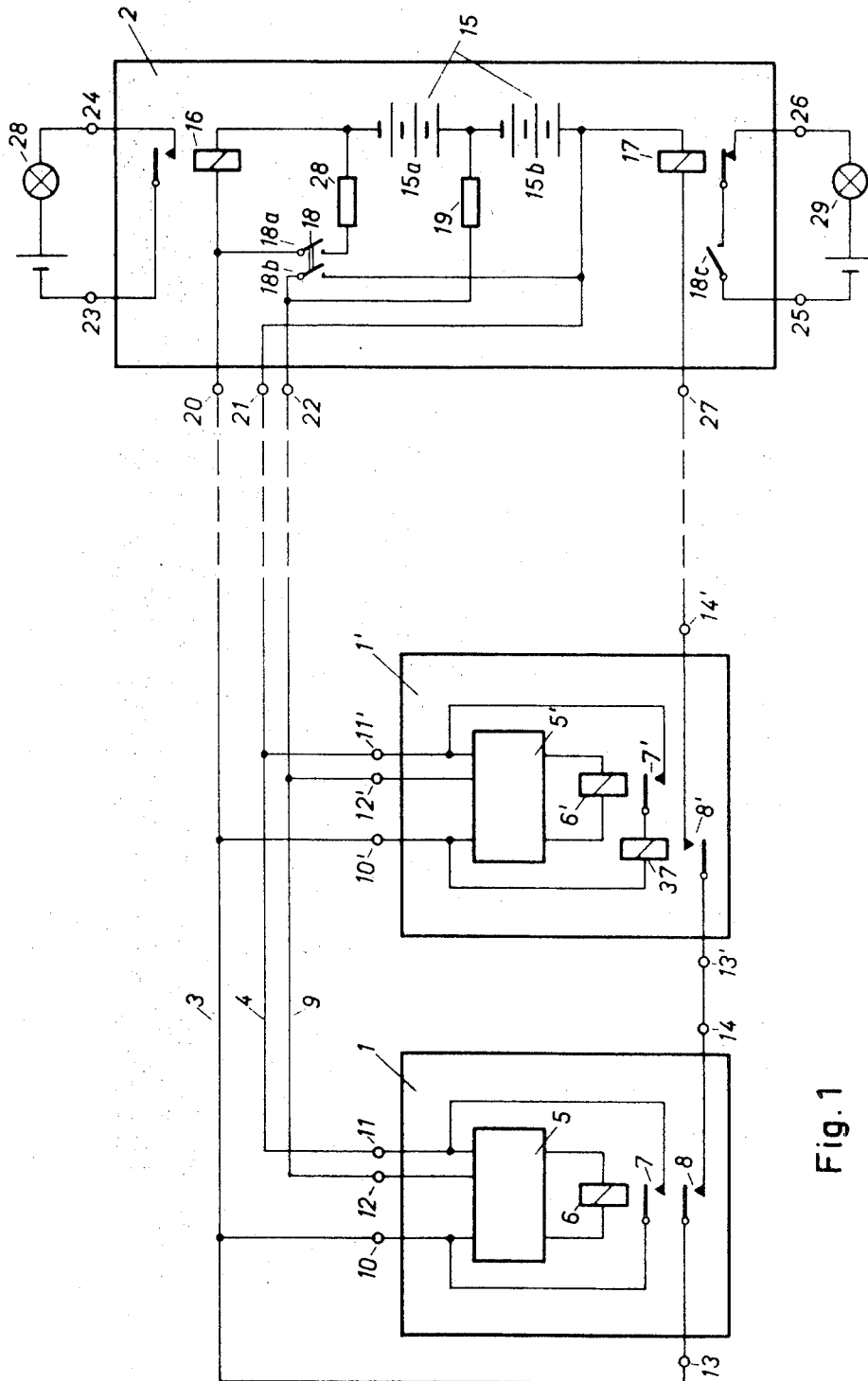


Fig. 1

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ATTORNEYS

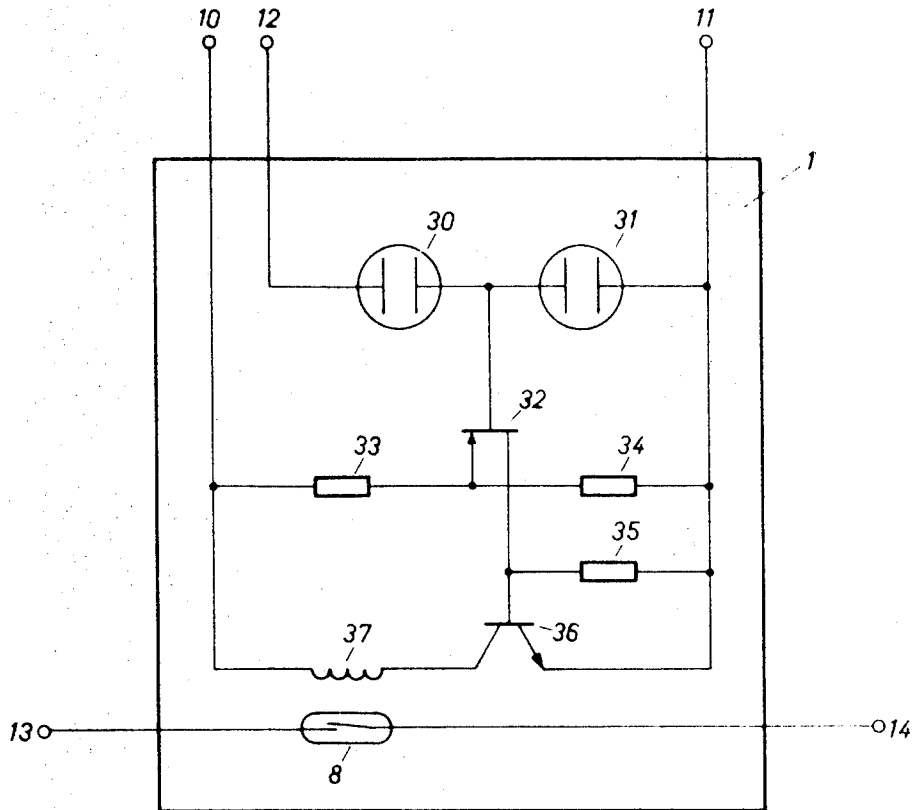


Fig. 2

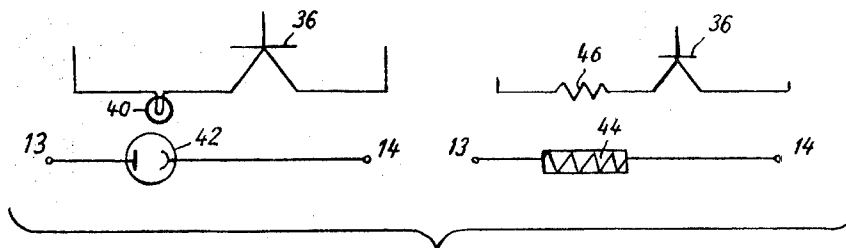


Fig. 2a

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TEST OF PARALLEL ALARM UNITS

BACKGROUND OF THE INVENTION

The present invention generally relates to alarm signal installations and particularly concerns an improved alarm signal installation of the type incorporating a plurality of parallel connected individual alarm units along with a device enabling the simultaneous remote triggering of each alarm unit for the purpose of checking the operational readiness of the same.

Alarm units, in their basic structural format, generally comprise an electrical switch or contact which, upon the occurrence of a predetermined change in magnitude of some condition being monitored, alters its switching state. The change or alteration of the switching state generally triggers an indicating device at some remote, central location. If the basic alarm unit is of the type wherein its switching or electrical contact is normally open in the rest or unactuated condition of the associated alarm unit, then one would be concerned with the measurement of a working current in the entire alarm circuit to indicate the occurrence of an alarm condition. On the other hand, if the alarm unit is such that its switching contact normally is closed when its associated alarm unit is in a rest or unactuated condition, then one would be concerned with detecting the interruption of some ambient current which normally would be flowing from the remote central station through the alarm unit except upon the occurrence of an alarm condition. Alarm units of this basic type can generally be connected either in series with one another or in parallel circuit relation within any given signal installation. Generally speaking, if the individual alarm units are all connected in series, then such alarm units must be of the type wherein their individual switching contacts are normally closed and wherein the signal installation draws some ambient current during an unactuated condition of the alarm units.

