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Description

The present invention relates to an infrared ray detector of dual structure employing infrared ray detecting elements for detecting an intruder or the like.

EP-A-0 080 114 describes an infrared ray detector of dual structure having two electrically connected pyroelectric infrared ray detecting elements which are mounted adjacent each other with a shield disposed between them. The shield projects forward from the two elements at an angle which may be 90° . It may be mounted within or external to a housing and be formed of a material which may either partially or fully absorb or reflect infrared energy. A set of lenses is arranged in an arcuate pattern in front of the sensing elements producing a plurality of fields of view.

The just mentioned lenses help to provide distinct signals of high amplitude from certain directions. However, the lenses need space and they have to be fixed to a holder.

It is the object of the present invention to provide an infrared ray detector of dual structure having simple construction, but outputting well determined signals of high amplitude when receiving signals from a moving object from different directions.

The infrared ray detector of the present invention comprises:

- a pair of pyroelectric infrared ray detecting elements having substantially identically directed light receiving surfaces, said pair of detecting elements having opposite polarities while being electrically connected with each other in order to generate an output signal representing the difference therebetween, and
- a mirror means being spaced a predetermined distance in front of said light receiving surfaces, said mirror means having a predetermined width, said predetermined distance and predetermined width restricting an incident infrared light ray on one of said pair of detecting elements while another of said pair of detecting elements receives said incident infrared light ray directly on a light receiving surface and also receives a reflected infrared light ray from said mirror means.

The detector of the present invention also uses a shield means, as the detector of the prior art, however, it does not use a lense. The shield means is a mirror means arranged in a predetermined relation against the detecting elements. Due to this construction, distinct signals of high amplitude can be received from different directions without using lenses.

These and other objects, features, aspects, and

advantages of the present inventions will become more apparent from the following detailed description of the present invention when taken in conjunction with the accompanying drawings.

Fig. 1 is a sectional view showing a first embodiment of the present invention;

Fig. 2 typically illustrates the principle of measurement in the embodiment as shown in Fig. 1; Fig. 3 illustrates output waveforms of the infrared ray detecting elements in the embodiment as shown in Fig. 1;

Fig. 4 illustrates output waveforms of difference with the infrared ray detecting elements in the embodiment as shown in Fig. 1;

Figs. 5 and 6 are perspective and sectional views for illustrating an exemplary construction of the embodiment as shown in Fig. 1;

Fig. 7 illustrates output waveforms of the infrared ray detecting elements of the embodiment as shown in Fig. 1 in an actual operation state and Fig. 8 illustrates output waveforms of difference with the infrared ray detecting elements;

Fig. 9 is a circuit diagram showing an example of an amplification circuit contained in a case in the embodiment of Fig. 1;

Fig. 10 illustrates the bandwidth of the amplification circuit as shown in Fig. 9;

Figs. 11 and 12 illustrate directivity of detection sensitivity of the embodiment as shown in Fig. 1 Fig. 11 showing that in an X-Y plane and Fig. 12 that in a Y-Z plane;

Fig. 13 illustrates a second embodiment of the present invention, in which an infrared ray transmission restricting member is provided in addition to the structure shown in Fig. 1;

Fig. 14 illustrates output waveforms of difference with the infrared ray detecting elements in the embodiment as shown in Fig. 13;

Fig. 15 is a sectional view showing an infrared ray detector according to a third embodiment of the present invention, and Fig. 16 is a plan view thereof;

Fig. 17 illustrates output waveforms of infrared ray detecting elements in the embodiment as shown in Fig. 16 in an actual operation state;

Fig. 18 illustrates directivity of detection sensitivity of the embodiment as shown in Fig. 15; and

Figs. 19 and 20 illustrate modifications of the embodiment as shown in Fig. 15, in which Fig. 21 is a plan view showing arrangement of infrared ray detecting elements and Fig. 20 shows arrangement of shield members.

Description is now made for preferred embodiments of the present invention with reference to the accompanying drawings.

Referring to Fig. 1, an infrared ray sensor 20 according to this embodiment is in the so-called

dual structure formed by a pyroelectric member 20c which is provided thereon with two infrared ray detecting elements 20a and 20b. At least one mirror member 21 is upwardly provided in the light receiving area of the infrared ray sensor 20. Namely, the mirror member 21 is arranged in a plane extending between the infrared ray detecting elements 20a and 20b to separate the same on both sides thereof. The mirror member 21 has reflective surfaces on both sides to reflect heat rays (far-infrared rays) radiated from a detected object, which heat rays are in turn incident upon the infrared ray detecting element 20a or 20b.

It is assumed here that the detected object moves in the arrow direction in parallel with the light receiving surface of the infrared ray sensor 20 at uniform velocity. Referring to Fig. 2, the infrared ray detecting elements 20a and 20b directly receive heat rays 23 radiated from an object 22. Positioned in a point (A) separated from the infrared ray sensor 20. However, when the object 22 moves to a point (X) closer to the infrared ray sensor 20, the infrared ray detecting element 20a receives the heat rays in an amount 24a of direct incidence as well as an amount 24b reflected by the mirror member 21 while incidence of the heat rays is restricted or intercepted with respect to the other infrared ray detecting element 20b. When the object 22 moves to a point (B), both of the infrared ray detecting elements 20a and 20b directly receive the heat rays emitted from the object 22.

Fig. 3 conceptually shows output signals from the infrared ray detecting elements 20a and 20b in this case. Symbol a denotes output levels upon direct incidence of the heat rays and symbol b denotes an output level upon incidence of the amount 24b of heat rays reflected by the mirror member 21 on the infrared detecting element 20a. Thus, differential output from the infrared ray sensor 20, i.e., added output of the infrared ray detecting elements 20a and 20b connected in an opposite-polarity manner is as shown in Fig. 4, in which the output signal b with superpose of the amount 24b reflected by the mirror member 21 is approximately doubled in output level in comparison with the output signal a with only the amount of direct incidence and is at a high frequency level. The peak value of the output signal b depends on the reflection coefficient of the mirror member 21. Further, the pulse width of the output signal b depends on the height h of the mirror member 21, i.e., the distance from the light receiving surface, the width w of the mirror member 21 and the space s between the infrared ray detecting elements 20a and 20b as shown in Fig. 1. The space s is generally constant, and hence the height h and the width w of the mirror member 21 are appropriately determined in design. The width w of the mirror

member 21 is so determined as to temporarily restrict, or preferably prevent incidence of the heat rays upon the infrared ray detecting elements 20a and 20b, and hence the mirror member 21 may be reduced in size. Dot lines a_1 and b_1 in Fig. 10 denote output levels in such case where difference phase is caused in the heat rays entering the infrared ray detecting elements 20a and 20b by the space s, and differential output levels in this case are shown by dot lines a and d in Fig. 4. Further, a two-dot chain line 25 denotes the plane separating the infrared ray detecting elements 20a and 20b. When the object 22 moves to a point (Y) beyond the plane 25, the infrared ray detecting element 20b receives an amount 26a of direct incidence in superpose with a reflected amount 26b. It is obviously understood from Figs. 3 and 4 that the output levels are symmetrical with respect to a point (B) as the result.

Description is now made on definite structure of the first embodiment.

Referring to Figs. 1, 5 and 6, an infrared ray sensor 20 of dual structure is formed by a pyroelectric member 20c provided thereon with two infrared ray detecting elements 20a and 20b. The back surface of the pyroelectric member 20c is fixed to a ceramic substrate (not shown) through an electrode, and the infrared ray sensor 20 is contained in a case 27 having an entrance window as shown in Figs. 5 and 6. A U-shaped mirror member 29 is provided in a plane separating the two infrared ray detecting elements 20a and 20b across a light receiving surface 28 of the infrared ray detector 20. The mirror member 29 has optical reflective surfaces on both sides thereof, and is about 0.5 mm in thickness and about 6 to 7 mm in length (width) in a direction perpendicular to the light receiving surface 28. The case 27 is made of plastic, and contains an FET, a filter circuit and the like. Numeral 30 denotes terminals.

