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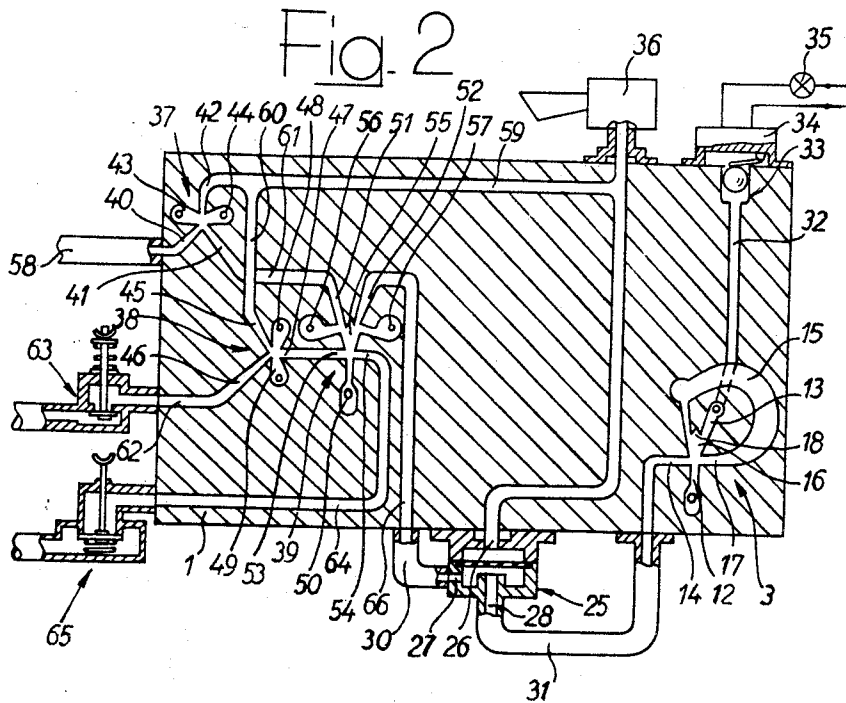
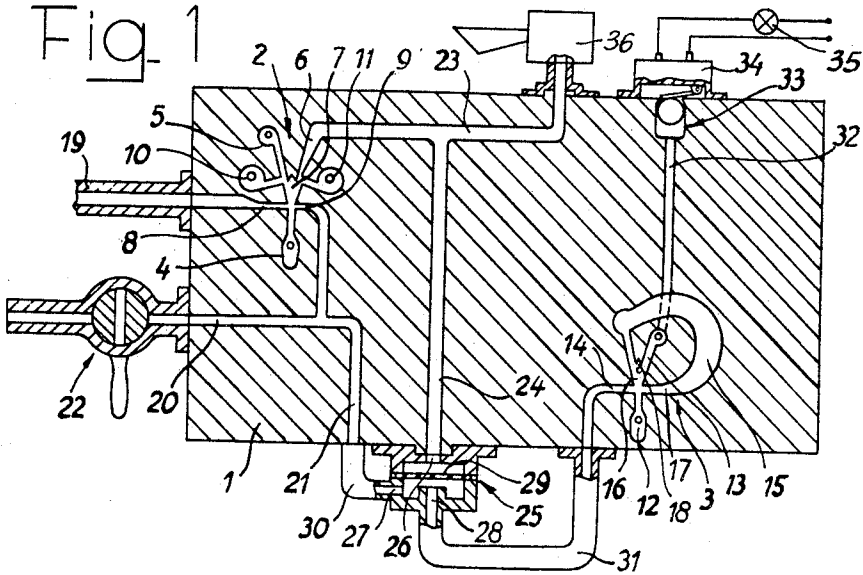
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ALARM CIRCUITS AND SYSTEMS

Filed June 5, 1967

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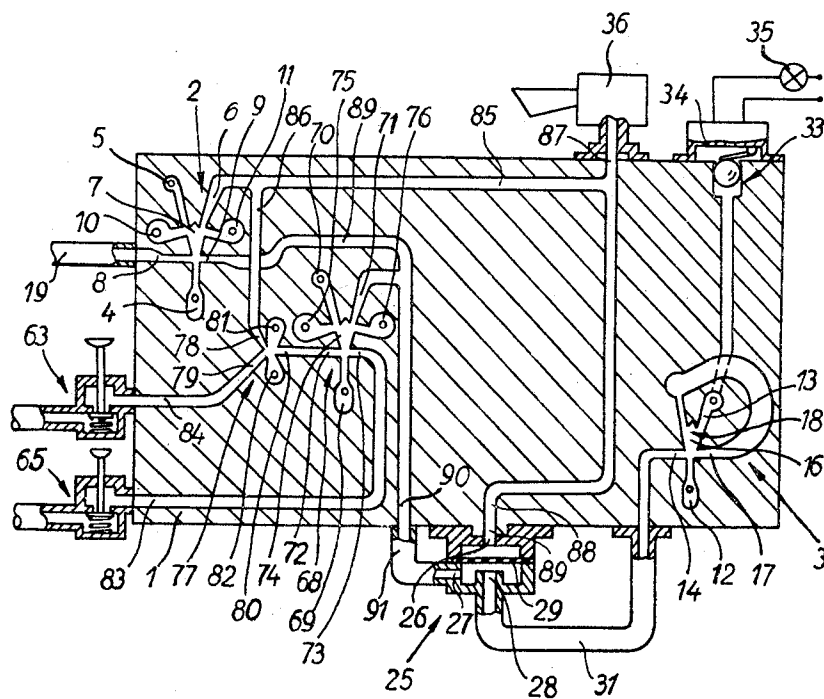
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Fig. 3



