

5 Name of the invention: Dial-Type Timer Device

Detailed Explanation of the Invention (Embodiment No.1)

0001. Industrial Application

 This invention relates to a dial-type timer. More specifically, it relates to a dial-type timer which em-
10 ploys a setting ring and is ideally suited for repeatedly setting the same operating time.

0002. Existing Technology

 Figure 6 shows an existing dial-type timer. On the upper portion of dial 21 on the face of timer 20, locking
15 pawl 22 protrudes from the surface of the dial. Locking pawl 22 locks setting ring 23, shown in Figure 7, to dial 21. It does this by engaging in groove 23a on the outer periphery of the aforesaid setting ring 23. In this way pawl 22 fixes the position of setting ring 23.

20 0003. Setting ring 23 is used to make it easier to set the timer when the same operating time is set repeatedly. It also prevents accidental missettings resulting from different workers performing the same job. On the outer periphery of setting ring 23, as discussed above, is slot
25 23a. On its inner periphery are pawls 23b, which engage in slots 21a on the outer periphery of dial 21 to set the operating time.

0004. Setting ring 23 is used to set a repeated operating time as follows. Dial 21 is set to the position
30 which corresponds to the aforementioned repeated operating time. The aforesaid setting ring 23 engages with the sawteeth on the outer periphery of dial 21 in such a way that slot 23a on setting ring 23 engages in locking pawl 22 on timer body 20.



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0005. In this way dial 21 and setting ring 23 are made to rotate as a single entity. When dial 21 is to reset a repeated operating time, as discussed earlier, it is returned to the position in which slot 23a on setting ring
5 23 engages in locking pawl 22 on timer body 20. This causes the timer to be reset to the aforementioned designated position.

0006. Problems Which This Invention Attempts to Solve
With an existing dial-type timer of this sort, locking
10 ing pawl 22 on the upper portion of the face of the timer gets in the way when dial 21 is used without setting ring 23, making the operation difficult.

0007. In light of the difficulties described above, the objective of this invention was to improve the ease of
15 operation of the dial when it was used without the setting ring.

0008. Means Employed to Solve These Problems

In order to achieve the objectives described above, this invention has been designed as follows.

20 0009. The dial-type timer of this invention has a dial for setting the operating time on its face; a cover with an opening in it corresponding to the aforesaid dial which can be mounted on the face of the aforesaid timer; a setting ring mounted on the outer periphery of the
25 aforesaid dial, which projects through the aforesaid opening when the said cover is mounted on the face of the timer; and a locking pawl on the aforesaid cover which engages with the grooves on the outer periphery of the aforesaid setting ring mounted on the outer edge of the
30 aforesaid dial and so determines the position in which the aforesaid setting ring is to be set.



0010. Operation

With the design described above, the locking pawl which fixes the set position of the setting ring is on a cover which is separate from the timer body. There is thus no need to have a locking pawl on the timer body, as in existing timers. When the timer is used without the setting ring, the timer body can be used by itself without mounting the cover with the pawl. The locking pawl will not get in the way when the dial on the timer body is operated.

0011. Embodiment

In the following section we shall give a detailed explanation of an embodiment of this invention, with reference to the drawings.

0012. Figure 1 is an exploded oblique view of a dial-type timer in which this invention has been implemented.

0013. Dial-type timer 1, in which this invention has been implemented, consists of timer body 2; cover 3, which can be mounted on the face of the said timer body 2; and setting ring 5, which is mounted on dial 4 on timer body 2 when the aforesaid cover 3 is in place.

0014. Timer body 2 has a dial 4 on its face, as described above. The outer periphery of this dial 4 is formed into grooves 4a, as can be seen in the frontal view in Figure 2 (A). Dial 4 has an indicator 6 and a scale along its circumference for setting the time. It also has a number of windows 7 to display the numerals for the scale, and a window 8 to display the time unit. Along the circumference of dial 4 are POWER and OUT displays 9 and 10, operating function switch 11 and operating function display window 12. Figure 2 (B) is a partial side view of the face of timer body 2.





0015. The structure described above is basically the same as that of the existing timer described in the example. However, the timer of this invention does not have a locking pawl on the upper portion of the face of the timer body 2 to engage in the slot on setting ring 5. The locking pawl, then, does not get in the way when dial 4 is operated, so the timer is easier to operate than the existing timer described.

0016. Cover 3 is mounted on the face of timer body 2 when setting ring 5 is to be used. It has a round opening 13 for dial 4, and openings 14 and 15 for displays 9 and 10 on timer body 2. Cover 3 has a single locking pawl 3a molded on its face in a location corresponding to the upper portion of the face of timer body 2 when the cover is mounted on the timer body, as shown in the front view in Figure 3 (A) and the cross section of a side view in Figure 3 (B). This locking pawl engages in the slot on the outer periphery of setting ring 5.

0017. Setting ring 5 engages in grooves 4a on the outer periphery of dial 4, which projects forward through opening 13 of cover 3 when the cover is mounted on the face of timer body 2. On the outer periphery of setting ring 5 is slot 5a, into which locking pawl 3a on cover 3 engages, as shown in the front view, cross sectional side view and rear view pictured in Figures 4 (A), (B) and (C). In four locations on the inner periphery of setting ring 5, pawls 5b are provided, which engage in grooves 4a on the outer periphery of dial 4.

0018. When setting ring 5 is to be used with dial-type timer 1, which has the configuration described above, cover 3 with its locking pawl 3a is mounted on the face of timer body 2. Dial 4 is then set in the position corresponding to the regular operating time. The aforesaid



5 setting ring 5 is locked onto the outer periphery of dial 4 in such a way that locking pawl 3a on cover 3 engages in slot 5a on the outer periphery of the setting ring. The frontal view and partial side view pictured in Figures 5 (A) and (B) show the setting ring locked onto the dial.

10 0019. In this way dial 4 and setting ring 5 are made to rotate as a single entity. When dial 4 is to reset a repeated operating time, as discussed earlier, it is returned to the position in which locking pawl 3a on cover 3 engages in slot 5a on setting ring 5. This causes the timer to be reset to the aforementioned designated position.

15 0020. The materials used for cover 3 and setting ring 5 of this invention are available in a variety of colors, so they can be chosen to match the color of the panel on which timer body 2 is mounted. This ensures an esthetically pleasing result.

0021. Effects of the Invention

20 With the invention described above, a cover with a locking pawl on it is mounted on the timer when the setting ring is to be used. This allows the timer to function in the same way as previous timers of this type. When the setting ring is not going to be used, the cover
25 is removed from the timer so that the locking pawl does not interfere with the operation of the dial. The result is a timer with improved ease of operation.

Detailed Explanation of the Invention (Embodiment NO.2)

0001. Industrial Application

30 This invention relates to a dial-type timer. More specifically, it relates to a dial-type timer which is



ideally suited for applications such as process control which require that values once set can be changed only within a limited range.

0002. Existing Technology

5 Generally speaking, when dial-type timers are used in process control, they are set to values which should be changed only within a fixed range.

0003. However, existing dial-type timers are incapable of preventing values from being set beyond the upper and
10 lower limits of the desired range.

0004. Problem Which This Invention Attempts to Solve

Thus when such a dial-type timer is used for process control, the operator must pay careful attention whenever he changes a set value and note whether or not the new
15 value falls within the fixed range of permitted values. He is, then, unable to relax. He may also mistakenly set values which exceed the aforesaid fixed range.

0005. In light of the problem discussed above, the objective of this invention is to make it possible to fix
20 an upper and lower limit for values to be set, and to prevent values which exceed these limits from being set.

0006. Means Employed to Solve These Problems

To achieve the objective described above, this invention is constructed as follows.

25 0007. The dial-type timer described in Paragraph 1 of this application consists of the timer itself, which has a dial on its front to set the operating time; two setting rings mounted on the perimeter of the aforesaid dial in such a way that they rotate as a single piece with
30 that dial; a molded tooth formed on the perimeter of each

of the aforesaid setting rings; and a stop on the body of the timer which comes in contact with the aforesaid teeth on the setting rings mounted on the dial so as to limit the range of rotation of that dial.

5 0008. The dial-type timer described in Paragraph 2 of this application consists of the timer itself, which has a dial on its front to set the operating time; a cover which can be mounted on the front of the aforesaid timer body, with an opening for the aforesaid dial; two setting
10 rings, which are mounted on the perimeter of the aforesaid dial in such a way that they rotate as a single piece with that dial, which protrudes from the front of the timer through the aforesaid opening in the cover when that cover is mounted on the front of the timer; a molded
15 tooth formed on the perimeter of each of the aforesaid setting rings; and a stop on the aforesaid cover which comes in contact with the aforesaid teeth on the setting rings mounted on the dial so as to limit the range of rotation of that dial.

20 0009. Operation

The timer of the invention described in Paragraphs 1 and 2 of this application has two setting rings with a tooth on each which can be set in a position to indicate the upper and lower limit of the range of rotation of a
25 dial. These setting rings are mounted on the perimeter of the said dial in such a way that the teeth come in contact with a stop on the timer body or its cover. In this way the rotation of the dial is constrained not to go beyond the said positions for upper and lower limits.
30 This invention, then, makes it possible to restrict the setting of an operating time to a fixed range defined by the aforesaid upper and lower limits.





0010. The timer of the invention described in Paragraph 2 of this application has a cover mounted on its face with an opening for the dial. This cover encloses and protects the various setting switches and prevents them from being operated inadvertently. It also allows the color and appearance of the timer to be selected to match the design of the panel on which the timer is mounted. In other words, the addition of a cover allows the design of a dial-type timer to be changed.

10 0011. Embodiment

In the following section, we shall give a detailed explanation of an embodiment of this invention with reference to the drawings.

0012. Figure 1 is an oblique exploded view of a dial-type timer in which this invention has been implemented.

0013. The dial-type timer 1 of this embodiment consists of timer body 2; dial 4, which is used to set the operating time for timer body 2; and setting rings 25 and 35, which are mounted on the perimeter of dial 4. These setting rings limit the range in which dial 4 can be set.

0014. Stop 36 protrudes from the upper portion of the face of dial 4 on timer body 2. This stop limits the range of rotation of dial 4 when it comes in contact with teeth 25a and 35a on setting rings 25 and 35, as described above. As can be seen in the frontal view pictured in Figure 2 (A), the perimeter of dial 4 on timer body 2 is formed into gear teeth 4a. Dial 4 has an indicator 6 and a scale along its circumference for setting the time. It also has a number of windows 7 to display the numerals for the scale, and a window 8 to display the time unit. Gear teeth 4a on the perimeter of dial 4 are used to determine the position in which setting rings 25



and 35 are to be mounted, as discussed below. For that reason they are cut at a pitch of $1/2$ the scale units for setting the time. Along the circumference of dial 4 are POWER and OUT displays 9 and 10, operating function switch 11 and operating function display window 12. Figure 2 (B) is a partial side view of the face of timer body 2.

0015. Front and rear views of setting ring 25 are shown in Figures 3 (A) and (B). This setting ring is mounted in such a way as to engage in gear teeth 4a on the perimeter of dial 4 on timer body 2. Tooth 25a, which protrudes from the perimeter of the setting ring, comes in contact with stop 36 on timer body 2. Its surface 25c makes contact with surface 36a of stop 36 on the timer body, which is shown in Figure 2 (A). In four locations on the inner periphery of setting ring 25 are teeth 25b, which engage in gear teeth 4a on the perimeter of dial 4.

0016. A front view of the second setting ring, setting ring 35, is shown in Figure 4. This setting ring is also mounted so as to engage in gear teeth 4a on the perimeter of dial 4 on timer body 2. Tooth 35a, which protrudes from the perimeter of the setting ring, comes in contact with stop 36 on timer body 2. Its surface 35c makes contact with surface 36b of stop 36 on the timer body, which is shown in Figure 2 (A). In four locations on the inner periphery of setting ring 35 are teeth 35b, which engage in gear teeth 4a on the perimeter of dial 4.

0017. In a dial-type timer constructed as described above, the range of settings is controlled by the dial through the use of setting rings 25 and 35. When dial 4 is set in the position corresponding to the lower limit of the allowable values, surface 35c of tooth 35a on setting ring 35 comes in contact with surface 36b of stop 36

on timer body 2. Setting ring 35 engages with the perimeter of dial 4. When dial 4 is set in the position corresponding to the upper limit of the allowable values, surface 25c of tooth 25a on setting ring 25 comes in contact with surface 36a of stop 36 on timer body 2. Setting ring 25 then engages with the perimeter of dial 4. These situations are illustrated in the frontal view shown in Figure 5 (A) and the partial side view in Figure 5 (B).

0018. Thus dial 4 and setting rings 25 and 35 rotate as a single entity, and the setting on dial 4 can be changed only within the range between tooth 25a on setting ring 25 and tooth 35a on setting ring 35. The operator is prevented from setting any value outside of that range.

0019. For stop 36, which protrudes from the surface of the face of timer body 2, a lock generally found in existing timers can be used. This lock protrudes from the upper portion of the face of the timer. It is used to determine the reset position of the setting ring so that it can be reset easily when a standard operating time is being set repeatedly. This lock can be used for both purposes in the new timer.

0020. Figure 6 is an exploded oblique view of another dial-type timer in which this invention has been implemented. Components which correspond to those of the preceding embodiment have been given the same numbering.

0021. The dial-type timer 1₀ of this embodiment consists of timer body 2₀; cover 3, which can be mounted on the face of the aforesaid timer body 2₀; and setting rings 25 and 35, which are mounted on the perimeter of dial 4 on timer body 2₀ when the aforesaid cover 3 is mounted on timer body 2₀.



0022. Unlike the previous embodiment, this timer does not have a stop 36 protruding from the upper portion of dial 4 on timer body 2₀.

5 0023. Cover 3 is already mounted on the face of timer body 2₀ when setting rings 25 and 35 are used. The cover has a round opening 13 for dial 4, and two small openings 14 and 15 for displays 9 and 10 on timer body 2₀.

10 0024. Openings 13 through 15 are the only windows in cover 3. When this cover is mounted on the face of timer body 2₀, operating function switch 11 and the other setting switches are completely enclosed. With the cover in place, there is no possibility that anyone will operate these switches mistakenly.

15 0025. Stop 37 protrudes from the surface of cover 3 in a location corresponding to the upper face of the aforesaid timer body 2₀, as shown in Figure 7 (A), a frontal view, and 7 (B), a cross section of the side. Stop 37 limits the range of rotation of dial 4 when it is contacted by teeth 25a and 35a on setting rings 25 and 35. Surface
20 25c of tooth 25a on setting ring 25 comes in contact with surface 37a of stop 37. Surface 35c of tooth 35a on setting ring 35 comes in contact with surface 37b of stop 37.

25 0026. To mount cover 3 on the face of timer body 2₀, tabs 3b on the inner surface of cover 3 (shown in Figure 7 (B)) are inserted into slots 2a on timer body 2₀ (shown in Figure 6).

30 0027. When cover 3 is mounted on the face of timer body 2₀, dial 4 projects out the front of opening 13 in that cover, and setting rings 25 and 35, which engage with the





outer edge 4a of dial 4, are disposed exactly as in the previous example.