The operation of this embodiment is now described with reference to Figs. 2 and 7. When the intruder 22 approaches the infrared ray detecting element 20a, the infrared ray detecting elements 20a and 20b receive the heat rays 23 emitted from the intruder 22, thereby to develop smoothly increased output voltages a_1 and b_1 as shown in Fig. 7. When the intruder 22 reaches the point (X), the mirror member 21 starts serving as a shield means for the infrared ray detecting member 20b with the intruder 22 along the arrow, whereby the infrared ray detecting element 20b is completely shielded against the heat rays and the output voltage thereof becomes zero as shown by b_2 in Fig. 7. At this point (X), on the other hand, the infrared ray detecting element 20a receives the heat rays in the amount 24b reflected by the mirror member 21 in addition to the amount 24a directly received from

the intruder 22, and the total amount of heat rays entering the infrared ray detecting element 20a is substantially twice that of direct incidence. Thus, the output voltage developed in the infrared ray detecting element 20a is abruptly increased as shown by a_2 in Fig. 7. When the intruder 22 further moves along the arrow, the mirror member 21 terminates reflection of the heat rays with respect to the infrared ray detecting element 20a. A two-dot chain line 31 in Fig. 7 indicates such case where the human body 22 is in a position right in front of the mirror member 21, in which the heat rays directly apply the infrared ray detecting element 22b.

With further movement of the intruder 22, the infrared ray detecting element 20a is in turn shielded against the heat rays by the mirror member 21, whereby its output voltage is abruptly lowered as shown by a_3 in Fig. 7. Thereafter the infrared ray detecting element 20a is released from the influence by the mirror member 21 to again receive the heat rays directly from the intruder 22. On the other hand, the infrared ray detecting element 20b additionally receives the amount 26b of heat rays reflected by the mirror member 21 with the movement of the intruder 22, whereby its output voltage is temporarily increased as shown by b_3 in Fig. 7.

Thus, output obtained from the infrared ray sensor 20 appears as differential output of the output signals from the infrared ray detecting elements 20a and 20b, and hence pulse-like output signals a and b having high peak values are obtained as shown in Fig. 8. Since the mirror member 21 exerts influence on the velocity of the intruder 22 for a short time, the output signals a and b are higher in amplitude than output signals V_a and V_b with direct incidence of the heat rays.

Fig. 9 illustrates an example of an amplifier employed in the present invention and contained in the case 27. The infrared detecting elements (detectors) 20a and 20b are connected in series with each other in an opposite-polarity manner, and output signals thereof are supplied to an amplifier AMP through an impedance conversion circuit formed by a field-effect transistor (FET). An electrical active filter circuit formed by a capacitor C and a resistor R is connected to the input part of the amplifier AMP, whose negative feedback circuit is formed by a capacitor C_1 and a resistor R_1 . The amplifier AMP is so formed as to be in such bandwidth corresponding to the band of the signals obtained from the infrared ray sensor 20 as shown in Fig. 10. The lower cut-off frequency f_1 of the bandwidth is determined by the capacitor C and the resistor R, while the higher cut-off frequency f_2 is determined by the capacitor C_1 and the resistor R_1 .

The output frequency of the infrared ray sensor

according to this embodiment can be increased to about 10 Hz in comparison with the conventional case of about 1 Hz, and hence, e.g., the capacitor C for determining the lower cut-off frequency f_1 can be minimized to about 1/13 in volume ratio, whereby the intruder infrared ray detector can be remarkably reduced in size.

Figs. 11 and 12 respectively illustrate directivity of a sensing region of the inventive infrared ray detector provided with the mirror member 29. With coordinates X, Y and Z axes as shown in Fig. 5, a sensing region in the plane of the X and Y axes is wider along the plan of the mirror member 29, i.e., along the X axis and narrower in the direction perpendicular to the plane of the mirror member 29, i.e., along the Y axis, as obvious from Fig. 11. On the other hand, a sensing region in the plane of the Y and Z axes protrudes in a direction perpendicular to the light receiving surface 28, i.e., along the Z axis as shown in Fig. 12. As hereinabove described, the sensing region has directivity by provision of the mirror member 29. Thus, the infrared ray detector according to the present invention may be mounted on, e.g., the ceiling of a passageway to provide a watching space across the detecting zone.

Although no light transmission restricting panel is provided in the light receiving area of the infrared sensor in the aforementioned embodiment, a light transmission restricting panel 32 as shown in Fig. 13 may be provided in the light receiving area. In this case, difference phase is caused by the gap between infrared ray detecting elements 20a and 20b upon incidence of heat rays. When, for example, a detected object moves along the arrow in Fig. 13, the infrared ray detecting element 20b develops an output signal with a phase delay when compared to that of the infrared ray detecting element 20a, and differential output from the infrared ray sensor 20 includes signals c and d having low peak values and low frequency levels and signals a and b having high peak values and high frequency levels as shown in Fig. 14. The low-frequency signals c and d are removed by a band-pass filter as shown in Fig. 9, so that the high-frequency signals a and b are outputted from the infrared ray sensor 20.

Description is now made on a third embodiment of the present invention with reference to Figs. 15 to 18. The fourth embodiment is a modification of the embodiment as shown in Figs. 1 and 4, and is provided with a plurality of mirror members as shield members.

Fig. 17 is a sectional view showing the third embodiment. An infrared ray sensor 50 of dual structure is formed by a pyroelectric member provided thereon with two parallel-connected infrared ray detecting elements and fixed to one surface of

a ceramic substrate 56, to be contained in a metal case 58 having an entrance window 57 sealed by window material. An impedance conversion circuit 59 is arranged on the other surface of the ceramic substrate 56, to provide an independent sensor portion 60 as a whole.

The sensor portion 60 is mounted in a central space 62 of a frame member 61 made of plastic, with the entrance window 57 directed to the exterior. Six mirror members 63 are upwardly provided at regular intervals along the central space 62, to be covered by a plastic cover 64.

In further detail with reference to Fig. 16, the frame member 61 is formed in the side provided with the mirror member 63, i.e., in the front surface thereof with a ring-shaped groove 65 concentric with the space 62, while through-holes 66 are provided in two portions of the bottom of the groove 65 oppositely through the space 62.

As shown by dot lines in Fig. 16, the mirror members 63 are partially integrally connected to a ring-shaped base portion 67 at the bottom sides thereof, to be directed to the center of the ring-shaped base portion 67. In such a state, the ring-shaped base portion 67 is inserted in the ring-shaped groove 65 of the frame member 61 so that bottom edges 68 of the mirror members 63 are placed in intervals 70 between respective protrusions 69 to fix the spaces therebetween. The size of each mirror member 63 in the central direction is selected to be in such length that its forward end portion protrudes in the central space 62 of the frame member 61 not to reach the center thereof, e.g., 6 to 10 mm. Further, each mirror member 63 has an arcuate outer edge 71, whose height is about 5 to 12 mm. This mirror member 63 is prepared by pressing or bending metal such as iron, nickel and phosphor bronze, and both surfaces thereof are specularly worked by plating, evaporating or sputtering of chromium, aluminum or the like to provide optical reflective surfaces reflecting the light having the wavelength of 5-10 μm , which are about 0.1 to 0.5 mm in thickness.

The plastic cover 64 is prepared by infrared transparent material such as polyethylene resin which transmits infrared rays of 5 to 10 μm in wavelength emitted from an intruder, and its thickness is about 0.5 mm.

The frame member 61 can be divided into two parts along a mating face 72, and is provided therein with a circuit 73 for processing signals detected by the infrared ray sensor 50. This circuit 73 is formed by an electrical active filter circuit and an amplifier similarly to the circuit as shown in Fig. 9, and may contain a DC power supply circuit, AC power rectifying circuit, a DC amplifier, a comparator, a converter and the like at need.