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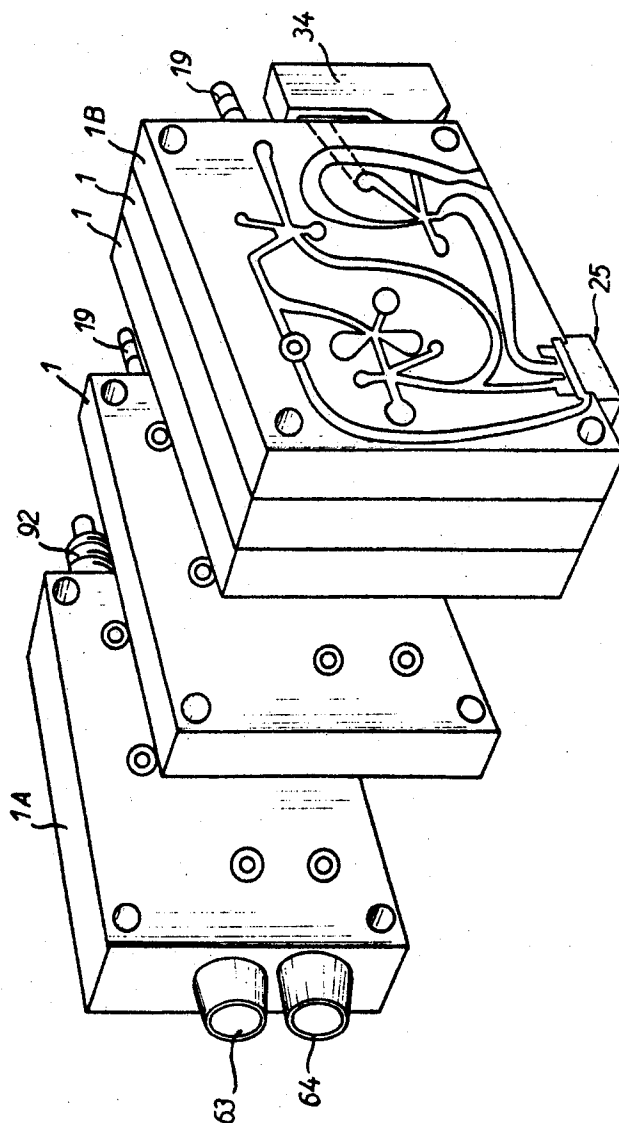
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Fig. 4



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ALARM CIRCUITS AND SYSTEMS

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14 Claims

ABSTRACT OF THE DISCLOSURE

The present invention relates to alarm circuits for use in alarm systems, particularly centralized systems, the alarm circuits specified incorporating a positive reaction fluid amplifier. The positive reaction fluid amplifier is utilized in a pressure fluid system to control a visual signaling means which may be either electrical or mechanical in nature. The amplifier provides either for flashing of the visual signaling means by functioning as an oscillator or for the display of a persistent visual effect by the said means. In the latter case the amplifier functions as a relay. The method of altering the function of the amplifier includes the use of an intercepting valve under the control of fluid devices sensitive to the reception of alarm signals from an alarm generator.

The invention relates to alarm circuits and alarm systems including them, and more particularly to alarm circuits and centralized alarm systems including them.

Centralized alarm systems are employed for the automatic control of industrial plants and processes, such systems audibly or visually signal any disturbances or abnormal conditions that arise within the plant and indicating, by means of visual signals, the location or locations in the plant where the abnormal conditions have arisen. This latter provision of course enables rapid removal of the causes of the disturbances signaled.

In known centralized systems of this type each component circuit comprises a visual signaling means, the visual signaling means of all the component circuits being grouped together to form an alarm board and whereas alarm circuits used individually are each provided with their own audible signaling means, in a centralized system a signaling means common to all the component circuits is conveniently used.

Generators of alarm signals, such as electric relays, are installed at all essential locations of plant. These generators are connected to the centralized alarm system and supply an alarm signal in relation to a predetermined value of the item to be controlled. Each signal generator is operatively connected to a detector pertaining to one of the component circuits of the alarm system. When such a detector receives an alarm signal it converts it into a control signal for activating the visual and audible signaling means of its associated circuit.

The visual signaling means are distinguished by suitable inscriptions to denote the location of the plant corresponding to their respective circuit and each visual signaling means in each circuit has associated therewith a device adapted to flash a light on receipt of a control signal. Each circuit is also provided with manually operable means whereby an operator may inactivate the audible signaling means and change the flashing light to fixed light.