Drawbacks exist when considering this type of an alarm installation wherein each of the alarm units of a plurality of alarm units are connected in series circuit. For example, upon the occurrence of an alarm, an interruption of the normally flowing ambient current through the series circuit would occur. The same interruption of the current through the series circuit would also take place upon the occurrence of some disturbance, not an alarm, at an alarm unit. Disturbance, as utilized herein, should be construed as a malfunctioning, rather than an actuation, of an alarm unit. Thus, when utilizing a series connection of a plurality of individual alarm units, disturbances cannot be differentiated from an actual alarm condition. When one considers that present day alarm units generally comprise rather complex electronic circuits which are prone to malfunctions or other disturbances, and when one further considers that security installations can comprise several hundred of such alarms wherein the response from each individual alarm unit generally is desired to result in the undertaking of some specific corrective measure such as would be the case with the utilization of such alarm systems by police or fire departments, then the importance of being able to distinguish between a disturbance and an actual alarm at an individual unit can be better appreciated. By connecting the individual alarm units in parallel circuit and thus relying on operation wherein the individual contacts of each alarm unit are normally in an open condition and close upon an alarm condition, higher reliability with respect to the distinguishment of an alarm from a disturbance can be realized. With a parallel alarm unit connection, a defect or other disturbance in one of the alarm units would only cause the particular affected alarm unit to be placed out of operation and would not automatically trigger a spurious or false alarm at the remote central location. Further when utilizing the parallel connected individual alarm units, the entire installation is not made inoperative by virtue of a single defective alarm unit as would be the case when utilizing a series connection of alarm units. This latter drawback has oftentimes precluded the utilization of series alarm unit connections in modern day alarm installations.

Continuing with the development of the art, the utilization of signal installations comprising a plurality of alarm units, each generally connected in parallel with one another across two supply conductors leading to a central remote location has become more and more prevalent. Provisions normally have been made so as to enable the operator of the system to discover and recognize the occurrence of a possible defect or malfunctioning at one or more of the plurality of alarm units. In this regard, so-called checking systems and the like have been developed which serve to periodically transmit to each of the alarm units alarm-simulating conditions, the response of the alarm units to the alarm-simulating conditions transmitted being monitored at the central station. Again, bearing in mind that the type of signal installation referred to herein comprises a plurality of parallel connected alarm units having switching contacts which, upon the occurrence of an alarm or an alarm-simulating condition, close to effectively short the supply conductors, the checking technique proposed in the prior-art involves the comparison, at the central station, of the total current I_t flowing through the alarm units during the checking operation with some reference value current I_0 , deviations of the total actual value of current from the reference value being considered as indicative of a disturbance. Yet, alarm units as actually utilized today are generally not constructed with very close or high tolerances of their individual electrical characteristics. Furthermore, the measuring instruments generally utilized today at the central station to monitor and compare the difference between the actual current flowing during a checking operation and some reference value also are not constructed in a manner inherently affording a high accuracy of the readings. Thus, this prior-art operational-readiness checking technique inherently possesses a high degree of unreliability and, in fact, normally is unsuitable for use when the system comprises a large number of alarm units, such as 30 or more, combined into a single given group. The accuracy of measurement and thus the reliability of the operational-readiness checking techniques has been improved in accordance with still another prior-art system wherein a separate wire is run from each individual alarm unit back to the central station thus affording the opportunity of monitoring each alarm unit separately from the others. Yet, this particular approach is difficult or impossible to be put into practice due to the problems involved in the installation of the plurality of wires and further due to the high economic cost.

SUMMARY OF THE INVENTION

Thus, there exists a need in the prior-art for the provision of a new and improved signal installation of the type utilizing a plurality of parallel connected alarm units, which signal installation, however, enables checking the operational readiness of the alarm units in a particularly simple, economical yet highly reliable manner. It is the primary object of the instant invention to satisfy this need.

Now, in order to implement the above object as well as further objects of the instant invention which will become more readily apparent as the description proceeds, the invention is generally manifested by the features that, in addition to the usual electrical switching contacts coupled in parallel across the supply conductors in a parallel alarm system installation, further electrical contacts are provided at each of the fire alarm units and are interconnected in their own series connected circuit. The series connected additional electrical contacts operate in conjunction with the main or switching electrical contacts yet are coupled in series connection to the central or remote station or location with a voltage source and a separate current measuring device. During the checking operation, the current measuring device at the central location determines the flow of current through the series connection of additional contacts and, if no such current exists, a disturbance indicating device is triggered.