Fig. 17 shows actual output V from the infrared

ray detecting elements 50a and 50b in this embodiment. Assuming that an intruder perpendicularly approaches a plane of a specific mirror member at uniform velocity to pass the same, the heat rays emitted from the intruder straightly and simultaneously apply the infrared ray detecting elements 50a and 50b from a point separated from the infrared ray sensor 50. Therefore, output voltages a_1 and a_2 of the infrared ray detecting elements 50a and 50b are smoothly increased with approach of the intruder to reach saturation points. With further approach of the intruder, the mirror member serves as a thermal shield to one of the infrared ray detecting elements 50a and 50b to completely shield the same against the heat rays emitted from the intruder, whereby the output level of the infrared ray detecting element becomes zero as shown by b_2 . At this time, the other infrared ray detecting element receives the heat rays reflected by the mirror member in addition to those directly emitted from the intruder, and the amount of the heat rays as received is substantially twice that of direct incidence. Thus, the output voltage a_2 of the other infrared ray detecting element is abruptly increased. With further movement of the intruder, both of the infrared ray detecting elements receive only heat rays directly emitted from the intruder. The two-dot chain line 55 denotes such case where the intruder moves to a point directly in front of the mirror member. With further movement of the intruder, the other infrared detecting ray element is in turn shielded by the mirror member to form a trough a_3 and a peak b_3 .

The output from the infrared ray sensor 50 appears as the differential output of the infrared ray detecting elements 50a and 50b, to provide pulse-like output voltages b and c higher in peak value than output voltages a and d with only direct incidence of heat rays, similarly to the case shown in Fig. 4. Further, the output voltages b and c are at high frequency levels since the mirror members exert influence on the velocity of movement of the intruder for a short time.

As shown in Fig. 16, this embodiment employs six mirror members 63a to 63f each having the aforementioned function. The sensing region in this case is remarkably enlarged in comparison with a sensing region 74 with no mirror member provided, on a plane formed by an X axis in the horizontal direction of Fig. 15 and a Y axis perpendicular thereto in the plane direction of the mirror members 63a to 63f as shown in Fig. 18, with the so-called directivity. The reflecting functions of the mirror members are particularly remarkable in the direction of the plane separating the two infrared ray detecting elements 50a and 50b, i.e., on the X axis.

Although the six mirror members are provided

along the central hole 62 of the frame member 61 in the aforementioned embodiment, the number of the mirror members and the relation therebetween are not restricted to the same. For example, the mirror members 63e and 63f in Fig. 18 may be removed so that sensitivity is lowered in the upper portion in the drawing. Or, the mirror members 63b and 63e may be removed to retain sensitivity in a biased direction. Further, although the angle between each adjacent pair of the mirror members 63a to 63f is 60° in Fig. 16, the angle between, e.g., the mirror members 63b and 63c may be 120°. In other words, the number of and the angle between the mirror members in this embodiment can be freely determined in design.

When the two infrared detecting elements 50a and 50b are arranged in a parallel manner, the sensing region is remarkably extended along the X axis while the same is not much extended in other directions as obvious from Fig. 18. This is because the amount of reflected light is decreased by the angles of arrangement of the mirror members 63b, 63c, 63e and 63f. Provided in such case are circular three-terminal infrared ray detecting elements 75 and 76 as shown in Fig. 19, each comprising two series-connected infrared ray detecting elements in a concentric manner while electrodes 75a, 75b, 76a and 76b on both ends are displaced by 90° in position. The infrared ray detecting elements 75 and 76 are substantially identical in area so as to generate identical output signals upon incidence of the same amount of heat rays. Further, the infrared ray detecting elements 75 and 76 are polarized in the directions of the electrodes 75c and 76c in both side portions thereof as shown by arrows, while these infrared ray detecting elements 75 and 76 are connected in a parallel manner to, e.g., an impedance conversion circuit.

With the aforementioned structure of the infrared sensor, the sensing region can be prevented from extension in a specific direction (along X axis) as shown in Fig. 18, so that the sensing region can be made substantially even along the plane direction of crosswisely arranged mirror members 77a to 77d as shown in Fig. 20. Such an infrared ray sensor is effectively mounted on, e.g., the ceiling of a diverging point of a detecting zone.

Claims

1. An infrared ray detector of dual structure (20,50) having two electrically connected pyroelectric infrared ray detecting elements, comprising
 - a pair of pyroelectric infrared ray detecting elements (20a,20b;50a,50b;75,76) having substantially identically directed light receiving surfaces, said pair of de-

tecting elements having opposite polarities while being electrically connected with each other in order to generate an output signal representing the difference therebetween, and

- a mirror means (21;29;63a-63f) being spaced a predetermined distance in front of said light receiving surfaces, said mirror means having a predetermined width, said predetermined distance and predetermined width restricting an incident infrared light ray on one of said pair of detecting elements while another of said pair of detecting elements receives said incident infrared light ray directly on a light receiving surface and also receives a reflected infrared light ray from said mirror means.

2. A detector according to claim 1, wherein said mirror means (21, 29, 63a - 63f) is provided with reflective surfaces on both sides thereof.

3. A detector according to one of the claims 1 or 2, wherein a plurality of mirrors (63a - 63f) is provided such that one of said mirrors is arranged in a plane extending between said infrared ray detecting elements (50a, 50b) to separate the same on both sides thereof.

4. A detector according to one of the preceding claims, wherein each mirror of said mirror means is a sector-shaped panel member (29) recessed at its central portion.

5. A detector according to one of the preceding claims, further comprising:

- a frame member (61) having a processing circuit (73) for processing signals, a ring-shaped groove (65) in a surface thereof and a central space (63) in the center;
- a sensor portion (60) being provided in said central space;
- a base portion (67) of said mirror means, inserted into said ring-shaped groove, wherein said mirror means is a plurality of mirrors (63a - 63f) integrally connected to said groove, and being provided in planes which contain a center line and do not touch each other; and
- a cover (64) being transparent and covering said mirror means.

6. A detector according to claim 5, wherein said processing circuit comprises a bypass filter, an amplifier and a lowpass filter having a capacitor (C₁) and a resistor (R₁) as a negative

feedback circuit, and is provided as a band-pass filter filtering the output signals from the infrared ray detecting elements (20a, 20b, 50a, 50b).

7. A detector according to one of the preceeding claims, further comprising a ceramic substrate (56) having front and rear surfaces, said pair of detecting elements (20a, 20b; 50a, 50b) being fixed to said front surface of said ceramic substrate, and an impedance circuit being arranged on the rear surface of said ceramic substrate. 5 10
8. A detector according to one of the claims 5 to 7, wherein said frame member has opposed through-holes (66) provided at two positions in the bottom of said ring-shaped groove (65). 15
9. A detector according to one of the preceeding claims, wherein said mirror means comprises six mirrors (63a - 63f). 20
10. A detector according to one of the preceeding claims, **characterized in that** said mirror means comprises mirrors with an angle between them of 60° . 25
11. A detector according to claim 1 to 9, **characterized in that** said mirror means comprises mirrors with an angle between them of 120° . 30
12. A detector according to one of the claims 1 to 9, wherein said mirror means comprises four mirror which are arranged crosswise at an angle of 90° . 35
13. A detector according to one of the preceeding claims, wherein said pair of detecting elements are circular three-terminal infrared ray detecting elements (75, 76) each detecting element comprising two series-connected infrared ray detecting elements in a concentric manner and having electrodes (75a, 75b, 76a, 76b) arranged on both ends being displaced 90° from each other, said detecting elements being polarized in the directions of the electrodes on both side portions thereof and being connected in parallel manner. 40 45 50

Revendications

1. Détecteur de rayonnement infrarouge à structure double (20, 50) possédant deux éléments détecteurs de rayonnement infrarouge pyroélectriques connectés électriquement, comportant 55

- une paire d'éléments détecteurs de rayonnement infrarouge pyroélectriques (20a, 20b ; 50a, 50b ; 75, 76) possédant des surfaces réceptrices de lumière dirigées sensiblement identiquement, ladite paire d'éléments détecteurs possédant des polarités opposées tout en étant électriquement connectés entre eux afin de générer un signal de sortie représentant la différence entre eux, et
- des moyens formant miroir (21 ; 29 ; 63a-63f) étant espacés d'une distance prédéterminée devant lesdites surfaces réceptrices de lumière, lesdits moyens formant miroir possédant une largeur prédéterminée, lesdites distance prédéterminée et largeur prédéterminée limitant un rayonnement de lumière infrarouge incident sur l'un de ladite paire d'éléments détecteurs tandis que l'autre de ladite paire d'éléments détecteurs reçoit ledit rayonnement de lumière infrarouge incident directement sur une surface réceptrice de lumière et reçoit également un rayonnement de lumière infrarouge réfléchi en provenance desdits moyens formant miroir.

