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(54) Compact monitor camera.

(57) A compact monitor camera includes a camera unit (3) and a peripheral circuit unit (4) both of which are mounted on a single base plate (2) and the camera unit (3) is supported by the base plate (2) rotatably about a predetermined axis to make the field of view of a lens (12) thereof regulatable. The monitor camera can be mounted at any position with a simple means with the camera unit (3) being in any arbitray attitude.

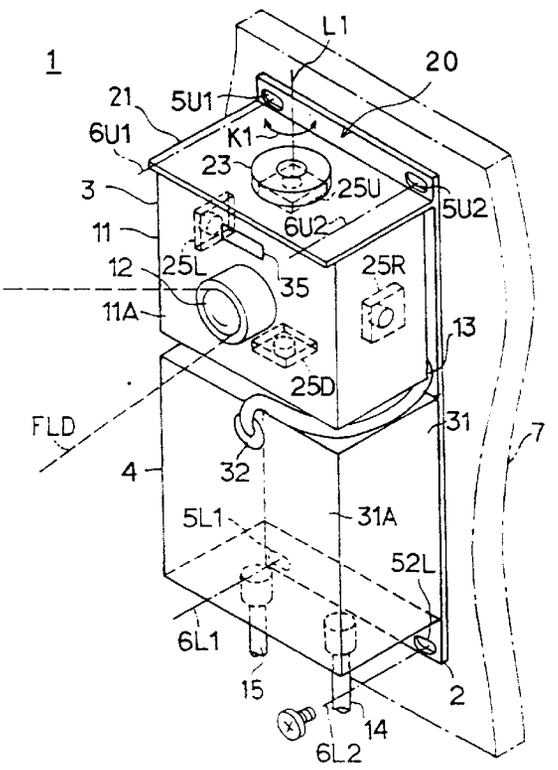

FIG. 1

EP 0 488 776 A2

The present invention relates to a compact monitor camera and, in particular, to such camera whose attitude against an object to be monitored or field of view can be easily set.

Conventionally, a monitor device for detecting any abnormality occured on an object to be monitored has been used for realizing a monitoring, for example, a metal mold in an injection molding cycle of an injection molding machine, testing products having parts mounted thereon, such as printed circuit boards, or preventing crime, and one in which a variation of magnitude (that is, brightness on a display screen) of a monitor video signal obtained from a predetermined position of a region covered by a television camera is detected as a monitor information and a monitor result can be evaluated based on whether or not the monitor information is fallen within a predetermined tolerable range.

In a case where it is desired to obtain a monitor video signal according to such method, in order to obtain a monitor information suitable to an object to be monitored, it is necessary to finely set a setting position of a television camera and an orientation of field of view thereof. However, it is frequently required, practically, to shot an object to be monitored at a necessary angle within a limited space or to set it in inconspicuous manner with respect to such object to be monitored, for example.

According to this invention, a compact monitor camera comprises a camera unit for converting an image focused through a lens to a photoelectric conversion element into an electric image signal by scanning the image, a peripheral circuit unit including signal conversion means for converting the image signal into a video signal, a base plate mounting casings and of the camera unit and the peripheral circuit unit, and a camera unit supporting portion for supporting the camera unit rotatably around a predetermined center axis on the base plate.

With the mounting of the camera unit and the peripheral circuit unit commonly on the base plate and the rotatable supporting of the camera unit with respect to the base plate, it is easily possible to realize a compact monitor camera capable of being easily set in a setting manner optimum with respect to various setting conditions of the mounting wall surrounding a monitoring place.

The present invention provides a compact monitor camera capable of being easily set on a setting object such as a mounting wall surrounding an object to be monitored according to demand.

A particular embodiment of a camera monitor in accordance with this invention will now be described with reference to the accompanying drawings; in which:-

Fig. 1 is a perspective view showing an embodiment of a compact monitor camera according to the present invention;

Fig. 2 is an enlarged, disassembled perspective view of a camera unit supporting portion of the camera shown in Fig. 1 for explaning a holding mechanism of its camera unit;

Fig. 3 is a front view showing the camera unit mounted on the base plate in a reverse mounting state;

Fig. 4 is a front view showing the camera unit mounted on the base plate in a fallen mounting state;

Fig. 5 is a front view of the camera unit mounted on the base plate in a right fallen state;

Fig. 6 is a diagram illustrating a method of setting the compact monitor camera at respective monitoring positions in a room;

Fig. 7 is a diagram illustrating a method of setting the compact monitor camera at amonitoring positions in a corner of a room;

Fig. 8 is a front view of the monitor camera according to another embodiment of the present invention, in which Fig. 8A is a front view of a main portion of the compact monitor camera whose camera unit is rotated by a reversible motor and Fig. 8(B) is a cross section showing a detailed construction of a coupling portion between an output shaft of the reversible motor in Fig. 8(A) and the camear unit;

Fig. 9 is an enlarged, partial cross section of a portion of the monitor camera shown in Fig. 8, which Fig. 9(A) is a front view of a main portion of the compact monitor camera whose camera unit is rotated by a reversible motor and Fig. 9(B) is a cross section showing a detailed construction of a coupling portion between an output shaft of the reversible motor in Fig. 9(A) and the camera unit;

Fig. 10 is a perspective view showing an embodiment in which a compact monitor camera is mounted on a large automobile;

Fig. 11 is a perspective view showing a state where the base plate in Fig. 10 is opened;

Fig. 12 is a perspective view of a compact monitor camera having temperature regulating means;

Fig. 13 is a perspective view of a compact monitor camera having temperature regulating means;

Fig. 14 is a perspective view of a compact monitors camera comfluoged as an illumination device:

Fig. 15 is a side view of the base plate of another embodiment;

Fig. 16 is a side view of the base plate of another embodiment;

Fig. 17 is a perspective view of a compact monitor camera set in a porch of a house;

Fig. 18 is a perspective view showing an application of a compact monitor camera to an interior of an office room;

Fig. 19 is a perspective view showing an application of the present monitor camera in a goldfish

bowl;

Fig. 20 is a perspective view showing a compact monitor camera using a fallen U shaped mounting plate portion:

Fig. 21 is a partially cross sectioned side view of another embodiment of the present monitor camera which can be rotated by a motor;

Fig. 22 is a front view of Fig. 21;

Fig. 23 is a partial cross sectioned side view of a compasct monitor camera whose base plate can be set manually;

Fig. 24 is a front view of a third embodiment of the compact monitor camera whose base plate and camera unit can be rotated by a motor;

Fig. 25 is a cross section showing a driveing mechanism of a camera unit in Fig. 24;

Fig. 26 is a front view of another embodiment of the present monitor camera in which, in Fig. 24, a rotational position of the base plate can be set manually;

Fig. 27 is a side view of a fourth embodiment of the present monitor camera in which a motor for driving a camera unit is mounted on a base plate;

Fig. 28 is a side view of a compact monitor camera in which a base plate is mounted on a horizontal member;

Fig. 29 is a front view of another embodiment of a compact monitor camera in which a motor for driving a camera unit mounting portion and a motor for driving a camera unit are mounted on a base plate;

Fig. 30 is a side view of a fifth embodiment of the present monitor camera in which a base plate on which a motor for driving a camera unit mounting portion and a motor for driving a camera unit are mounted is attached to a lower surface of a supporting member;

Fig. 31 shows a detailed construction of a rotational position detecting portion in Fig. 30; and

Fig. 32 is a block diagram of a signal processing device in Fig. 30.

An embodiment of the present invention will be decsribed in detail with reference to the drawings.

[1] First Embodiment

In Fig. 1 shows a compact monitor camera as a whole, a camera unit 3 is mounted on an end portion of a rextangular base plate 2 and a peripheral circuit unit 4 is mounted on the other end portion.

In the case of this embodiment, the base plate 2 has a vertically elongated configulation and a pair of screw holes 5U1, 5U2 are formed in an upper end portion thereof and a pair of screw holes 5L1, 5L2 are formed in a lower end portion thereof. The compact monitor camera 1 can be set on a surface of a wall 7 as a mounting object by fixing the base plate 2 through these screw holes to the wall 7 by means of screws 6U1, 6U2 and 6L1, 6L2.

The camera unit 3 is set on a surface plate 11A of the casing 11 having substantially square front shape, with a lens 12 thereof being protruded forwardly, so that an object within a field of view FLD and to be shot is focussed on a photo-electroc conversion element composed of, for example, a CCD (Charge Coupled Device) and converts the focused optical image into an electric image signal by reading it electrically, which is supplied to the peripheral circuit unit 4 through an image signal cable 13.

The image signal thus supplied is converted by signal conversion means in the peripheral circuit unit 4 into a video signal according to a standard television signal system and then supplied to, for example, a central monitoring/processing device provided in, for example, a central monitor room through a video signal cable 14.

The central monitoring/processing device receives video signals supplied from a plurality of such monitor locations and then forms monitor informations each indicative of whether or not an abnormality occurs in each monitor location and displays them, and, by displaying the video signal on a monitor, monitoring personnel can visually confirm a situation of the object in each monitoring location on demand.

In the case of this embodiment, a power source circuit is included in the peripheral circuit unit 4 and power is delivered to respective constitutional parts of the camera unit 3 and the peripheral circuit unit 4 by using power source supplied from, for example, a commercial power source through a power source/control signal cable 15.

A mounting plate portion 21 is provided in an upper end position of the base plate 2 and protrudes forwardly and, at substantially a center position, a camera unit supporting portion 20 such as shown in Fig. 2 is mounted. The camera unit supporting portion 20 has a through-hole 22 penetrating the thickness of the mounting plate portion 21, and by screwing fixing screw 23 being inserted into the through-hole 22 into thread hole 25A of an attachment member 25U provided in an inner surface of an upper surface plate 24 of the casing 11 and thus screwing the fixing screw 23 into the thread hole 25A of the attachment member 25U such that the mounting plate portion 21 is pinched, it is possible to fix the camera unit 3 by the fixing screw 23 as a whole, with it being suspended from the mounting plate portion 21.

In this case, the fixing direction of the camera unit 3 can be changed by loosening the fixing screw 23 and rotating the camera unit 3 around the fixing screw 23, and, thus, it is possible to fix the camera unit 3 on the mounting plate portion 21 with the lens 12 being directed to a predetermined direction by setting a direction of the field of view FLD (Fig. 1) of the lens 12 to the desired direction around a single center axis

L1 as a center as desired by a user and then tightening the fixing screw 23. As a result, the camera unit 3 is constituted such that it can be set its field of view FLD over about 180 degree in a rotating direction in right and left direction shown

In this embodiment, a gap of a predetermined width is provoded between the casing 11 of the camera unit 3 and the base plate 2, by which the sacing 11 is made not contact with the base plate 2 when the field of view FLD of the camera unit 3 and a image signal cable 13 can be derived from a rear surface side of the casing 2 laterally of the casing 11 by using this gap and then taken into a cable take-in hole 32 provided in an upper end portion of a front plate 31A of the casing 31 of the peripheral circuit unit 4, by which it is possible to compact the image signal cable 13 without disturbing the direction setting work of the camera unit 3.

Further, in this embodiment, in addition to the provision of the attachment member 25U on the upper surface plate, similar attachment members 25D, 25L and 25R are provided on a lower surface, a left side surface and a right side surface of the casing 11 of the camera unit 3, and, by screwing fixing screw 23 to its thread hole, the camera unit 3 can be fixed on the base plate 2 the mounting condition of which is selectively in vertically reversed, laterally fallen in right or left direction on demand, thereby expanding freedom of mounting with respect to the mounting direction of the basse plate 2.

In addition to this, a correct position indicating mark 35 is attached to the surface plate 11A of the casing 11 on which the lens 12 is mounted, and, by this correct position indicating mark 35, the user who sees the correct position indicating mark 35 can visually know an image (indicates a horizontal and vertical scan directions in converting the focussed image into the image signal) in a correct position of the optical image focussed on the CCD.

In the construction mentioned above, when the compact monitor camera 1 can be set with the base plate 2 being vertical longitudinally according to the mounting wall 7 surrounding a location to be monitored, the base plate 2 is set on the mounting wall 7 with the camera unit 3 being arranged on the upper side as mentioned with respect to Fig. 1 or with the camera unit 3 being arranged on the lower side of the peripheral circuit unit 3 as shown in Fig. 3.

For example, as shown in Fig. 6, the compact monitor camera 1 in the correct position such as shown in Fig. 1 is set on a inconspicious position near a wall of a room 41 to be monitored, such as a position 1X1 or the compact monitor camera 1 in a fallen position such as shown in Fig. 3 is set in a position 1X2. By doing so, it is possible to set the compact monitor camera 1 in a relatively inconspicious position.

Particularly, in a case where it is desirted to monitor an object to be monitored from a corner of a ceiling, a corner of a floor or from the floor, the compact monitor camera 1 in the correct position is set in a mounting position 1X3 at the corner of the ceiling or the compact monitor camera 1 in the fallen state is set in a mounting position 1X4.

Further, for example, in a case where it is desired to set the compact monitor camera 1 in a position on a mounting wall 42 near a ceiling 43, the compact monitor camera 1 is set in a mounting position 1X6 or 1X7 near the ceiling by screwing fixing screws 23 to the left attachment member 25L (Fig. 4) and the right attachment member 25R (Fig. 5) with the camera unit 3 being left fallen or right fallen state, as shown in Figs. 4 and 5.

Further, it is possible to set the compact monitor camera 1 in the correct mounting state (Fig. 1) in a mounting position 1X8 on the ceiling, or the compact monitor camera 1 in a fallen mounting state (Fig. 3) is set in s mounting position 1X9 on the ceiling.

Further, it is possible to set the compact monitor camera 1 in the left fallen mounting state (Fig. 4) or the right fallen mounting state (Fig. 5) in a mounting position 1X10 or 1X11 on the ceiling 43 near the side wall 42.

Further, as shown in Fig. 7, it is possible to set the compact monitor camera 1 in an inconspicious position within a room by setting the compact monitor camera 1 in the fallen mounting state (Fig. 3) or the correct mounting state (Fig. 1) in a corner space portion of side walls 42A and 42B.

Similarly, it is possible to set the compact monitor camera even on a floor surface according to demand.

Although it is popssible to set the compact monitor camera 1 in the correct mounting state (Fig. 1), or the reversed mounting state (Fig. 3) or the left fallen mounting state (Fig. 4), or the right fallen mounting state (Fig. 5) in in a position on the mounting walls surrounding the place to be monitored, the setting of the field of view FLD with respect to the monitoring object can be done more easily by rotating the field of view FLD of the camera unit 3 in the said setting state within a range of 180 degree around the center axis L1.

With the construction mentioned above, it is possible to obtain the object to be monitored in the field of view FLD in more reliably, by selecting the mounting state of the camera unit to meet with a specific condition of the place under monitoring.

In this case, the setting of the field of view FLD can be more facilitated by the fact that the rotation of the camera unit 3 is limited to the rotation range of freedom 1 around the center axis L1 of the fixing screw 23.

Incidentally, since, when the compact monitor camera 1 is set at any position shown in Figs. 6 and 7, de-mounted temporarily for, for example, repairment, and then mounted again, it is enough to regulate the outer axis of the mounting screw 23, it is

possible to set it again easily with substantially the same setting conditions as those before the repairment.

For example, when mounting means such as a pan head whose freedom is 3, it is difficult to make setting conditions coincident with those before repairment since regulation after the repairment must be done for three axes. On the contrary, in the present invention, the reproducibility of setting of the field of view FLD can be further increased since it uses only one axis about which rotation is to be regulated.