In this way the operator can identify the signal and locate the disturbance in the plant. It is then, of course, possible to eliminate the cause of the disturbance and re-establish normal operating conditions by effecting a

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suitable repair. After such repair has been effected, the alarm circuit is re-set and the light signal still persisting on the board is extinguished.

To this end re-setting means are provided and these are either automatic or operable manually by the operator, the re-setting means acting on both signaling means for inactivation thereof.

Where abnormal operating conditions persist after re-setting of the alarm, the latter is again triggered as before.

Known alarm circuits, whether they function individually of in a centralized alarm system, incorporate electric and/or electronic components and these of course require special attention when installed in dangerous, for instance fire-risk, surroundings. Furthermore, electronic circuits are responsive to variations in temperature and such circuits thus require the provision of special compensating circuit elements.

It has previously been proposed to obviate the above drawbacks by substituting pneumatic relays for the customary electric and electronic components of the alarm circuits, sometimes by using miniature relays. In addition to advantageously eliminating the need for special fire precautions when the alarm circuits are employed in dangerous surroundings, the use of such pneumatic systems means that alarm signals supplied by pneumatic signaling means, as are used in most chemical and petrochemical plants, can be directly utilized.

However, pneumatic relays are not as sensitive and rapid in action as electric or electronic relays because they include mechanical moving parts. Also, the structure of alarm circuits utilizing pneumatic relays is much more complex than the structure of electronically equipped circuits.

An object of the present invention is to provide an alarm circuit which maintains the advantages, such as sensitivity and speed of response, of known alarm circuits which utilize electric and electronic components, but which operates without the use of electric or electronic components.

It is a further object to provide an arrangement that is particularly suitable for use in dangerous surroundings.

A still further object of the invention is to provide an arrangement which is simplified with respect to conventional alarm circuits which use electric, electronic or pneumatic relay components, such simplification being attained by utilizing multiple function components, the number of which components can therefore be reduced.

Accordingly, the present invention consists of an alarm circuit for incorporation in an alarm system which system includes at least one generator of alarm signals and at least one audible and at least one visual signaling means, and which circuit includes detector means responsive to alarm signals emitted by the generator and adapted to convert them into control signals which cause the audible signaling means to sound and means associated with the visual signaling means to cause the said visual signaling means to provide a flashing visual effect, the circuit further including means for identifying the signal by inactivating the audible signaling means and converting the flashing effect to a persistent effect and re-setting means for deactivating both the said signaling means, wherein the said means associated with the visual signaling means comprises a positive reaction fluid amplifier, the amplifier having a first and inoperative outlet conduit which serves to re-cycle the working fluid therefor and a further and operative outlet conduit for connection to the visual signaling means, a pipe being provided which is connected at one end to a control conduit for the said amplifier and at its other end to an intercepting valve which valve is so under the control of the said detector means and the

said identifying means that signals from the detector means close the valve and cause the amplifier to function as an oscillator whereas signals emitted by the said identifying means cause the valve to open and the amplifier to function as a relay.

In order to make the invention more clearly understood, reference will now be made to the accompanying drawings which are given by way of examples and in which:

FIG. 1 is a diagrammatical view of an alarm circuit according to the invention;

FIGS. 2 and 3 show two possible modifications of the alarm circuit of FIG. 1; and

FIG. 4 is a partly exploded perspective view of an alarm system incorporating a plurality of alarm circuits according to the invention.

Like reference numerals represent like parts throughout.

In FIG. 1 there is shown a bedplate 1 of plastic material in which are located a fluid multivibrator 2 and a positive reaction fluid amplifier 3. The multivibrator 2 comprises a main conduit 4 for the inlet of a working fluid, a working fluid outlet conduit 5 which opens to the exterior and a further working fluid outlet conduit 6. The conduits 4, 5 and 6 converge to and meet at a convergence and interaction region 7.

Two conduits 8 and 9 for a control fluid are also provided, these being coaxial with and opposed to, each other. They also meet at the region 7.

As is well known, in the absence of fluid flow in the control conduits 8 and 9, working fluid fed through the main conduit 4 will flow through either one of the two outlet conduits 5, 6. The presence of fluid flow in one of the two control conduits 8, 9 will, on the other hand, cause the working fluid to flow through a selected one of the conduits 6, 5, respectively, and remain so flowing therein even when fluid flow in the control conduit has ceased. The conduit selection will, of course, depend on through which of the conduits 8 and 9 the control fluid flows. The multivibrator 2 has therefore two conditions of stability in one of which the working fluid is deflected to the conduit 5 and in the other of which it is deflected to the conduit 6.

Two overflow conduits 10, 11, are provided which open to the exterior, these conduits being located one on either side of the two conduits 5, 6 and serving to discharge to the exterior any working fluid in excess of that which can flow through a selected conduit 5, 6. The conduits 10, 11 therefore act as impedance adaptors.