2. Détecteur selon la revendication 1, dans lequel lesdits moyens formant miroir (21, 29 ; 63a-63f) sont munis de surfaces réfléchissantes sur leurs deux côtés.
3. Détecteur selon l'une quelconque des revendications 1 ou 2, dans lequel une pluralité de miroirs (63a-63f) est prévue de telle sorte qu'un desdits miroirs est disposé dans un plan s'étendant entre lesdits éléments détecteurs de rayonnement infrarouge (50a, 50b) pour les séparer sur leurs deux côtés.
4. Détecteur selon l'une quelconque des revendications précédentes, dans lequel chaque miroir desdits moyens formant miroir est un élément de panneau en forme de secteur (29) évidé en sa partie centrale.
5. Détecteur selon l'une quelconque des revendications précédentes, comportant en outre :
 - un élément formant cadre (61) possédant un circuit de traitement (73) pour traiter des signaux, une gorge annulaire (65) dans l'une de ses surfaces et un espace central (63) au centre ;
 - une partie capteur (60) étant disposée dans ledit espace central ;
 - une partie de base (67) desdits moyens formant miroir, insérée dans ladite gorge

annulaire, dans lequel lesdits moyens formant miroir sont une pluralité de miroirs (63a-63f) reliés de façon unitaire à ladite gorge, et étant disposés dans des plans contenant un axe et ne se touchant pas l'un l'autre ; et

- un couvercle (64) transparent et recouvrant lesdits moyens formant miroir.

6. Détecteur selon la revendication 5, dans lequel ledit circuit de traitement comporte un filtre de dérivation, un amplificateur et un filtre passe-bas possédant un condensateur (C_1) et une résistance (R_1) en tant que circuit de contre-réaction, et est prévu en tant que filtre passe-bande filtrant les signaux de sortie provenant des éléments détecteurs de rayonnement infrarouge (20a, 20b, 50a, 50b).

7. Détecteur selon l'une quelconque des revendications précédentes, comportant en outre un substrat céramique (56) possédant des surfaces antérieure et postérieure, ladite paire d'éléments détecteurs (20a, 20b ; 50a, 50b) étant fixés à ladite surface antérieure dudit substrat céramique, et un circuit d'impédance étant disposé sur la surface postérieure dudit substrat céramique.

8. Détecteur selon l'une quelconque des revendications 5 à 7, dans lequel ledit élément formant cadre possède des trous traversants opposés (66) pratiqués en deux endroits dans le fond de ladite gorge annulaire (65).

9. Détecteur selon l'une quelconque des revendications précédentes, dans lequel lesdits moyens formant miroir comportent six miroirs (63a-63f).

10. Détecteur selon l'une quelconque des revendications précédentes, caractérisé en ce que lesdits moyens formant miroir comportent des miroirs faisant entre eux un angle de 60° .

11. Détecteur selon l'une quelconque des revendications 1 à 9, caractérisé en ce que lesdits moyens formant miroir comportent des miroirs faisant entre eux un angle de 120° .

12. Détecteur selon l'une quelconque des revendications 1 à 9, dans lequel lesdits moyens formant miroir comportent quatre miroirs qui sont disposés en croix selon un angle de 90° .

13. Détecteur selon l'une quelconque des revendications précédentes, dans lequel ladite paire d'éléments détecteurs sont des éléments dé-

tecteurs de rayonnement infrarouge à trois bornes circulaires (75, 76), chaque élément détecteur comportant deux éléments détecteurs de rayonnement infrarouge montés en série d'une manière concentrique et possédant des électrodes (75a, 75b, 76a, 76b) disposées sur les deux extrémités décalées de 90° entre elles, lesdits éléments détecteurs étant polarisés dans les directions des électrodes sur les deux parties latérales de celles-ci et étant connectés en parallèle.

Patentansprüche

1. Infrarotdetektor in Dualanordnung (20, 50) zweier elektrisch verbundener pyroelektrischer Infrarot-Detektorelemente, mit

- einem Paar pyroelektrischer Infrarot-Detektorelemente (20a, 20b; 50a, 50b) 75, 76) mit im wesentlichen identisch ausgerichteten Lichtempfangsflächen jedoch entgegengesetzten Polaritäten, die elektrisch miteinander verbunden sind und ein der Differenz zwischen ihren Potentialen entsprechendes Ausgangssignal liefern, und
- einer Spiegeleinrichtung (21; 29; 63a - 63f), die in vorgegebener Entfernung vor den Lichtempfangsoberflächen angeordnet ist und eine bestimmte Breite aufweist, derart, daß einfallender Infrarotstrahl auf eines der Detektorelemente des Paares begrenzt wird, während das einfallende Infrarotlicht direkt auf die Lichtempfangsfläche des anderen Detektorelementes auftrifft, das ebenfalls reflektiertes Infrarotlicht von der Spiegeleinrichtung empfängt.

2. Detektor nach Anspruch 1, bei dem die Spiegeleinrichtung (21, 29, 63a - 63f) mit reflektierenden Flächen auf beiden Seiten versehen ist.

3. Detektor nach einem der Ansprüche 1 oder 2, bei dem mehrere Spiegel (63a - 63f) in einer Anordnung vorhanden sind, bei der einer der Spiegel in einer Ebene ausgerichtet ist, die sich zwischen den Infrarot-Detektorelementen (50a, 50b) erstreckt, wodurch die beiden so trennt, daß sie zu beiden Seiten des Spiegels liegen.

4. Detektor nach einem der vorangehenden Ansprüche, bei dem jeder Spiegel der Spiegeleinrichtung ein sektorförmiges Trägerteil (29) mit einer Aussparung in seinem mittleren Bereich ist.

5. Detektor nach einem der vorangehenden Ansprüche mit
- einem Rahmenteil (61) mit einer Signal-Verarbeitungsschaltung (73), einem ringförmigen Graben (65) in einer Oberfläche und einem mittleren Raum (63) in der Mitte;
 - einem Sensorbereich (60) im mittleren Raum;
 - einem Basisbereich (67) der Spiegeleinrichtung, der in den ringförmigen Graben eingesetzt ist, wobei die Spiegeleinrichtung aus mehreren Spiegeln (63a - 63f) besteht, die integral mit dem Graben verbunden und in Ebenen angeordnet sind, die eine Mittellinie enthalten, wobei sich die Spiegel nicht berühren; und mit
 - einer durchsichtigen Abdeckung (64) für die Spiegeleinrichtung.
6. Detektor nach Anspruch 5, bei dem die Verarbeitungsschaltung ein Bypassfilter, einen Verstärker und ein Tiefpaßfilter mit einem Kondensator (C_1) und einem Widerstand (R_1) als Rückkopplung aufweist, und als Bandpaßfilter für die Ausgangssignale der Infrarot-Detektorelemente (20a, 20b, 50a, 50b) ausgebildet ist.
7. Detektor nach einem der vorangehenden Ansprüche, der ein Keramiksubstrat (56) mit einer vorderen und einer hinteren Fläche aufweist, wobei das Detektorelementpaar (20a, 20b; 50a, 50b) mit der vorderen Fläche des Keramiksubstrats verbunden und eine Impedanzschaltung auf der hinteren Seite des Keramiksubstrats angeordnet ist.
8. Detektor nach einem der Ansprüche 5 bis 7, bei dem das Rahmenteil einander gegenüberliegende Durchgangslöcher (66) an zwei Positionen am Boden des ringförmigen Grabens (65) aufweist.
9. Detektor nach einem der vorangehenden Ansprüche, bei dem die Spiegeleinrichtung sechs Spiegel (63a - 63f) aufweist.
10. Detektor nach einem der vorangehenden Ansprüche, **dadurch gekennzeichnet**, daß die Spiegeleinrichtung Spiegel mit einem gegenseitigen Winkelabstand von 60° aufweist.
11. Detektor nach einem der Ansprüche 1 bis 9, **dadurch gekennzeichnet**, daß die Spiegeleinrichtung Spiegel mit einem gegenseitigen Winkelabstand von 120° aufweist.
12. Detektornach einem der Ansprüche 1 bis 9,