In effect, then, the provision of the series circuit of additional electrical contacts for the checking operation alone af-

fords the simplicity of operation inherent with the determination of the mere presence or absence of current flow. Yet, the disadvantages of not being able to distinguish between a disturbance or an actual alarm condition is eliminated.

BRIEF DESCRIPTION OF THE DRAWINGS

The instant invention itself as well as additional advantageous features thereof will be better understood from the following detailed description of a preferred operational embodiment, such description referring to the appended drawings wherein:

FIG. 1 is an electrical block diagram of a preferred embodiment of the inventive signal installation;

FIG. 2 is a circuit diagram depicting, in simplified form, one embodiment of an individual alarm unit of the system; and,

FIG. 2a depicts alternative elements for the circuit of FIG. 2.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

Describing now the drawings and referring particularly to the exemplary embodiment of the inventive signal installation depicted in block circuit diagram in FIG. 1, it will be seen that such inventive installation comprises a plurality of alarm units 1, 1'...electrically connected to a central remote station 2. For illustrative convenience, however, only two such alarm units 1 and 1' have been indicated on FIG. 1 although it should be appreciated that any number of alarm units can be utilized. Each of the alarm units 1, 1'...are coupled with supply conductors 3 and 4, across such supply conductors and in parallel circuit relation with respect to one another. Each such alarm unit 1, 1'...essentially embodies or comprises a signal transmitter 5, 5'...responsive to the occurrence of some condition that is desired to be monitored. For example, the signal transmitters 5, 5'...could be responsive to the size of combustion particles in the air and thus to the occurrence of a fire. Each alarm unit further is provided with an associated electronic circuit as well as a switch, supply as a relay 6, 6'...respectively, actuated by the associated signal transmitter.

The relay 6 of alarm unit 1 is illustrated as comprising two work current or switching contacts 7 and 8 whereas the relay 6' of alarm unit 1' is illustrated as comprising a single work current or switching contact 7'. Contacts 7 and 7' are coupled to the supply conductors 3 and 4 in such a manner that, in the closed position of these contacts, supply conductors 3 and 4 are short-circuited. As a further variant of the switching contact connection, a relay 37 having a work current contact 8' such as illustrated with respect to alarm unit 1' can be connected in series circuit with the switching contact 7' itself. In either case, energization of the relay 6 or 6' effects closing of the additional contacts 8 and 8', respectively.

The work current or additional contacts 8 and 8' of alarm units 1 and 1' as well as the additional contacts provided in a similar manner for each of the other alarm units connected in the installation are themselves coupled in series circuit with one another. The additional contact 8 of alarm unit 1 from which the series circuit connection commences is advantageously coupled with one of the two supply conductors 3 and 4 and, in the case illustrated, contact 8 is coupled with supply conductor 3. Each of the alarm units 1, 1'...further comprises supply conductor inputs 10, 11; 10', 11'...and exchangeable input and output leads 13 and 14, 13', 14'...leading to the respective work contacts 8, 8'.... An additional control input 12, 12'...is provided for each alarm unit and such control input as well as its function will be discussed hereinbelow.

The central or remote station 2, which for illustrative clarity and convenience has been depicted in a simplified form, comprises a battery 15 having cells 15a and 15b, a signal relay 16, a disturbance indicator relay 17, and a testing switch 18 having switch contacts 18a, 18b, and 18c. The series connection of the battery 15 and the signal relay 16 is disposed between the clamps or connections 20 and 21 of the supply conductors

3 and 4. Signal relay 16 is designed in such a fashion that the "rest" current flowing through the fire alarm groups or units 1, 1'...when the respective contacts 7, 7'...are open does not switch the relay. Upon the occurrence and transmission of an alarm signal by one of the alarm units, in other words, upon closing of one of the "work" current contacts 7, 7'...signal relay 16 responds to the new value of current flowing in the signal installation and itself closes a work current contact situated between the output terminals or clamps 23 and 24 as illustrated. Consequently, an alarm signal indicating lamp 28 is therefore caused to illuminate.