The positive reaction amplifier 3 comprises a main conduit 12 for the inlet of the working fluid, an outlet conduit 13 for the working fluid, the axis of which conduit 13 is offset from the axis of the inlet conduit 12, a conduit 14 for a control fluid having its axial axis substantially orthogonal to the axis of the main conduit 12 and at an angle to the axis of the outlet conduit 13 which exceeds 90°, and a reaction conduit 15 which branches from a convergence region 16 of the three conduits 12, 13 and 14. The reaction conduit 15 opens at one end into the convergence region 16 by a terminal section 17, the axis of which is substantially orthogonal to the axis of the main conduit 12 and is coincident with the axis of the control conduit 14. At its other end the conduit 15 opens into the said section 17 via an initial section, the axis of which lies between the axis of the outlet conduit 13 and that of the control conduit 14.

The adjacent walls of the outlet conduit 13 and initial section of the reaction conduit 15 are interconnected by a section 18 which acts a divider.

The main conduit 12 is offset from the divider 18 in such manner that in the absence of fluid flow in the control conduit 14, working fluid fed through the main conduit 12 will tend to flow through the reaction conduit 15 in a closed cycle. On the other hand, in the presence of fluid flow in the control conduit 14 of sufficient power,

the working fluid from the main conduit 12 will be deflected to the outlet conduit 13.

The conduit 8 is connected, by a passage 19, to an alarm signal generator of known pneumatic type (not shown), and the conduit 9 is bifurcated to form two branches 20, 21. The branch 20 terminates externally of the plate 1 at a manually operable control valve 22 by means of which the said branch 20 may be connected to a pressure fluid reservoir (not shown) and the branch 21 connects with an external passage 30 in a manner and for a purpose to be later explained.

The conduit 6 is sub-divided into two branches 23, 24, the branch 23 being connected with an audible signaling means 36 located externally of the plate 1. Such a means may for instance be an acoustic siren of the cylinder-valve type which is well known in the technique of pneumatic signaling. The branch 24 terminates in a three-way intercepting valve 25 fitted to the plate 1, incorporating ways 26, 27 and 28 and provided with a membrane shutter 29.

As shown, the valve way 26 is situated on the other side of the membrane 29 with respect to the two other valve ways 27 and 28 and the arrangement is such that in the absence of external influences the membrane 29 allows free interconnection of the ways 27, 28. The way 27 connects with the branch 21 through the aforementioned passage 30 arranged outside the plate 1 and the way 28 connects with the conduit 14 through a passage 31 also arranged outside the plate 1. When a pressure fluid reaches the valve way 26 via the branch 24, the membrane 29 is deformed and cuts off the communication between the ways 27 and 28 by closing the mouth of way 28.

From the foregoing description of the amplifier 3 and its operation, it will be evident that when the membrane 29 effects such closure of the way 28 the working fluid in the amplifier 3 will flow through the reaction conduit 15 in a closed circuit. As it will be thus returned to the inlet it will serve to stabilize its own flow direction. This fluid will of course also fill the conduit 14 and passage 31.

Under such circumstances a pressure wave is set up in the passage 31 and this propagates at a rate dependent upon the pressure gradient created in the passage. The wave soon reaches the end of the passage 31 which is closed by the valve 25 and is reflected back therefrom to return through the conduit 14 towards the region 16 of the amplifier 3. When pressure wave from the conduit 14 arrives at the region 16 it effects switching of the fluid flow from the conduit 15 to the conduit 13 of the amplifier 3.

This new fluid flow state is, however, not stable because as it is adopted, the switching cause is removed. In accordance with the positive reaction characteristics of the amplifier 3 the working flow thus returns to the conduit 15 and re-establishes the conditions for the start of a fresh cycle. These cycles then continue to repeat themselves.

As shown, the outlet conduit 13 is connected by a conduit 32 to a ball valve 33. The ball in the valve 33 floats in contact with the operating lever of a microswitch 34, which switch is connected in the electric circuit of a lamp 35 and is normally open.

Closure of the microswitch 34 as a result of displacement of the ball in valve 33 following the flow of fluid through the conduit 13, serves to switch on the lamp 35. An intermittent flow of fluid in the conduit 32 will thus produce a similarly intermittent illumination of the lamp.

In the multivibrator 2 the outlet conduit 5 is "inoperative" in that it is open to the exterior, whereas the outlet conduit 6 is "operative" in that it is connected with the three-way valve 25 and the aural signaling means 36. In the amplifier 3 the conduit 15 is "inoperative" in that it acts to re-cycle the reaction fluid, whereas the outlet conduit 13 is "operative" in that it controls the aural signaling means.

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In use the alarm circuit operates as follows:

In the inoperative condition corresponding to normal operation of the plant, with which the circuit is associated, the working fluid in the multivibrator 2 flows through the conduit 5 and is externally discharged. However, an alarm signal transmitted by the generator to the conduit 8 switches over the working fluid flow from conduit 5 to conduit 6 and the resultant flow activates the aural signaling means 36 via the branch 23.