dadurch gekennzeichnet, daß die Spiegeleinrichtung vier Spiegel aufweist, die kreuzweise unter einem Winkel von 90° angeordnet sind.

13. Detektor nach einem der vorangehenden Ansprüche, bei dem die Detektorelemente des Paares ringförmige Infrarot-Detektorelemente (75, 76) mit drei Anschlüssen sind, wobei jedes Detektorelement zwei konzentrisch angeordnete und in Reihe geschaltete Infrarot-Detektorelemente und Elektroden (75a, 75b, 76a, 76b) an den beiden um 90° gegeneinander versetzten Enden aufweist, welche Detektorelemente in Richtung der Elektroden an ihren beiden Endbereichen polarisiert und parallel geschaltet sind.

FIG. 1

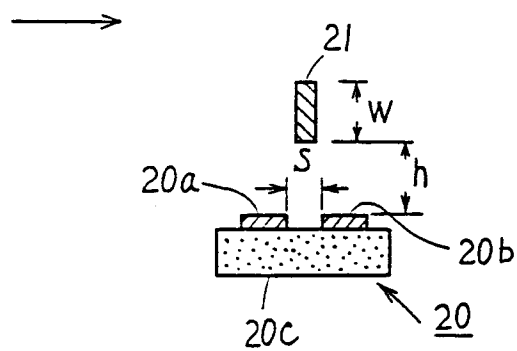


FIG. 2

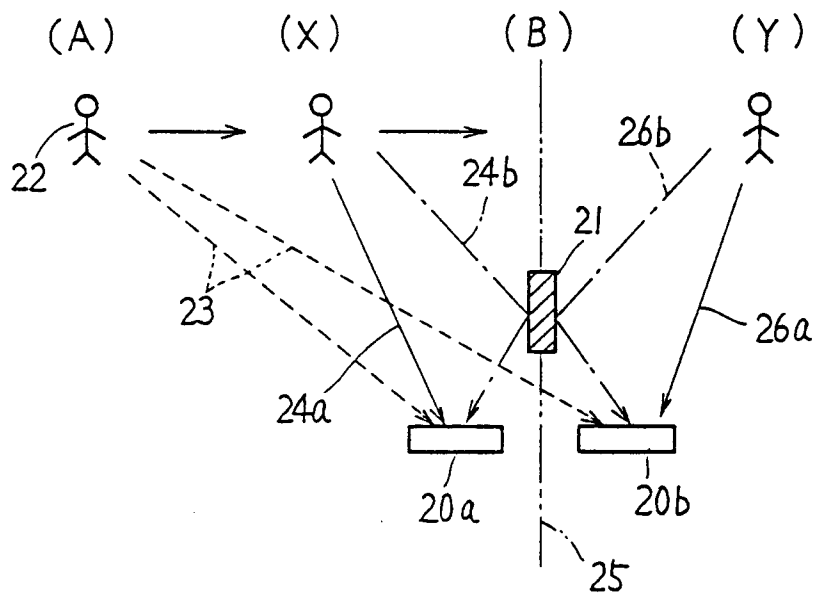


FIG. 3

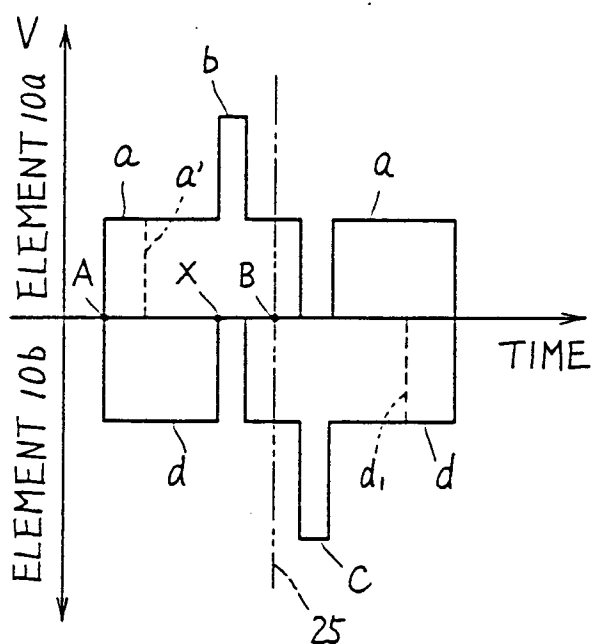


FIG. 4

