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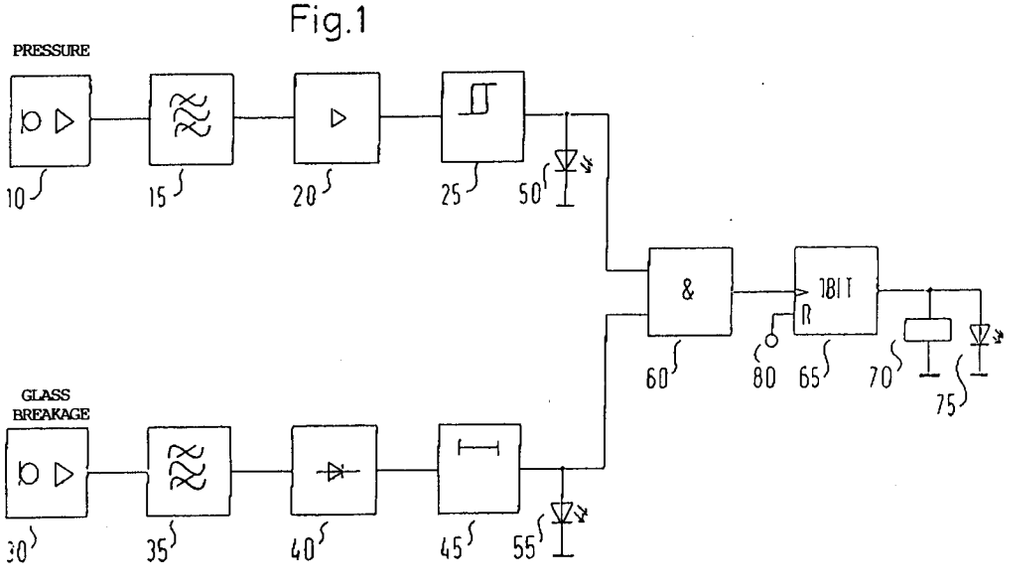
(54) Intruder detector.

(57) A description is given of an intruder detector having two different detecting devices (10,30) for the same security zone, which triggers an alarm only if both detecting devices respond in a specific way, one detecting device being a glass breakage detecting device which comprises a glass breakage detector (30) and a bandpass filter (35) and the other detecting device being a pressure fluctuation detecting device which comprises a pressure detector (10) and a second bandpass filter (15), it being possible for the pressure detector and the glass breakage detector to be formed by a single sensing element. An alarm is triggered only if both detecting devices are addressed in specific frequency bands.

Fig.1



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The invention relates to an intruder detector according to the preamble of Patent Claim 1 and in particular to an acoustic pressure wave glass monitor.

German Offenlegungsschrift 2,656,318, which is the starting point of the preamble of Patent Claim 1, discloses a device for detecting the movement of bodies emitting heat, in which two different detectors are connected such that an alarm is triggered only given the response of both detectors. In this case, one detector is embodied as an ultrasonic detector and one detector is embodied as an infrared detector.

A problem with an intruder detector of this type consists in that an infrared detector can detect only movements perpendicular to the principal axis of its security zone and an ultrasonic detector can detect only movements in the direction of the principal axis of its security zone. An intruder who moves only on the principal axis of the security zone or only at a right angle to the principal axis of the security zone of the detector can, by adopting this method of locomotion, avoid triggering the alarm since in so doing he always triggers only one of the two detectors.

It is the object of the invention to develop an intruder detector according to the preamble of Patent Claim 1 in such a way that intrusions are reliably detected and false alarms are avoided with the aid of simple means.

This object is achieved by means of the measures specified in Patent Claim 1.

It is therefore provided according to the invention to combine a pressure fluctuation detecting device with a glass breakage detecting device in such a way that an alarm is triggered only if both detecting devices are addressed with frequencies which are situated in a frequency range that is characteristic of the respective detection criterion. A high security against intrusions and false alarms is guaranteed by the selection of the glass breakage criterion and of the pressure fluctuation criterion, since on the one hand both criteria are always fulfilled given the destruction of a pane in the security zone, while on the other hand both criteria are virtually incapable of being fulfilled by a person legitimately staying in the room to be secured.