A part of the fluid from the conduit 6 also flows through branch 24 to the valve way 26 in the valve 25 and deforms the membrane 29 to close the way 28. Under these conditions, as stated above, the fluid amplifier 3 operates as an oscillator and supplies pulsatory signals, the frequency of which is constant and depends upon the size of the passage 31. These signals are transmitted to the microswitch 34 which accordingly cyclically opens and closes the circuit for the lamp 35. In this way there is created a flashing light signal.

As will be evident the alarm will be signaled by the signaling means 36 and the lamp 35 even after cessation of the initial signal from the alarm generator. This is because the multivibrator 2 will remain in that switching position wherein the fluid flows to the conduit 6.

Identification of the signal conveniently takes place by disabling of the audible signaling means 36 and conversion of the flash indicating light to a persistent light and these ends are simultaneously achieved by manually opening the valve 22. This is possible because opening of this valve delivers a stream of pressure fluid to the conduit 20, the said stream flowing in part to the conduit 9 and in part through branch 21 and valve way 27 to the valve 25. The pressure fluid flow in the conduit 9 switches the working fluid flow in the multivibrator 2 from conduit 6 over to conduit 5 and this inactivates the audible signaling means 36. The pressure fluid flow in the valve 25 opens the way 28 and continues, through passage 31, to the conduit 14. At the region 16 it permanently deflects the fluid jet to the conduit 13 and the microswitch 34 is similarly permanently held closed. The lamp 35 thus gives the required persistent light signal.

The circuit is re-set by closing the valve 22. When this is done the pressure in the conduit 14 falls and there is deflection of the working fluid in the amplifier 3 back to the conduit 15. As the valve ways 27 and 28 are now interconnected, the working fluid of the amplifier 3 is externally discharged via the conduit 14, passage 31, the now-interconnected ways 27 and 28, passage 30, branch 21, conduit 9 and conduit 11. The valve 22 is deactivated and the microswitch 34 remains open with the lamp 35 "off."

A single circuit of the type shown in FIG. 1 can be used for controlling one alarm location only. Thus, with centralized alarm systems involving a plurality of alarm locations, a similar plurality of circuits to that described should be employed.

However, in an alarm system comprising a plurality of alarm locations, a single identification control and a single re-setting control are frequently desirable, automatic re-setting being required when the cause of an alarm ceases before identification.

FIG. 2 illustrates an alarm circuit which provides for such automatic re-setting and which is suitable for use in alarm systems calling for a single identification control and a single re-setting control.

In FIG. 2 there is shown the bedplate 1 which is here provided, in addition to the amplifier 3, with two fluid coincidence elements 37 and 38 and a fluid bistable multivibrator 39.

Each coincidence element 37, 38 comprises respectively two trigger conduits 40, 41; 45, 46 and an outlet conduit 42, 47 as well as two overflow conduits 43, 44; 48, 49 opening to the exterior. The multivibrator 39 comprises a main working fluid inlet conduit 50, two outlet conduits 51, 52, two control fluid conduits 53, 54 and two

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overflow conduits 56, 57 which externally discharge any excess working fluid that is delivered.

All the conduits in the multivibrator 39 open into a convergence region 55 at which region the working fluid and control fluid interact.

A passage 58 connects the conduit 40 to a pneumatic alarm signal generator (not shown) which is arranged at a location of the plant to be supervised.

The conduit 42 is bifurcated into two branches 59, 60.

The branch 60 interconnects the conduit 42 of the element 37 and the conduit 45 of the element 38 while the branch 59 is itself sub-divided into two branches which respectively connect with the audible signaling means 36 and with the valve way 26 of the valve 25. The way 27 of the valve 25 is connected, by the passage 30, and a conduit 66, to the conduit 52 of the multivibrator 39. The conduit 41 of the element 37 is connected, by a conduit 61, to the conduit 51 of the multivibrator 39. The conduit 46 of the element 38 is connected to a conduit 62, to one side of a normally closed and manually operable pressure control valve 63, the other side of which valve is connected to a source of pressure fluid.

The conduit 54 of the multivibrator 39 is connected, by a conduit 64, to one side of another normally closed and manually operable pressure control valve 65, the other side of which valve is also connected to the pressure fluid source.

In use and in the absence of an alarm signal from the signal generator (not shown), the working fluid in the multivibrator 39 is deflected into the conduit 51 and flows, through the conduit 61, into the element 37 from whence it is externally discharged through conduit 43. Under such conditions the valve 25 is open and the working fluid in the amplifier is thus externally discharged through the conduit 51 of the multivibrator 39 after flowing, for the reasons detailed in connection with FIG. 1, through the conduit 14, passage 31, valve 25, passage 30, conduit 66 and conduit 52.

The above conditions persist while there is no signal incoming from the conduit 58 to the coincidence element 37 and under these conditions the audible signaling means 36 is disabled, as is the lamp 35 due to the microswitch 34 being open.