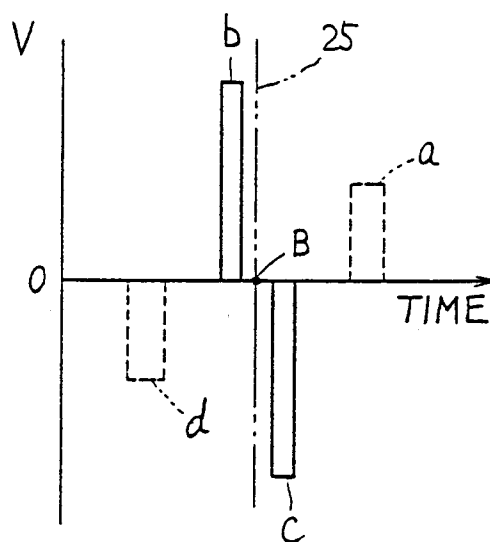


FIG. 5

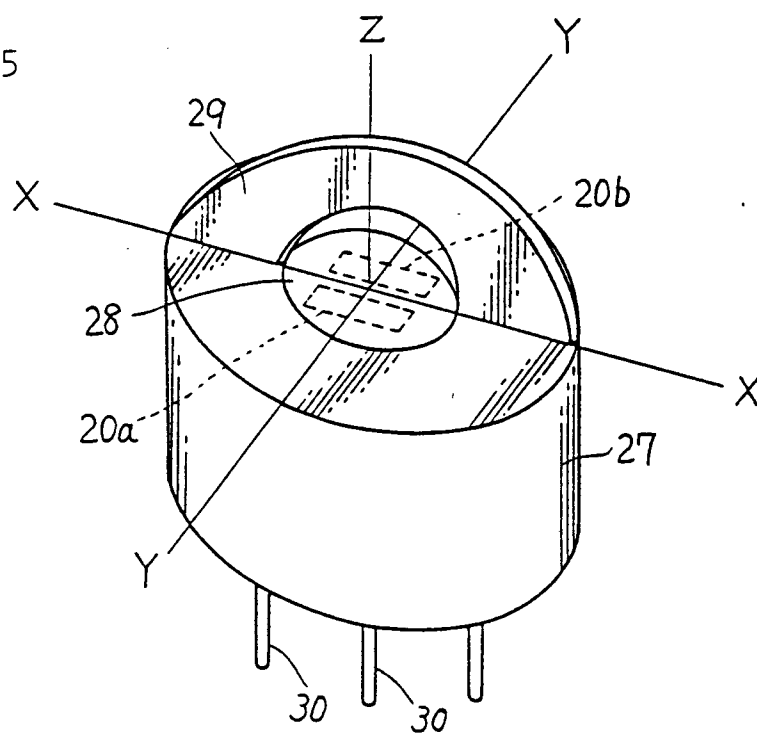


FIG. 6

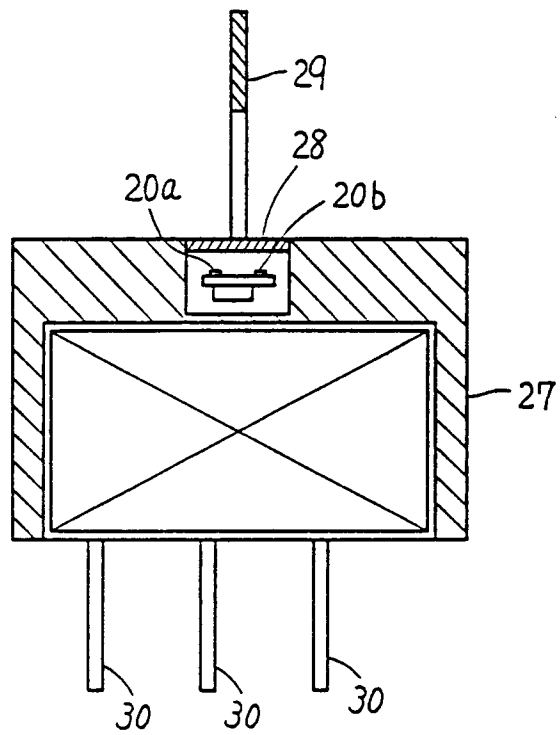


FIG. 7

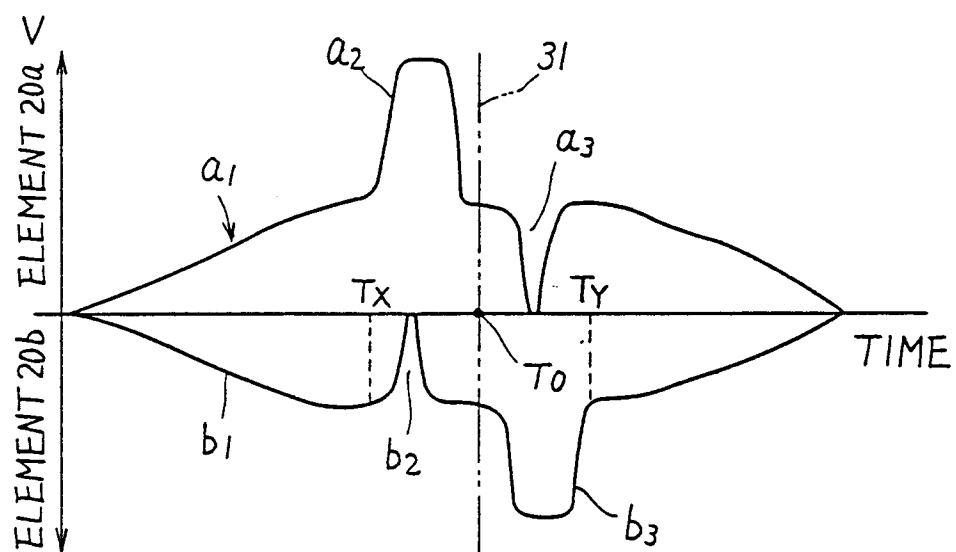


FIG. 8

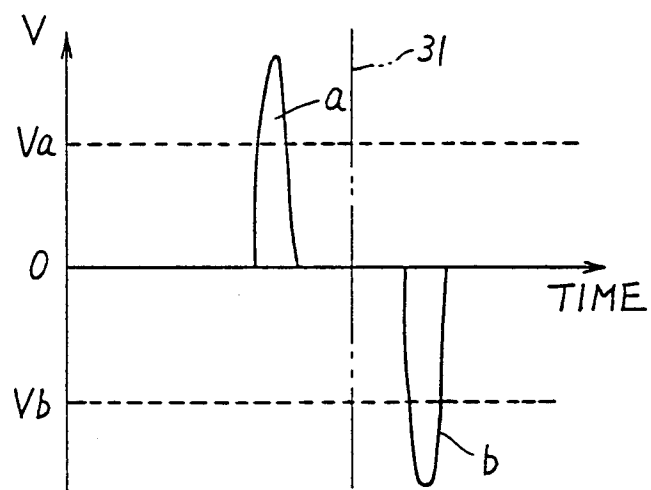


FIG. 9

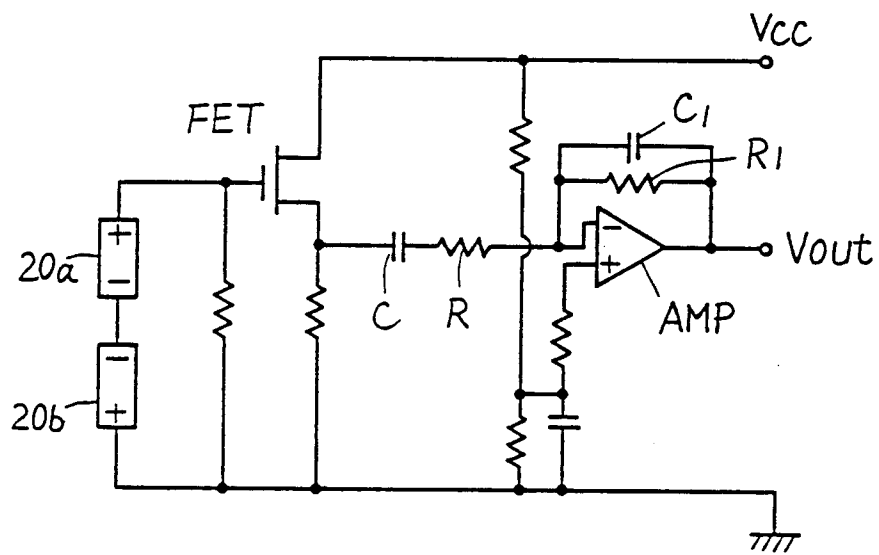


FIG. 10

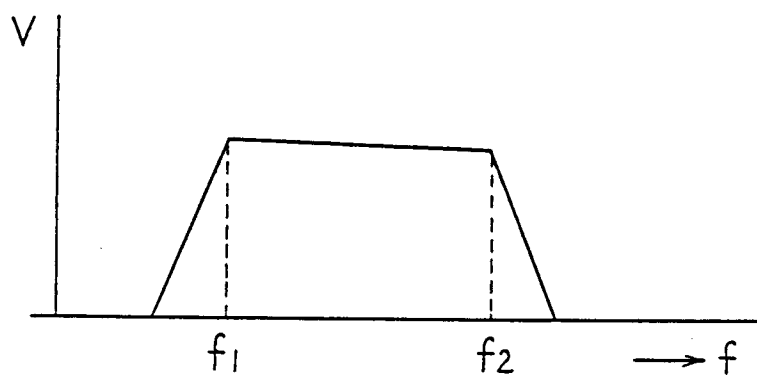


FIG. 11

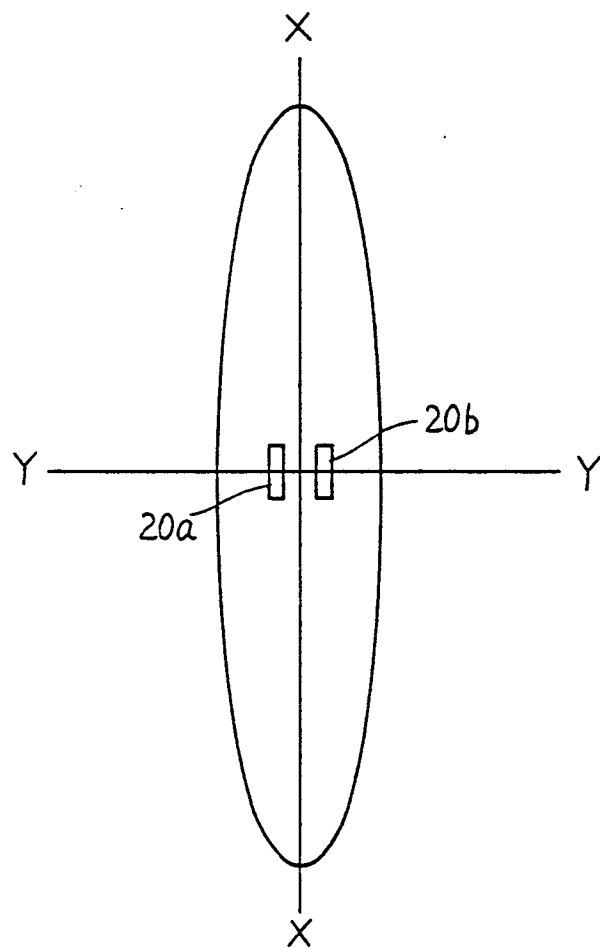


FIG. 12