Moreover, the security against false alarms is further enhanced owing to the fact that triggering of the detecting devices is restricted to frequencies the combination of which arises exclusively given the destruction of the pane in a room.

Moreover, by using the trigger according to Patent Claim 3 it is achieved that too slight pressure fluctuations, such as can arise upon movement of a door, for example, cannot trigger the pressure fluctuation detecting device, so that security against false alarms is further improved by these measures.

Since the sound waves of the noise of glass breakage generally reach the detecting devices before the pressure waves, by using the time-delay circuit according to Patent Claim 4 it is achieved that the two detecting devices pass on an intrusion at the same time.

Further advantageous embodiments of the invention are specified in the remaining subclaims.

The invention is explained in more detail below using the description of exemplary embodiments with reference to the drawing, wherein:

Figure 1 shows a block diagram of a first exemplary embodiment of the intruder detector according to the invention in the form of an acoustic pressure wave glass monitor, and

Figure 2 shows a block diagram of a second exemplary embodiment of the intruder detector according to the invention with a joint detector for both detecting devices.

A pressure detector 10 according to Figure 1 has a structure known per se and is designed such that it can effectively sense fluctuations in room pressure down to 0.3 mbar. It is arranged in the room to be secured in such a way that it senses pressure fluctuations in the entire security zone.

The output signal of the pressure detector 10 is fed to a first bandpass filter 15 which suppresses interfering signals not situated in the pressure fluctuation frequency range characteristic of a breaking pane. As could be established by trials, the frequencies of the pressure fluctuations arising given the destruction of a pane are situated between 5 Hz and 10 Hz.

Since the amplitudes of the pressure fluctuations are relatively low, the output signal of the bandpass filter 15 is fed to an amplifier 20 which has a gain of 300 at a frequency of 7.5 Hz.

The filtered and amplified signal of the pressure detector 10 is fed to a trigger 25 or to a Schmitt trigger circuit. This trigger is the junction between the analog pressure-sensing circuit and the downstream digital circuit. The output of the trigger is a high signal when the output signal of the amplifier 20 overshoots an adjustable threshold value, or a low signal when a smaller signal than the threshold value is present at the input of the trigger 25. The threshold value of the trigger is selected such that fluctuations in room pressure of less than 0.3 mbar or in a range from -0.3 mbar to +0.3 mbar correspond to a low signal at the output of the trigger 25. The output signal of the trigger 25 is fed to an AND element 60 and a light-emitting

diode 50 which displays the undershooting or overshooting of the threshold value pressure of +0.3 mbar.

A glass breakage detector 30 is either mounted directly on a pane or arranged such that it can sense any noises from the breakage of a plurality of panes, which need not be situated in a plane window front. In the first case, the glass breakage detector 30 has a conventional structure, and in the second case the glass breakage detector 30 is a microphone having a frequency response and a pickup pattern by means of which a glass breakage in the entire security zone of the glass breakage detector can be effectively sensed.

The output signal of the glass breakage detector 30 is fed to a second bandpass filter 35 which suppresses interfering signals which are not situated in the frequency range of the noises of glass breakage. In order for the glass breakage frequencies of panes such as bullet-proof glass, plastics-containing panes or pure glass panes to be covered, the lower limiting frequency is selected at 4 kHz and the upper limiting frequency at 12 kHz.

The output signal of the second bandpass filter is fed to a rectifier 40, since the downstream digital circuit operates with positive levels. Furthermore, the signal is smoothed or lengthened by the rectifier, so that it can be more effectively detected by the downstream circuit.

The glass breakage signal is delayed by a time T1 = 0.1 s in a time-delay circuit 45. Given glass breakage, there is a high signal at the output of the time-delay circuit 45, and in the absence of glass breakage there is a low signal. This signal is fed to the AND element 60 and a light-emitting diode 55, which displays a noise of glass breakage.

If a high signal is fed simultaneously to the AND element 60 from the trigger 25 and the time-delay circuit 45, a high signal likewise arises at the output of the AND element 60.