0028. In dial-type timer 1₀, which is constructed as described above, the range of settings is controlled by the dial through the use of setting rings 25 and 35. First, cover 3 is mounted on the face of timer body 2₀. Dial 4 is set in the position corresponding to the lower limit of the allowable values, and surface 35c of tooth 35a on setting ring 35 comes in contact with surface 37b of stop 37 on cover 3. Setting ring 35 engages with the perimeter of dial 4. Dial 4 is then set in the position corresponding to the upper limit of the allowable values, causing surface 25c of tooth 25a on setting ring 25 to come in contact with surface 37a of stop 37 on timer body 2₀. Setting ring 25 then engages with the perimeter of dial 4. This process is illustrated in the frontal view shown in Figure 8 (A) and the partial side view in Figure 8 (B).

0029. Thus dial 4 and setting rings 25 and 35 rotate as a single entity, and the setting on dial 4 can be changed only within the range between tooth 25a on setting ring 25 and tooth 35a on setting ring 35. The operator is prevented from setting any value outside of that range, just as in the previous example.

0030. In this embodiment, the materials used for cover 3 and setting rings 25 and 35 are available in a variety of colors, so they can be chosen to match the color of the panel on which timer body 2₀ is mounted. This ensures an esthetically pleasing result.

0031. Effects of the Invention

The invention described above has two setting rings, each of which has a single tooth, which set the upper and



lower limits of the rotation of a dial. These setting rings are mounted in such a way that their teeth come in contact with a stop which protrudes either from the timer itself or from its cover. In this way the rotation of the dial is stopped at the locations corresponding to the upper and lower limits. Thus the values of the settings can be changed only within the range defined by the said upper and lower limits. The operator is free to alter the settings without worry.

0032. The invention described in the Paragraph 2 of this application has a cover mounted on the face of the timer. This cover encloses and protects the various setting switches which might cause problems if operated by mistake.

Detailed explanation of the Invention (Embodiment No.3)

0001. Industrial Application

This invention relates to a timing device in which an output relay is caused to operate by output from a time-limit circuit to measure time which is driven by a DC power supply.

0002. Existing Technology

The circuit design shown in Figure 2 is well known as a timing device of the type which this invention concerns. In Figure 2, 1 is the time-limit circuit, which comprises an IC; 2 is the output relay; time-limit circuit 1 and output relay 2 are connected in parallel to DC power supply 3 through switch 4. 5 is the output switching element. Its base is connected to the output terminal of the aforesaid time-limit circuit 1. This element is switched on and off by the output from time-limit circuit 1. The aforesaid output relay 2 is connected in series with the collector-emitter pathway of output



switching element 5. 6 in the diagram is a diode used to prevent reverse flow of current.

0003. In an existing timing device constructed as described above, current I_0 is supplied by DC power supply 3 when switch 4 is thrown. A part of this current, I_1 , is supplied to time-limit circuit 1, and circuit 1 operates and begins timing. After a specified time has elapsed, the aforesaid time-limit circuit 1 determines that the time is up. Its output causes switching element 5 to go on, and output relay 2 is operated by current I_2 .

0004. Problems Which This Invention Attempts to Solve
With the existing timing device described above, current I_0 is supplied by DC power supply 3. This current I_0 must be equal to $I_1 + I_2$, that is, to the sum of the current supplied by time-limit circuit 1 and that supplied by output relay 2. It is thus necessary to use a power supply with a current large enough to supply total current I_0 . Further, the current I^0 supplied by DC power supply 3 is liable to fluctuate significantly when output relay 2 switches on or off. A power supply must be used which has sufficient capacity so that the power supply voltage V_0 does not fluctuate when output relay 2 goes on or off. If the power supply does not have sufficient capacity, it will prove difficult to supply stable power to time-limit circuit 1, and the circuit will malfunction.

0005. This invention was devised in order to solve the problems discussed above. Its objective was to provide a timing device which could use a small-capacity power supply and yet could assure that the supply of power to the time-limit circuit was stable.

0006. Means Used to Solve These Problems



In order to achieve the objective described above, the timing device of this invention is constructed as follows. It has a time-limit circuit to measure the time; an output switching element which goes on or off according to the output from the time-limit circuit; an output relay which operates when the output switching element goes on or off; and a dummy resistor which has virtually the same impedance as the output relay. The output relay and the time-limit circuit are connected in series; the said output relay and the dummy resistor are each connected to their own switching elements, which go on and off in complementary fashion at corresponding times. These switching elements are operated by the on or off state of the aforesaid output switching element.

0007. Operation

With this invention, the output relay and the time-limit circuit are connected in series, and the current flowing into the output relay flows unchanged into the time-limit circuit. This arrangement makes it possible to lower the current supplied by the power supply. When timing is in progress, current flows along the route consisting of the switching element in parallel with the dummy resistor, and the time-limit circuit. When the time is up, current flows along the route consisting of the output relay, the switching element in parallel with the dummy resistor, and the time-limit circuit. The current, then, is not affected by the output relay being switched on or off. A steady current flows, and there is minimum fluctuation of current in the circuit as a whole. Thus stable power can be supplied to the time-limit circuit.

0008. Embodiment

We shall next explain an embodiment of this invention with reference to the drawings.



Figure 1 shows the configuration of the circuit in a timing device in which this invention has been implemented. Numbers 1 through 6 in this diagram refer to components identical to those in the example of an existing timer. They have been given the same numbers, and their explanation has been omitted.

0009. In Figure 1, 7 is the dummy resistor with virtually the same impedance as output relay 2. Dummy resistor 7 and output relay 2 are connected to time-limit circuit 1 in series. 8 and 9 are the switching elements connected in parallel to the aforesaid output relay 2 and dummy resistor 7, respectively. These switching elements are operated by the switching on or off of output switching element 5 in such a way that when one goes on, the other goes off.

0010. In a timing device with the configuration described above, timing is begun when switch 4 is thrown. In the process of timing, current I, which supplied by DC power supply 3, flows into switching element 8 and dummy resistor 7, as shown by the dotted arrow, and the specified power is supplied to time-limit circuit 1. When the specified time has elapsed, the aforesaid time-limit circuit determines that the time is up, and its output causes switching element 5 to go on. When element 5 switches on, the aforesaid switching element 8 goes off, and switching element 9 goes on. Current I from DC power supply 3 flows into output relay 2 and switching element 9, as shown by the solid arrow, and the specified power is supplied to time-limit circuit 1.

0011. The impedance R_2 of the aforesaid output relay 2 and R_1 of dummy resistor 7 are virtually identical, so the current does not vary either during timing or when timing has been completed. A virtually constant current is made

to flow, and stable power can be supplied to time-limit circuit 1.

0012. Effects of the Invention

As has been discussed above, this invention entails
5 connecting the output relay and the time-limit circuit in
series so that the current which goes into the output
relay flows unchanged into the time-limit circuit. This
being the case, less current is required of the power
supply, and a lower-capacity power supply can be used.
10 Furthermore, there is virtually no fluctuation of current
either during timing or when timing has been completed,
so a constant current is made to flow regardless of whe-
ther the output relay is on or off. Current fluctuation
is minimized throughout the circuit, stable power can be
15 supplied to the time-limit circuit, and malfunctions can
effectively be prevented.

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A Brief Explanation of the Drawings (Embodiment No.1)

Figure 1.

Figure 1 is an exploded oblique view of an embodiment of this invention.

5 Figure 2.

Figure 2 shows a frontal view and a partial side view of the timer body.

Figure 3.

10 Figure 3 shows a frontal view and a cross section of a side view of the cover.

Figure 4.

Figure 4 shows a frontal view, a cross sectional side view and a rear view of the setting ring.

Figure 5.

15 Figure 5 shows a front view and a partial side view of the timer with cover and setting ring mounted on it.

Figure 6.

Figure 6 is an oblique view of an existing timer.

Figure 7.

20 Figure 7 shows the setting ring of an existing timer.

A Brief Explanation of the Drawings (Embodiment NO.2)

Figure 1.

25 Figure 1 is an exploded oblique view of an embodiment of this invention.

Figure 2.

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Figure 2 shows a frontal view and a partial side view of the body of the timer.

Figure 3.

Figure 3 shows front and rear views of one of the
5 setting rings.

Figure 4.

Figure 4 shows a front view of the other setting ring.

Figure 5.

10 Figure 5 shows a frontal view and a partial side view of the timer body with the two setting rings mounted on it.

Figure 6.

15 Figure 6 is an exploded oblique view of another embodiment of this invention.

Figure 7.

Figure 7 shows a frontal view and a cross section of the side of the cover pictured in Figure 6.

Figure 8.

20 Figure 8 shows a frontal view and a partial side view of the timer body with the two setting rings mounted on it.

A Brief Explanation of the Drawings (Embodiment NO.3)

Figure 1.

25 Figure 1 shows the configuration of the circuit in a timing device in which this invention has been implemented.



Figure 2.

Figure 2 shows the configuration of the circuit in an existing timing device.

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Claims:

Paragraph 1. A dial-type timer distinguished by the fact that it has: A dial for setting the operating time on its face;

5 A cover with an opening in it corresponding to the aforesaid dial which can be mounted on the face of the aforesaid timer;

A setting ring mounted on the outer periphery of the aforesaid dial, which projects through the aforesaid
10 opening when the said cover is mounted on the face of the timer;

And a pawl on the aforesaid cover which engages with the grooves on the outer periphery of the aforesaid setting ring mounted on the outer edge of the aforesaid dial
15 and so determines the position in which the aforesaid setting ring is to be set.

Paragraph 2. A dial-type timer which is distinguished by the fact that it consists of: the timer itself, which has a dial on its front to set the operating
20 time;

Two setting rings mounted on the perimeter of the aforesaid dial in such a way that they rotate as a single piece with that dial;

A molded tooth formed on the perimeter of each of
25 the aforesaid setting rings and facing outward;

And a stop on the body of the timer which comes in contact with the aforesaid teeth on the setting rings mounted on the dial so as to limit the range of rotation of that dial.

30 Paragraph 3. A dial-type timer which is distinguished by the fact that consists of: the timer itself, which has a dial on its front to set the operating time;





A cover which can be mounted on the front of the aforesaid timer body, with an opening for the aforesaid dial;

Two setting rings, which are mounted on the perimeter of the aforesaid dial in such a way that they rotate
5 as a single piece with that dial, which protrudes from the front of the timer through the aforesaid opening in the cover when that cover is mounted on the front of the timer;

10 A molded tooth formed on the perimeter of each of the aforesaid setting rings;

And a stop on the aforesaid cover which comes in contact with the aforesaid teeth on the setting rings mounted on the dial so as to limit the range of rotation
15 of that dial.

Paragraph 4. A timing device distinguished by the fact that it has: a time-limit circuit to measure the time; an output switching element which goes on or off according to the output from the time-limit circuit; an
20 output relay which operates when the output switching element goes on or off; and a dummy resistor which has virtually the same impedance as the output relay. The output relay and the time-limit circuit are connected in series; the said output relay and the dummy resistor are
25 each connected to their own switching elements, which go on and off in complementary fashion at corresponding times. These switching elements are operated by the aforesaid output switching element's going on or off.





Summary

Embodiment No.1

Objective: Our objective was to improve the ease of operation of the dial on a dial-type timer on which a setting ring can be used, when that setting ring is not used.

Construction: The locking pawl which fixes the set position of the setting ring is not on the timer itself, but rather on a cover which can be mounted on that timer.

- 10 Result: The cover with the locking pawl on it is removed from the timer when the setting ring is not being used. This prevents the locking pawl from interfering with the operation of the dial.

Embodiment No.2

- 15 Objective: To make it impossible to change the settings on a dial-type timer except in a fixed range.

Construction: Two setting rings are mounted on the perimeter of the dial in such a way that they rotate as a single entity with the said dial. Each of the rings has a single molded tooth on its outer edge. A stop protrudes from the body of the timer which is contacted by the aforementioned teeth on the setting rings mounted on the dial. When the teeth come in contact with the stop, the range of rotation of the said dial is constrained.

- 20
25 Effects: Two setting rings are set in positions which indicate the upper and lower limits of a dial's rotation. When these rings are mounted on the perimeter of the said dial, the settings achieved by the dial can be changed

only within the range between the said upper and lower limits.

Embodiment No.3

Objective: To make it possible for a timing device to
5 use a small-capacity power supply, to prevent the current from varying either during timing or when timing is completed, and to make it possible to supply stable power to the time-limit circuit.

Construction: This timing device is constructed as follows.
10 Time-limit circuit 1 and output relay 2 are connected in series. Output relay 2 and dummy resistor 7, which has virtually the same impedance as relay 2, are connected to this series circuit. Switching elements 8 and 9, which go on and off in opposite sense at a given
15 time, are connected in parallel to dummy resistor 7 and output relay 2, respectively. These switching elements are made to switch on or off by the change of state of output switching element 5.