When an alarm signal in the form of a fluid stream is transmitted by the signal generator to the conduits 58 and 40, the said signal stream interacts with the stream from the conduit 51 of the bistable multivibrator 39 and there is created an outflowing stream in the conduit 42, which causes actuation of the signaling means 36. Part of this stream also reaches the conduit 45 of the coincidence element 38 through conduit 60 and yet another part passes through the other branch of the branch 59 and causes interception of communication between the ways 27 and 28 in the valve 25. The stream part flowing through the conduit 45 is externally discharged through the conduit 49.

Under these conditions, the amplifier 3 acts as an oscillator and intermittently opens and closes the microswitch 34 by means of the valve 33. The lamp 35 thus flashes.

This condition will persist while the alarm signal persists, cessation of the signal causing the circuit to be automatically re-set and restored to its initial condition.

If, however, the valve 63 is momentarily opened while the alarm is still being signaled, a fluid stream from the said valve will flow to the coincidence element 38 and impinge upon the jet issuing from the conduits 60 and 45. As a result fluid will flow to the outlet conduit 47 and this causes deflection of the main fluid flow in the multivibrator 39 from conduit 51 over to conduit 52.

The resultant absence of a jet in the conduit 51 will cause termination of the outlet signal flow in the conduit 42 of the element 37 and the signaling means 36 will be consequently deactivated. At the same time fluid will flow in the conduit 52 and will pass through conduit 66, passage 30 to valve way 27. This will open the valve 25, the

flow from conduit 52 will thus be free to pass from way 27 to way 28 and on through passage 31, conduit 14 and region 16 to permanently deflect the working fluid flow in the amplifier 3 into the conduit 13. In this way the microswitch 34 can be permanently closed and thus the lamp 35 be permanently illuminated.

When the signaled fault has been attended to the valve 65 can be momentarily opened and a flow of pressure fluid directed through conduit 64 to the conduit 54 in order to switch the flow in the conduit 52 of the multivibrator 39 over to the conduit 51 thereof. This will of course restore the initial conditions.

In the event that the fault still persists, the alarm generator will immediately transmit a fresh signal to the coincidence element 37 and the fault will be resigaled by a repeat of the above described sequence.

When a plurality of circuits of the type described with reference to FIG. 2 are grouped together as an alarm system with a plurality of locations to be supervised or checked, a single control valve may be employed for identifying the signal in all the various component circuits and a single control valve employed for re-setting all the said circuits. In such a case the single control valve used for identification is a single valve 63 associated with a common collector connected to the conduits 62 of all the circuits. Similarly, the single control valve used for re-setting is a single valve 65 associated with a further common collector connected to the conduits 64 of all the circuits.

A further type of circuit which may be used in centralized alarm systems wherein a single valve may be employed for identifying the signal and a single valve employed for re-setting all the component circuits, is shown in FIG. 3.

The circuit shown in FIG. 3 differs from the circuit shown in FIG. 2 in that the former is provided with a storage arrangement which causes the audible signal and the flashing light signal to persist even when the alarm signal emitted by the generator is of pulsating type.

In FIG. 3 the bedplate 1 is provided, in addition to the positive reaction fluid amplifier 3, with a fluid bistable multivibrator 68 and a fluid coincidence element 77.

The multivibrator 68 comprises a main working fluid conduit 69, two outlet conduits 70, 71 for the working fluid, conduits 72, 73 for the control fluid, a convergence region 74 and two overflow conduits 75, 76. The coincidence element 77 comprises two trigger conduits 78, 79, an outlet conduit 80 and two discharge conduits 81, 82.

The conduit 73 of the multivibrator 68 is connected to a manually operable control valve 65 by a conduit 83, the trigger conduit 79 of the element 77 being connected to a manually operable control valve 63 by a conduit 84.

The storage function of the circuit of FIG. 3 is effected by an arrangement of a bistable multivibrator at the inlet in the manner of that of FIG. 1. Therefore, this multivibrator is generally referenced 2, the conduits composing it being provided with the same reference numerals as the conduits of the multivibrator 2 shown in FIG. 1. The conduit 6 of the said multivibrator 2 is sub-divided into two branches 85, 86. The branch 86 is connected with the conduit 78 of the element 77 and the branch 85 is itself sub-divided into two sub-branches 87, 88 respectively connected to the signaling means 36 and the valve way 26 of the valve 25, the connection with the valve way being via a short external passage 89.

The outlet conduit 71 of the multivibrator 68 is sub-divided into two branches 89, 90 which are respectively connected to the control conduit 9 of the multivibrator 2 and, via an external passage 91, to the valve way 27 of the valve 25. The valve way 28 of the valve 25 is connected to the conduit 14 of the amplifier 3 by means of the passage 31. As shown, the outlet conduit 80 of the element 77 is connected to the control conduit 72 of the multivibrator 68 and the further outlet conduits 5

and 70 open externally and are therefore "inoperative."