A downstream storage device 65 passes the high signal on to a downstream relay 70 and a light-emitting diode 75, which displays the case of an alarm. In this regard, the storage device 65 stores the high signal of the AND element 60 until a reset signal is applied to the storage device 65 via the reset input 80, or until the operating voltage of the storage device 65 is switched off. The storage device 65 is designed such that it stores a low signal given application of the operating voltage.

Finally, the alarm report is transmitted, for example, to an alarm indicator or a report control centre by means of a contact assembly (not shown) of the relay 70.

The detector 85 according to Figure 2 is arranged in the room to be secured in such a way that it can effectively sense pressure fluctuations and noises of glass breakage in the entire security zone.

The detector 85 can detect vibrations in a range from 5 Hz to 12 kHz, and can be formed, for example, by a microphone which can sense this range.

The output signal of the detector 85 is fed to the bandpass filters 15 and 35, which transmit the corresponding frequency components thereof, as already in the case of the first exemplary embodiment. The circuit downstream of the glass breakage detector 30 and the pressure detector 10 or the detector 85 is identical.

The mode of functioning of the acoustic pressure wave glass monitor, which is the same in both exemplary embodiments, is explained in more detail below. In this connection, the sequence in the case of an actual intrusion is first described.

When a glass pane is pushed in or smashed in, or when a hole is cut out of it, in the security zone a noise of glass breakage arises, on the one hand, and pressure fluctuations are triggered in the room to be secured, on the other hand. The noise of glass breakage is recorded by the glass breakage detector 30 or the detector 85, and the pressure fluctuations are recorded by the pressure detector 10 or likewise by the detector 85, the pressure fluctuations generally being recorded with a delay of approximately 0.1 s, since pressure waves have a lower rate of propagation than sound waves.

The sound waves of the noise of glass breakage are detected by the glass breakage detector 30 or the detector 85, conducted via the second bandpass filter 35 to the rectifier 40, where they are rectified and smoothed or maintained for a specific time T2 and transmitted with a 0.1 s delay time T1 via the time-delay circuit 45 as a high signal to the AND element 60, a light-emitting diode 55 simultaneously lighting up. The time T2 can be selected in the range from 0.1 s to 1 s. In the meantime, the pressure fluctuation has also reached the AND element 60 via the pressure detector 10 or the detector 85, the first bandpass filter 15, the amplifier 20 and the trigger 25 as a high signal, the light-emitting diode 55 lighting up and there arising at the output of the AND element 60 a high signal which is maintained via the storage device 65 and actuates the relay 70 as well as switching on a light-emitting diode 75. Finally, an alarm report is transmitted to an alarm indicator or a report control centre via a contact assembly of the relay 70.

A high security against false alarms is achieved by means of the acoustic pressure wave glass monitor according to the invention. If the glass

breakage detector is constructed as a microphone and mounted in a room in such a way that it monitors a plurality of windows or glass doors, the noises that are not situated in the frequency range of the noises of glass breakage are suppressed via the second bandpass filter 35.

Moreover, by using the first bandpass filter 15 it is achieved that only the fluctuations typical of a glass breakage are transmitted.

In addition, it is ensured by means of the delay time T1 of the time-delay circuit 45 that a pressure change and a noise of glass breakage trigger an alarm only in a sequence characteristic of a glass breakage.

Finally, by means of the AND element 60 the breaking of a glass or, for example, the crack of a supersonic aircraft breaking the sound barrier is reliably detected as a false alarm and an alarm report is prevented.

Pressure fluctuations in the room owing to wind conditions around the building in which the zone to be secured is situated, or pressure fluctuations owing to the opening of a door or a window have fluctuation frequencies which are situated below the lower limiting frequency of the first bandpass filter 15. Moreover, pressure fluctuations owing to the impact of a bird on a pane are generally of so low an amplitude that the signals generated by the pressure detector 10 or the detector 85 are situated below the threshold voltage of the trigger 25.

The pressure detector and the glass breakage detector or the entire acoustic pressure wave glass monitor can be accommodated in a single housing.

The acoustic pressure wave glass monitor according to the invention can be used in rooms of up to 50 m^2. Its mode of functioning is ensured even if individual windows or doors of the house to be secured are open.