The simultaneous triggering of all of the alarm units for the purpose of checking or testing the operational readiness thereof can be undertaken in a number of different ways. For illustrative simplification, the exemplary embodiment of the inventive system depicts each alarm unit as having a single control input 12, 12'...which is connected to a common control conductor 9. Control conductor 9 is connected via terminal 22 to the central station 2 and, via resistor 19, with the center tap of both cells 15a and 15b of the battery 15. Upon actuation of the testing switch or key 18, the control conductor 9 is switched via contact 18b to the input terminal or side of cell 15b of the battery. By virtue of this switching action, a potential change is caused to appear on the control conductor 9 and this potential change likewise is reflected at the individual control inputs 12, 12'...of the alarm units thus causing triggering of the alarm units to actuate relays 6, 6'...therein assuming the individual alarm unit is functioning properly.

Obviously, the triggering of the alarm units for the purpose of checking the operational readiness of such units, can take place in a variety of different manners utilizing different techniques. One such technique known to the art utilizes supply conductors 3 and 4 to trigger the checking operation and thus do not require the provision of an additional control conductor 9. So as to suppress, during the operational readiness checking operation, the transmission of an actual alarm signal such as would occur, for example, upon triggering of a fire alarm, the signal relay 16 is shunted or bypassed via the action of contact 18a which places a small resistor 28 across the relay 16.

The series circuit connection of the additional work current contacts 8, 8'...of the individual alarm units is coupled to the battery 15 at the central station 2 via a terminal 27 and a disturbance relay 17. Disturbance relay 17 comprises a specialized form of a common current measuring device. During an operational readiness checking operation, if all of the individual alarm units are functioning and operating properly, then a current circuit is closed comprising battery 15, resistor 28, switching contact 28a, supply conductor 3, the series connection of the plurality of additional work contacts 8, 8'..., and the disturbance relay 17. Disturbance relay 17 would then respond opening its associated switching contact in the auxiliary current circuit consisting of the terminal 25, a checking switch contact 18c which is closed by action of switch 18, indicating lamp 29, and the terminal 26. Thus, if all of the individual alarm units properly respond to the operational readiness check, disturbance indicating lamp 29 will not illuminate.

On the other hand, if only a single alarm unit fails to respond during the checking operation, then at least one of the additional work contacts 8, 8'...would fail to close and disturbance relay 17 would remain unexcited. Thus, the auxiliary current circuit comprising the terminal 25, the closed checking switch contact 18c, illuminating lamp 29, and terminal 26 would remain in a closed, continuous loop path such that the disturbance indicating lamp 29 would illuminate.

Although the additional work current contacts 8, 8'...utilized for the operational readiness checking procedure have been described as being connected in series circuit and particularly the connection of the terminal 13 comprising the checking input of the first alarm unit 1 has been described as being coupled with one of the two supply conductors 3 and 4 leading back to the central station 2, it should be appreciated that a direct connection with a separate conductor can be

made from terminal 13 of the first alarm unit 1 back to the central station 2.

Referring now to FIG. 2, a preferred embodiment of an actual alarm unit utilized in the inventive signal installation is disclosed, the alarm unit itself generally being of known construction and being equipped with ionization chambers or compartments so as to operate as a fire alarm. A measuring ionization chamber 30 is disposed in series circuit relation with a reference ionization chamber 31 across terminals 11 and 12 of the signal installation described with reference to FIG. 1. The midpoint between the ionization chambers 30 and 31 is coupled via a lead to an amplifier element having a high ohmic input, the amplifier element being illustrated here as comprising a field-effect transistor 32, the cathode of which is prebiased via a voltage divider resistor 33 and resistor 34, the anode of which is coupled to the base of a further transistor 36. A resistor 35 is connected in parallel to the emitter-base path of transistor 36 whereas the emitter of transistor 36 is directly coupled to supply conductor 11. The collector of transistor 36 is coupled to the supply conductor 10 through a relay winding 37.