[2] Modifications of the First Embodiment

(2-1) Figs. 8(A) and 8(B) show a modification of the first embodiment of the present invention and, as indicating with using same reference numerals as thos used in Figs. 1 to 7 for corresponding portions, instead of the screwing the fixing screws 23 into the thread holes 25A of the attachment members 25U, 25D, 25L, 25R with the mounting plate portion 21 being pinched, it is constituted such that the camera unit 3 can be rotated around a rotation center L2 of a drive shaft 41 penetrating the through-hole 22 of the mounting plate portion 21 by fixing one end of the drive shaft 41 to the attachment members 25U - 25R and coupling the other end to an output shaft 42A of a reversible motor 42.

With this construction, it is possible to precisely chamge the field of view FLD of the camera unit 3 by rotating the reversible motor 42 according to user's demand.

In addition to the construction shown in Fig. 8(A) and Fig. 8(B), as shown in Fig. 9(A) and Fig. 9(B), in this embodiment, as shown in Fig. 8(B), the drive shaft 41 is supported by the mounting plate portion 21 through a beraing 41A and the reversible motor 42 is mounted on a mounting base 42C fixed on the mounting plate portion 21 by a mounting screw 42B.

It may be possible to insert coupling gears 43A and 43B between the oiutput shaft 42A of the reversible motor 42 and the drive shaft 41, in which case it is possible to set the field of view FLD of the camera unit 3 more precisely.

(2-2) Fig. 10 shows another embodiment of the present invention, in which the camera unit 3 and the peripheral circuit unit 4 mounted on the base plate 2 are housed in a receiving chamber 46 formed in a mounting wall 45, which is adapted to be closed by the base plate 2.

The base plate 2 is openably mounted on the mounting wall 45 by means of a rotary supporting portion 47 in the form of a hinge and, by rotating the base plate 2 around the rotary supporting portion 47 in a monitoring operation mode, it is possible to derive the camera unit 3 and the peripheral circuit unit 4 outside as shown in Fig. 9(B) to set the compact camera 1 such that it can shoot a monitoring object entered into the field of view FLD of the lens 12.

When the construction shown in Figs. 10 and 11 is set on a side face of a large automobile, the compact monitor camera 1 is set in a monitor mode shown in Fig. 11 when the large automobile is steered and driven and when it is necessary to monitor a scene of a side portion or a rear portion of a body of the automobile which is usually in dead angle for a driver, or is received in the receiving state shown in Fig. 10 when there is no need of monitoring, giving protection for the compact monitor camera 1.

With this construction, it is possible to realize a compact monitor camera 1 capable of having more various functions in addition to the above mentioned effect.

(2-3) Fig. 12 shows a further embodiment, in which heaters 61 and 62 are provided in the casing 11 of the camera unit 3 and the casing 31 of the peripheral circuit unit 4, respectively, and fans 64 are provided for the respective casings 11 and 31.

Thus, when temperature of a place to be monitored is extremely lower than an operating temperature of the camera unit 3 and the peripheral circuit unit 4, the heaters 61 and 62 and the fans 64 are actuated to produce warm air flow to thereby hold the operations of the camera unit 3 and the peripheral circuit unit 4 stabilized.

On the other hand, when temperature of the place to be monitored is extremely higher, the heaters 61 and 62 are not actuated while the fans 64 are driven to cool the camera unit 3 and the peripheral circuit unit 4 down to a suitable temperature.

According to the construction shown in Fig. 12, it is possible to operate the camera unit 3 and the peripheral circut unit 4 stably even when the compact monitor camera 1 is used at a temperature which is far from the optimum operating temperature thereof. In this case, the camera unit 3 and the peripheral circuit unit 4 should be mounted on the base plate 2 mechanically rigidly so that such additional components can be attached without problem.

(2-4) In a case shown in Fig. 13, although the heat insulating or cooling means are provided in the casing 11 of the camera unit 3 and the casing 31 of the peripheral circuit unit 4. Instead thereof, the casings 11 and 31 of the camera unit 3 and the peripheral circuit unit 4 are received in an outer casing 71 and a fan 72 is mounted on the outer casing 71 and the outer cassing 71 is mounted on the base plate 2, as shown in Fig. 13.

In addition to this, the casings 11 and 31 of the camera unit 3 and the peripheral circuit unit 4 are secured onto the base plate 2 not directly but through respective spacers 73 and 74, etc., so that air layers are provided between the base plate 2 and the casings 11 and 31.

In the construction shown in Fig. 13, when temperature of the place to be monitored is low, it is poss-

ible to maintain a suitable temperature of the casings 11 and 31 by the air layers provided between the outer casing 71 and the casings 11 and 31.

On the contrary, when temperature of the place to be monitored is little higher than the optimum operating temperature of the camera unit 3 and the peripheral circuit unit 4, it is possible to maintain temperature of the camera unit 3 and the peripheral circuit unit 4 at the optimum operating temperature by radiating heat from the casings 11 and 31 by the fan 72.

In doing so, it is possible to mount easily and safely facilities for heat insulating and coolong by the fact that it is possible to mount all parts on the common base plate 2.

(2-5) In the case shown in Figs. 12 and 13, it has been described witn reference to a case where facilities for maintaining temperature at an optimum operating temperature of the camera unit 3 and the peripheral circuit unit 4 are provided, instead thereof, it is possible to make the compact monitor camera 1 usable in outdoor condition by a provision of a waterproof hood on the base plate 2.

In this case, also, by the dact that the water-proof hood can be mounted on the common base plate 2, it is possible to mount the water-proof hood eassily and safely.

(2-6) Fig. 14 shows a further embodiment, which is effective to camouflage the fact that the compact monitor camera 1 is functioning as monitor means against persons in question when the compact monitor camera 1 is used for, particularly, preventing crime.

With regard to this point, with the construction shown in Fig. 1, it can be easily received in, for example, illimination device or bird box by mounting the camea unit 3 and the peripheral circuit unit 4 on the common base plate 2.

When comouflaging as illumination device, as shown in Fig. 14, an illumination device such as, for example, a U shaped fluorescent lamp 71, is mounted on an outer surface of the peripheral circuit unit 4. A fluorescent transformer 72 is provided separately from the U shaped fluorescent lamp 71 and receives power from a power source consent 73 and produces high frequency power which is supplied to the U shaped fluorescent lamp 71 through a code 74.

In this case, the compact monitor camea 1 is camouflaged as a portion of the illumination device.

(2-7) Although, in the above mentioned embodiment, the base plate 2 has been described as a flat plate. Instead thereof, it is possible to bend the base plate 2 such that there is a difference in height between a portion thereof on which the camera unit 3 is mounted and a portion thereof on which the peripheral circuit unit 4 is mounted, as shown in Fig. 15 or the base plate 2 is folded such that the camera unit 3 is stacked on the casing 31, as shown in Fig. 16, etc.

(2-8) As a method for making the compact monitor camera as inconpicious as possible, the compact monitor camera 1 may be housed in a dome shaped hood 79 of a partial transparent material when the compact monitor camera 1 is set, for example, in a porch in front of a door 78, as shown in Fig. 17, or, when the compact monitor camera 1 is to be set on a wall 80 of an office room, it may be housed in a semi-circular hood 81 of semi-transparent material as shown in Fig. 18. Alternatively, when the compact monitor camera 1 is to be set within a goldfish bowl, the camera 1 may be housed in a hood 82 of water-proof material, as shown in Fig. 19.

(2-9) Although, in the embodiment shown in Figs. 1 - 19, the construction in which the camera unit 3 is mounted on the mounting plate portion 21 protruding forwardly from the rectangular base plate 1 in such a way that it can rotate in a plate surface direction has been described, instead thereof, as shown in Fig. 20, a mounting plate portion 21X having a fallen U shaped cross section is used to mount the camera unit 3 rotatably on a surface of the base plate 2. That is, the mounting plate portion 21X is fixed to the base plate 2 at a center bottom portion of the U shaped mounting plate and a casing of the camera unit 3 is rotatably supported by fixing screws 21XC penetrating opposite leg portions 21XA and 21XB of the U shaped mounting plate portion 21X such that an angle of declination of the camera unit 3 is regulatable, with similar effect to that in the case of the above mentioned.

[3] Second Embodiment

(3-1) Figs. 21 and 22 show a second embodiment, as attaching the same reference numerals to portions as those used for the corresponding portions in Fig. 1, for a base plate 2, it is coupled to a base plate rotating motor 85 of a base plate rotation portion 84 by utilizing thread holes 51L1 and 51L2 provided in an end portion on the side of the peripheral circuit unit 4 thereof.

The base plate rotating motor 85 is fixed to a lower surface of a ceiling mounting base 86 by means of mounting screw 87 and an output gear 88 is fixed to its output shaft 85A.

To the ceiling mounting base 86, a cylindrical rotation transmitting portion 99 is arranged in juxtaposed relation to the base plate rotating motor 85 and its upper end portion is integrally fixed to the ceiling mounting base 86 by for example welding.

On a center axis of the driving power transmission portion 89, a transmission shaft 91 is provided which is supported rotatably at a lower end portion and an upper end portion thereof by bearings 90A and 90B and, by meshing a transmission gear 92 provided on the upper end portion of the shaft 91 with the output gear 88 of the output shaft 85A of the driving motor 85, it is possible to derive rotation force of the outpuit shaft 85A of the base plate rotating motor 85 through a rotation output shaft portion 94 coupled with a lower end

of the transmission shaft 91 by means of a coupling gear 93 through the transmission gear 92 and thge transmission shaft 91 as rotational force of the base plate rotation portion 84.

The rotational output shaft portion 94 is fixedly connected to a coupling member 96 by a mounting screw 95 and coupling screws 97A and 97B protrude from one side of the coupling member 96 and by screwing the coupling screws 97A and 97B into the screw holes 5L1 and 5L2 of the base plate 2, the base plate 2 can be rotated around a center axis of the rotational output shaft 94 while maintaining the attitude in an vertical extension direction of the base plate 2.

The camera unit 2 of the compact monitor camera 1 has a mounting plate portion 21X having a U shaped cross section similar to that mentioned with respect to Fig. 20 and this mounting plate portion 21X is fixed to the base plate 2 by, for example, screws, with a bottom plate portion 21XG which connects a pair of protruding plate portions 21XA and 21XB which protrude in parallel to each other being in contact with the base plate 2.

The pair of the protruding plate portions 21XA and 21XB have through-holes 21XE and 21XF in centers of top end portions in opposing relation horizointally through which fixing screws 21XC and 21XD are passed and, thus, by screwing the fixing screws 21XC and 21XD into the attachment members 25L and 25R (Fig. 1) provided in the casing 11 of the camera unit 3, it is possible to fix the camera unit 3 with the latter being rotated to a vertical rotation position around the through-holes 21XE and 21XF according to demand.

In the construction shown in Figs. 21 and 22, the ceiling mounting base 86 which is the object to mount is mounted on the ceiling by utilizing mounting holes 86X.

In this state, the output shaft portion 94 of the base driving portion 84 extends substantially vertically and the base plate 2 of the monitor camera 1 can be rotated horizontally about the output shaft portion 94 by an amount of rotation corresponding to an amount of drive of the base plate rotating motor 85.

As a result, the field of view FLD of the camera unit 3 can be changed around the center of the center line of the output shaft portion 94.

In addition to this, since the compact monitor camera 1 itself is allowed to rotate vertically around the the bearing through holes 21XE and 21XF extending horizontally by untightnening the fixing screws 21XC and 21XD, the field of view FLD can be changed vertically.

Thus, according to the construction shown in Figs. 21 and 22, a range which can be covered by the field of view FLD of the camera unit 3 can be set according to demand by setting rotation position in vertical rotation direction of the camera unit 3 by operating manually the fixing screws 21XC and 21XD and the direction of the field of view FLD set in the vertical rotation directions in horizontal right and left directions can be changed by driving the base plate rotating motor 85, resulting in that it is possible to set the camera unit 3 with respect to the object to be monitored more easily.

(3-2) Although, in the embodiment shown in Figs. 21 and 22, the base plate 2 of the compact monitor camera 1 can be rotated automatically by the base plate rotating motor 85 and the rotation force transmission portion 89 mounted on the ceiling mounting base 86, instead thereof, the coupling member 96 is fixed to the ceiling mounting base 86 by manually screwing the fixing screw 99 into the coupling member 96 as shown in Fig. 23.

By doing so, it is possible to set the compact monitor camera 1 on the ceiling easily with its direction in right and left directions which is preliminarily set by setting a right and left direction of the base plate 2 and then tightening the fixing screw 99 to the fixing member 96 by an operator.

(3-3) In this embodiment also, such modifications as mentioned with respect to Figs. 10 - 16 can be applied according to demand.

[4] Third Embodiment

(4-1) Figs. 22 and 23 show a third embodiment, and, as depicting corresponding portions to those in Fig. 22 by same reference numerals, contrary to the case in Fig. 22 in which the rotation position of the camera unit 3 to vertical rotation direction is fixed by screwing the fixing screws 21XC and 21XD through the bearing through-holes 21XE and 21XF to the camera unit 3, it can be automatically rotated by a camera unit rotation motor 101 in the case shown in Figs. 24 and 25.

The camera unit rotation motor 101 is mounted on either of the pair of the protruding plate portions 21XA and 21XB, for example, the 21XB, by means of a mounting screw 102 and an output shaft 101A of the motor 101 is inserted into an attachment 25L provided in a casing 11 through a bearing hole 103 formed in the protruding plate portion 21XB and integrated with the attachment member 25L by a fixing screw 104.

A rotary shaft pin 106 is inserted into an attachment 25R of the casing 11 through a bearing hole 105 formed in the other protruding plate portion 21XA and the attachment 25R is fixed to a top end of the pin by a fixing screw 107.

In the construction shown in Figs. 24 and 25, when the camera unit rotation motor 101 is actuated, its output shaft 101A rotates together with the casing 11 of the camera unit 3, by which the field of view FLD of the lens 12 of the camera unit 3 is rotated vertically.

According to the construction in Figs. 24 and 25, the base plate 2 of the compact monitor camera 1 can be rotated horizontally by the base plate rotating motor 85 and the camera unit 3 can be rotated verti-

cally by the camera unit rotating motor 101. Therefore, since the field of view FLD of the camera unit 3 can freely rotate horizontally and vertically, the positioning of the field of view FLD can be done more easily.

(4-2) Fig. 24 shows another embodiment in which the base plate rotating motor 85 in Figs. 24 and 26 are removed and, instead thereof, the fixing screw 99 mentioned with respect ti Fig. 23 is used.

According to the construction in Fig. 26, since it is possible to set the the base plate 2 of the compact monitor camera 1 in a predetermined rotational position in right and left rotational direction on demand by operating the fixing screw 99 manually and to ratote the camera unit 3 in vertical rotational direction by using the camera unit rotating motor 101, the positioning of the field of view FLD of the camera unit 3 can be done easily.

[5] Fourth Embodiment

(5-1) Fig. 27 shows a fourth embodiment in which the camera unit rotating motor 110 is mounted by mounting screw 113 to a mounting base 112 mounted on the base plate 2 by mounting screw 111 in the vicinity of mounting position of the base plate 2 on which the camera unit 3 is mounted.

The base plate 2 is mounted to a ceiling mounting base 115 having L shaped cross section by mounting screw 114 by utilizing thread holes 5L1 and 5L2 provided in an end portion on the side of the peripheral circuit unit 4 and, by mounting the ceiling mounting base 115 by means of its mounting hole 115X, the base plate 2 can be held in substantially vertically suspended state.

The camera unit rotating motor 110 has an output shaft 110A protruded downwardly and the end of the downwardly protruded shaft is screwed to an attachment member 21H provided inside a connecting plate portion of the mounting plate portion 21X.