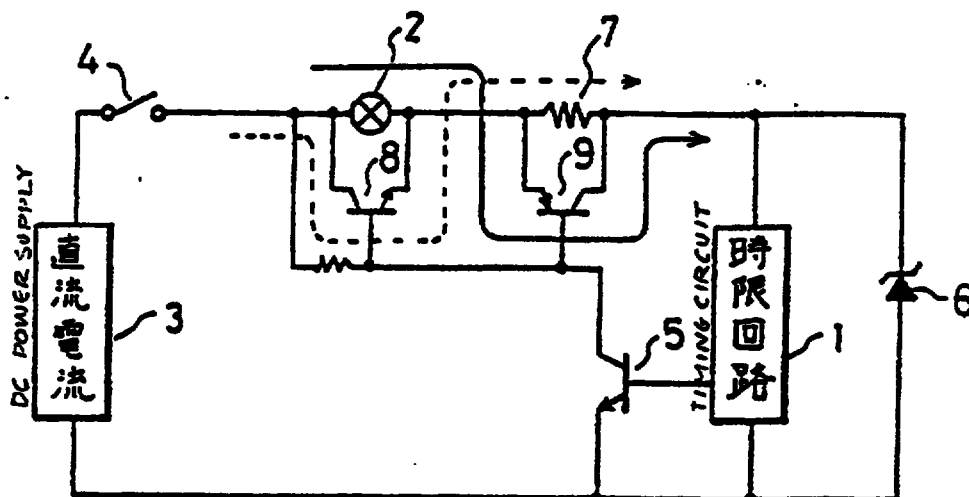
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DRAWINGS
図面FIGURE 1
[図 1]

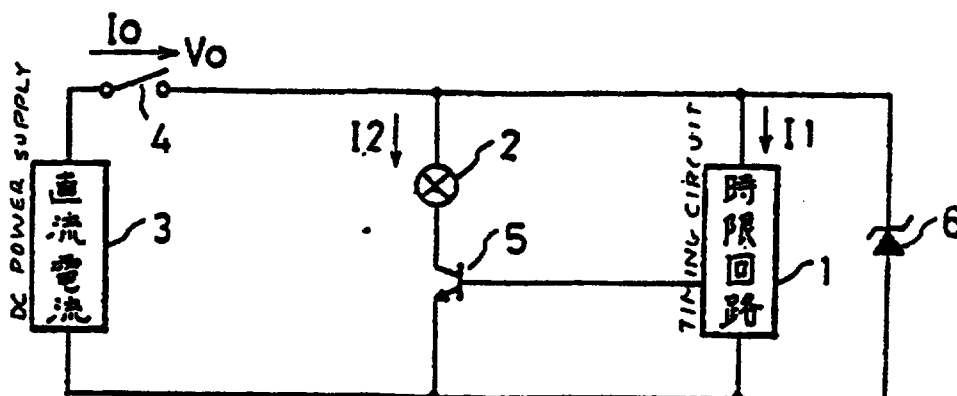
Embodiment No. 3



- 2 : 出力リレー - OUTPUT RELAY
 5 : 出力スイッチング素子 - OUTPUT SWITCHING ELEMENT
 7 : ダミー抵抗 - DUMMY RESISTOR
 8, 9 : スイッチング素子 - SWITCHING ELEMENTS

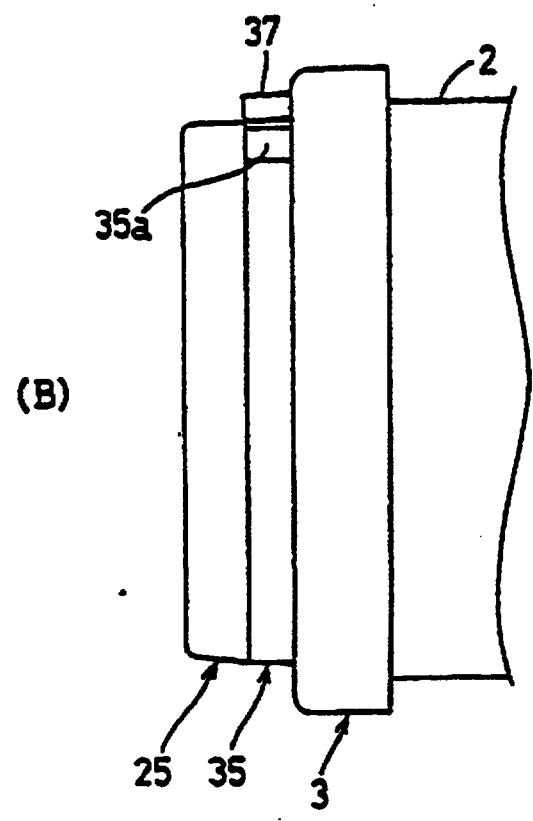
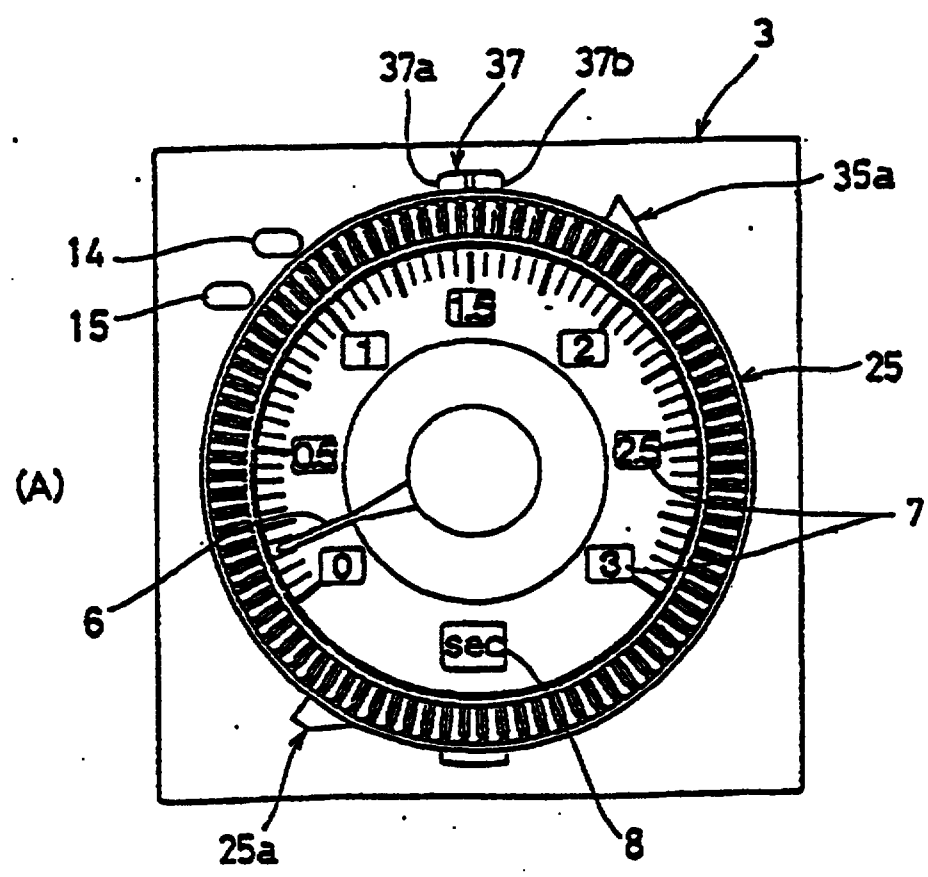
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【図 8】



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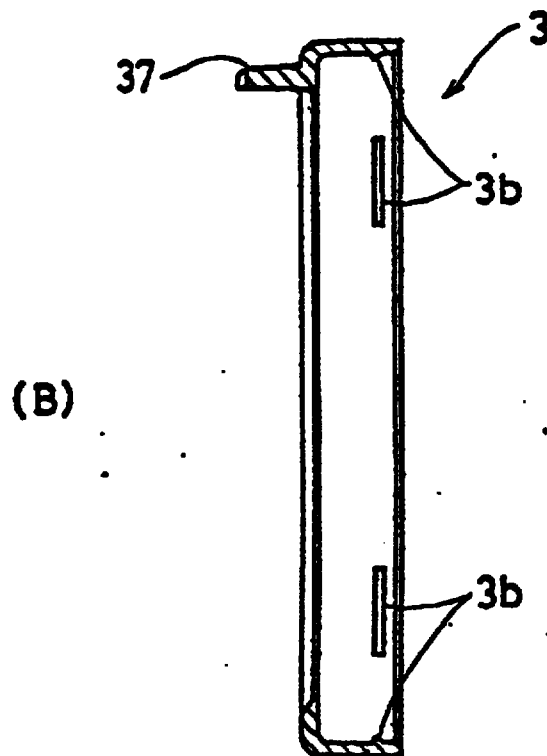
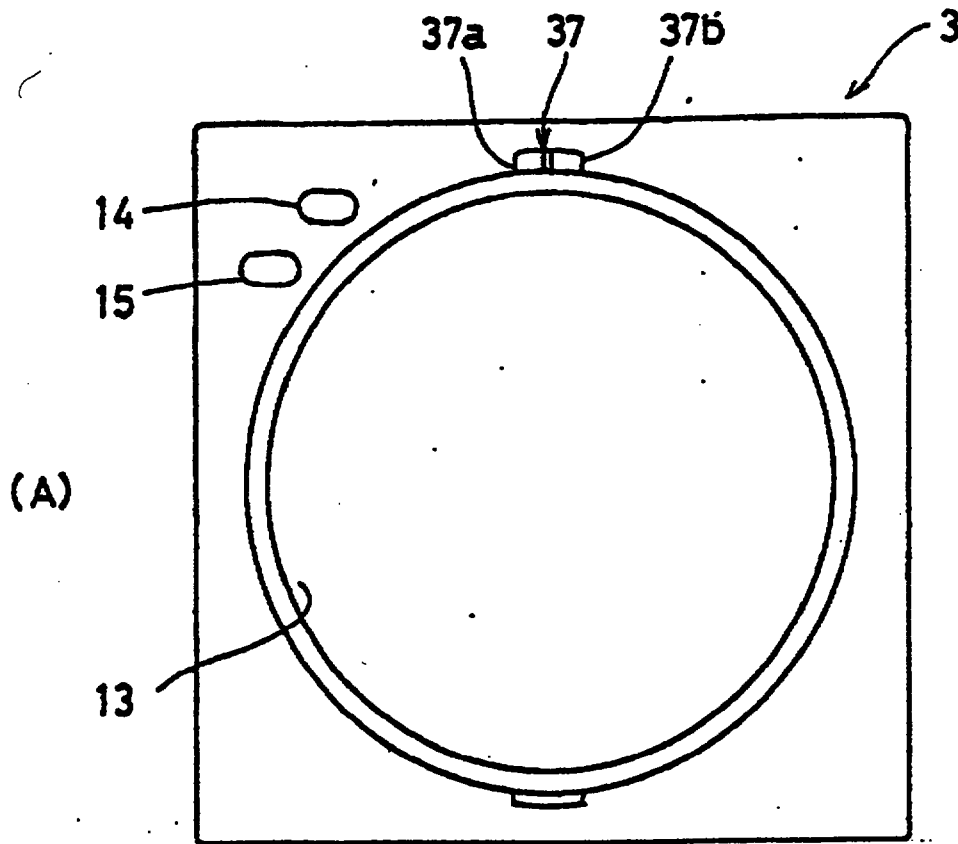
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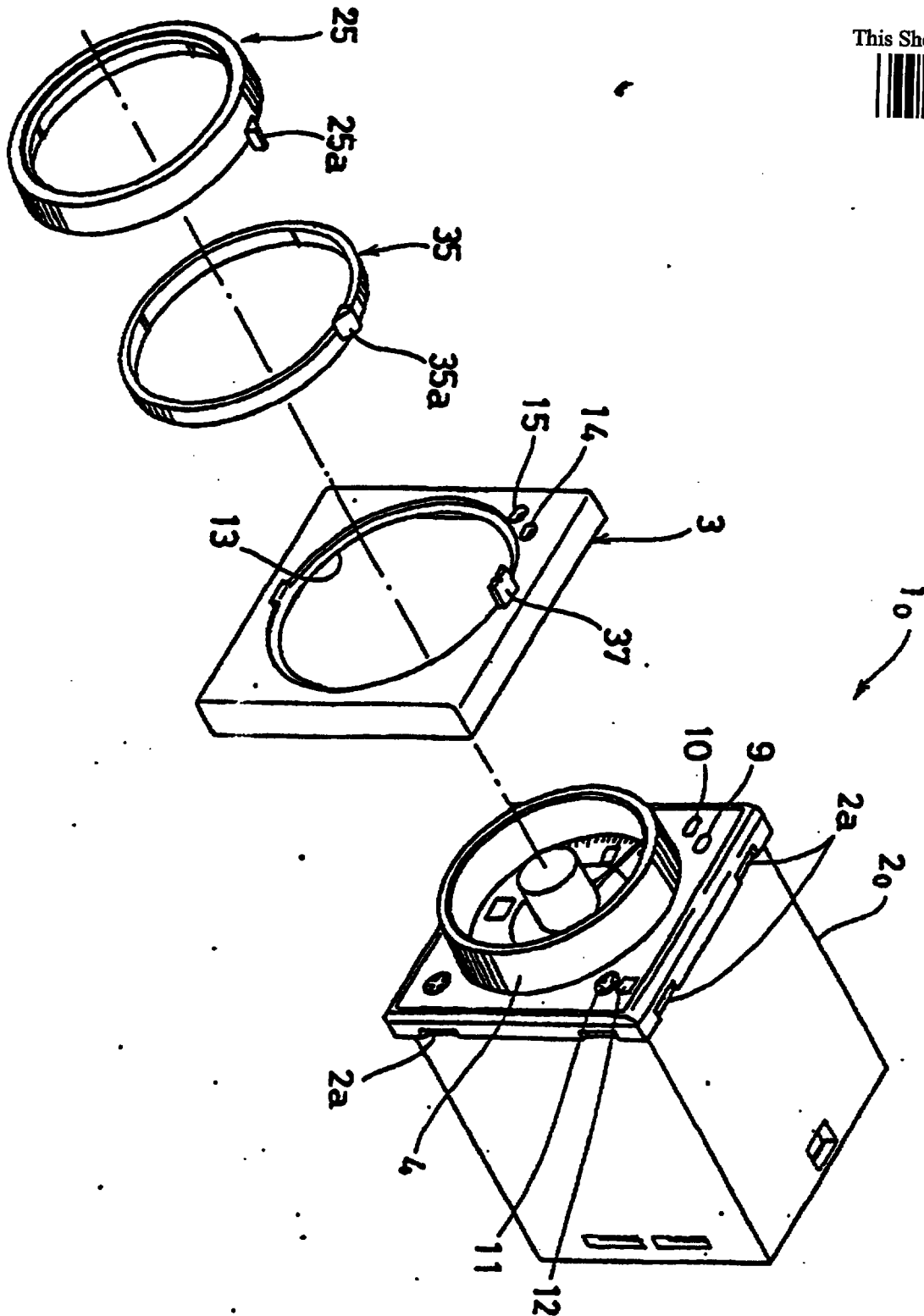
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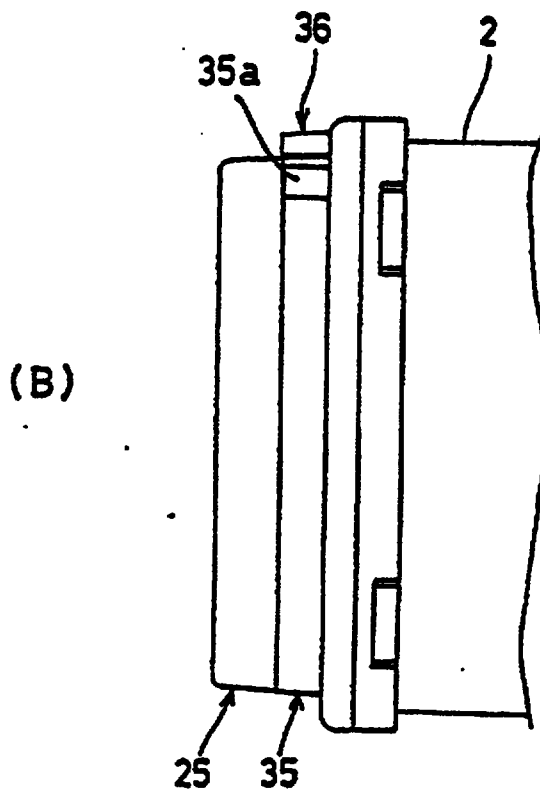
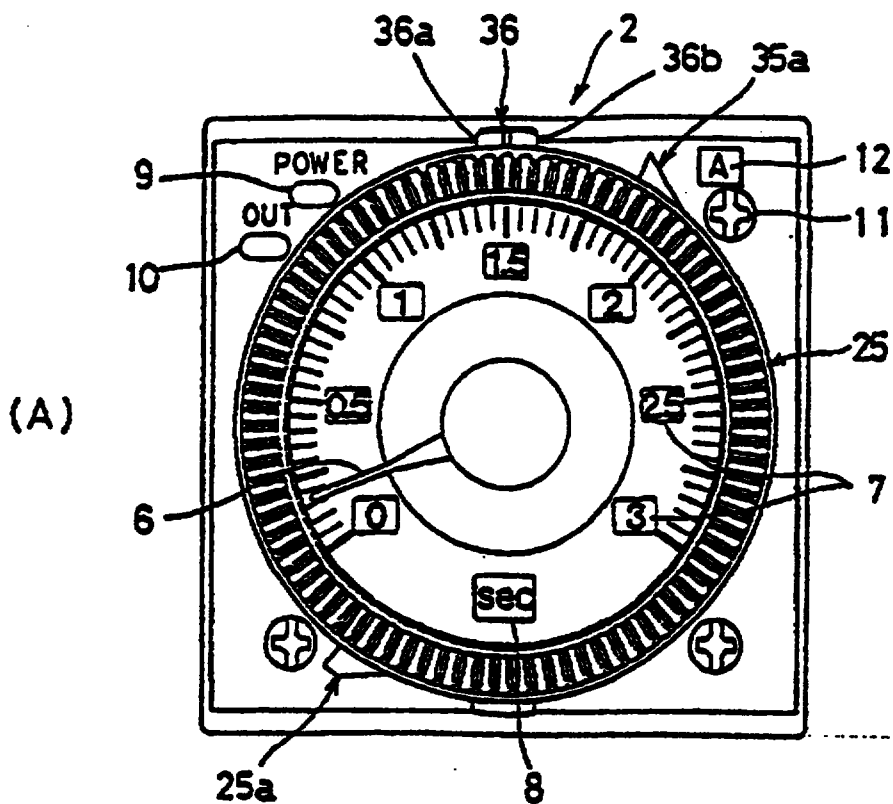