Now, if the potential at the gate of the field-effect transistor 32 undergoes a change such as an increase of the gate-cathode voltage, then field-effect transistor 32 and therefore, transistor 36, begins to conduct. The potential change necessary at the gate of field-effect transistor 32 as described may be brought about by a change in the ionization current flowing through the ionization chambers 30 and 31 due to the occurrence of a fire, or may alternatively be brought about due to a change of the voltage at the control terminal 12 such as would be the case during an operational-readiness checking procedure initiated at the central station 2. In any case, when transistor 36 begins to conduct, a current flows between supply conductors 10 and 11 through transistor 36 and the relay winding 37, this current flow triggering the alarm indicating device at the central station and simultaneously causing the closing of contact 8 depicted here as a gas-enclosed reed switch due to the interaction between the reed switch and the relay coil 37. Accordingly, transistor 36 assumes the function of relay 6' and its associated work contact 7' such as described with respect to the overall installation of FIG. 1. On the other hand, the additional work current contact 8' described with respect to the alarm unit 1' of FIG. 1 finds its counterpart in the actual alarm unit depicted in FIG. 2 serves the same function as relay 37 of the signal installation in FIG. 1.

Now, if any type of a malfunction or defect occurs at the alarm unit of FIG. 2, other than a sticking of the contacts 8, 8'...in a closed position, such occurrence being highly improbable, then during an operational-readiness checking procedure initiated at the central station, reed contact 8 would remain open. As described with respect to the installation of FIG. 1, if this would occur, a disturbance would be indicated by the disturbance indicating lamp 29. By virtue of this arrangement, it is ensured that each element which is essential for the transmission of an alarm, including transistor 36, is monitored. As should be appreciated, a separate monitoring of the supply conductors such as would be required with signal installations of the prior-art, is not necessary with the novel system of the instant invention.

It should also be appreciated that the additional switching element described herein as the relay 37 and the associated reed switch contact, can be replaced by other suitable components. For example, as shown in FIG. 2a, a light source 40 instead of relay winding 37 could be utilized in conjunction with a photoelectric cell 42 instead of the mechanical reed

switch contact 8. Alternatively, a temperature-sensitive resistor 44 could be utilized having a heating winding 46. The alternative provision of a light source and a photoelectric cell is particularly advantageous if the alarm unit itself is previously equipped with some type of an individual-indicator lamp signifying a proper operation. If this indicator lamp is simultaneously used as the light source for the photoelectric cell, then, apart from the economies realized by this physical construction, proper operation of the indicator lamp is also simultaneously monitored. It should further be appreciated that all switch elements described as comprising relays with associated working current contacts and the like can be replaced by electronic circuits and circuit elements such as transistors. Yet, if such replacement were made, the checking circuitry itself might take on a unidirectional nature prohibiting the free exchangeability within the checking circuit of the input and outputs 13 and 14, respectively, of the individual alarm units, which exchangeability, of course, constitutes an advantage from the installation standpoint.

It should now be apparent that the objects set forth at the outset of this specification have now been successfully achieved. ACCORDINGLY,

I claim:

1. A signal installation comprising a plurality of alarm units connected in parallel circuit relation across a pair of supply conductors with a central station, said alarm units each comprising a main switch element responsive to triggering of the associated alarm unit to shunt said supply conductors with a signal current circuit; means for the simultaneous remote triggering of the alarm units for checking the operational readiness of the same; each of said alarm units comprising additional work current switches normally closed in response to said remote triggering; circuit means connecting said additional work current switches of the individual alarm units in series circuit relation and to said central station, said circuit means comprising a voltage source and a current measuring means; said current measuring means, during the checking operation, monitoring the flow of a work current and, upon the absence of a current flow, triggering a disturbance indicator at said central station.

2. A signal installation as defined in claim 1, wherein said additional work current switches comprise reed switches in a protective gas atmosphere.

3. A signal installation as defined in claim 2, wherein each of said reed switches have an associated relay winding, means coupling said relay winding for the reed switch of each individual alarm unit in series circuit with said main switch element of the associated alarm unit, whereby closing of said main switch element in response to triggering of the associated alarm unit effects closing of said associated reed switch.

4. A signal installation as defined in claim 1, wherein said additional work current switches of each alarm unit comprise photoelectric elements and associated lamp means therefor, said lamp means being operatively connected with said main switch element and said signal current circuit of the respective alarm unit.

5. A signal installation as defined in claim 4, wherein said lamp means comprises an individual indicator lamp indicating the operational readiness of an alarm unit.

6. A signal installation as defined in claim 1, wherein said circuit means providing said series connection of said additional work current switches includes one of said supply conductors.

7. A signal installation as defined in claim 1, wherein said alarm units comprise fire alarms.