The mounting plate portion 21X is constituted similarly to that mentioned in Fig. 21 such that it can be positioned and held in a predetermined rotatiinal position in back and forth rotational direction around bearing through-holes 21XE and 21XF by fixing screws 21XC and 21XD passing through beraing through-holes 21XE and 21XF formed in a pair of protruded plate portions 21XA and 21XB.

In the construction in Fig. 27, the camera unit rotating motor 110 can rotate the mounting plate portion 21X and hence the camera unit 3 in right and left directions automatically.

In addition to this, the rotational position of the camera unit 3 with respect to the mounting plate portion 21X can be changed on demand by untightening the fixing screws 21XC and 21XD.

Thus, according to the construction in Fig. 27, it is possible to position the field of view FLD of the camera unit 3 in right and left directions according to an amount of rotation of the camera unit rotating motor 110 and, since the field of view FLD can be positioned in a predetermined rotational position in vertical direction by using the fixing screws 21XC and 21XD, it is possible to easily position the field of view FLD to a predetermined orientation on demand, ultimately.

In doing so, by mounting main parts on the base plate 2, the setting of the compact monitor camera 1 becomes more easily.

(5-2) Fig. 28 shows another embodiment than in Fig. 27, in which the base plate 2 is mounted directly to the ceiling by using the thread holes 5L1, 5L2 and 5U1, 5U2.

In this case, the camera unit rotating motor 110 is mounted on the base plate 2 by the mounting screw 115 with its output shaft 110A being protruded downwardly and, completely similarly to the case in Fig. 27, the mounting plate portion 21X holding the camera unit 3 rotatably in back and forth direction is fixed integrally to the downwardly protruded end of the output shaft 110A rotatably in right and left directions.

According to the construction in Fig. 28, the field of view FLD of the camera unit 3 can be set in a predetermined rotational position in right and left directions by the camera unit rotating motor 110 and the rotational position in back and forth directions can be set by the fixing screws 21XC and 21XD, thus, the field of view FLD can be set easily.

In doing so, since all parts can be mounted on the base plate 2, the setting of the compact monitor camera 1 can be done easily enough practically.

(5-3) Fig. 29 shows a further embodiment other than Fig. 27, in which, as depicting corresponding portions to Fig. 27 by same reference numerals, the mounting plate portion 21X is mounted to the protruded end of the output shaft 110A of the camera unit rotating motor 110.

In addition to this, on the protruded plate portion 21XB of the mounting plate portion 21X, the camera unit rotating motor 101 is mounted by the mounting screw 102 in the similar manner as shown in Fig. 25 and its output shaft 101A is fixed to the attachment member 25L provided inside the camera unit 3 through the beraing hole 103 provided in the protruded plate portion 21XB by the fixing scrw 104.

The beraing hole 105 is formed in a position facing to the beraing fole 103 of the protruded plate portion 21XA, a rotational shaft pin 106 is inserted into the bearing hole 105 and its inserted end is fixed to the attachment member 25R provided within the camera unit 3 by the fixing screw 107.

According to the construction in Fig. 29, it is possible to set the orientation of the field of view FLD of the camera unit 3 in right and left directions by the camera unit rotating motor 110 on demand and to position in a required rotational position in back and forth directions of the field of view FLD of the camera unit 3 by the camera unit rotating motor 110.

Thus, according to the construction in Fig. 29, the setting of the field of view of the camera unit 3 can be done more eassily and, by the fact that all parts can be mounted on the base plate 2, it is possible to easily set the compact monitor camera 1.

[6] Fifth Embodiment

(6-1) Figs. 30 - 32 shows the fifth embodiment, in which the compact monitor camera 1, as depicting corresponding portions to those in Fig. 28 by same reference numerals, is made such that the camera unit rotating motor 110 is mounted on the base plate 2 mounted on a lower surface of a mounting object, for example of a hull of an air plane and the mounting plate portion 21X can be rotated by its output shaft 110A.

On one protruded plate portion 21XA of the mounting plate portion 21X, the camera unit rotating motor 101 for rotating the camera unit 3 in back and forth diections is mounted.

In the case of this embodiment, the mounting structure for mounting the camera unit rotating motor 101 on the protruded plate portion 21XA such that the camera unit 3 is rotated and the mounting structure for mounting the camera unit 3 rotatably on the mounting plate portion 21X are the same as those mentioned with respect to Fig. 25 and thus the orientation of the field of view FLD of the camera unit 3 can be rotated within a rotation range near 180 degree from forward through below to rearward.

On the mounting plate portion 21X, a rotational position detector 114 is provided.

As shown in Fig. 31, the rotational position detector 114 comprises a photodetector 115 arranged on an inner surface of the connecting plate portion of the mounting plate portion 21X and a reflection mirror 116 arranged on a lower surfasce of the camera unit 3 opposing to the connecting plate portion 21C.

For the photo detector 115, a downward direction detecting photodetector element 117A, a forward rotational limit detecting photodetector element 117B and a rearward rotational limit detecting photodetector element 117C, each of which includes a light emitting element and a light receiving element, are mounted on a mounting base plate 118.

The downward direction detecting photodetector element 117A is positioned such that, when the field of view FLD of the camera unit 3 oriented just downward direction as shown by a simbol K0, emitted detecting light L0 is reflected by the reflection mirror 116 back to the light receiving element.

The forward rotational limit detecting photodetector element 117B is positioned such that, when the camera unit 3 is rotated up to a permissible forward rotational position, emitted detecting light L1 is reflected by the reflection mirror 116 back to the light receiving element.

The rearward rotational limit detecting photodetector element 117C is positioned on the mounting base plate 118 such that, when the camera unit 3 is rotated up to a permossible rearward rotational position as shown by an arrow K2, emitted detecting light L2 is reflected by the reflection mirror 116 back to the light receiving element.

Detection signals S1, S2 and S3 of the downward direction detecting photodetector element 117A, the forward rotational limit detecting pohotodetector element 117B and the rearward rotational limit detecting photodetector element 117C are supplied to the peripheral circuit 4 and supplied to a signal processing device 120 through a power source/control cable 15 as detection input signals-S10, S11 and S12, as shown in Fig. 32, upon which, on the basis of video signal VD1 obtained from the camera unit 3, a display of video signal VD2 supplied to the signal processing device 120 through the peripheral circuit unit 4, a video signal cable 14 is controlled.

In the construction in Fig. 30, in a state where the base plate 2 is mounted on the lower surface of the mounting object, that is, the hull of the air plane by utilizing the mounting holes 5L1, 5L2 and 5U1, 5U2, by driving the camera unit rotating motor 101, the field of view FLD of the camera unit 3 can be changed over a wide range from an orientation of the base plate 2 directed fowrardly (for example, left, nose direction of the air plane) through an orientation directed downwardly to rearward direction (that is, left, tail direction of the air plane).

And, this field of view FLD can be rotated in right and left directions by driving the camera unit rotating motor 110 and thus the field of view FLD of the camera unit 3 can be set easily as the whole according to demand.

However, when the camera unit 3 rotates from the forward position through the downward position to the rearward position, and when the camera unit 3 can obtain a correct position image (the image is referred to as correct position image) through the field of view FLD when rotating to the forward position, an image plane obtainable by the camera unit 3 through the field of view FLD when the latter rotates through the downward position to the rearward position becomes an image which is the correct position image reversed horizontally and vertically (this is referred to as reverse position image).

When such reverse position image is displayed on a monitor as it is, an observer of the monitor feels uncomfortability and, in some case, there may be an erroneous monitoring decision.

In order to solve this problem, in the case of this embodimenr, a video signal processing is performed in the signal processing device in Fig. 32 such that a-reverse position image obtained from the camera unit 3 can be displayed on the monitor as the correct position image.

After the video signal VD2 is converted by an A/D converter 121 into a digital signal, it is written in a frame memory 123 under control of a write control circuit 122.

The video signal written in the frame memory 123 is read out as a digital readout video signal VD4 under control of a readout control circuit 124 and after converted into an analog video signal VD5 by a digital-/analog converter circuit supplied to an image processing circuit 126.

The image processing circuit 126 is adapted to process the analog video signal VD5 according to demand. One processing is to make a monitoring of a scene currently obtained in the camera unit 3 on the monitor 127 possible.

In addition to the construction mentioned above, the input detection signal S10 inputted on the basis of the detection signal S0 of the downward direction detecting photodetector element 117A is supplied to a clock input end CK of a correct position/reverse position discriminating circuit 130 composed of, for example, a JK flip-flop circuit so that a logical level of a discrimination output obtained at a Q output end is switched every time the input detection signal S10 is obtained.

In the case of this embodiment, when the camera unit 3 is set in the forward rotational position again from the rearward rotational position through the downward position, the correct position/reverse position discriminating circuit 130 sends a discrimination output S21 in "0" logic level upon the input detection signal S10 inputted on the basis of the detectio signal S0 obtained from the diwnward direction detecting photodetector element 117A when the camera unit 3 passes through the downward direction.

In this state, when the camera unit 3 is set in the rearward rotational position again from the forward rotational position through the downward position, the correct position/reverse position discriminating circuit 130 switches the logic level of the discrimination output S21 from "0" to "1" upon the input detection signal S10 inputted on the basis of the detectio signal S0 obtained from the downward direction detecting photodetector element 117A when the camera unit 3 passes through the downward direction.

The discrimination output S21 of the correct position/reverse position discriminating circuit 130 is given to a D input end of a forward/reverse control signal forming circuit 131 composed of a D flip-flop circuit.

To a clock input end CK of the forward/reverse control signal forming circuit 131, a synchronizing signal S22 sent from a synchronizing signal separator circuit 132 which receives the video signal VD2 is given through an inverter 133 and thus the logic level of the discrimination output S21 is read in the forward-/reverse control signal forming circuit 131 at a timing the vertical synchronizing signal S22 is obtained.

Thus, the discrimination output S21 whose logic level becomes "0" when the camera unit 3 is in the forward rotational position is written in the forward/reverse control signal forming circuit 131 at the timing the vertical synchronizing signal S22 is obtained ans the Q output which has a logic level "0" at this time is supplied to a read out control circuit 124 as a forward-/reverse control signal S22. The frame memory 123 comprises a 2-port read/write memory array which, for write and read, can read or write a shared memory array independently and a first-in first-out (FIRST-IN-FIRST-OUT) operation or a first-in last-out (FIRST-IN-LAST-OUT) operation can be selected according to the logic level of the forward/reverse control signal S22 given to the read out control circuit 124.

Thus, the frame memory 123 can write the correct position image in the memory array as the first-in first operation when the forward/reverse control signal S22 is in logic level "0" and read the correct position image and display on the monitor 127 as it is. Contrary to this, when the forward/reverse control signal S22 is switched to logic level "1", the correct position image is read as the reverse position image with reversing it horizontally and vertically by reading the correct position image which is written in the memory array, by the first-in last-out operation, and display it on the monitor 127.

By this, the video signal written in the frame memory 123 is displayed on the monitor 127 as the correct position image.

When the camera unit 3 is rotated to the rearward rotational position during this state, the forward/reverse control signal S22 of the forward/reverse contrrol signal forming circuit 131 is switched to logic level "1" and therefore the frame memory 123 performs the first-in last-out operation by the read out control circuit 124 to display the image obtained by the camera unit 3 by the field of view FLD on the monitir 127 as the reverse position image which is the correct position image reversed horizontally and vertically.

In this manner, according to the construction in Figs. 30 - 32, even when the camera unit 3 obtains the so-called reverse picture by a rotational movement of the camera unit, it can be disdplayed on the monitor camera as the correct position image.

The input detection signal S11 is given to a reset terminal R of the correct position/reverse position discriminating circuit 130 on the basis of the detection signal S1 of the forward rotational limit detecting photodetector element 117B according to which the discrimination output S21 id forcively reset to logic "1" level by operating the correct position/reverse position discriminating circuit 130 in a resetting operation when the camera unit 3 rotates to a rotational position beyond the forward rotational limit.

By doing so, even when the coreect position/reverse position discriminating circuit 130 is reversed in setting condition for some reason when the camera

unit 3 is in a forward rotational position, this can be corrected to the correct condition.

In the case of this embodiment, the input detection signals S11 and S12 inputted on the basis of the input detection signals S11 and S12 based on the forward and reaward rotational limit detecting photodetector elements S1 and S2 are inputted to a camera unit rotating motor control circuit 140 and by making the drive control signal S31 sent from the camera unit rotating motor control circuit 140 the drive signal S32 and by driving and controlling the camera unit rotating motor 101, the camera unit rotating motor 101 is prevented from rotating forwardly or rearwardly beyond it. (6-2) In Figs. 30 - 32, the monitor camera 1 has been described as mounted to the lower surface of the air plane. However, the present invention is not limited thereto and can be applied to a mounting to a lower surface of other mounting objects. Further, not only the lower surface, the mounting portion of such structure can be an upper surface, side surfacem with the similar effect to the case mentioned above.

As mentioned hereinbefore, according to the present invention in which the camera unit and the peripheral circuit unit are mounted on the common base plate and the camera unit is supported rotatably with respect to the base plate to make the field of view of a lens thereof regulatable, it is easily possible to realize the compact monitor camera capable of being easily set in various states on a side wall of the place to be monitored or even on a surface of any structure to monitor an environment around the structure.

Claims

1. A compact monitor camera comprising:
   a camera unit (3) including a lens (12) and a camera unit casing (11), for converting an image focused on an photo-electric conversion element through said lens (12) into an electric image signal by scanning the image in a predetermined direction;
   a peripheral circuit unit (4) including signal conversion means for converting the image signal into a video signal;
   a peripheral circuit unit casing (31) for receiving said peripheral circuit unit (4);
   a base plate (2) for fixedly supporting said peripheral circuit unit casing (31); and,
   a camera unit supporting portion (20) provided on said base plate (2) for supporting said camera unit casing (11) rotatably about a predetermined central axis with respect to said base plate (2) to thereby orientate said lens (12) in an arbitrary direction.

2. The compact monitor camera claimed in claim 1, wherein said camera unit supporting portion (20) can fix said camera unit (3) in a first rotational position in which an erect image is focused on said photo-electric conversion element.

3. The compact monitor camera claimed in claim 1, wherein said camera unit supporting portion (20) can fix said camera unit (3) in a second rotational position in which a rightwardly fallen image is focused on said photo-electric conversion element or wherein said camera unit supporting portion (20) can fix said camera.unit in a third rotational position in which a reverse image is focused on said photoelectric conversion element.

4. The compact monitor camera claimed in claim 1, wherein said camera unit supporting portion (20) can fix said camera unit (3) in a fourth rotational position in which a leftwardly fallen image is focused on said photo-electric conversion element.

5. The compact monitor camera claimed in claim 1, wherein said camera unit supporting portion (20) can selectively fix said camera unit (3) in a rotational position in which an erect image, a rightwardly fallen image, a reverse image and a leftwardly fallen image is focused on said photoelectric conversion element.

6. The compact monitor camera claimed in any of claims 1 to 5, wherein said camera unit (3) further includes a visual indicator mark on said camera unit casing (11), for indicating said scanning direction.

7. The compact monitor camera claimed in any of claims 1 to 6, wherein said camera unit supporting portion (20) includes a reversible motor (42) for rotating said camera unit (3) reversibly about said central axis.

8. The compact monitor camera claimed in claim 7, further comprising a gear mechanism (43A and B) provided between an output shaft (42A) of said reversible motor (42) and said camera unit (3), to transmit a rotation on the output shaft (42A) of said reversible motor (42) to said camera unit (3).

9. The compact monitor camera claimed in claim 1, further comprising motor means for rotating said base plate (2).

10. The compact monitor camera claimed in any one of the preceding claims, further comprising a signal processor (120) for processing said video signal to switch a display thereof on said monitor according to a line of sight of said camera unit (3).