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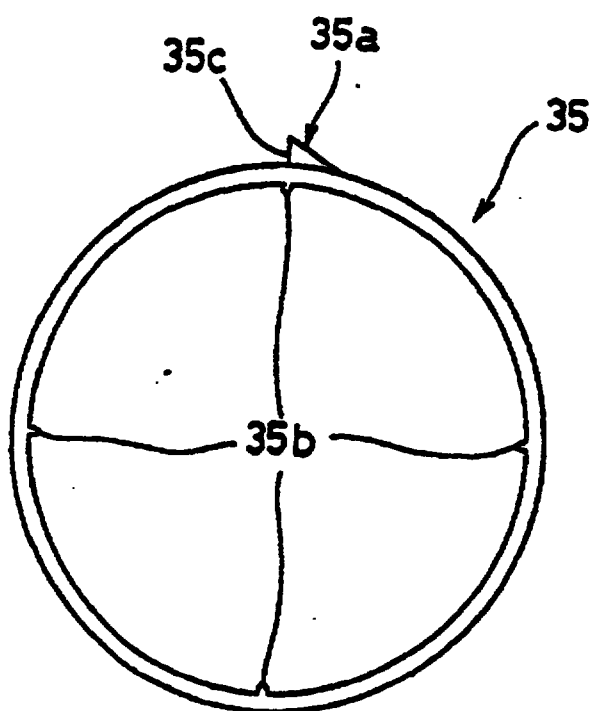


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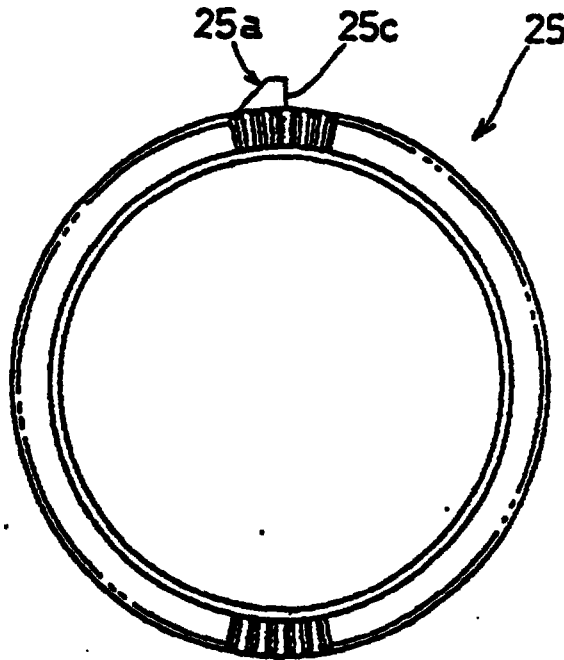
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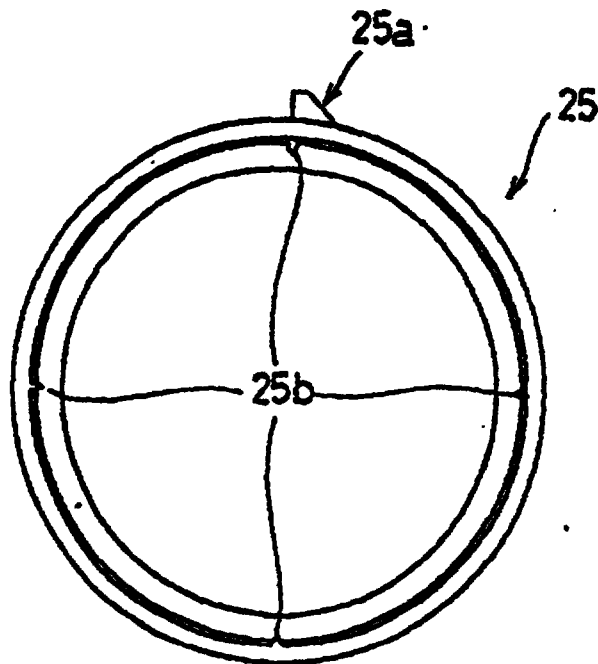
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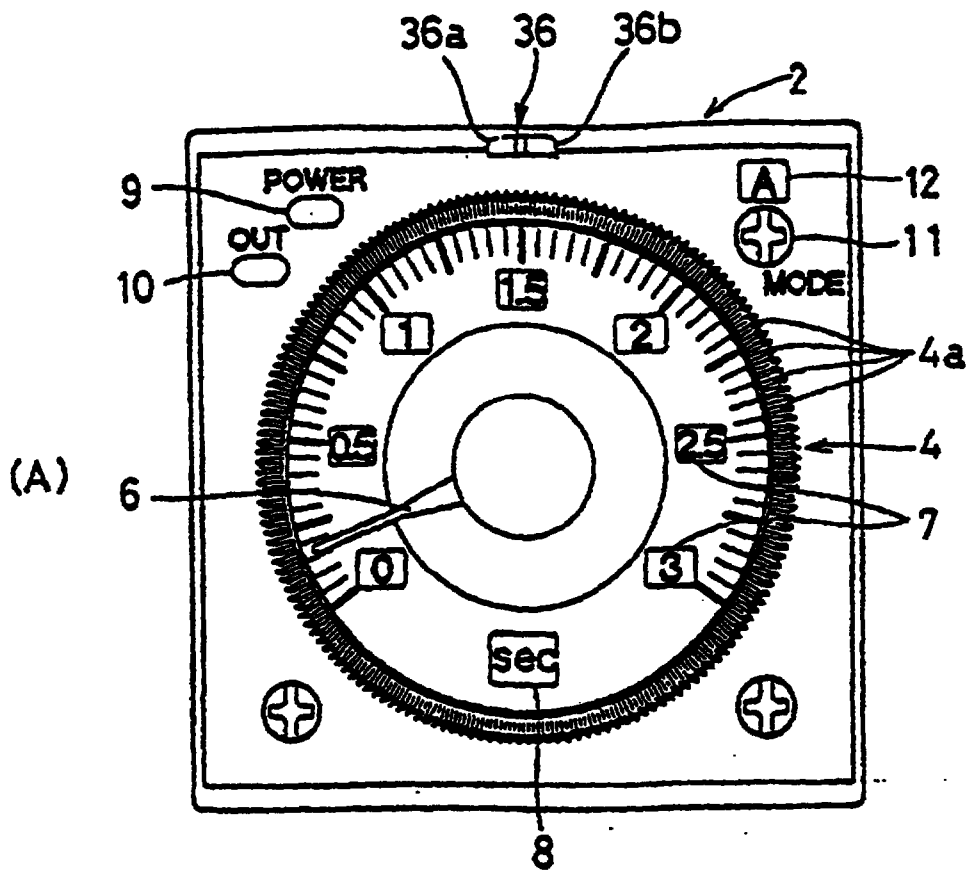


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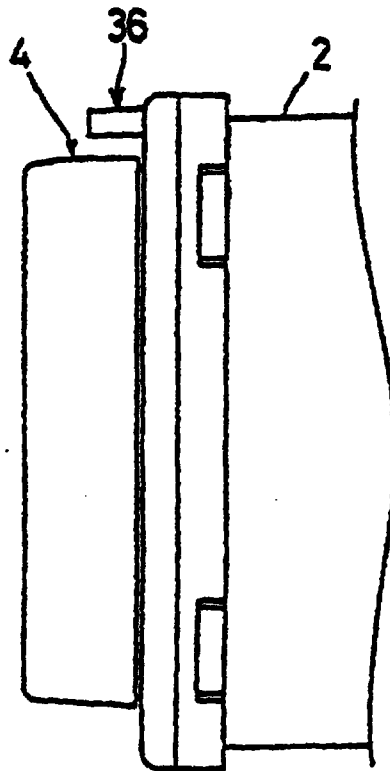


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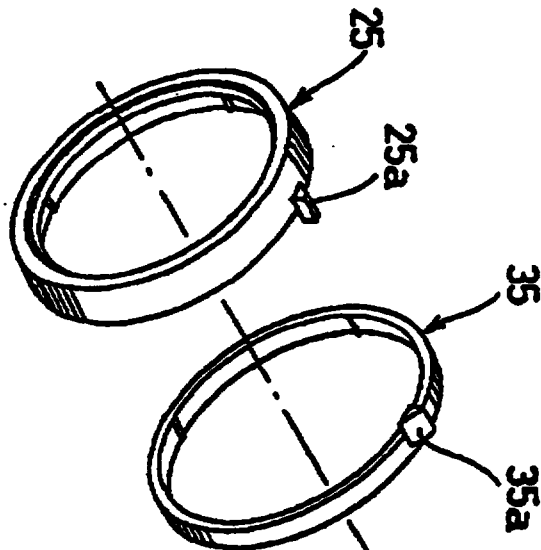
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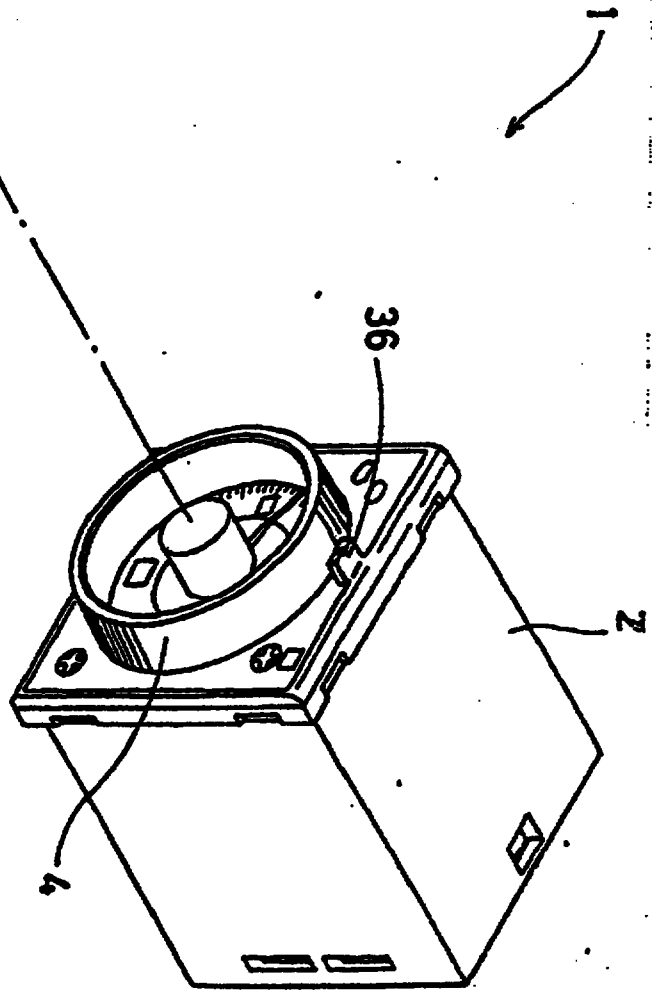
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Embodiment No. 2

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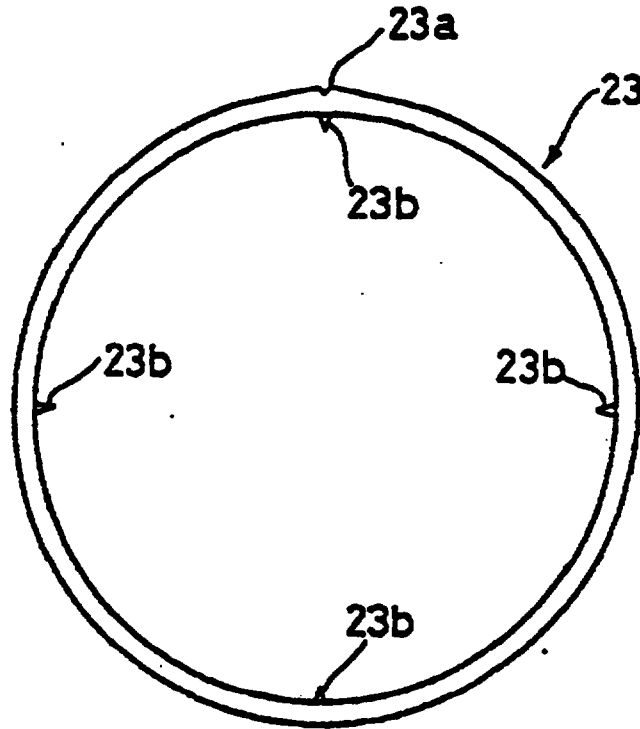