A description is given of an intruder detector having two different detecting devices for the same security zone, which triggers an alarm only if both detecting devices respond in a specific way, one detecting device being a glass breakage detecting device which comprises a glass breakage detector and a bandpass filter and the other detecting device being a pressure fluctuation detecting device which comprises a pressure detector and a second bandpass filter, it being possible for the pressure detector and the glass breakage detector to be formed by a single sensing element. An alarm is triggered only if both detecting devices are addressed in specific frequency bands.

Claims

1. Intruder detector having two different detecting devices for the same security zone, which triggers an alarm only if both detecting devices respond in a specific way, characterised in that one detecting device is a glass breakage detecting device (30,35,40,45; 85,35,40,45) which comprises a glass breakage detector (30; 85) and a bandpass filter (35), in that the other detecting device is a pressure fluctuation detecting device (10,15,20,25; 85,15,20,25) which comprises a pressure detector (10; 85) and a further bandpass filter (15), and in that an alarm is triggered only if both detecting devices are addressed in specific frequency bands.

2. Intruder detector according to Claim 1, characterised by a detector (85) which serves as a glass breakage detector and pressure detector.

3. Intruder detector according to Claim 1 or 2, characterised in that the pressure fluctuation detecting device comprises a trigger (25) which prevents pressure fluctuations of too small an amplitude from triggering the pressure fluctuation detecting device.

4. Intruder detector according to Claim 1, 2 or 3, characterised in that the glass breakage detecting device comprises a time-delay circuit (45) which delays the triggering of the glass breakage detecting device by a predetermined time T1.

5. Intruder detector according to one of the preceding claims, characterised in that the glass breakage detecting device comprises a rectifier circuit (40) which rectifies and smooths a signal of the glass breakage detecting device.

6. Intruder detector according to one of the preceding claims, characterised in that the pressure fluctuation detecting device comprises an amplifier (20).

7. Intruder detector according to one of the preceding claims, characterised in that given the triggering of both detecting devices an AND element (60) emits a signal by means of which an alarm is triggered.

8. Intruder detector according to Claim 7, characterised in that the alarm signal emitted by the AND element is retained by means of a storage device (65).

9. Intruder detector according to Claim 8, characterised in that the storage device is reset by switching off the operating voltage.

10. Intruder detector according to one of the preceding claims, characterised in that the bandpass filter of the pressure fluctuation detecting device has an upper and lower limiting frequency of 10 Hz and 5 Hz, respectively.

11. Intruder detector according to one of the preceding claims, characterised in that the bandpass filter of the glass breakage detecting device has an upper and lower limiting frequency of 12 kHz and 4 kHz, respectively.

12. Intruder detector according to one of Claims 3 to 11, characterised in that the threshold value of the trigger is selected in such a way that fluctuations in room pressure which are smaller than ±0.3 mbar do not trigger the pressure fluctuation detecting device.

13. Intruder detector according to one of Claims 4 to 12, characterised in that the predetermined time T1 is selected at 0.1 s.

14. Intruder detector according to one of Claims 5 to 13, characterised in that the rectifier circuit maintains a report signal of the glass breakage detecting device for a predetermined time T2 after the noise of glass breakage has died away.

15. Intruder detector according to one of Claims 6 to 14, characterised in that the amplifier has a gain of 300.

16. Intruder detector according to one of the preceding claims, characterised in that the pressure detector and the glass breakage detector are accommodated in a joint housing.

17. Intruder detector according to one of the preceding claims, characterised in that the entire intruder detector is accommodated in a single housing.