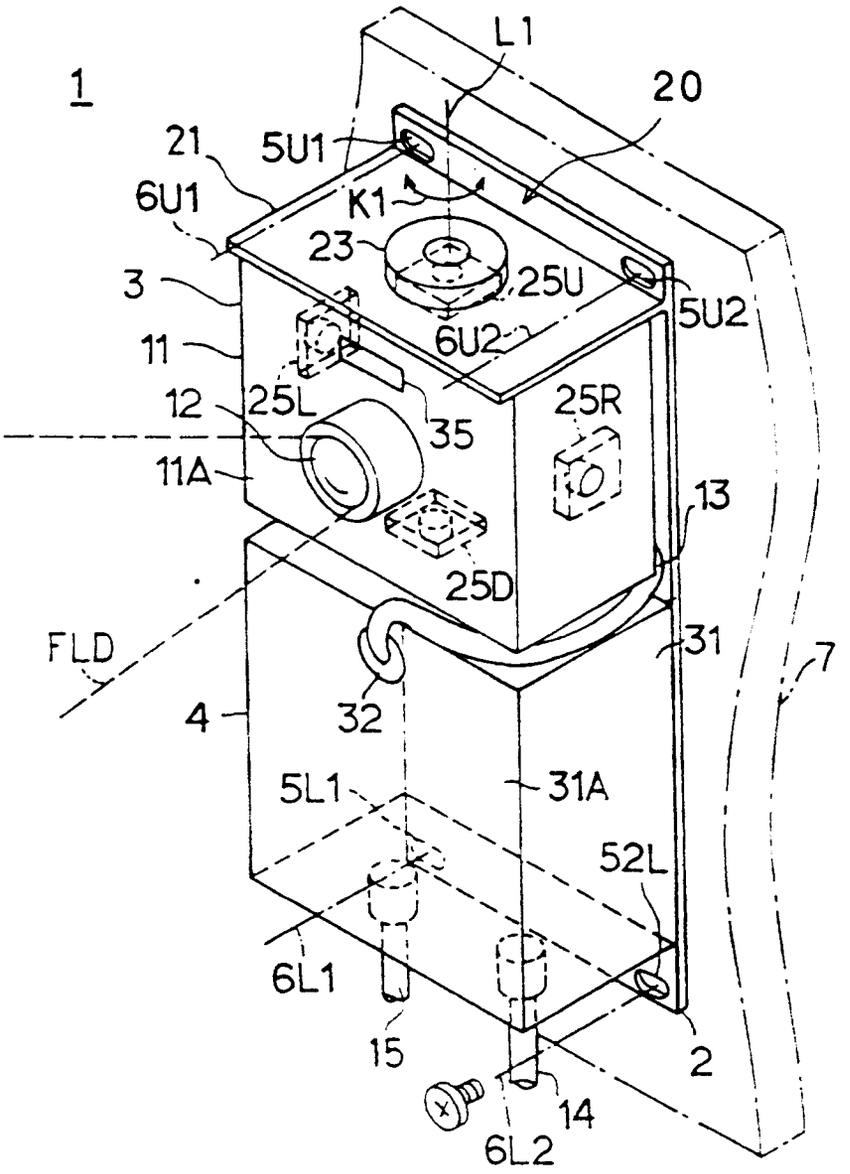
1
L1
20
21
5U1
6U1
K1
23
25U
5U2
3
6U2
11
12
25L
35
25R
11A
13
25D
FLD
31
7
4
32
5L1
31A
52L
6L1
15
2
14
6L2

FIG. 1

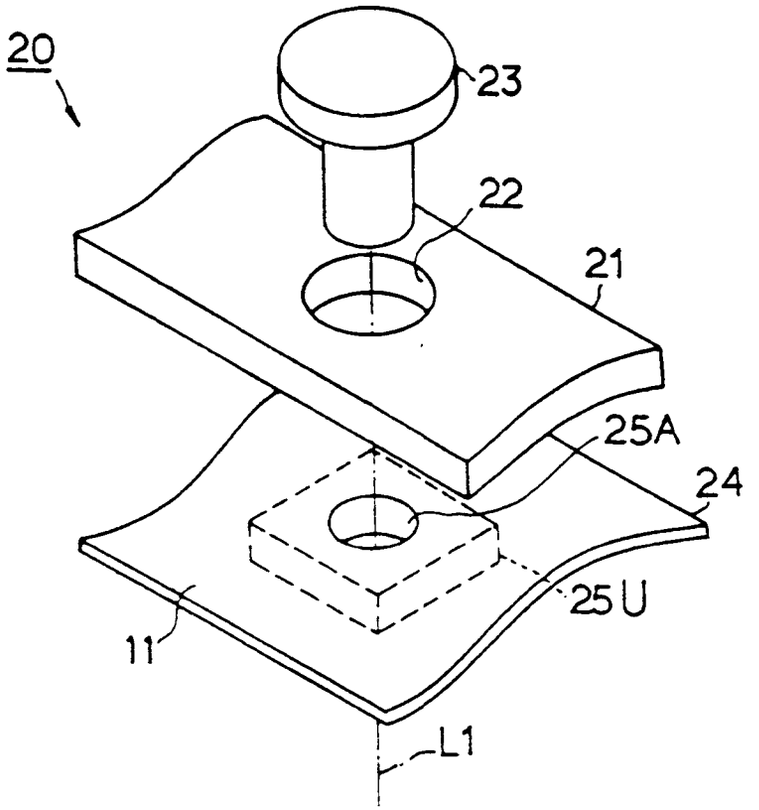

FIG. 2

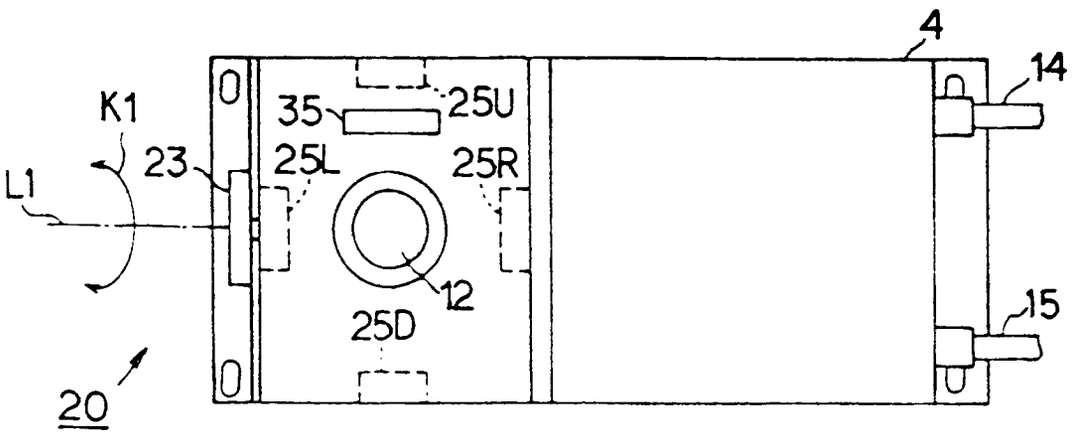

FIG. 4

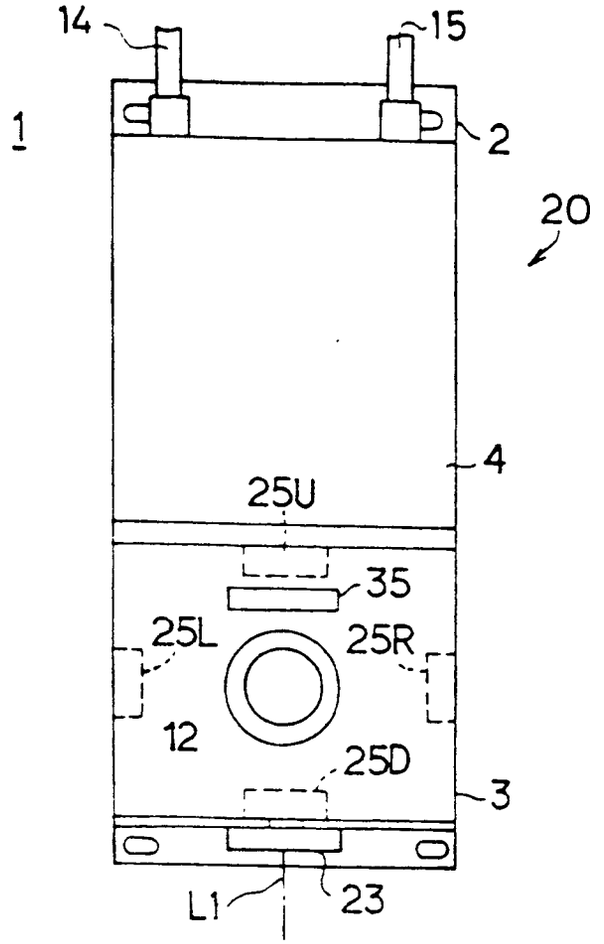
14
15
1
2
20
4
25U
35
25L
25R
12
25D
3
L1
23

FIG. 3

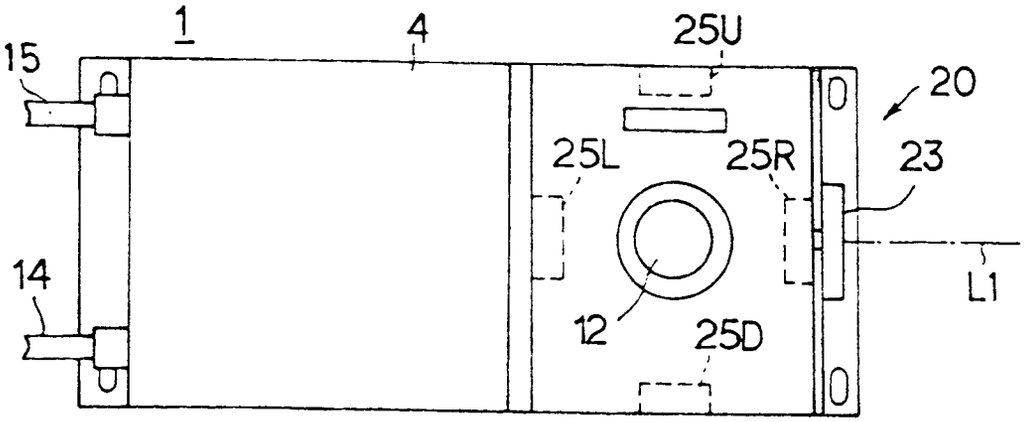
1
4
25U
15
20
25L
25R
23
14
12
25D
L1

FIG. 5

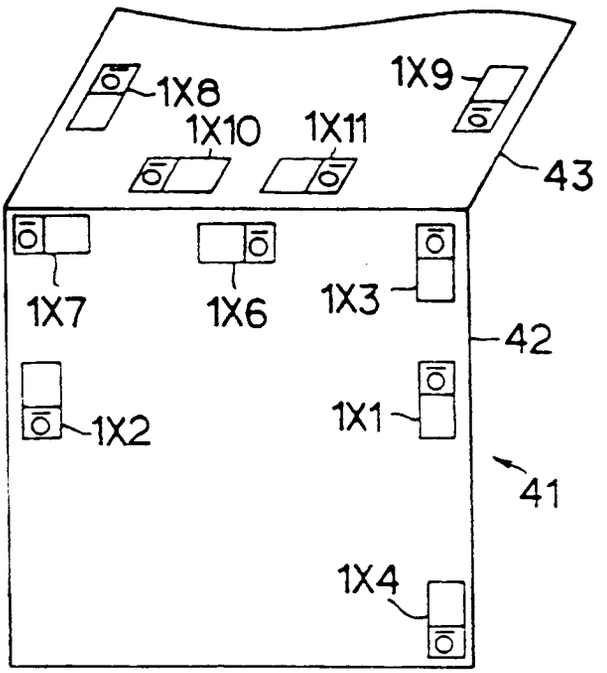

FIG. 6

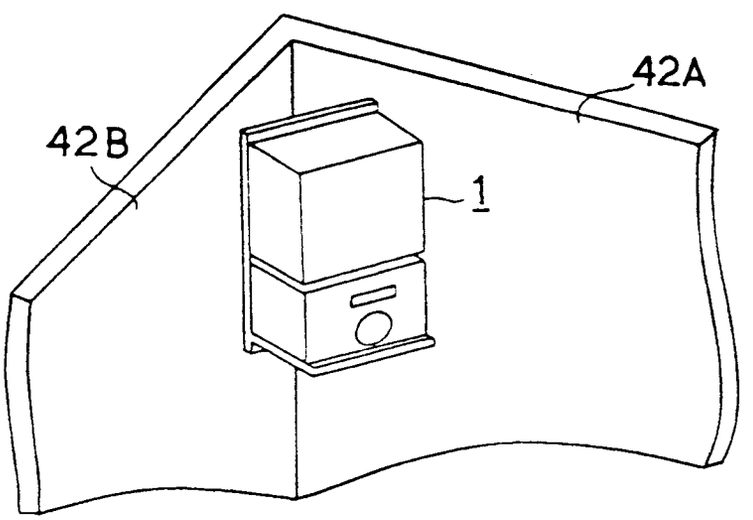

FIG. 7

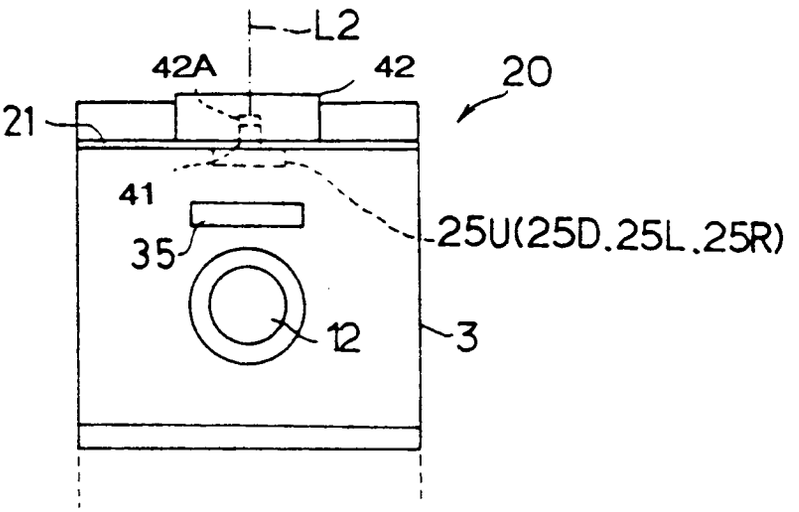
L2
42A
42
20
21
41
25U(25D.25L.25R)
35
12
3

FIG. 8(A)

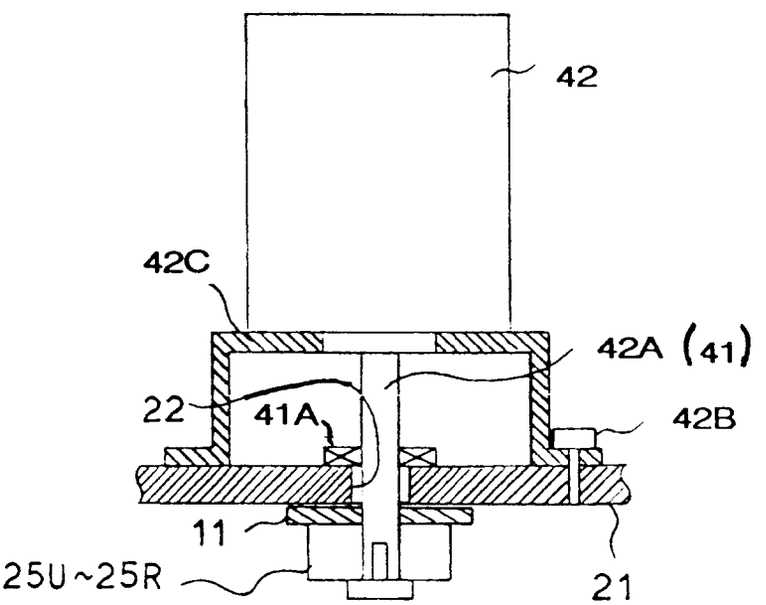
42
42C
42A (41)
22
41A
42B
11
25U~25R
21