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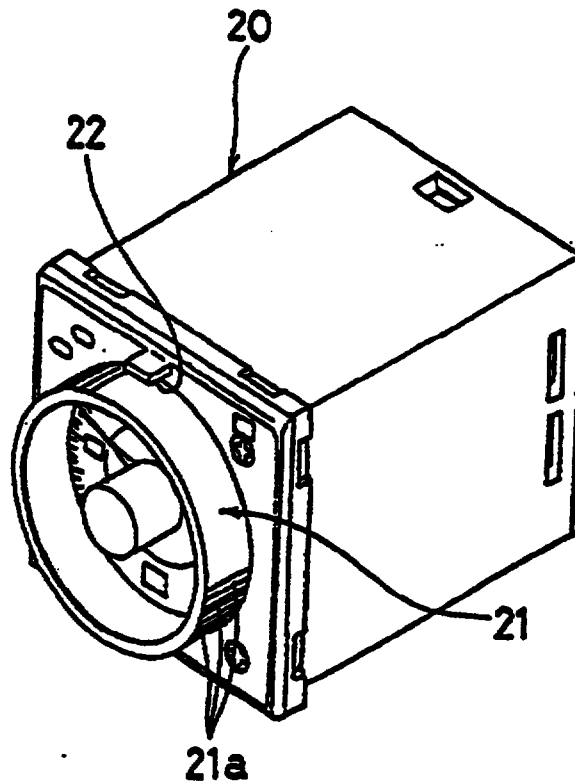
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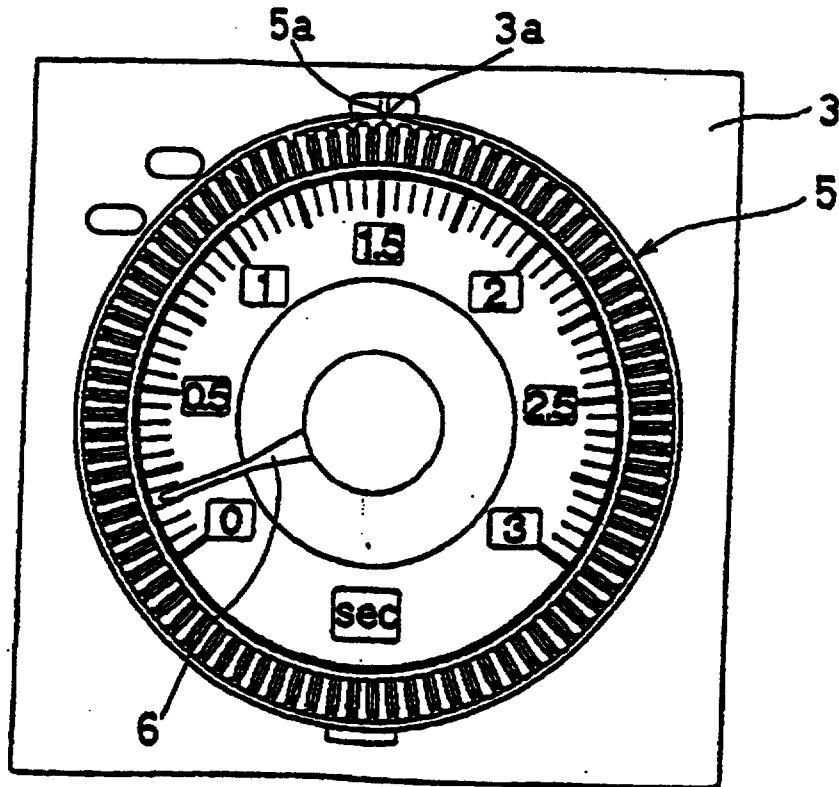
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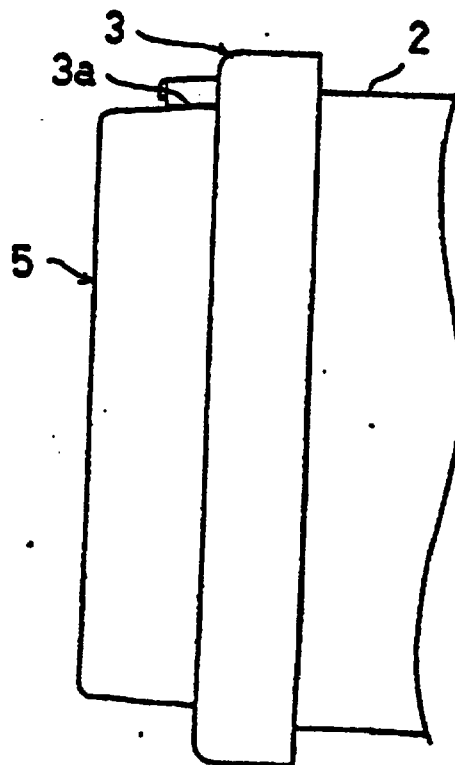
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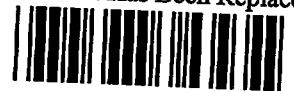
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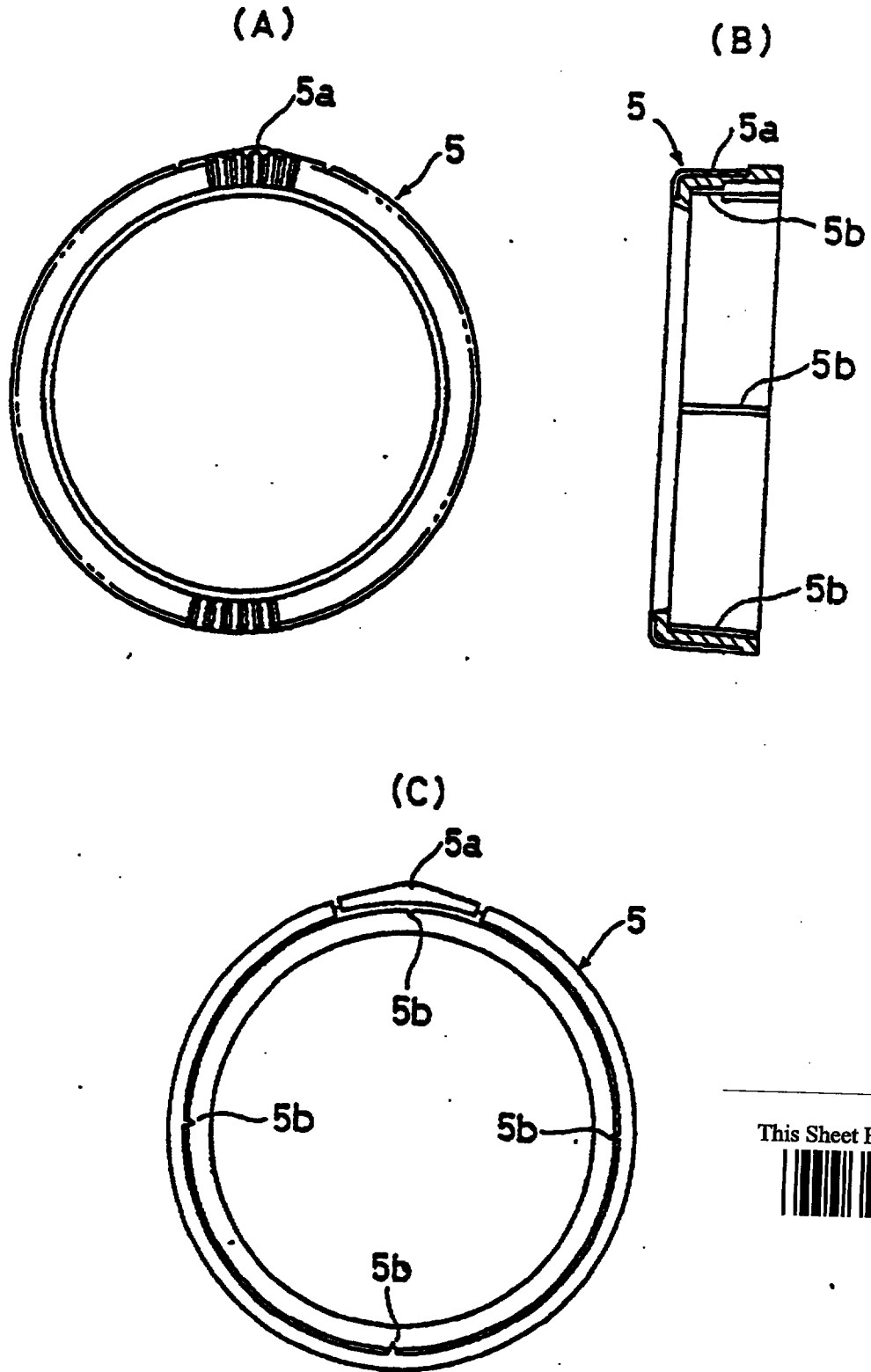
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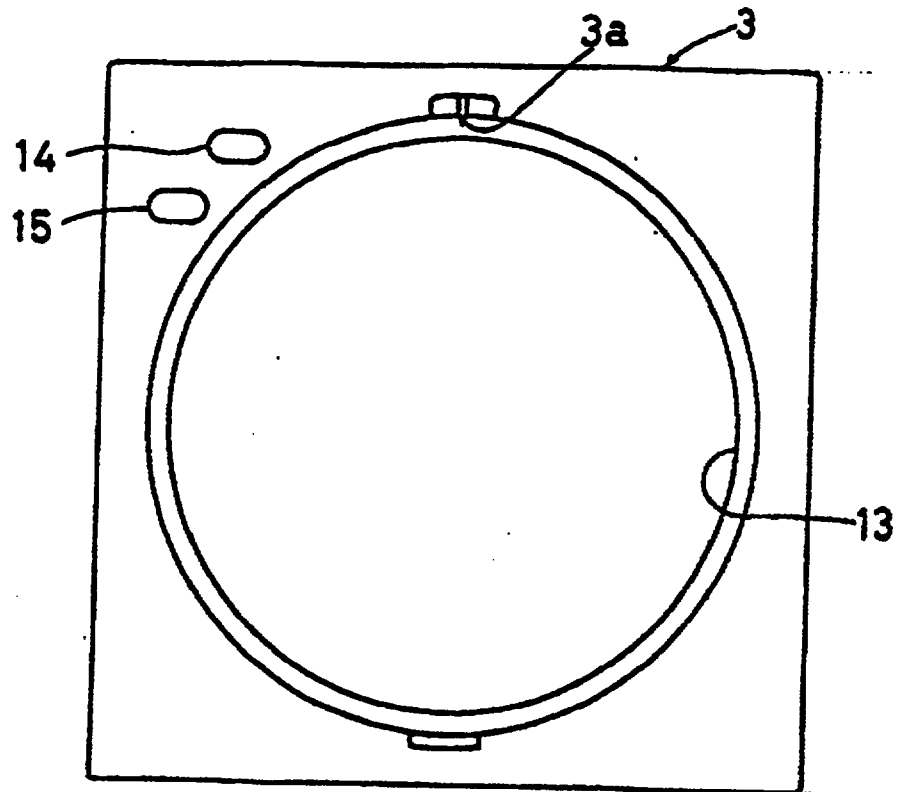


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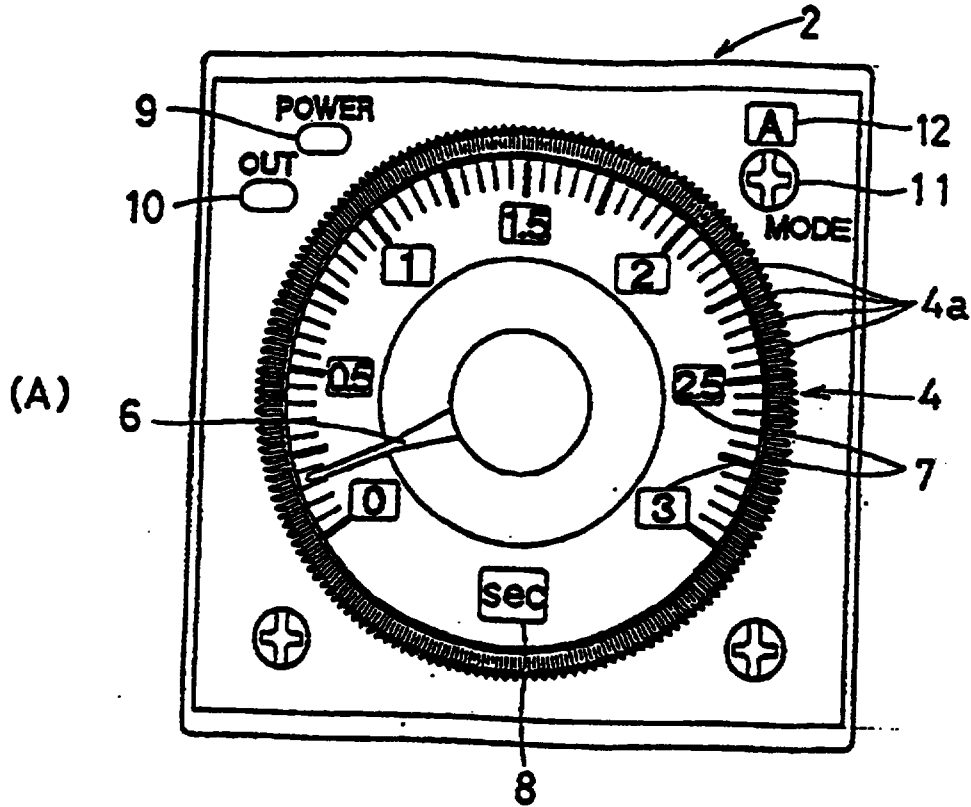
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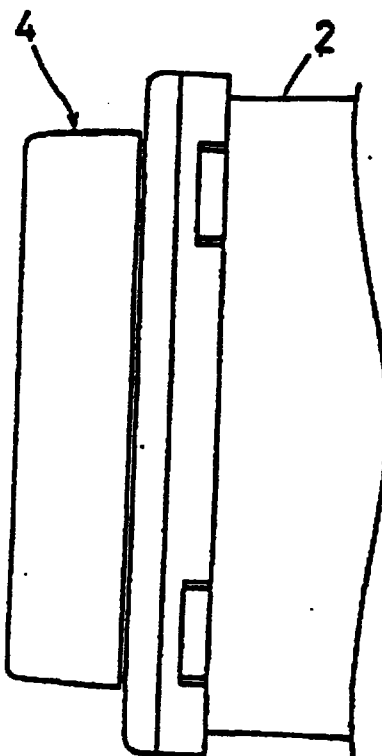
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【図 2】