Fig.1

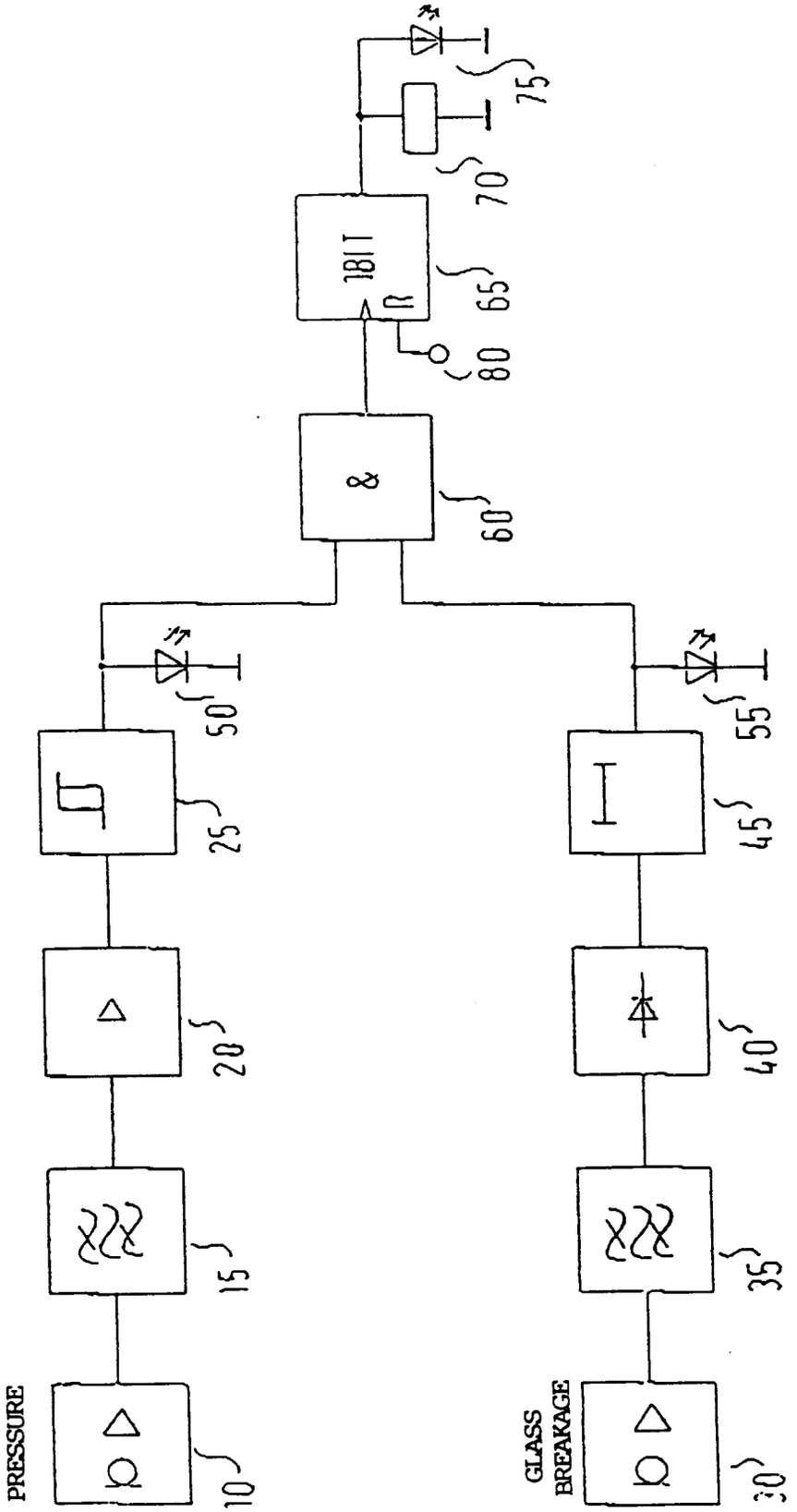
PRESSURE
GLASS BREAKAGE
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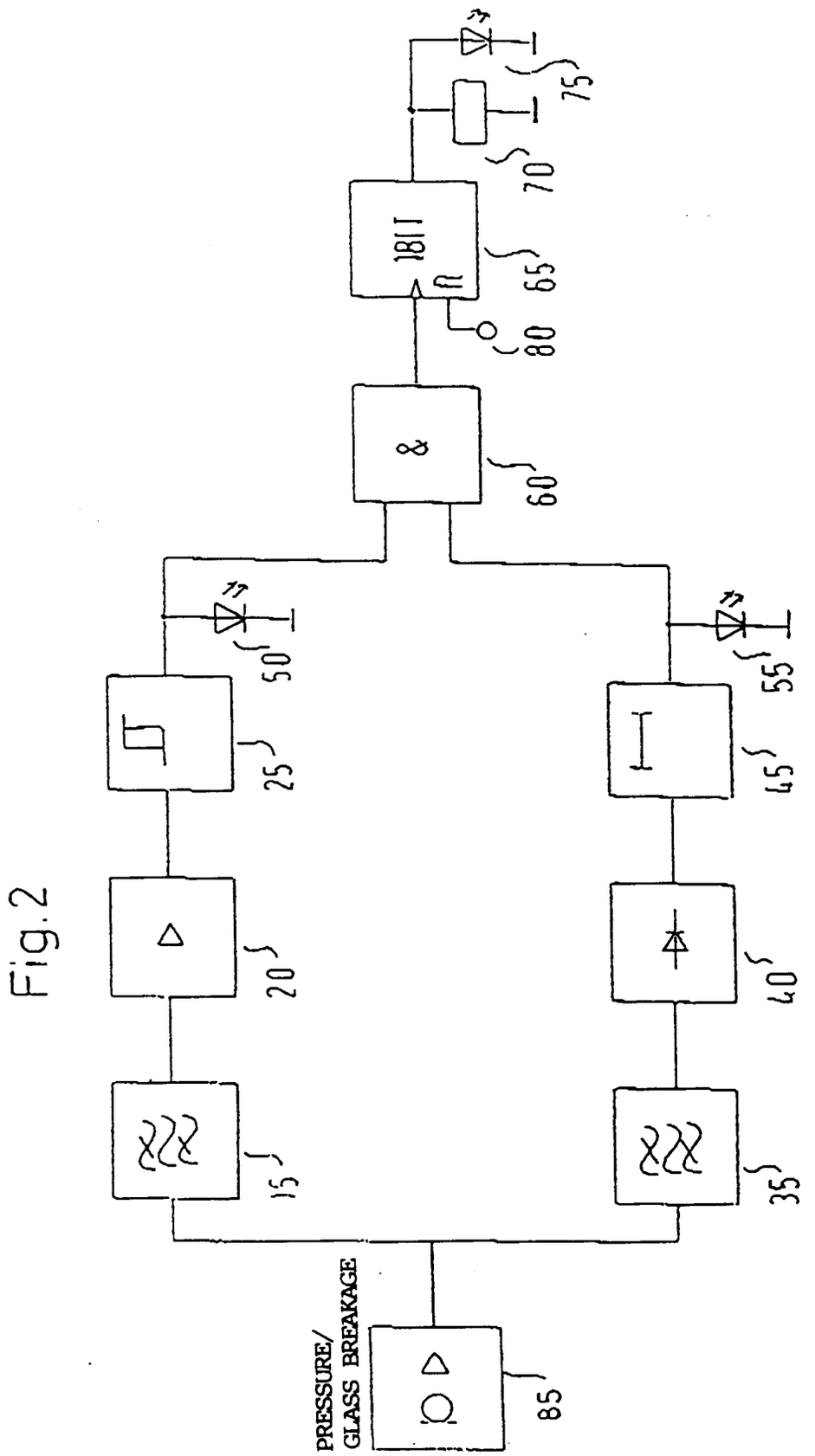
Fig.2



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EUROPEAN SEARCH REPORT

Application Number

EP 91 11 9446

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int. Cl.5)
Y	US-A-4 928 085 (DURAND III, ET AL.) * abstract; figures 4,5 * * column 4, line 3 - line 22 *	1-7	G08B13/16 G08B13/04 G08B19/00
Y	GB-A-2 171 518 (AUTOMATED SECURITY HOLDINGS LTD.) * abstract; figure 3 * * page 1, line 110 - page 2, line 24 *	1-7	
A	*idem*	10,11, 16,17	
A	US-A-4 853 677 (YARBROUGH ET AL.) * abstract; figures 1,2 * * column 2, line 55 - column 3, line 12 *	1	

TECHNICAL FIELDS SEARCHED (Int. Cl.5)

G08B

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
BERLIN	10 FEBRUARY 1992	DANIELIDIS S.

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