FIG. 8(B)

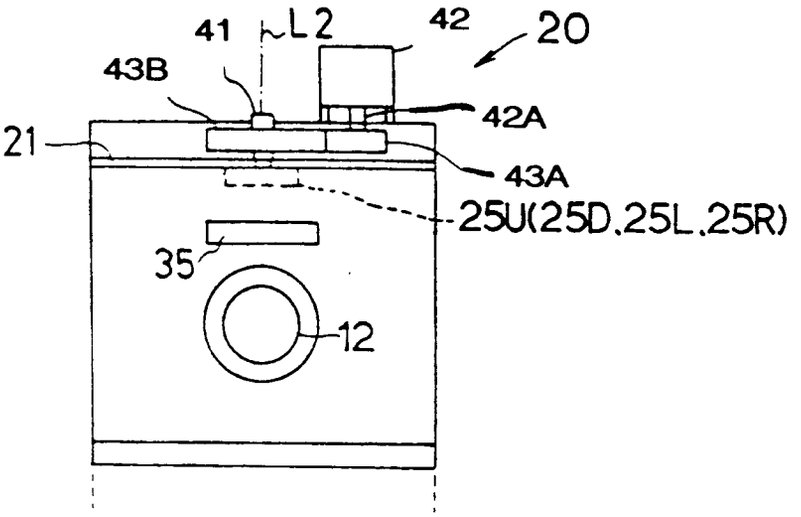
41
L2
42
20
43B
42A
21
43A
25U(25D,25L,25R)
35
12

FIG. 9(A)

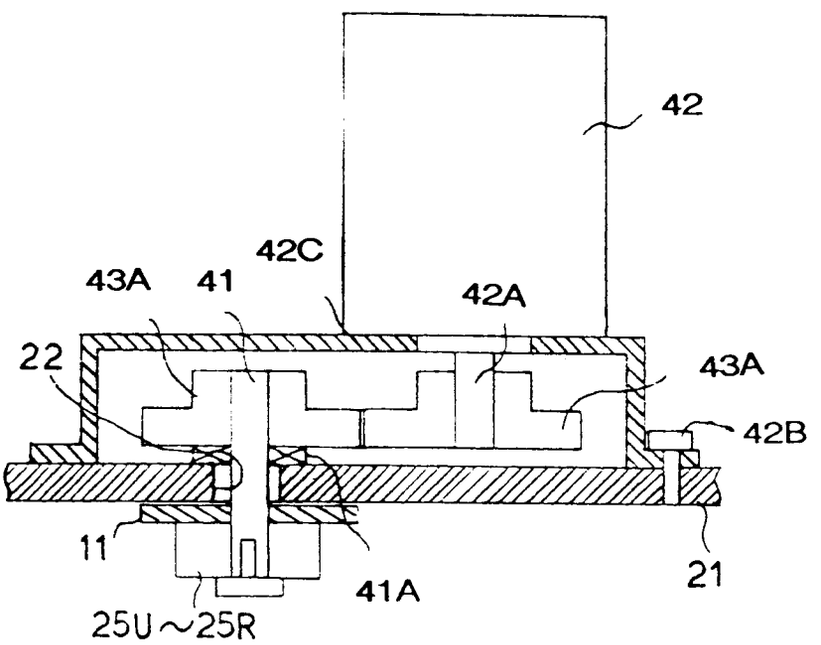
42
42C
43A
41
42A
22
43A
42B
11
41A
21
25U~25R

FIG. 9(B)