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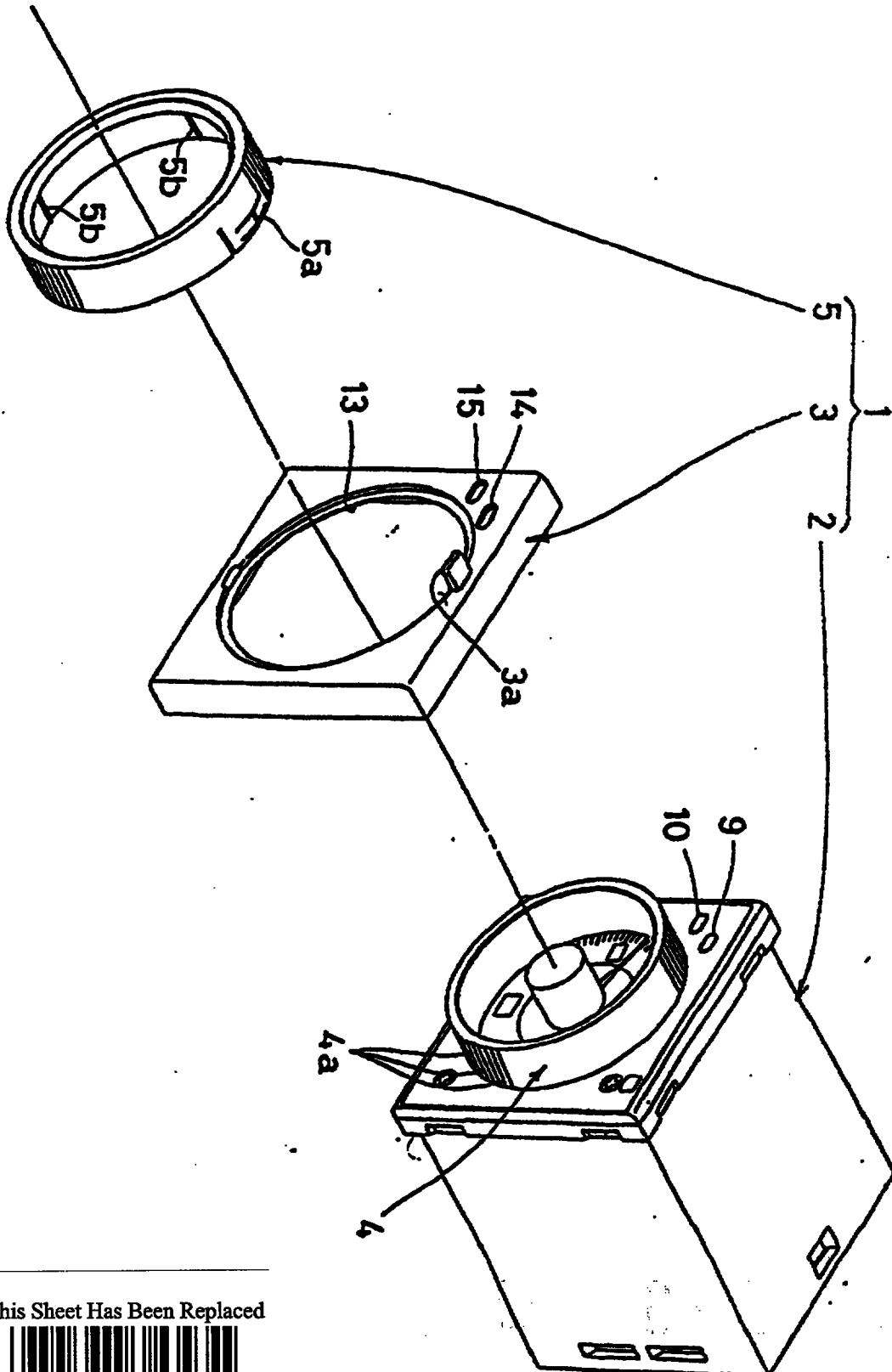
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【図 1】

Embodiment No. 1

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☒	Drawing(s)	: paged 46 to paged 46
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REPLACEMENT SHEETS		SG
☒	Description	: paged 1 to paged 30
☒	Claim(s)	: paged 21 to paged 22
☒	Drawing(s)	: paged 46 to paged 46
☒	Abstract	: paged 23 to paged 24
DATE OF RECEIPT 2/3/97		

5 Name of the invention: Dial-Type Timer Device

Detailed Explanation of the Invention (Embodiment No.1)

0001. Industrial Application

This invention relates to a dial-type timer. More specifically, it relates to a dial-type timer which employs a setting ring and is ideally suited for repeatedly setting the same operating time.

0002. Existing Technology

Figure 6 shows an existing dial-type timer. On the upper portion of dial 21 on the face of timer 20, locking pawl 22 protrudes from the surface of the dial. Locking pawl 22 locks setting ring 23, shown in Figure 7, to dial 21. It does this by engaging in groove 23a on the outer periphery of the aforesaid setting ring 23. In this way pawl 22 fixes the position of setting ring 23.

0003. Setting ring 23 is used to make it easier to set the timer when the same operating time is set repeatedly. It also prevents accidental missettings resulting from different workers performing the same job. On the outer periphery of setting ring 23, as discussed above, is slot 23a. On its inner periphery are pawls 23b, which engage in slots 21a on the outer periphery of dial 21 to set the operating time.

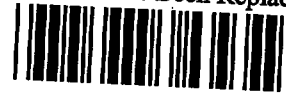
0004. Setting ring 23 is used to set a repeated operating time as follows. Dial 21 is set to the position which corresponds to the aforementioned repeated operating time. The aforesaid setting ring 23 engages with the sawteeth on the outer periphery of dial 21 in such a way that slot 23a on setting ring 23 engages in locking pawl 22 on timer body 20.

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0005. In this way dial 21 and setting ring 23 are made to rotate as a single entity. When dial 21 is to reset a repeated operating time, as discussed earlier, it is returned to the position in which slot 23a on setting ring
5 23 engages in locking pawl 22 on timer body 20. This causes the timer to be reset to the aforementioned designated position.

0006. Problems Which This Invention Attempts to Solve

With an existing dial-type timer of this sort, locking
10 ing pawl 22 on the upper portion of the face of the timer gets in the way when dial 21 is used without setting ring 23, making the operation difficult.

0007. In light of the difficulties described above, the objective of this invention was to improve the ease of
15 operation of the dial when it was used without the setting ring.

0008. Means Employed to Solve These Problems

In order to achieve the objectives described above, this invention has been designed as follows.

20 0009. The dial-type timer of this invention has a dial for setting the operating time on its face; a cover with an opening in it corresponding to the aforesaid dial which can be mounted on the face of the aforesaid timer; a setting ring mounted on the outer periphery of the
25 aforesaid dial, which projects through the aforesaid opening when the said cover is mounted on the face of the timer; and a locking pawl on the aforesaid cover which engages with the grooves on the outer periphery of the aforesaid setting ring mounted on the outer edge of the
30 aforesaid dial and so determines the position in which the aforesaid setting ring is to be set.

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0010. Operation

With the design described above, the locking pawl which fixes the set position of the setting ring is on a cover which is separate from the timer body. There is
5 thus no need to have a locking pawl on the timer body, as in existing timers. When the timer is used without the setting ring, the timer body can be used by itself without mounting the cover with the pawl. The locking pawl
10 will not get in the way when the dial on the timer body is operated.

0011. Embodiment

In the following section we shall give a detailed explanation of an embodiment of this invention, with reference to the drawings.

15 0012. Figure 1 is an exploded oblique view of a dial-type timer in which this invention has been implemented.

0013. Dial-type timer 1, in which this invention has been implemented, consists of timer body 2; cover 3, which can be mounted on the face of the said timer body
20 2; and setting ring 5, which is mounted on dial 4 on timer body 2 when the aforesaid cover 3 is in place.

0014. Timer body 2 has a dial 4 on its face, as described above. The outer periphery of this dial 4 is formed into grooves 4a, as can be seen in the frontal
25 view in Figure 2 (A). Dial 4 has an indicator 6 and a scale along its circumference for setting the time. It also has a number of windows 7 to display the numerals for the scale, and a window 8 to display the time unit. Along the circumference of dial 4 are POWER and OUT displays 9 and 10, operating function switch 11 and operating
30 function display window 12. Figure 2 (B) is a partial side view of the face of timer body 2.



0015. The structure described above is basically the same as that of the existing timer described in the example. However, the timer of this invention does not have a locking pawl on the upper portion of the face of the timer body 2 to engage in the slot on setting ring 5. The locking pawl, then, does not get in the way when dial 4 is operated, so the timer is easier to operate than the existing timer described.

0016. Cover 3 is mounted on the face of timer body 2 when setting ring 5 is to be used. It has a round opening 13 for dial 4, and openings 14 and 15 for displays 9 and 10 on timer body 2. Cover 3 has a single locking pawl 3a molded on its face in a location corresponding to the upper portion of the face of timer body 2 when the cover is mounted on the timer body, as shown in the front view in Figure 3 (A) and the cross section of a side view in Figure 3 (B). This locking pawl engages in the slot on the outer periphery of setting ring 5.

0017. Setting ring 5 engages in grooves 4a on the outer periphery of dial 4, which projects forward through opening 13 of cover 3 when the cover is mounted on the face of timer body 2. On the outer periphery of setting ring 5 is slot 5a, into which locking pawl 3a on cover 3 engages, as shown in the front view, cross sectional side view and rear view pictured in Figures 4 (A), (B) and (C). In four locations on the inner periphery of setting ring 5, pawls 5b are provided, which engage in grooves 4a on the outer periphery of dial 4.

0018. When setting ring 5 is to be used with dial-type timer 1, which has the configuration described above, cover 3 with its locking pawl 3a is mounted on the face of timer body 2. Dial 4 is then set in the position corresponding to the regular operating time. The aforesaid

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setting ring 5 is locked onto the outer periphery of dial 4 in such a way that locking pawl 3a on cover 3 engages in slot 5a on the outer periphery of the setting ring. The frontal view and partial side view pictured in Figures 5 (A) and (B) show the setting ring locked onto the dial.

0019. In this way dial 4 and setting ring 5 are made to rotate as a single entity. When dial 4 is to reset a repeated operating time, as discussed earlier, it is returned to the position in which locking pawl 3a on cover 3 engages in slot 5a on setting ring 5. This causes the timer to be reset to the aforementioned designated position.

0020. The materials used for cover 3 and setting ring 5 of this invention are available in a variety of colors, so they can be chosen to match the color of the panel on which timer body 2 is mounted. This ensures an esthetically pleasing result.

0021. Effects of the Invention

With the invention described above, a cover with a locking pawl on it is mounted on the timer when the setting ring is to be used. This allows the timer to function in the same way as previous timers of this type. When the setting ring is not going to be used, the cover is removed from the timer so that the locking pawl does not interfere with the operation of the dial. The result is a timer with improved ease of operation.

Detailed Explanation of the Invention (Embodiment NO.2)

0001. Industrial Application

This invention relates to a dial-type timer. More specifically, it relates to a dial-type timer which is



ideally suited for applications such as process control which require that values once set can be changed only within a limited range.

0002. Existing Technology

5 Generally speaking, when dial-type timers are used in process control, they are set to values which should be changed only within a fixed range.

0003. However, existing dial-type timers are incapable of preventing values from being set beyond the upper and lower limits of the desired range.

10

0004. Problem Which This Invention Attempts to Solve

Thus when such a dial-type timer is used for process control, the operator must pay careful attention whenever he changes a set value and note whether or not the new value falls within the fixed range of permitted values. He is, then, unable to relax. He may also mistakenly set values which exceed the aforesaid fixed range.

15

0005. In light of the problem discussed above, the objective of this invention is to make it possible to fix an upper and lower limit for values to be set, and to prevent values which exceed these limits from being set.

20

0006. Means Employed to Solve These Problems

To achieve the objective described above, this invention is constructed as follows.

25 0007. The dial-type timer described in Paragraph 1 of this application consists of the timer itself, which has a dial on its front to set the operating time; two setting rings mounted on the perimeter of the aforesaid dial in such a way that they rotate as a single piece with that dial; a molded tooth formed on the perimeter of each

30



of the aforesaid setting rings; and a stop on the body of the timer which comes in contact with the aforesaid teeth on the setting rings mounted on the dial so as to limit the range of rotation of that dial.

5 0008. The dial-type timer described in Paragraph 2 of this application consists of the timer itself, which has a dial on its front to set the operating time; a cover which can be mounted on the front of the aforesaid timer body, with an opening for the aforesaid dial; two setting
10 rings, which are mounted on the perimeter of the aforesaid dial in such a way that they rotate as a single piece with that dial, which protrudes from the front of the timer through the aforesaid opening in the cover when that cover is mounted on the front of the timer; a molded
15 tooth formed on the perimeter of each of the aforesaid setting rings; and a stop on the aforesaid cover which comes in contact with the aforesaid teeth on the setting rings mounted on the dial so as to limit the range of rotation of that dial.

20 0009. Operation

The timer of the invention described in Paragraphs 1 and 2 of this application has two setting rings with a tooth on each which can be set in a position to indicate the upper and lower limit of the range of rotation of a
25 dial. These setting rings are mounted on the perimeter of the said dial in such a way that the teeth come in contact with a stop on the timer body or its cover. In this way the rotation of the dial is constrained not to go beyond the said positions for upper and lower limits.
30 This invention, then, makes it possible to restrict the setting of an operating time to a fixed range defined by the aforesaid upper and lower limits.

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0010. The timer of the invention described in Paragraph 2 of this application has a cover mounted on its face with an opening for the dial. This cover encloses and protects the various setting switches and prevents them from being operated inadvertently. It also allows the color and appearance of the timer to be selected to match the design of the panel on which the timer is mounted. In other words, the addition of a cover allows the design of a dial-type timer to be changed.

10 0011. Embodiment

In the following section, we shall give a detailed explanation of an embodiment of this invention with reference to the drawings.

0012. Figure 1 is an oblique exploded view of a dial-type timer in which this invention has been implemented.

0013. The dial-type timer 1 of this embodiment consists of timer body 2; dial 4, which is used to set the operating time for timer body 2; and setting rings 25 and 35, which are mounted on the perimeter of dial 4. These setting rings limit the range in which dial 4 can be set.

0014. Stop 36 protrudes from the upper portion of the face of dial 4 on timer body 2. This stop limits the range of rotation of dial 4 when it comes in contact with teeth 25a and 35a on setting rings 25 and 35, as described above. As can be seen in the frontal view pictured in Figure 2 (A), the perimeter of dial 4 on timer body 2 is formed into gear teeth 4a. Dial 4 has an indicator 6 and a scale along its circumference for setting the time. It also has a number of windows 7 to display the numerals for the scale, and a window 8 to display the time unit. Gear teeth 4a on the perimeter of dial 4 are used to determine the position in which setting rings 25

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and 35 are to be mounted, as discussed below. For that reason they are cut at a pitch of $1/2$ the scale units for setting the time. Along the circumference of dial 4 are POWER and OUT displays 9 and 10, operating function switch 11 and operating function display window 12. Figure 2 (B) is a partial side view of the face of timer body 2.

0015. Front and rear views of setting ring 25 are shown in Figures 3 (A) and (B). This setting ring is mounted in such a way as to engage in gear teeth 4a on the perimeter of dial 4 on timer body 2. Tooth 25a, which protrudes from the perimeter of the setting ring, comes in contact with stop 36 on timer body 2. Its surface 25c makes contact with surface 36a of stop 36 on the timer body, which is shown in Figure 2 (A). In four locations on the inner periphery of setting ring 25 are teeth 25b, which engage in gear teeth 4a on the perimeter of dial 4.

0016. A front view of the second setting ring, setting ring 35, is shown in Figure 4. This setting ring is also mounted so as to engage in gear teeth 4a on the perimeter of dial 4 on timer body 2. Tooth 35a, which protrudes from the perimeter of the setting ring, comes in contact with stop 36 on timer body 2. Its surface 35c makes contact with surface 36b of stop 36 on the timer body, which is shown in Figure 2 (A). In four locations on the inner periphery of setting ring 35 are teeth 35b, which engage in gear teeth 4a on the perimeter of dial 4.

0017. In a dial-type timer constructed as described above, the range of settings is controlled by the dial through the use of setting rings 25 and 35. When dial 4 is set in the position corresponding to the lower limit of the allowable values, surface 35c of tooth 35a on setting ring 35 comes in contact with surface 36b of stop 36

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on timer body 2. Setting ring 35 engages with the perimeter of dial 4. When dial 4 is set in the position corresponding to the upper limit of the allowable values, surface 25c of tooth 25a on setting ring 25 comes in contact with surface 36a of stop 36 on timer body 2. Setting ring 25 then engages with the perimeter of dial 4. These situations are illustrated in the frontal view shown in Figure 5 (A) and the partial side view in Figure 5 (B).