Under inoperative conditions (i.e. with no alarm signal generated) the working fluid from the multivibrator 2 is externally discharged via the conduit 5 and the working fluid from the multivibrator 68 is externally discharged via the conduit 70. The valve way 27 connects with the valve way 28 and the working fluid from the amplifier 3 is thus externally discharged via conduit 14, valve 25, conduit 71 and conduit 76.

However, when an alarm signal is emitted by the signal generator and a fluid stream consequently reaches the conduit 8, the working fluid flow in the multivibrator 2 is switched into the "operative" conduit 6 and activates the signaling means 36. At the same time this fluid flow closes the valve way 28 and causes the amplifier 3 to function as an oscillator in the manner previously detailed. The lamp 35 thus flashes. Part of the flow from the conduit 6 also reaches the conduit 78 of the element 77 via branch 86 and is externally discharged through conduit 82.

This situation will persist even after the alarm signal has ceased.

In order to identify the signal, an operator briefly opens the valve 63 and causes fluid to flow through the conduit 79 of the element 77. The flow thus produced and the flow already present in the conduit 78 interact, and the resultant stream is conveyed to the conduit 80 and from there, via conduit 72, to the convergence region 74. At this region it causes switching of the working fluid flow in the multivibrator 68 from the "inoperative" conduit 70 to the "operative" conduit 71.

A part of the working fluid issuing from the conduit 71 flows to the way 27 of valve 25 and opens the way 28. This fluid part thus reaches the conduit 14 of the amplifier 3 and the flow in this amplifier is therefore deflected into the discharge conduit 13 thereof to cause microswitch 34 to close. The other part of the working fluid issuing from the conduit 71 flows through the branch 89 to the conduit 9 and effects switching of the multivibrator 2 by deflecting the working fluid flow therein to the discharge conduit 5.

Under these conditions fluid flow in the conduit 78 ceases and with it ceases the flow in conduit 80.

The circuit is re-set after repair of the plant fault by briefly opening the valve 65, the fluid flow issuing from this valve reaching the conduit 73 of the multivibrator 68 and causing switching of the working fluid flow from the "operative" conduit 71 to the "inoperative" conduit 70. The working fluid from the amplifier 3 is thus no longer deflected into the conduit 13 by a flow from the conduit 71 and is directed instead into the conduit 15. Flow in the conduit 13 thus ceases and the microswitch 34 opens. As a result the lamp 35 is extinguished.

In FIG. 4 there is shown a system comprising a combination of several alarm circuits each generally similar to the type shown in FIG. 3, such a combination constituting a centralized alarm system.

As shown, the bedplates 1 are grouped together in a stack. One end plate of the stack, referenced 1A, is provided with a fitting 92 whereby working fluid is supplied to the elements in all the circuits. The plate 1A is also fitted with push button operated control valves 63, 65 which are common to all the component circuits of the system. The plate 1A further carries an audible signaling means (not shown) which is common to all circuits.

Said microswitch 34 and valve 25 are attached externally to each plate 1, as is an external passage 19 for interconnecting each circuit to its respective alarm signal generator. In FIG. 4, however, only an opposite end plate 1B is shown with the members 34 and 25 in their respective positions.

The plates 1 are interconnected by through tierods or by adhesives.

Various modifications of the invention are of course possible within the scope of the appended claims.

By way of example, although in the alarm circuits described above, the visual signal is obtained by employing an electric lamp, in certain kinds of plants, for instance chemical and petrochemical plants, alarm systems are preferably constructed without the inclusion of any electrical components at all as a fire precaution. As will be evident, the circuits described herein are well suited to use in such non-electrical systems, the outlet signal from the positive reaction fluid amplifier 3 being easily utilized to activate a visual signal means of a mechanical type. Such a signaling means might for instance be of the curtain type whereby either a flashing sign or a persistent sign may be created. In one possible instance curtain faces of two different colors are used, the resulting effect being visually similar to the effect obtained from an electric lamp.

What we claim is:

1. Alarm circuit for incorporation in an alarm system, which includes:

- (a) at least one generator of alarm signals,
- (b) at least one audible signaling means, and
- (c) at least one visual signaling means,

the said circuit including:

- (a) detector means responsive to alarm signals emitted by the said generator and adapted to convert them into control signals which cause the audible signaling means to sound and the visual signaling means to provide a flashing visual effect,
- (b) means for identifying the signal by deactivating the audible signaling means and converting the flashing effect to a continuous effect, and
- (c) re-setting means for deactivating both the said signaling means,

the improvement lying in the fact that the said means associated with the said visual signaling means comprises a positive reaction fluid amplified having a first and inoperative outlet conduit which serves to re-cycle working fluid therefor and a further and operative outlet conduit for connection to the said visual signaling means, a passage being provided and an intercepting valve, the said passage being connected at one end to a control conduit of the said amplified and at its other end to the said intercepting valve, the said valve being in this way so under the control of the said detector and the said identifying means that signals from the said detector means close the said valve and cause the said amplifier to function as an oscillator whereas signals emitted by the said identifying means cause the said valve to open and the said amplifier to function as a relay.