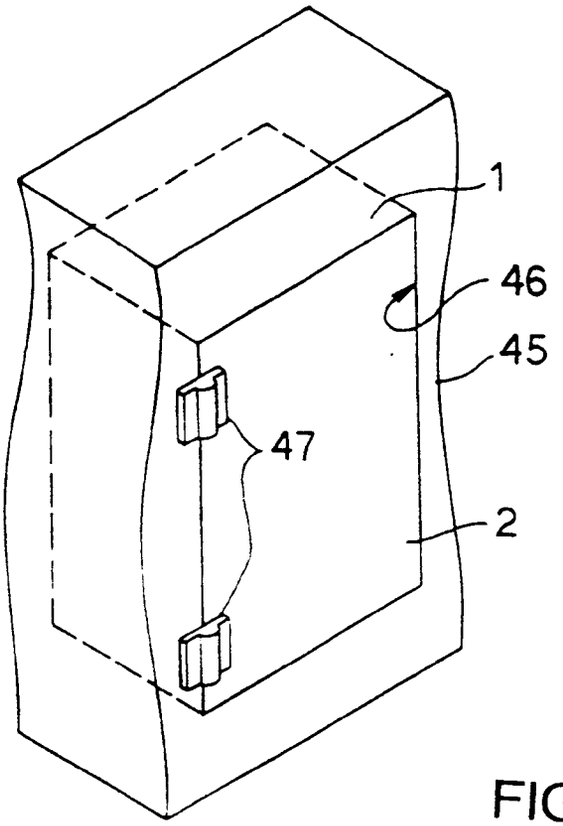

FIG. 10

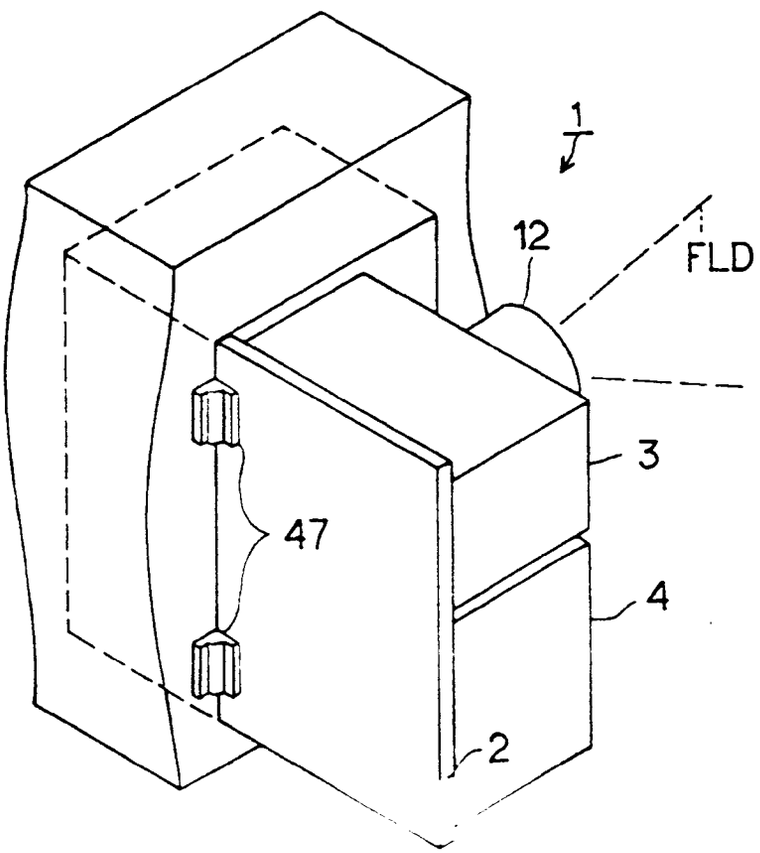

FIG. 11

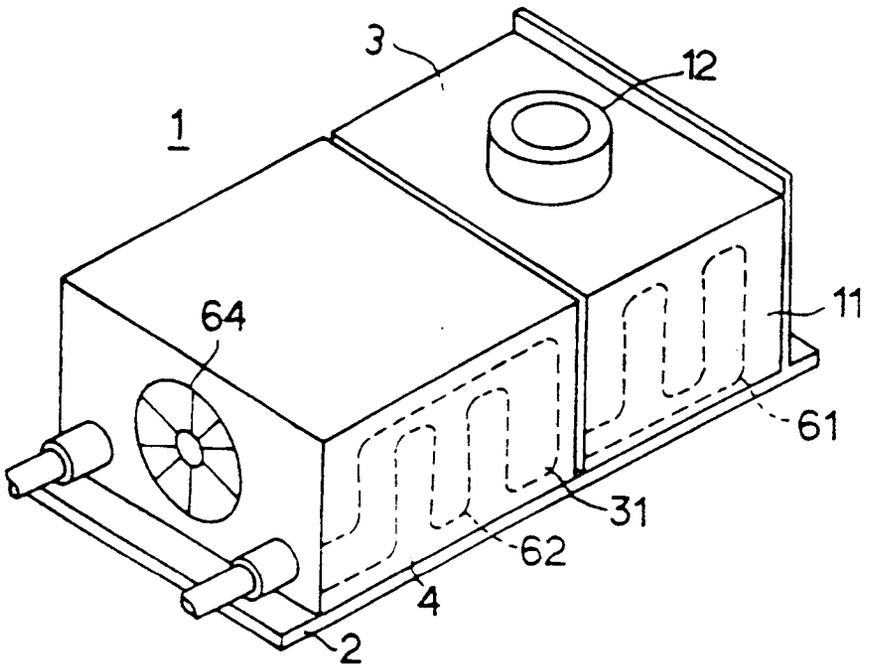

FIG. 12

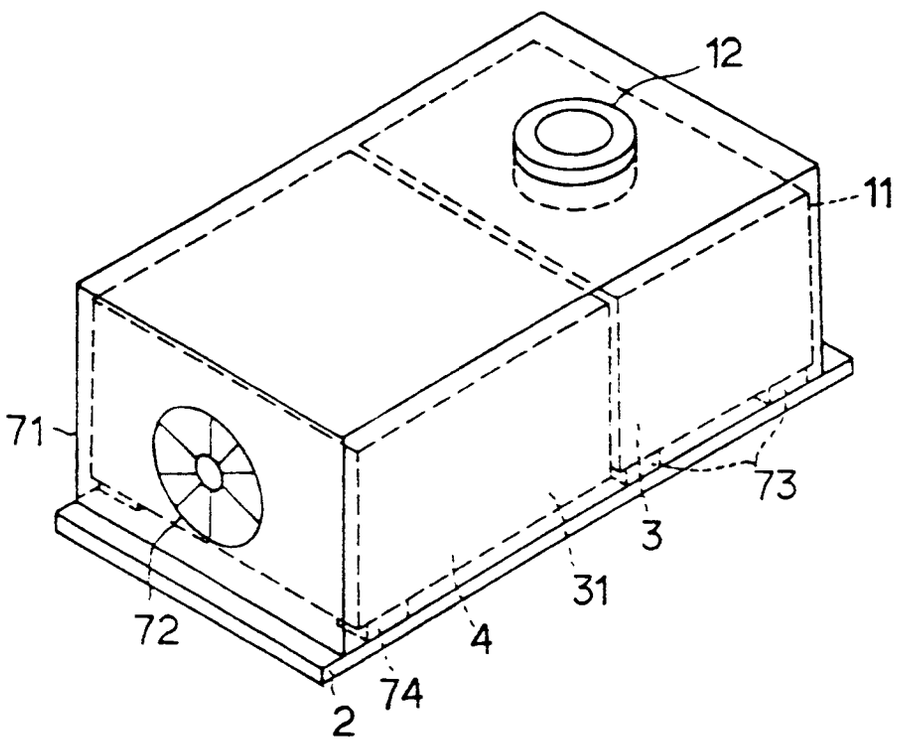

FIG. 13

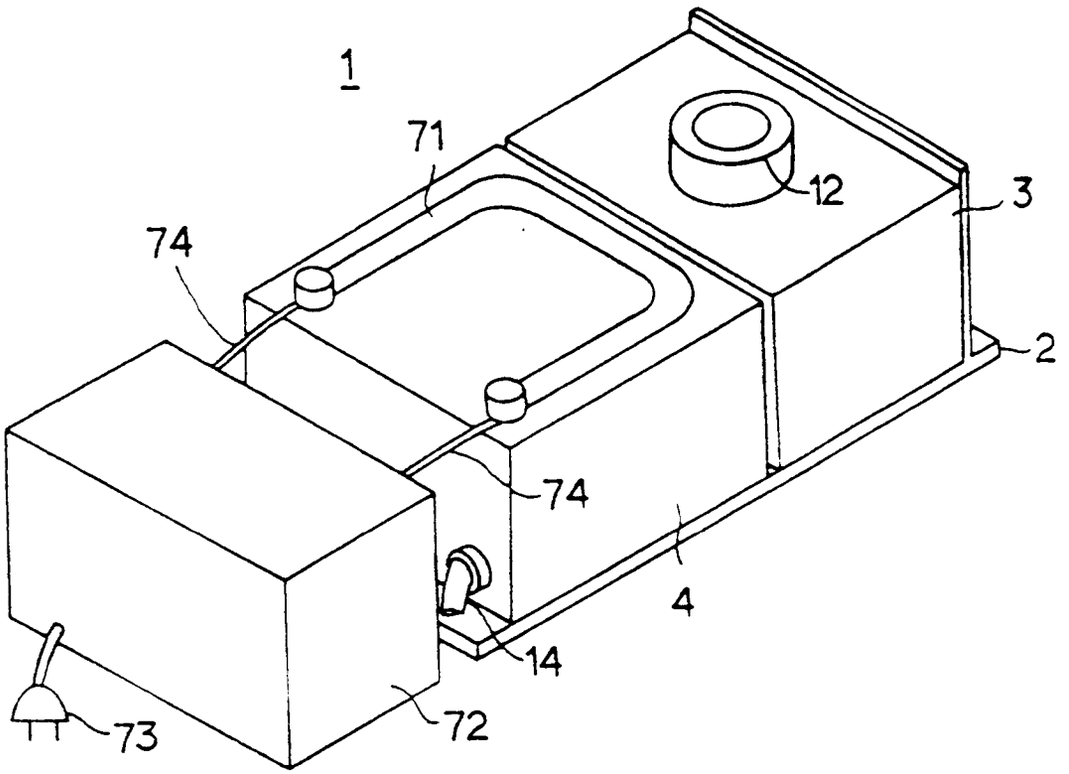

FIG. 14

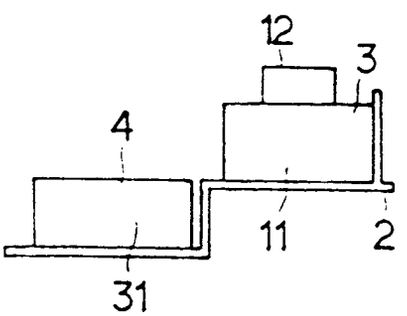

FIG. 15

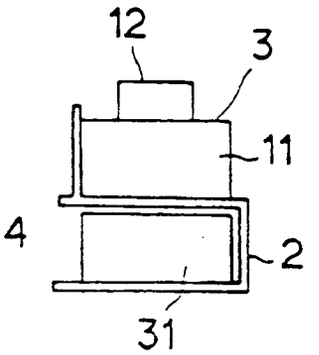

FIG. 16

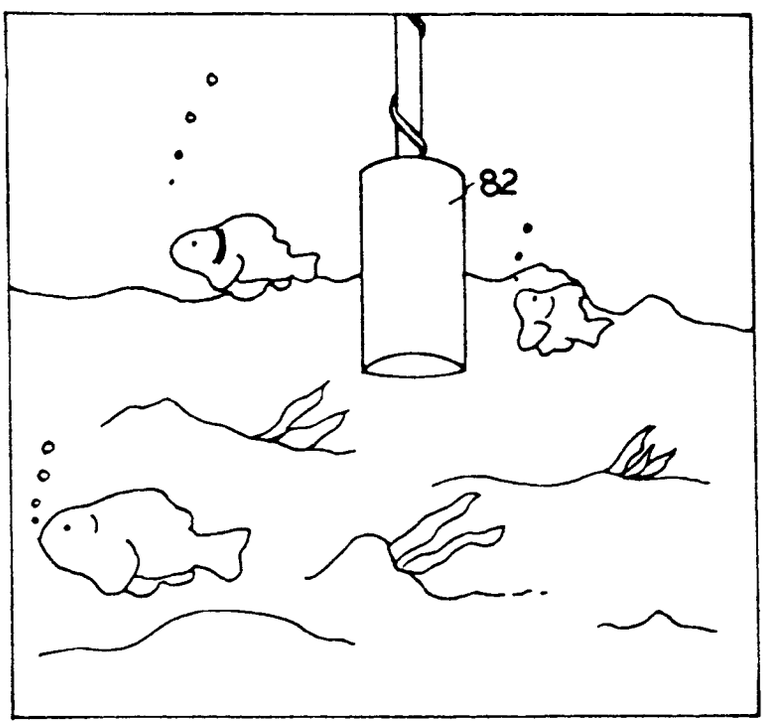

FIG. 19

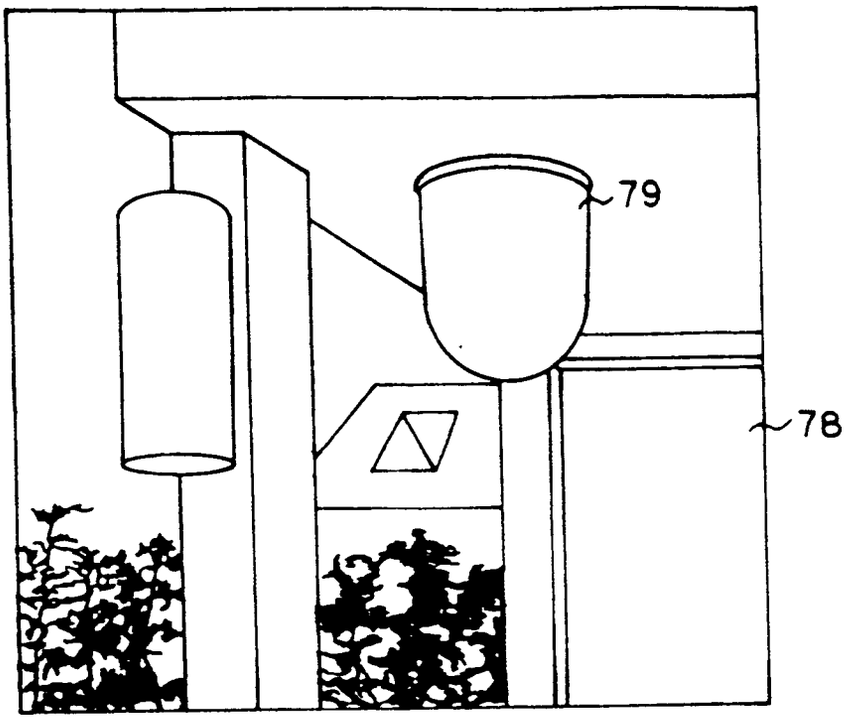

FIG. 17

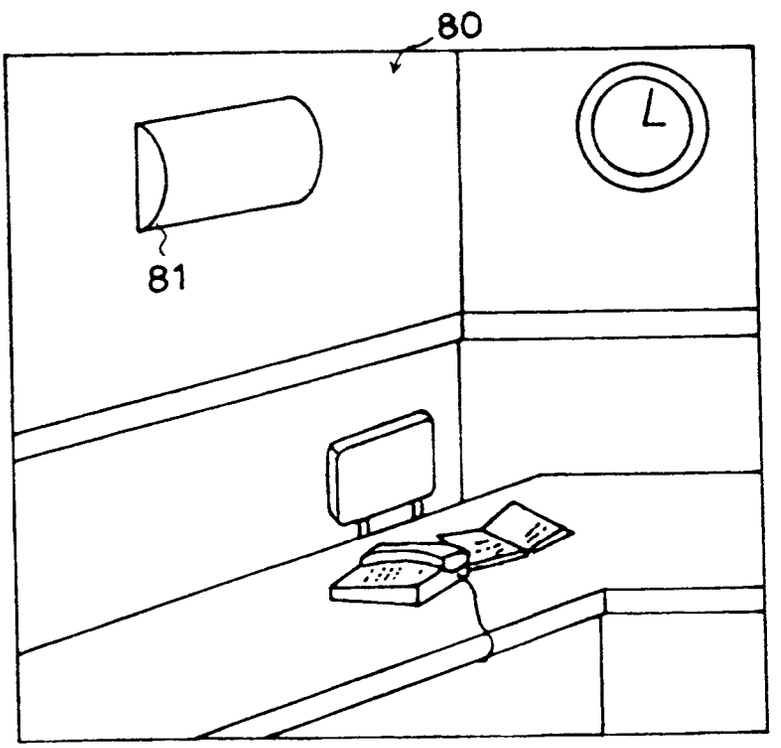

FIG. 18

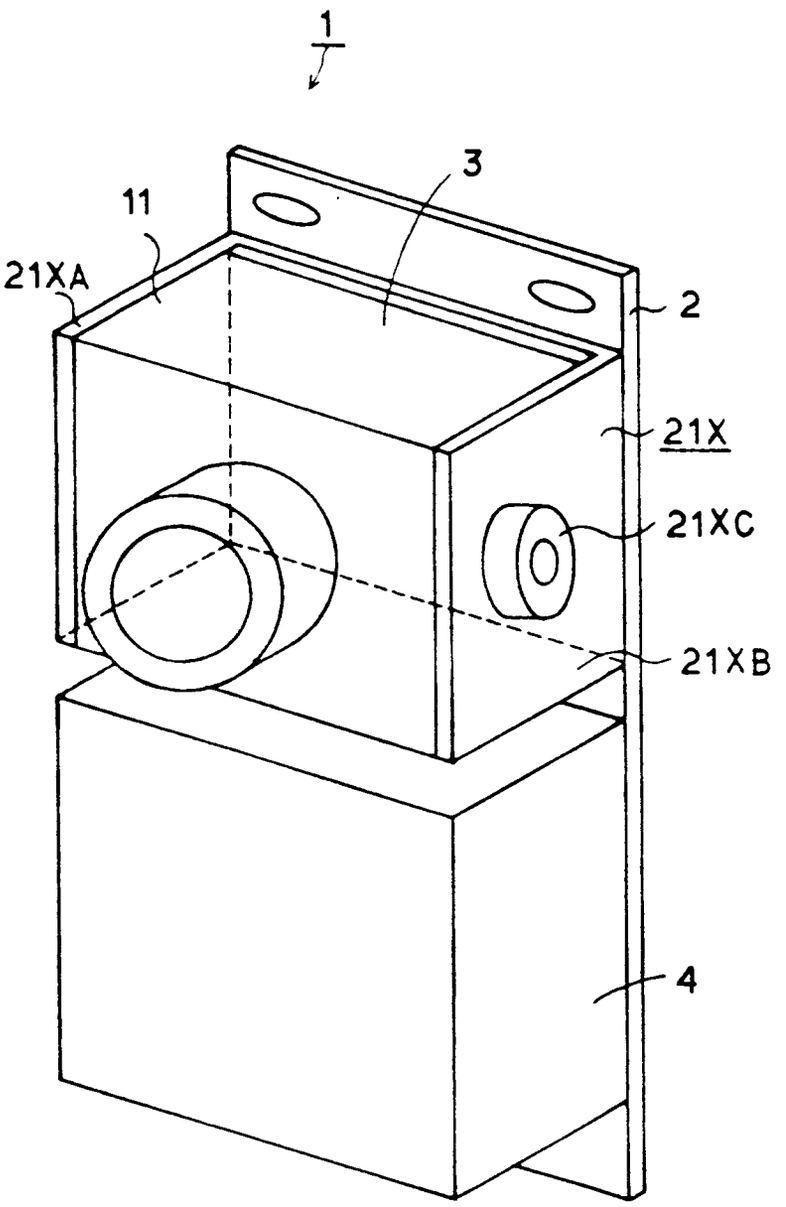

FIG. 20

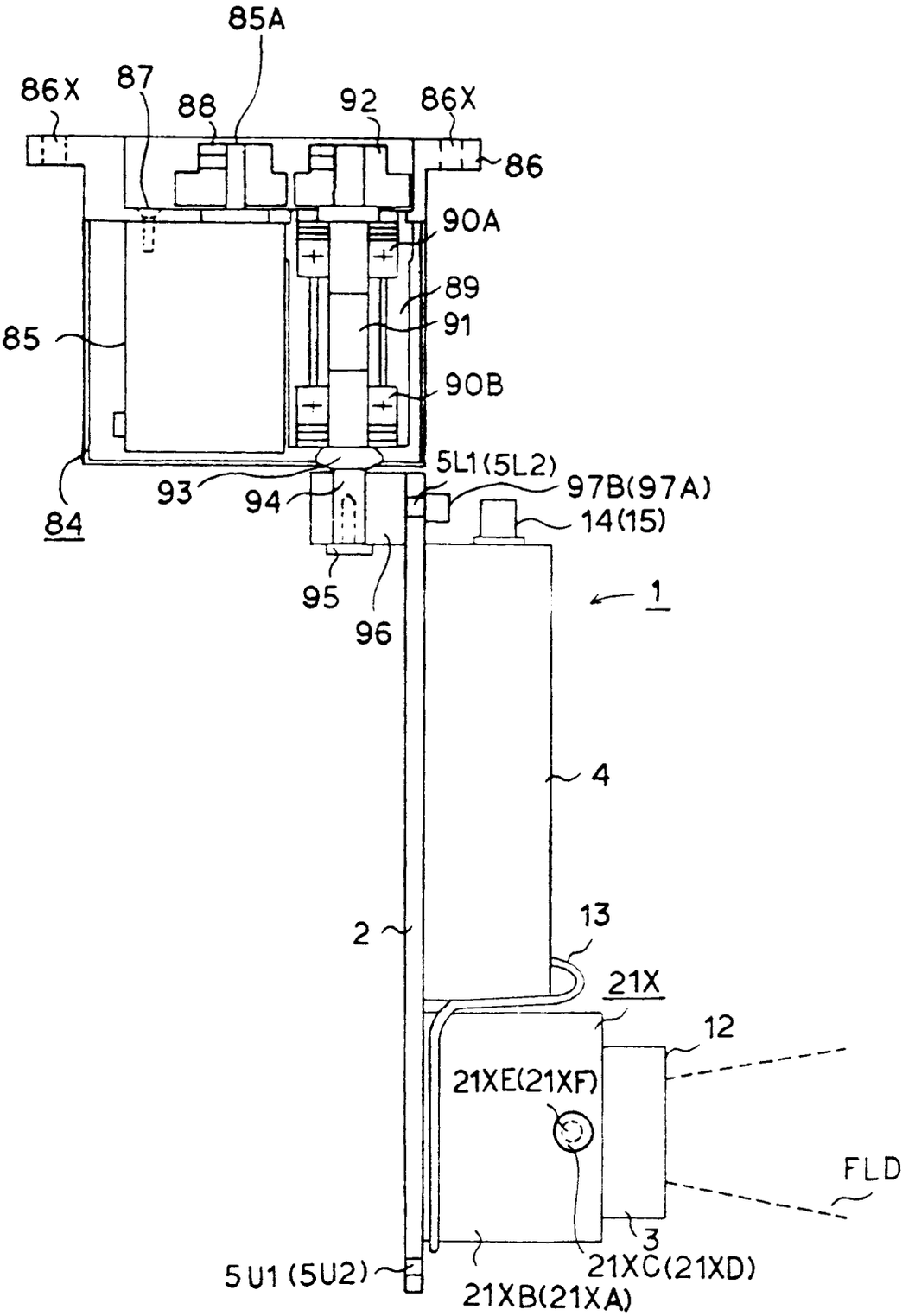
85A
86X
87
88
92
86X
86
90A
89
91
85
90B
5L1(5L2)
97B(97A)
93
94
14(15)
84
95
96
1
4
2
13
21X
12
21XE(21XF)
FLD
3
5U1(5U2)
21XC(21XD)
21XB(21XA)