0018. Thus dial 4 and setting rings 25 and 35 rotate as a single entity, and the setting on dial 4 can be changed only within the range between tooth 25a on setting ring 25 and tooth 35a on setting ring 35. The operator is prevented from setting any value outside of that range.

0019. For stop 36, which protrudes from the surface of the face of timer body 2, a lock generally found in existing timers can be used. This lock protrudes from the upper portion of the face of the timer. It is used to determine the reset position of the setting ring so that it can be reset easily when a standard operating time is being set repeatedly. This lock can be used for both purposes in the new timer.

0020. Figure 6 is an exploded oblique view of another dial-type timer in which this invention has been implemented. Components which correspond to those of the preceding embodiment have been given the same numbering.

0021. The dial-type timer 1₀ of this embodiment consists of timer body 2₀; cover 3, which can be mounted on the face of the aforesaid timer body 2₀; and setting rings 25 and 35, which are mounted on the perimeter of dial 4 on timer body 2₀ when the aforesaid cover 3 is mounted on timer body 2₀.

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0022. Unlike the previous embodiment, this timer does not have a stop 36 protruding from the upper portion of dial 4 on timer body 2₀.

5 0023. Cover 3 is already mounted on the face of timer body 2₀ when setting rings 25 and 35 are used. The cover has a round opening 13 for dial 4, and two small openings 14 and 15 for displays 9 and 10 on timer body 2₀.

10 0024. Openings 13 through 15 are the only windows in cover 3. When this cover is mounted on the face of timer body 2₀, operating function switch 11 and the other setting switches are completely enclosed. With the cover in place, there is no possibility that anyone will operate these switches mistakenly.

15 0025. Stop 37 protrudes from the surface of cover 3 in a location corresponding to the upper face of the aforesaid timer body 2₀, as shown in Figure 7 (A), a frontal view, and 7 (B), a cross section of the side. Stop 37 limits the range of rotation of dial 4 when it is contacted by teeth 25a and 35a on setting rings 25 and 35. Surface
20 25c of tooth 25a on setting ring 25 comes in contact with surface 37a of stop 37. Surface 35c of tooth 35a on setting ring 35 comes in contact with surface 37b of stop 37.

25 0026. To mount cover 3 on the face of timer body 2₀, tabs 3b on the inner surface of cover 3 (shown in Figure 7 (B)) are inserted into slots 2a on timer body 2₀ (shown in Figure 6).

30 0027. When cover 3 is mounted on the face of timer body 2₀, dial 4 projects out the front of opening 13 in that cover, and setting rings 25 and 35, which engage with the

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outer edge 4a of dial 4, are disposed exactly as in the previous example.

0028. In dial-type timer 1₀, which is constructed as described above, the range of settings is controlled by the dial through the use of setting rings 25 and 35. First, cover 3 is mounted on the face of timer body 2₀. Dial 4 is set in the position corresponding to the lower limit of the allowable values, and surface 35c of tooth 35a on setting ring 35 comes in contact with surface 37b of stop 37 on cover 3. Setting ring 35 engages with the perimeter of dial 4. Dial 4 is then set in the position corresponding to the upper limit of the allowable values, causing surface 25c of tooth 25a on setting ring 25 to come in contact with surface 37a of stop 37 on timer body 2₀. Setting ring 25 then engages with the perimeter of dial 4. This process is illustrated in the frontal view shown in Figure 8 (A) and the partial side view in Figure 8 (B).

0029. Thus dial 4 and setting rings 25 and 35 rotate as a single entity, and the setting on dial 4 can be changed only within the range between tooth 25a on setting ring 25 and tooth 35a on setting ring 35. The operator is prevented from setting any value outside of that range, just as in the previous example.

0030. In this embodiment, the materials used for cover 3 and setting rings 25 and 35 are available in a variety of colors, so they can be chosen to match the color of the panel on which timer body 2₀ is mounted. This ensures an esthetically pleasing result.

0031. Effects of the Invention

The invention described above has two setting rings, each of which has a single tooth, which set the upper and

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lower limits of the rotation of a dial. These setting rings are mounted in such a way that their teeth come in contact with a stop which protrudes either from the timer itself or from its cover. In this way the rotation of the dial is stopped at the locations corresponding to the upper and lower limits. Thus the values of the settings can be changed only within the range defined by the said upper and lower limits. The operator is free to alter the settings without worry.

0032. The invention described in the Paragraph 2 of this application has a cover mounted on the face of the timer. This cover encloses and protects the various setting switches which might cause problems if operated by mistake.

Detailed explanation of the Invention (Embodiment No.3)

0001. Industrial Application

This invention relates to a timing device in which an output relay is caused to operate by output from a time-limit circuit to measure time which is driven by a DC power supply.

0002. Existing Technology

The circuit design shown in Figure 2 is well known as a timing device of the type which this invention concerns. In Figure 2, 1 is the time-limit circuit, which comprises an IC; 2 is the output relay; time-limit circuit 1 and output relay 2 are connected in parallel to DC power supply 3 through switch 4. 5 is the output switching element. Its base is connected to the output terminal of the aforesaid time-limit circuit 1. This element is switched on and off by the output from time-limit circuit 1. The aforesaid output relay 2 is connected in series with the collector-emitter pathway of output

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switching element 5. 6 in the diagram is a diode used to prevent reverse flow of current.

0003. In an existing timing device constructed as described above, current I_0 is supplied by DC power supply 3 when switch 4 is thrown. A part of this current, I_1 , is supplied to time-limit circuit 1, and circuit 1 operates and begins timing. After a specified time has elapsed, the aforesaid time-limit circuit 1 determines that the time is up. Its output causes switching element 5 to go on, and output relay 2 is operated by current I_2 .

0004. Problems Which This Invention Attempts to Solve
With the existing timing device described above, current I_0 is supplied by DC power supply 3. This current I_0 must be equal to $I_1 + I_2$, that is, to the sum of the current supplied by time-limit circuit 1 and that supplied by output relay 2. It is thus necessary to use a power supply with a current large enough to supply total current I_0 . Further, the current I_0 supplied by DC power supply 3 is liable to fluctuate significantly when output relay 2 switches on or off. A power supply must be used which has sufficient capacity so that the power supply voltage V_0 does not fluctuate when output relay 2 goes on or off. If the power supply does not have sufficient capacity, it will prove difficult to supply stable power to time-limit circuit 1, and the circuit will malfunction.

0005. This invention was devised in order to solve the problems discussed above. Its objective was to provide a timing device which could use a small-capacity power supply and yet could assure that the supply of power to the time-limit circuit was stable.

0006. Means Used to Solve These Problems

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In order to achieve the objective described above, the timing device of this invention is constructed as follows. It has a time-limit circuit to measure the time; an output switching element which goes on or off according to the output from the time-limit circuit; an output relay which operates when the output switching element goes on or off; and a dummy resistor which has virtually the same impedance as the output relay. The output relay and the time-limit circuit are connected in series; the said output relay and the dummy resistor are each connected to their own switching elements, which go on and off in complementary fashion at corresponding times. These switching elements are operated by the on or off state of the aforesaid output switching element.

0007. Operation

With this invention, the output relay and the time-limit circuit are connected in series, and the current flowing into the output relay flows unchanged into the time-limit circuit. This arrangement makes it possible to lower the current supplied by the power supply. When timing is in progress, current flows along the route consisting of the switching element in parallel with the dummy resistor, and the time-limit circuit. When the time is up, current flows along the route consisting of the output relay, the switching element in parallel with the dummy resistor, and the time-limit circuit. The current, then, is not affected by the output relay being switched on or off. A steady current flows, and there is minimum fluctuation of current in the circuit as a whole. Thus stable power can be supplied to the time-limit circuit.

0008. Embodiment

We shall next explain an embodiment of this invention with reference to the drawings.

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Figure 1 shows the configuration of the circuit in a timing device in which this invention has been implemented. Numbers 1 through 6 in this diagram refer to components identical to those in the example of an existing timer. They have been given the same numbers, and their explanation has been omitted.

0009. In Figure 1, 7 is the dummy resistor with virtually the same impedance as output relay 2. Dummy resistor 7 and output relay 2 are connected to time-limit circuit 1 in series. 8 and 9 are the switching elements connected in parallel to the aforesaid output relay 2 and dummy resistor 7, respectively. These switching elements are operated by the switching on or off of output switching element 5 in such a way that when one goes on, the other goes off.

0010. In a timing device with the configuration described above, timing is begun when switch 4 is thrown. In the process of timing, current I, which supplied by DC power supply 3, flows into switching element 8 and dummy resistor 7, as shown by the dotted arrow, and the specified power is supplied to time-limit circuit 1. When the specified time has elapsed, the aforesaid time-limit circuit determines that the time is up, and its output causes switching element 5 to go on. When element 5 switches on, the aforesaid switching element 8 goes off, and switching element 9 goes on. Current I from DC power supply 3 flows into output relay 2 and switching element 9, as shown by the solid arrow, and the specified power is supplied to time-limit circuit 1.

0011. The impedance R_2 of the aforesaid output relay 2 and R_1 of dummy resistor 7 are virtually identical, so the current does not vary either during timing or when timing has been completed. A virtually constant current is made

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to flow, and stable power can be supplied to time-limit circuit 1.

0012. Effects of the Invention

As has been discussed above, this invention entails
5 connecting the output relay and the time-limit circuit in
series so that the current which goes into the output
relay flows unchanged into the time-limit circuit. This
being the case, less current is required of the power
supply, and a lower-capacity power supply can be used.
10 Furthermore, there is virtually no fluctuation of current
either during timing or when timing has been completed,
so a constant current is made to flow regardless of whe-
ther the output relay is on or off. Current fluctuation
is minimized throughout the circuit, stable power can be
15 supplied to the time-limit circuit, and malfunctions can
effectively be prevented.



A Brief Explanation of the Drawings (Embodiment No.1)

Figure 1.

Figure 1 is an exploded oblique view of an embodiment of this invention.

5 Figure 2.

Figure 2 shows a frontal view and a partial side view of the timer body.

Figure 3.

10 Figure 3 shows a frontal view and a cross section of a side view of the cover.

Figure 4.

Figure 4 shows a frontal view, a cross sectional side view and a rear view of the setting ring.

Figure 5.

15 Figure 5 shows a front view and a partial side view of the timer with cover and setting ring mounted on it.

Figure 6.

Figure 6 is an oblique view of an existing timer.

Figure 7.

20 Figure 7 shows the setting ring of an existing timer.

A Brief Explanation of the Drawings (Embodiment NO.2)

Figure 1.

25 Figure 1 is an exploded oblique view of an embodiment of this invention.

Figure 2.

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Figure 2 shows a frontal view and a partial side view of the body of the timer.

Figure 3.

Figure 3 shows front and rear views of one of the
5 setting rings.

Figure 4.

Figure 4 shows a front view of the other setting ring.

Figure 5.

10 Figure 5 shows a frontal view and a partial side view of the timer body with the two setting rings mounted on it.

Figure 6.

15 Figure 6 is an exploded oblique view of another embodiment of this invention.

Figure 7.

Figure 7 shows a frontal view and a cross section of the side of the cover pictured in Figure 6.

Figure 8.

20 Figure 8 shows a frontal view and a partial side view of the timer body with the two setting rings mounted on it.

A Brief Explanation of the Drawings (Embodiment N0.3)

Figure 1.

25 Figure 1 shows the configuration of the circuit in a timing device in which this invention has been implemented.

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Figure 2.

Figure 2 shows the configuration of the circuit in an existing timing device.

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claims:

Paragraph 1. A dial-type timer distinguished by the fact that it has: A dial for setting the operating time on its face;

5 A cover with an opening in it corresponding to the aforesaid dial which can be mounted on the face of the aforesaid timer;

A setting ring mounted on the outer periphery of the aforesaid dial, which projects through the aforesaid
10 opening when the said cover is mounted on the face of the timer;

And a pawl on the aforesaid cover which engages with the grooves on the outer periphery of the aforesaid setting ring mounted on the outer edge of the aforesaid dial
15 and so determines the position in which the aforesaid setting ring is to be set.

Paragraph 2. A dial-type timer which is distinguished by the fact that it consists of: the timer itself, which has a dial on its front to set the operating
20 time;

Two setting rings mounted on the perimeter of the aforesaid dial in such a way that they rotate as a single piece with that dial;

A molded tooth formed on the perimeter of each of
25 the aforesaid setting rings and facing outward;

And a stop on the body of the timer which comes in contact with the aforesaid teeth on the setting rings mounted on the dial so as to limit the range of rotation of that dial.

30 Paragraph 3. A dial-type timer which is distinguished by the fact that consists of: the timer itself, which has a dial on its front to set the operating time;



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A cover which can be mounted on the front of the aforesaid timer body, with an opening for the aforesaid dial;

Two setting rings, which are mounted on the perimeter of the aforesaid dial in such a way that they rotate as a single piece with that dial, which protrudes from the front of the timer through the aforesaid opening in the cover when that cover is mounted on the front of the timer;

A molded tooth formed on the perimeter of each of the aforesaid setting rings;

And a stop on the aforesaid cover which comes in contact with the aforesaid teeth on the setting rings mounted on the dial so as to limit the range of rotation of that dial.

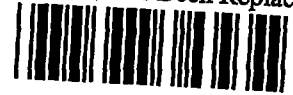
Paragraph 4. A timing device distinguished by the fact that it has: a time-limit circuit to measure the time; an output switching element which goes on or off according to the output from the time-limit circuit; an output relay which operates when the output switching element goes on or off; and a dummy resistor which has virtually the same impedance as the output relay. The output relay and the time-limit circuit are connected in series; the said output relay and the dummy resistor are each connected to their own switching elements, which go on and off in complementary fashion at corresponding times. These switching elements are operated by the aforesaid output switching element's going on or off.



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summary

Embodiment No.1

Objective: Our objective was to improve the ease of operation of the dial on a dial-type timer on which a setting ring can be used, when that setting ring is not used.

Construction: The locking pawl which fixes the set position of the setting ring is not on the timer itself, but rather on a cover which can be mounted on that timer.

10 Result: The cover with the locking pawl on it is removed from the timer when the setting ring is not being used. This prevents the locking pawl from interfering with the operation of the dial.

Embodiment No.2

15 Objective: To make it impossible to change the settings on a dial-type timer except in a fixed range.

Construction: Two setting rings are mounted on the perimeter of the dial in such a way that they rotate as a single entity with the said dial. Each of the rings has a single molded tooth on its outer edge. A stop protrudes from the body of the timer which is contacted by the aforementioned teeth on the setting rings mounted on the dial. When the teeth come in contact with the stop, the range of rotation of the said dial is constrained.