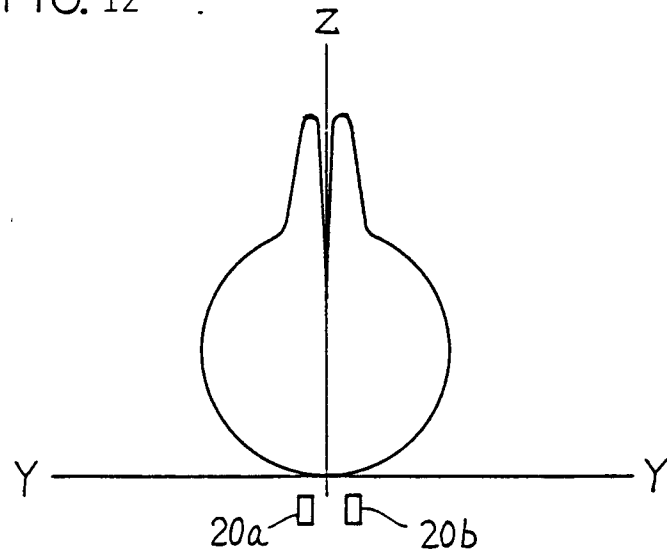


FIG. 13

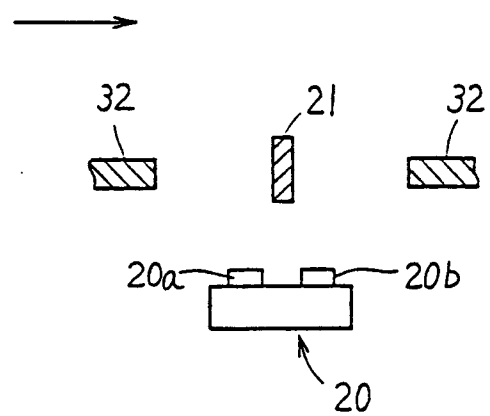


FIG. 14

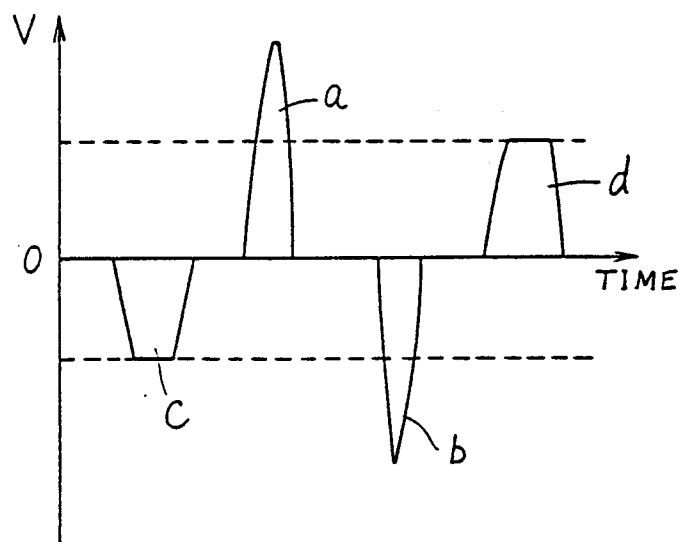


FIG. 15

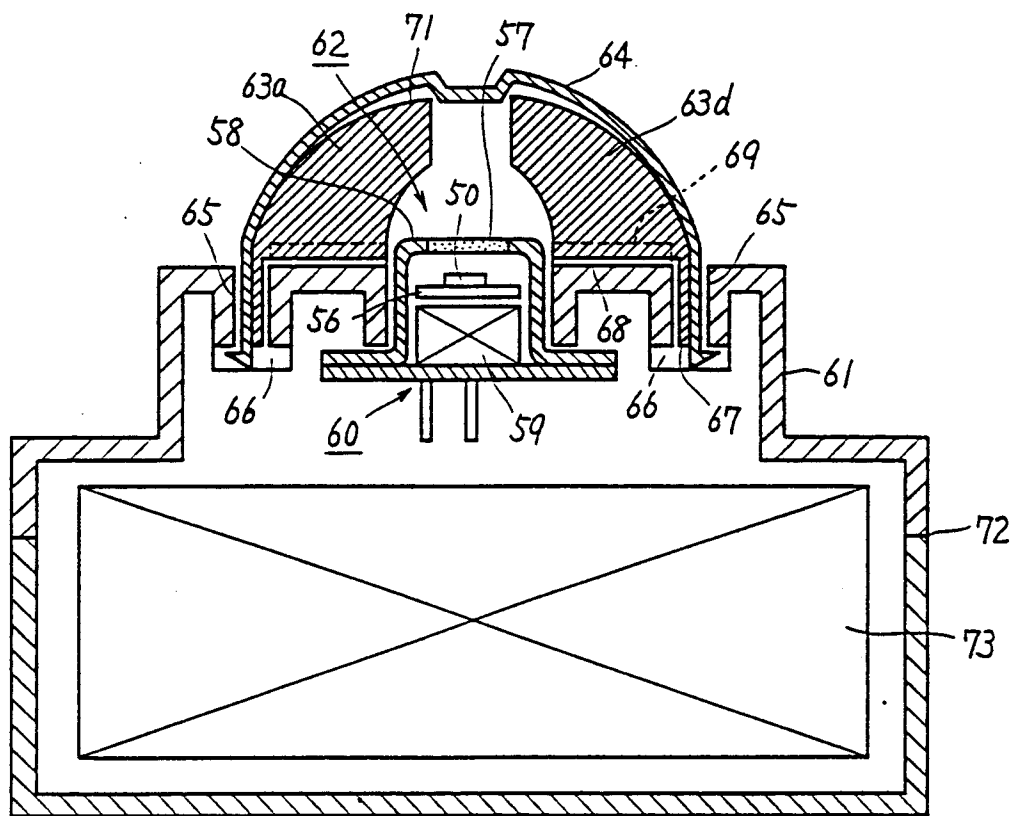


FIG. 16

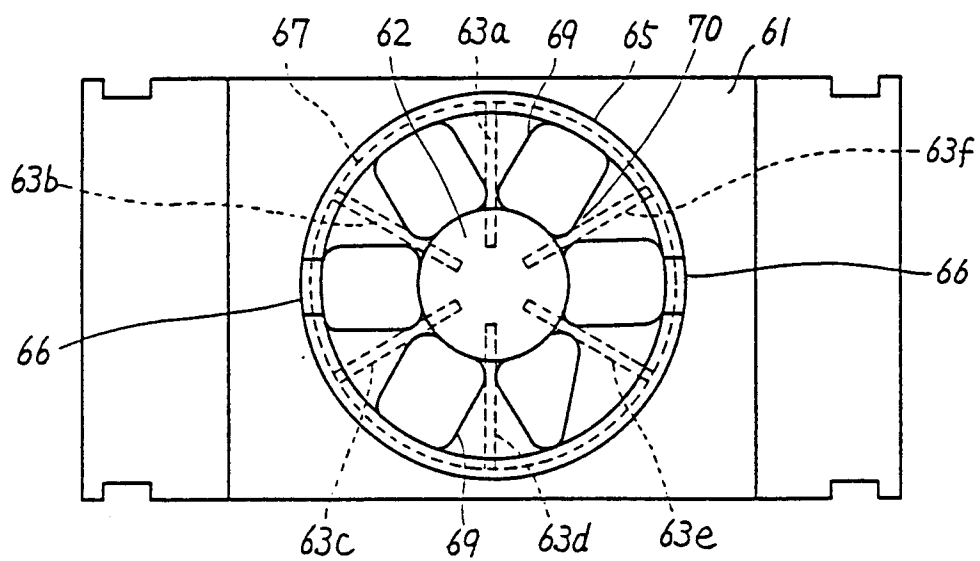


FIG. 17

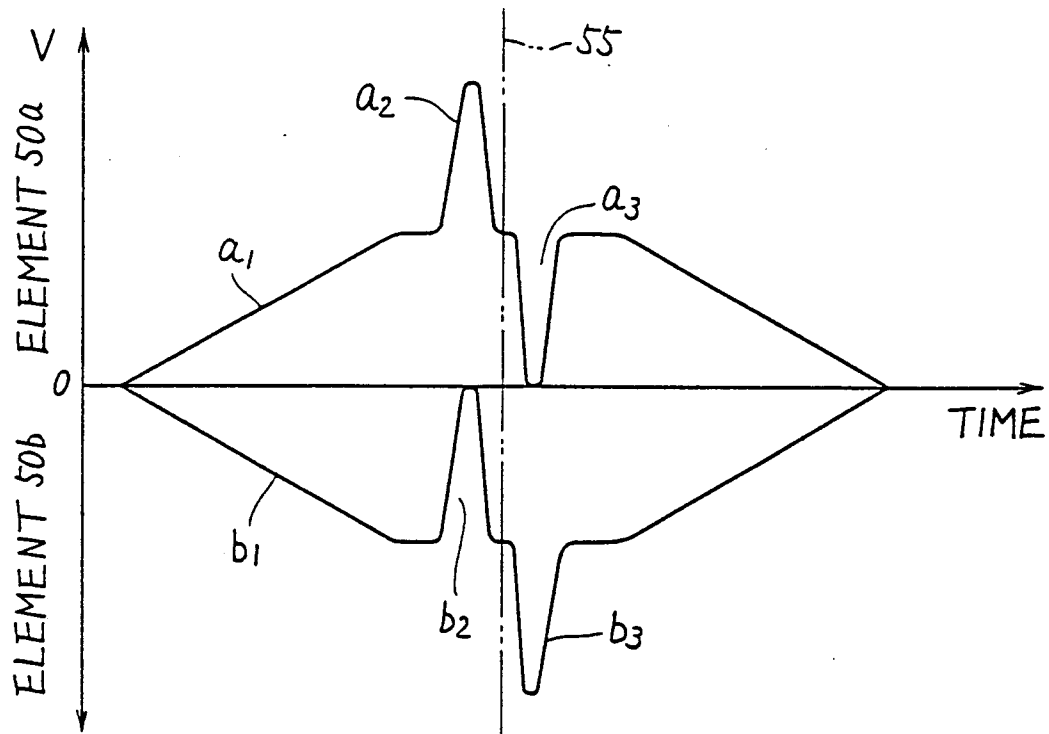


FIG. 18

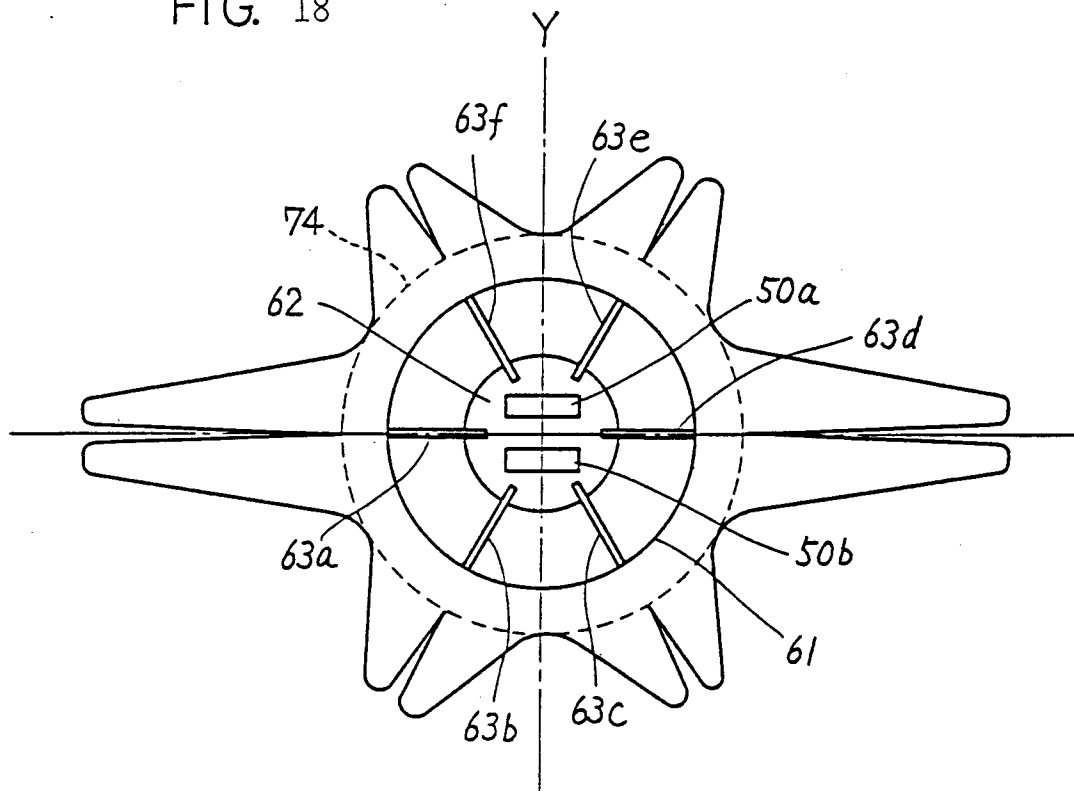


FIG. 19

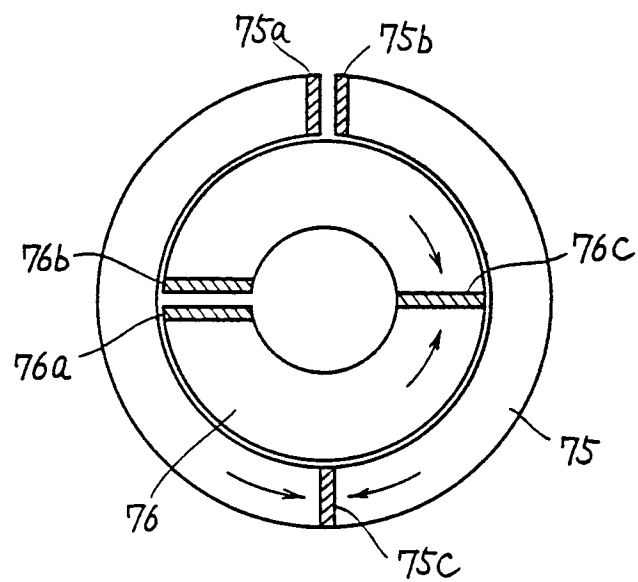


FIG. 20