FIG. 21

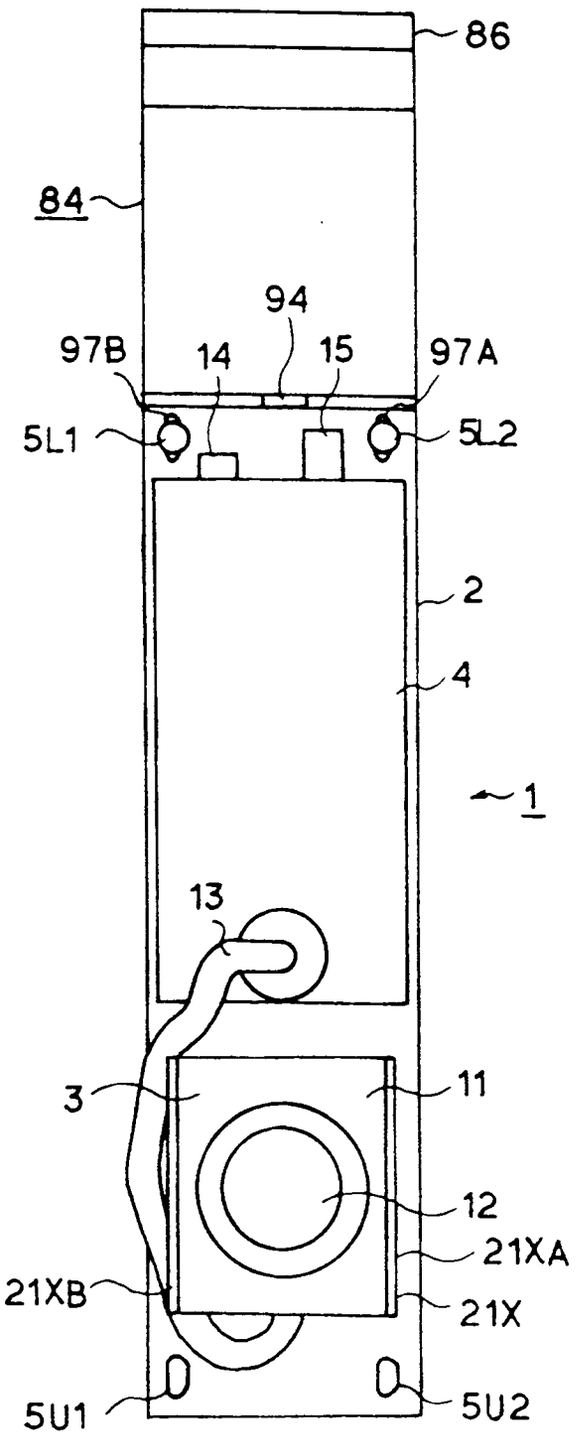

FIG. 22

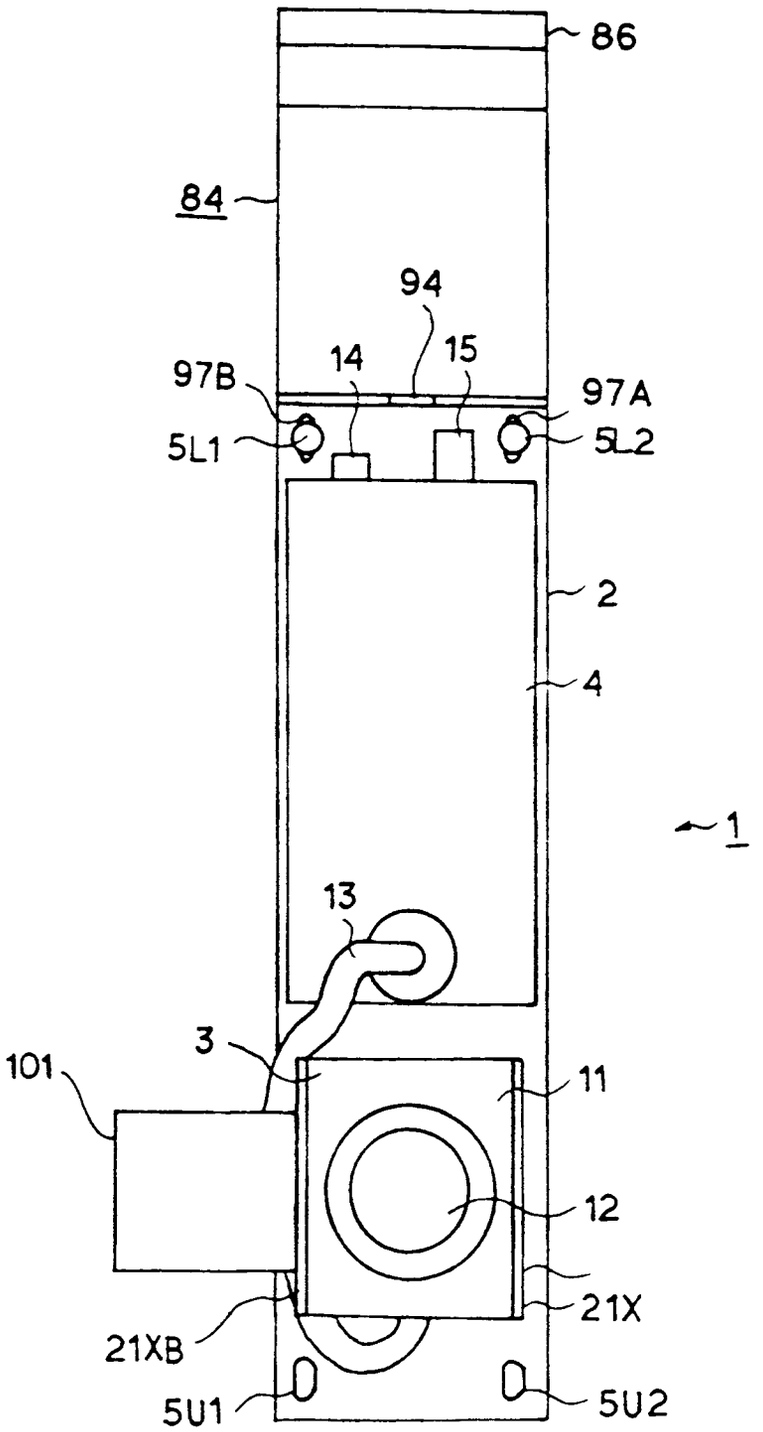

FIG. 23

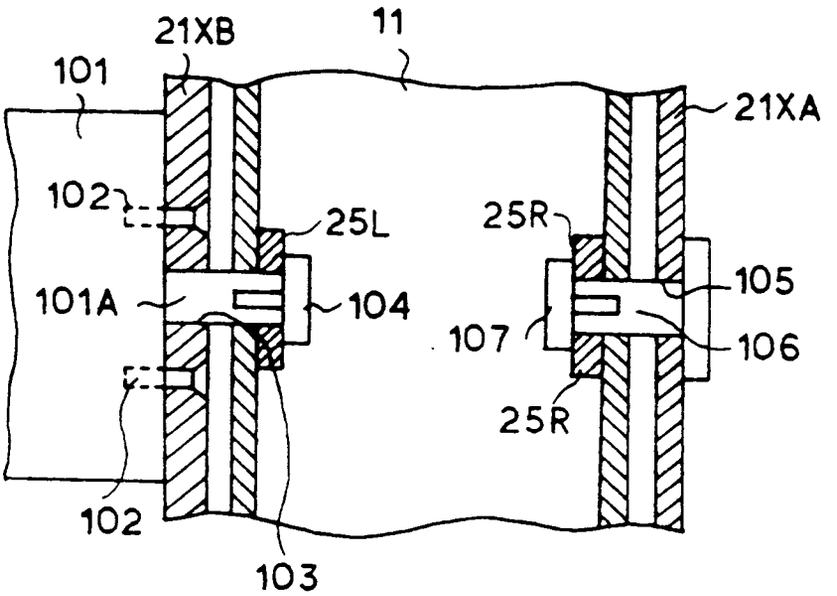
21XB
11
101
21XA
102
25L
25R
105
101A
104
107
106
25R
102
103

FIG. 24

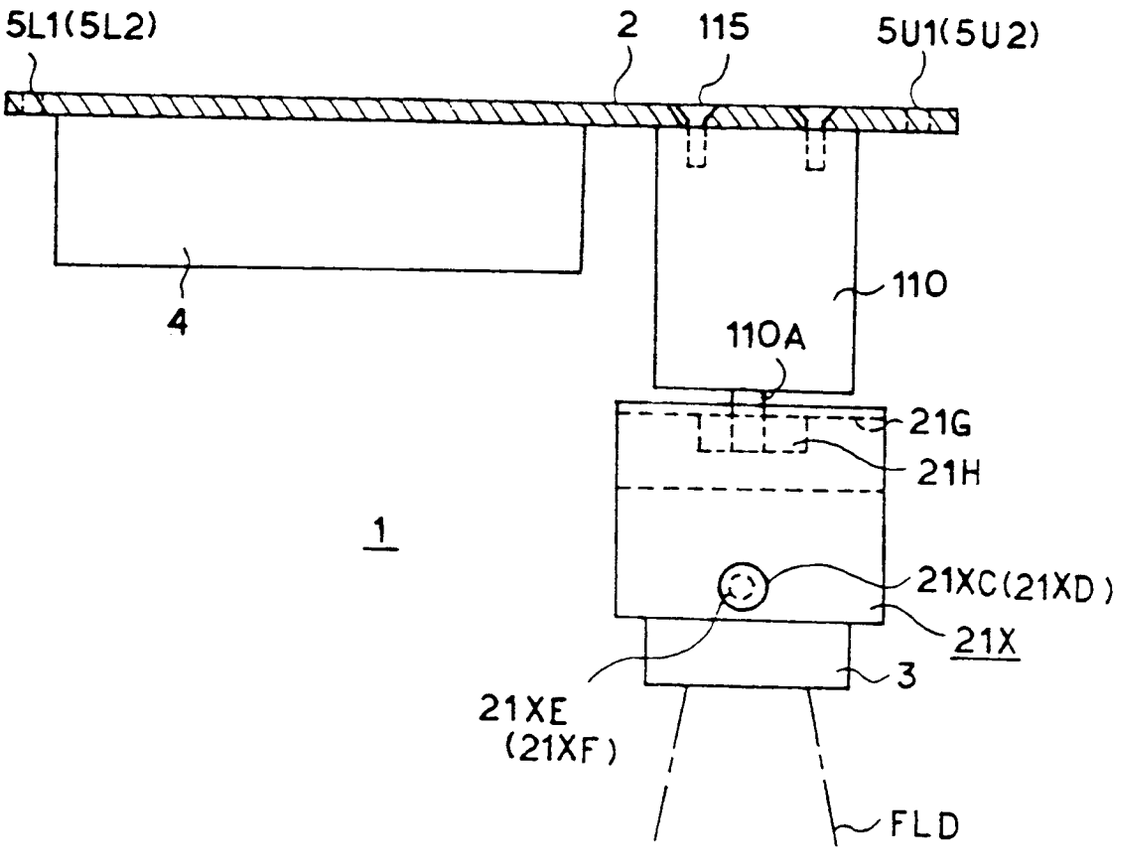
5L1(5L2)
2
115
5U1(5U2)
4
110
110A
21G
21H
1
21XC(21XD)
21X
3
21XE
(21XF)
FLD