2. Alarm circuit as claimed in claim 1, wherein the detector means comprise a fluid bistable multivibrator arranged at the inlet of the circuit, which multivibrator comprises a first and a further control conduit, the former having means for connecting to the alarm signal generator and receiving alarm signals therefrom, the said multivibrator further comprising an inoperative outlet conduit which opens externally and an operative outlet conduit for connection to the audible signaling means, the said operative outlet being so connected to the intercepting valve that on receipt of an incoming alarm signal from the signal generator the working fluid in the multivibrator is switched from the said inoperative outlet conduit to the said operative outlet conduit thereby to provide actuating signals for a said audible means when connected thereto and simultaneously to close the said valve.

3. Alarm circuit as claimed in claim 2, wherein the further control of the multivibrator is connected to the identifying means and receives therefrom, on activation of the said means, a signal opposite in sense to the alarm signal whereby the working fluid flow is switched from the multivibrator operative outlet conduit to the inoperative conduit.

4. Alarm circuit as claimed in claim 3, wherein the signal identifying means comprises a manually operable control valve for connection to a pressure source and serving to control the flow of fluid therefrom to the said other control conduit of the multivibrator and to the intercepting valve, opening of the control valve and a consequent flow of pressure fluid serving to switch the working fluid flow in the multivibrator into the inoperative conduit and switch the working fluid flow in the reaction amplifier to the operative outlet conduit thereby to actuate a said visual signaling means when connected thereto.

5. Alarm circuit as claimed in claim 4, wherein the circuit re-setting means comprises the said manually operable control valve, closure of this valve serving to switch the working fluid flow in the amplifier into the operative outlet conduit thereof.

6. Alarm circuit as claimed in claim 2, wherein the detector comprises a second bistable multivibrator having a first and inoperative outlet conduit which is inoperative and is open to the exterior and a further and operative outlet conduit connected to the further control conduit of the inlet multivibrator, the said means also comprising a fluid coincidence element of which an outlet conduit is connected to one of the control conduits of the second multivibrator and of which two trigger conduits are connected with the operative outlet conduit of the inlet multivibrator and with a pressure source respectively, through a manually operable and normally closed control valve.

7. Alarm circuit as claimed in claim 6, wherein the circuit re-setting means comprises a further hand-operated control valve for connection to a pressure source and serving to control the flow of fluid therefrom to the other control conduit for the second bistable multivibrator.

8. Alarm circuit as claimed in claim 1, wherein the signal detector means comprises a fluid coincidence element in which a first trigger conduit is provided for connection with the alarm signal generator and a bistable multivibrator with two operative working fluid outlet conduits connected one with a further trigger conduit of the first coincidence element and the other with the intercepting valve, an outlet conduit of the said coincidence element being provided for connection to the audible signaling means and with the intercepting valve so that the simultaneous presence of two streams in the said trigger conduits of the coincidence element, one from the multivibrator and one from the signal generator creates in the outlet conduit of the coincidence element, a jet which will activate said audible signaling means connected thereto and simultaneously close the intercepting valve, the absence of an alarm signal from the generator causing the absence of a jet in the outlet conduit of the coincidence element and consequent disabling of the said audible signal and opening of the intercepting valve.

9. Alarm circuit as claimed in claim 8, wherein the identifying means comprises a second coincidence element of which a trigger conduit is connected to the outlet conduit of the first coincidence element, the outlet conduit of the second coincidence element being connected to one of the two control conduits of the bistable multivibrator, the other trigger conduit of the second coincidence element being connected to one side of a manually operable normally closed control valve provided for connection to a pressure source and serving to control the flow of fluid from a pressure source, so that opening of the said control valve in the presence of a jet issuing from the first coincidence element creates a jet from the second coincidence element, which jet switches over the working fluid in the multivibrator from the outlet conduit connected with the first coincidence element to the outlet conduit connected to the intercepting valve, such switching causing the latter to open.

10. Alarm circuit as claimed in claim 8, wherein the circuit re-setting means comprises a normally closed hand-

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operable control valve provided for connection to a pressure source and serving to control the flow of fluid therefrom.

11. Alarm circuit as claimed in claim 1, wherein the control valve is a push button valve.

12. Alarm circuit as claimed in claim 1, wherein the pressure fluid is air.

13. Alarm circuit as claimed in claim 1, wherein the visual signaling means are formed without electrical components, comprising an arrangement of mechanical blinds.

14. An alarm circuit, comprising: generator means for generating alarm signals indicating a malfunction, at least one signaling means providing signals recognizable by humans, detectors means responsive to said alarm signals for providing control signals to said signaling means, and means for identifying the alarm signals by modifying the detector means so that the signaling means provides a continuous signal rather than a discontinuous or repeating signal, said detector means including a fluid amplifier oscillator, said oscillator being connected to activate the signaling means and being responsive to said control sig-

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nals to provide pulsating signals to said signaling means whereby the signaling means provides a repeating output signal, said identifying circuit being constructed to provide a signal to said fluid oscillator to effect a continuous output therefrom so that the signaling means provides a continuous rather than repeating output signal.

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