FIG. 28

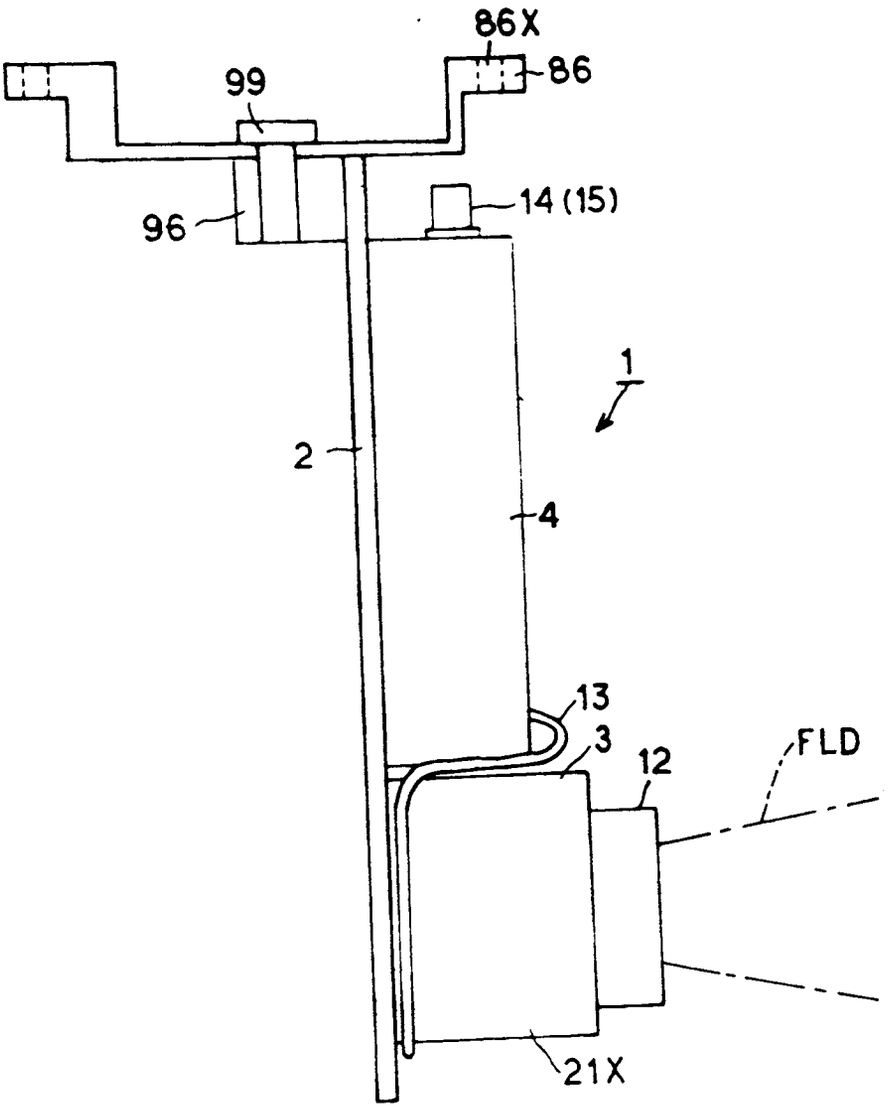

FIG. 25

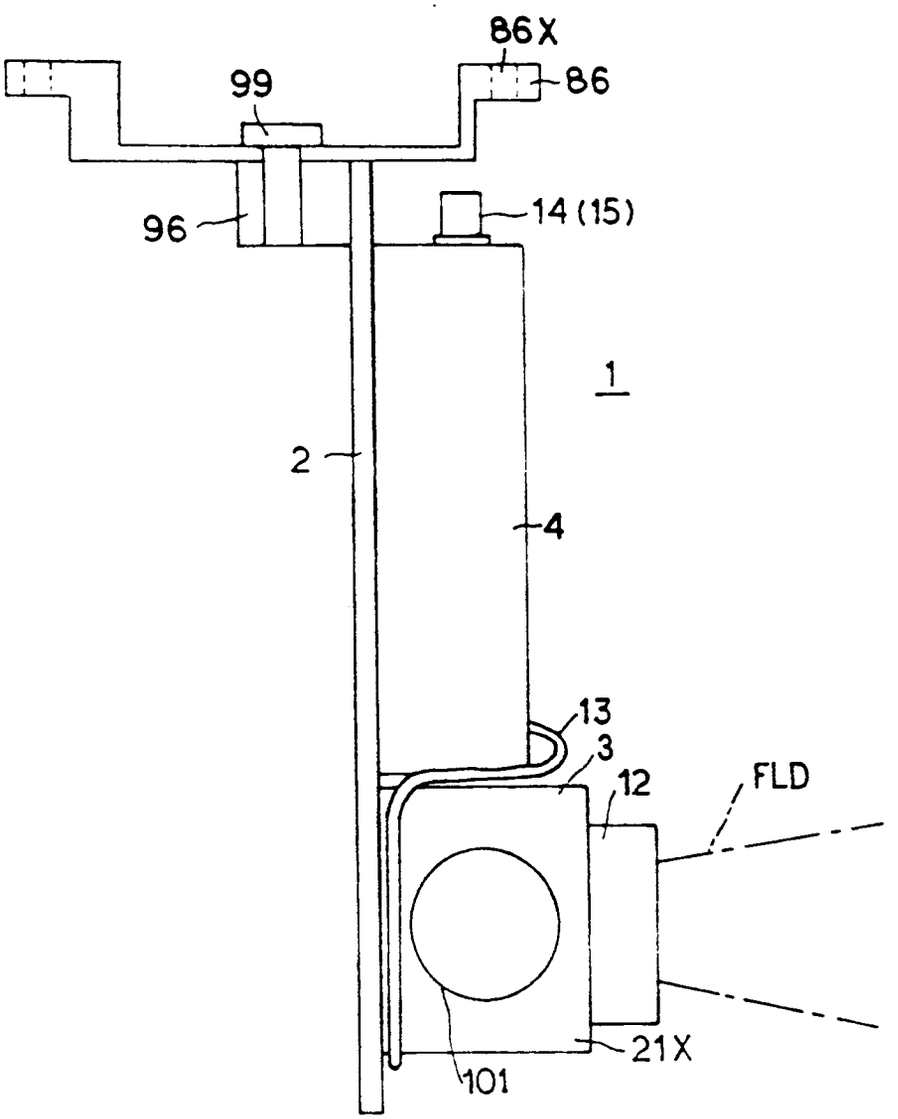

FIG. 26

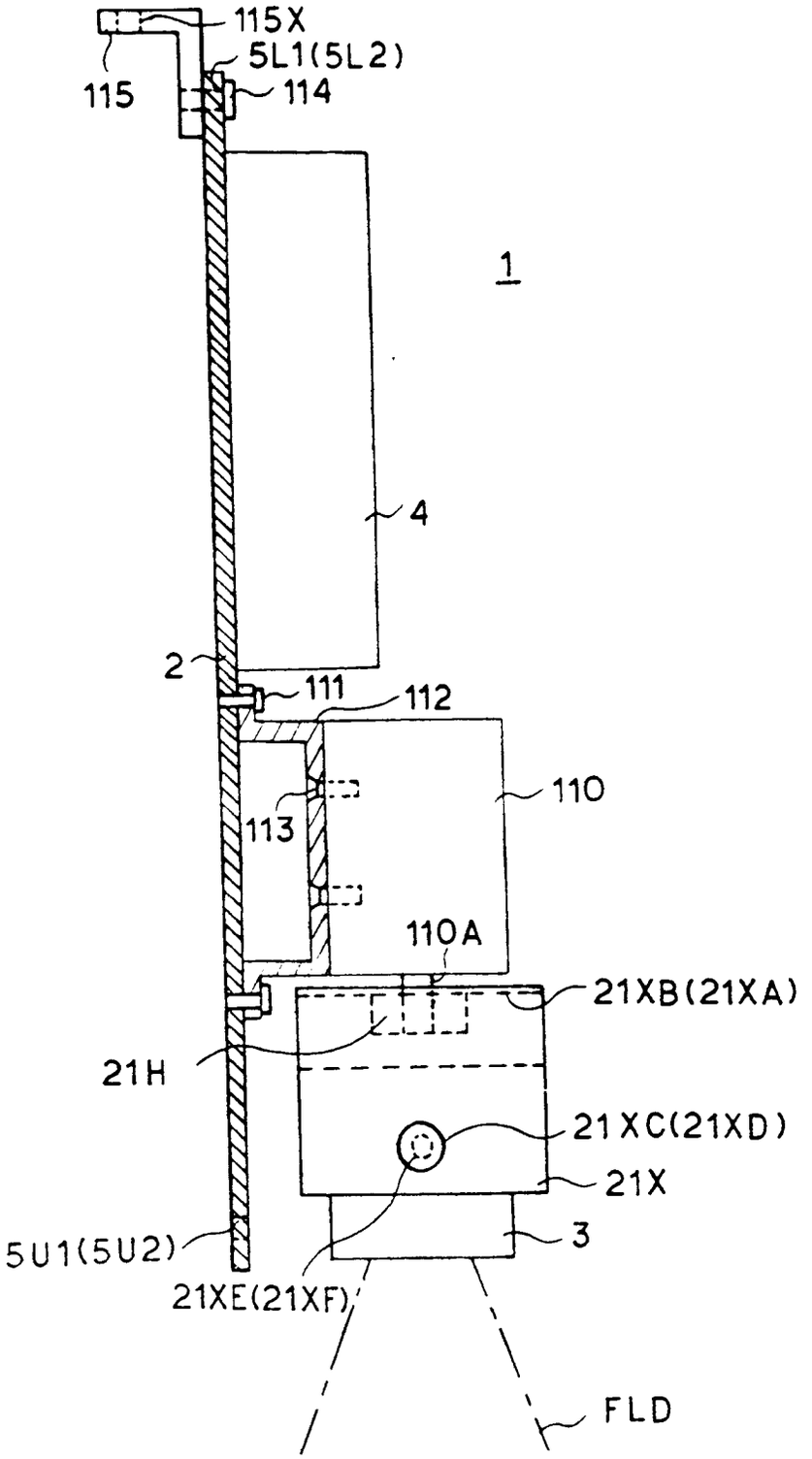
115X
5L1(5L2)
115
114
1
4
2
111
112
110
113
110A
21XB(21XA)
21H
21XC(21XD)
21X
3
5U1(5U2)
21XE(21XF)
FLD

FIG. 27

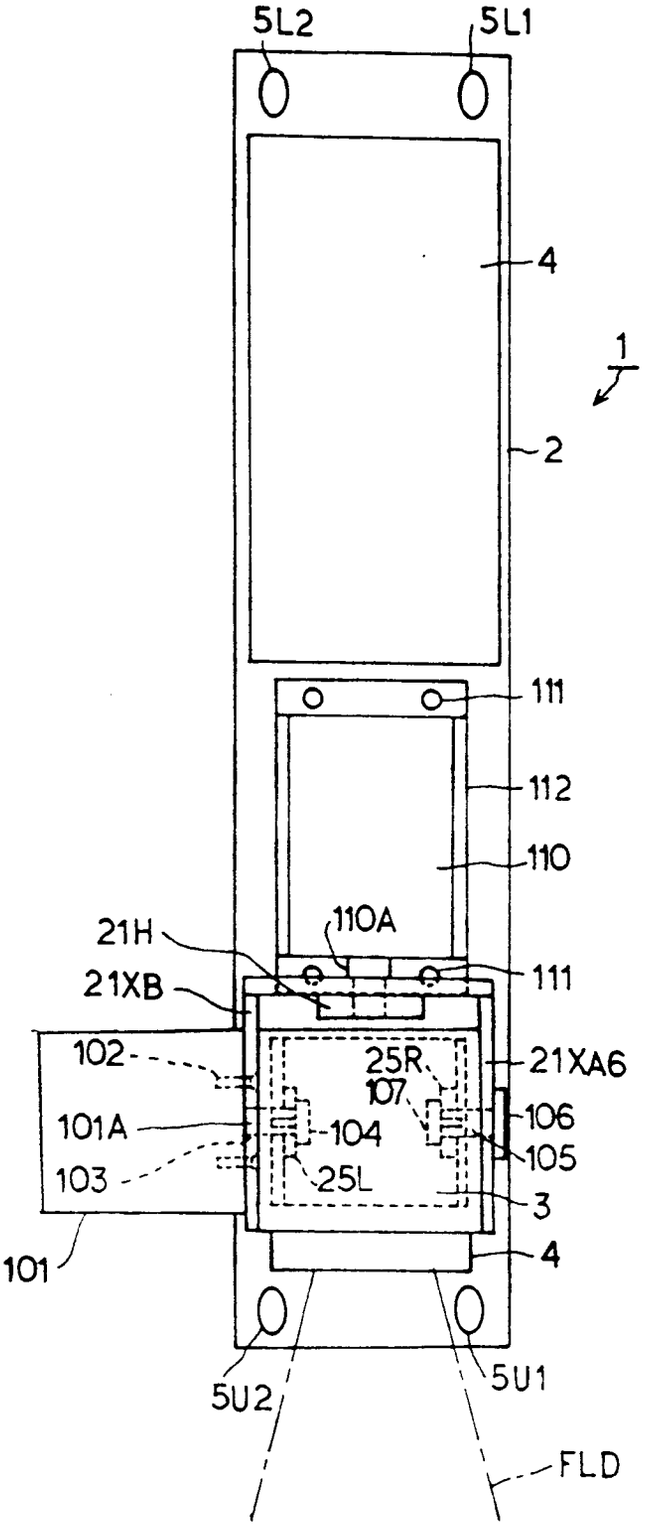
5L2
5L1
4
1
2
111
112
110
110A
21H
21XB
111
102
25R
21XA6
107
101A
104
106
105
103
25L
3
101
4
5U2
5U1
FLD

FIG. 29

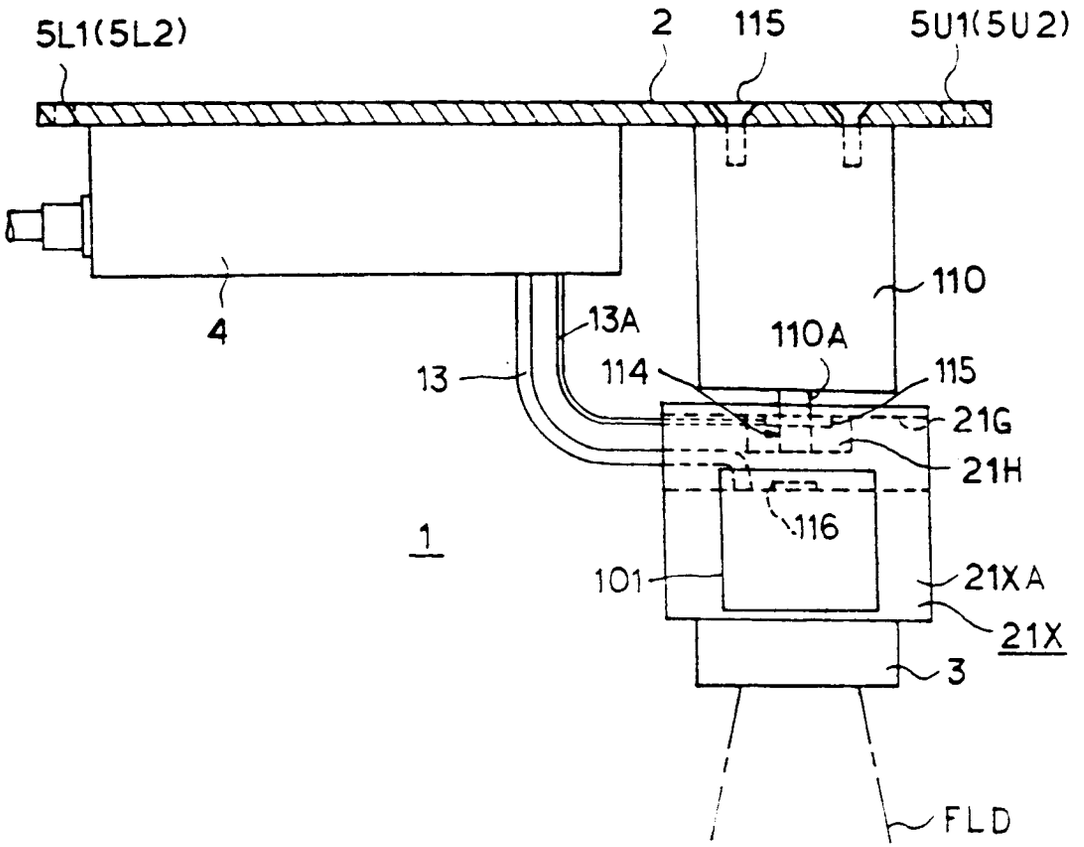
5L1(5L2)
2
115
5U1(5U2)
4
110
13A
110A
13
114
115
21G
21H
116
1
101
21XA
21X
3
FLD

FIG. 30

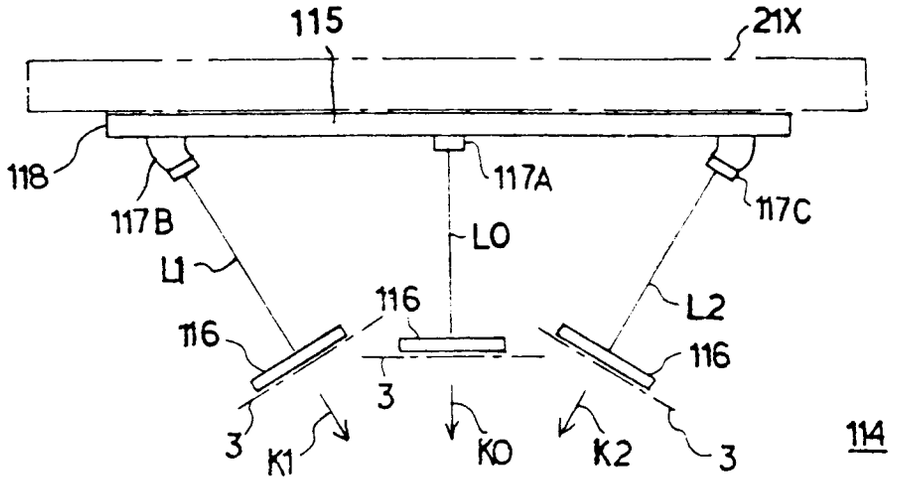
115
21X
118
117B
117A
117C
L0
L1
L2
116
116
116
3
3
3
K1
K0
K2
114

FIG. 31

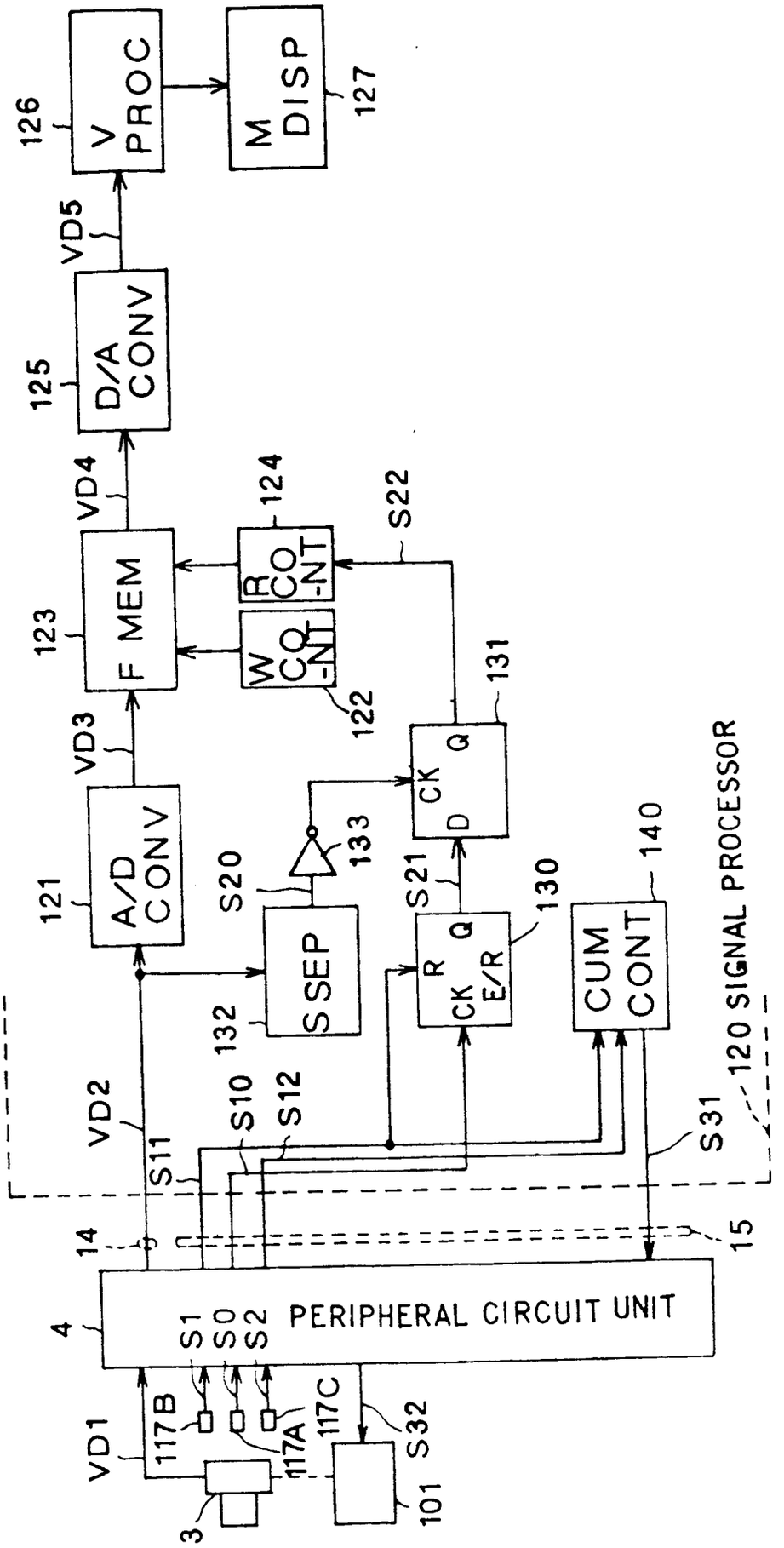
V PROC
126
M DISP
127
D/A CONV
125
VD5
VD4
F MEM
123
R CO-NT
124
W CO-NT
122
S22
VD3
A/D CONV
121
S20
SSEP
132
133
CK Q D
131
S21
R Q CK E/R
130
CUM CONT
140
VD2
S10
S12
S11
S31
120 SIGNAL PROCESSOR
14
15
4
PERIPHERAL CIRCUIT UNIT
S1 S0 S2
VD1
117B
117A
117C
S32
3
101

FIG. 32