25 Effects: Two setting rings are set in positions which indicate the upper and lower limits of a dial's rotation. When these rings are mounted on the perimeter of the said dial, the settings achieved by the dial can be changed

only within the range between the said upper and lower limits.

Embodiment No.3

Objective: To make it possible for a timing device to
5 use a small-capacity power supply, to prevent the current from varying either during timing or when timing is completed, and to make it possible to supply stable power to the time-limit circuit.

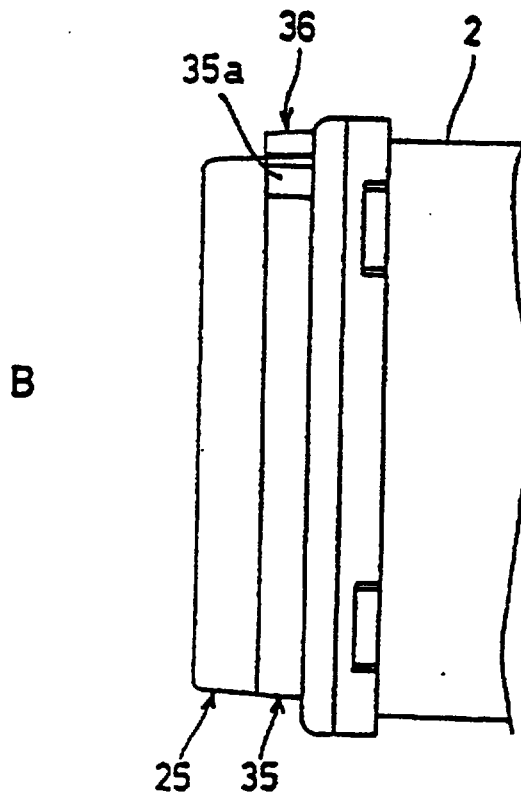
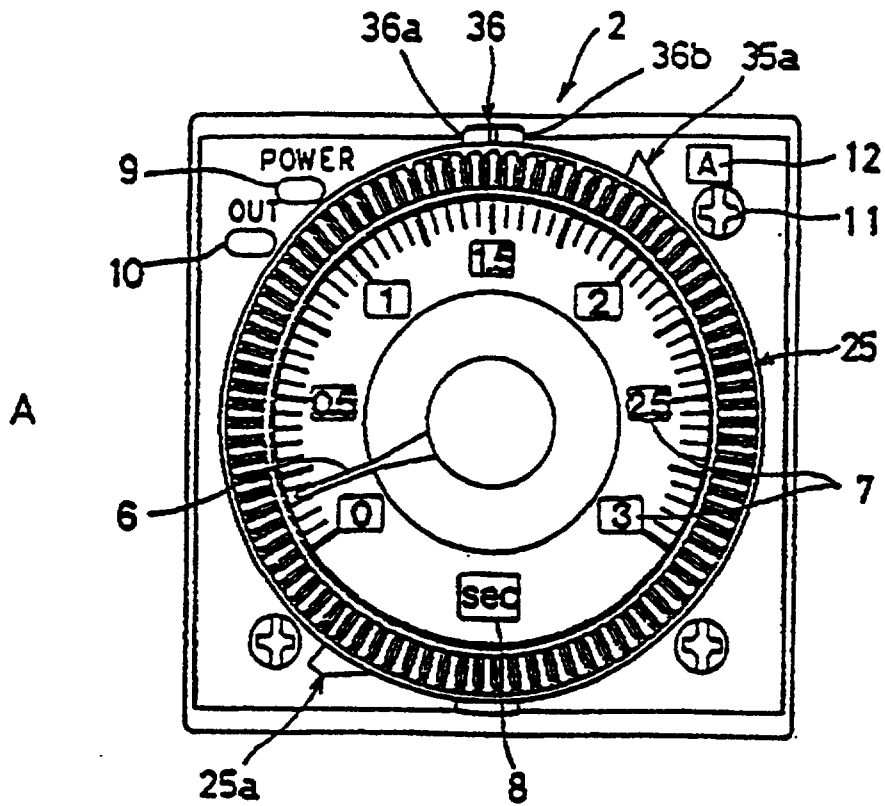
Construction: This timing device is constructed as follows.
10 Time-limit circuit 1 and output relay 2 are connected in series. Output relay 2 and dummy resistor 7, which has virtually the same impedance as relay 2, are connected to this series circuit. Switching elements 8 and 9, which go on and off in opposite sense at a given
15 time, are connected in parallel to dummy resistor 7 and output relay 2, respectively. These switching elements are made to switch on or off by the change of state of output switching element 5.

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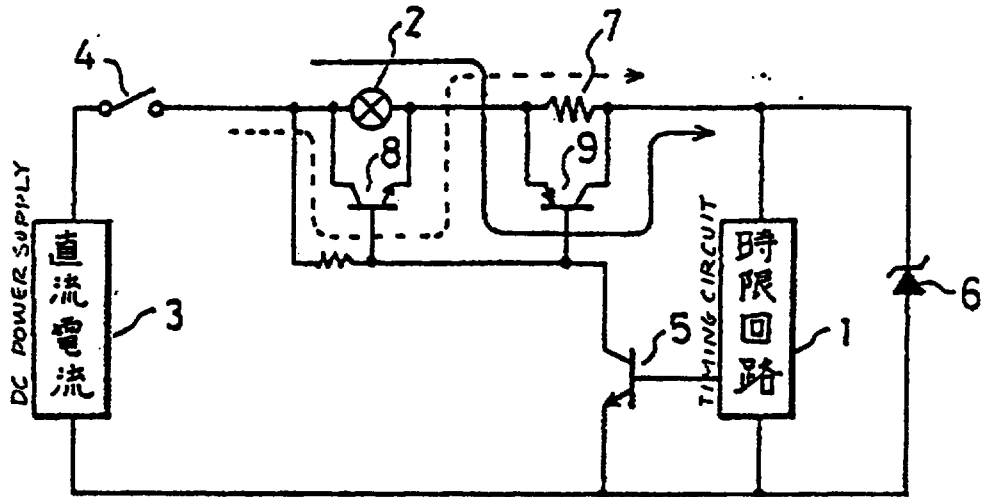
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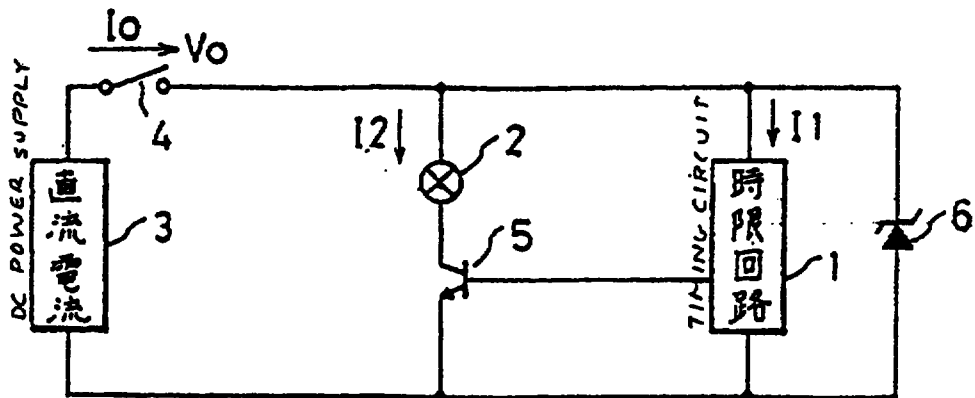
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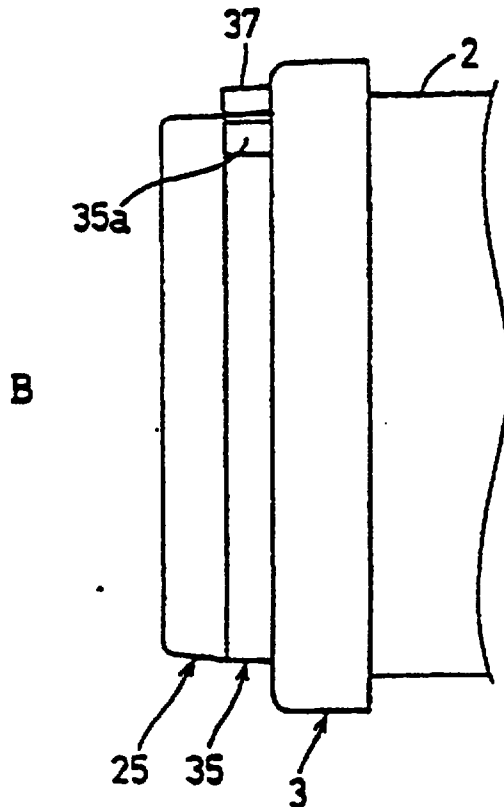
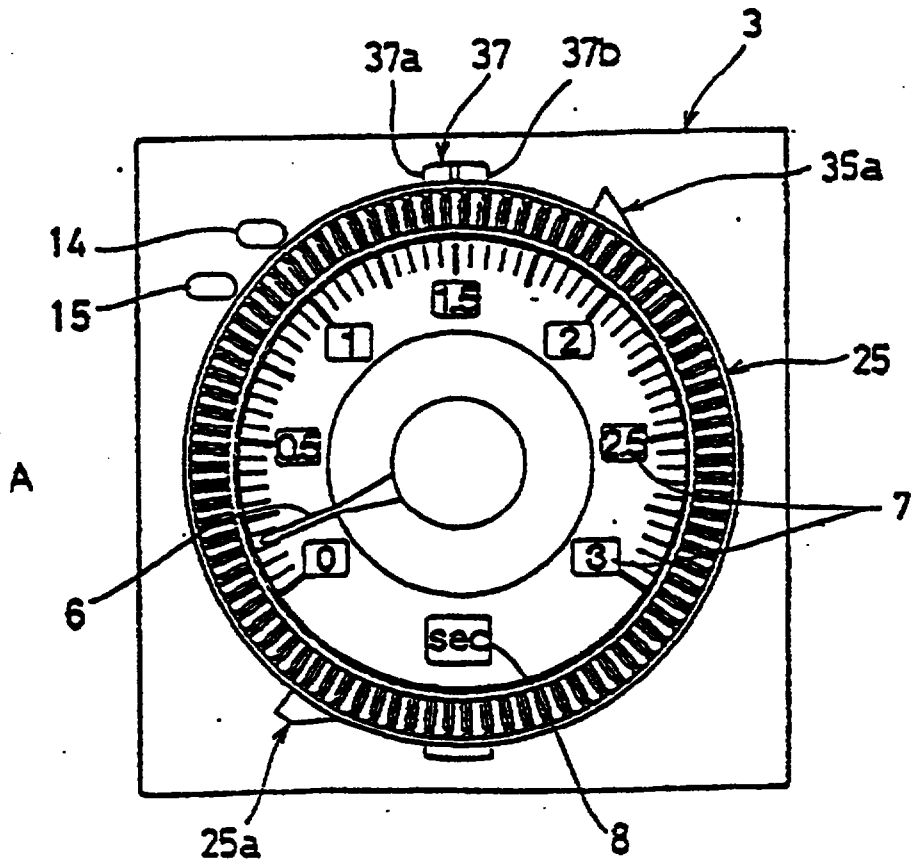


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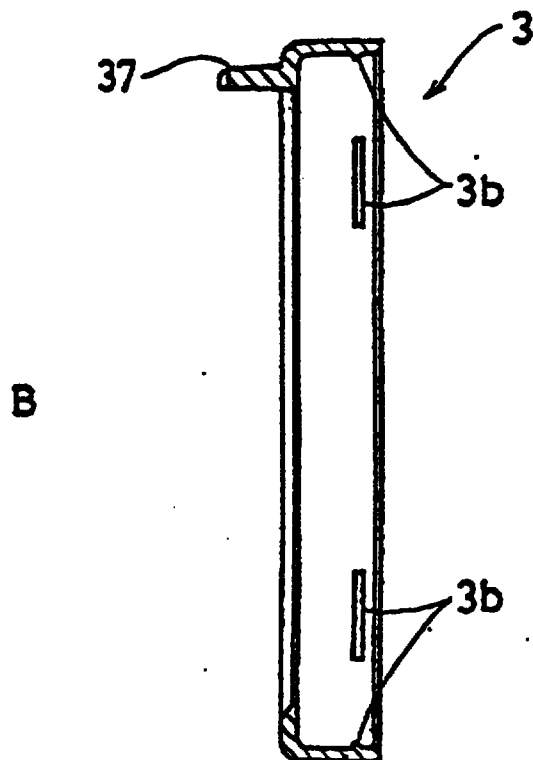
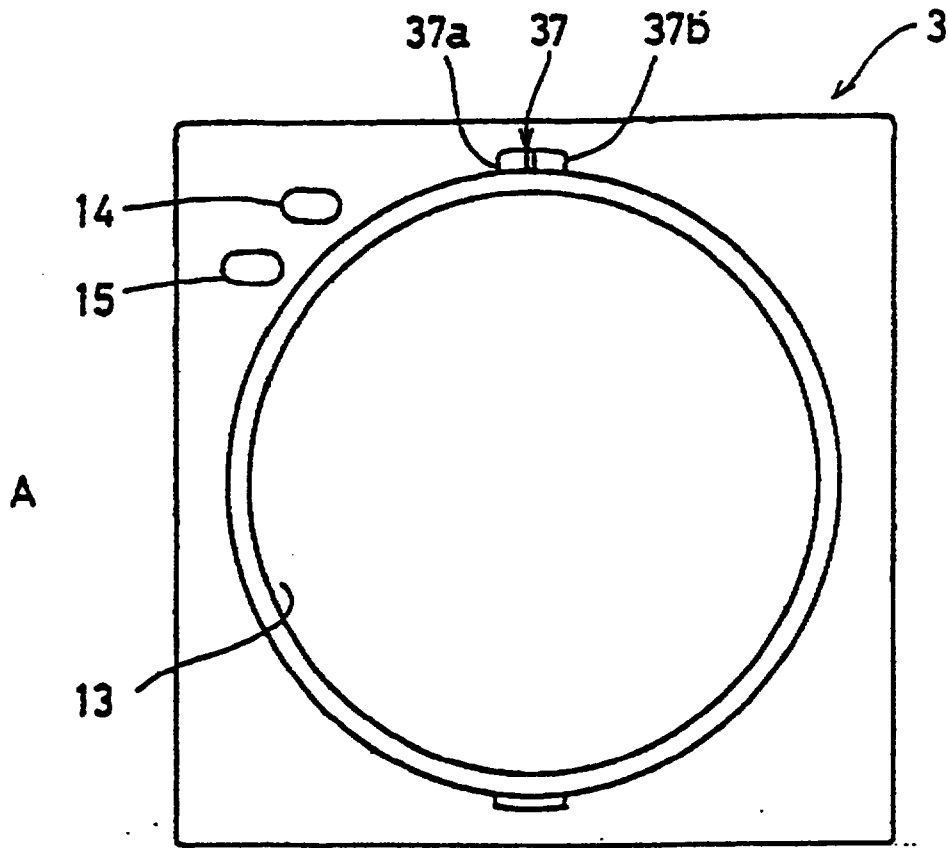


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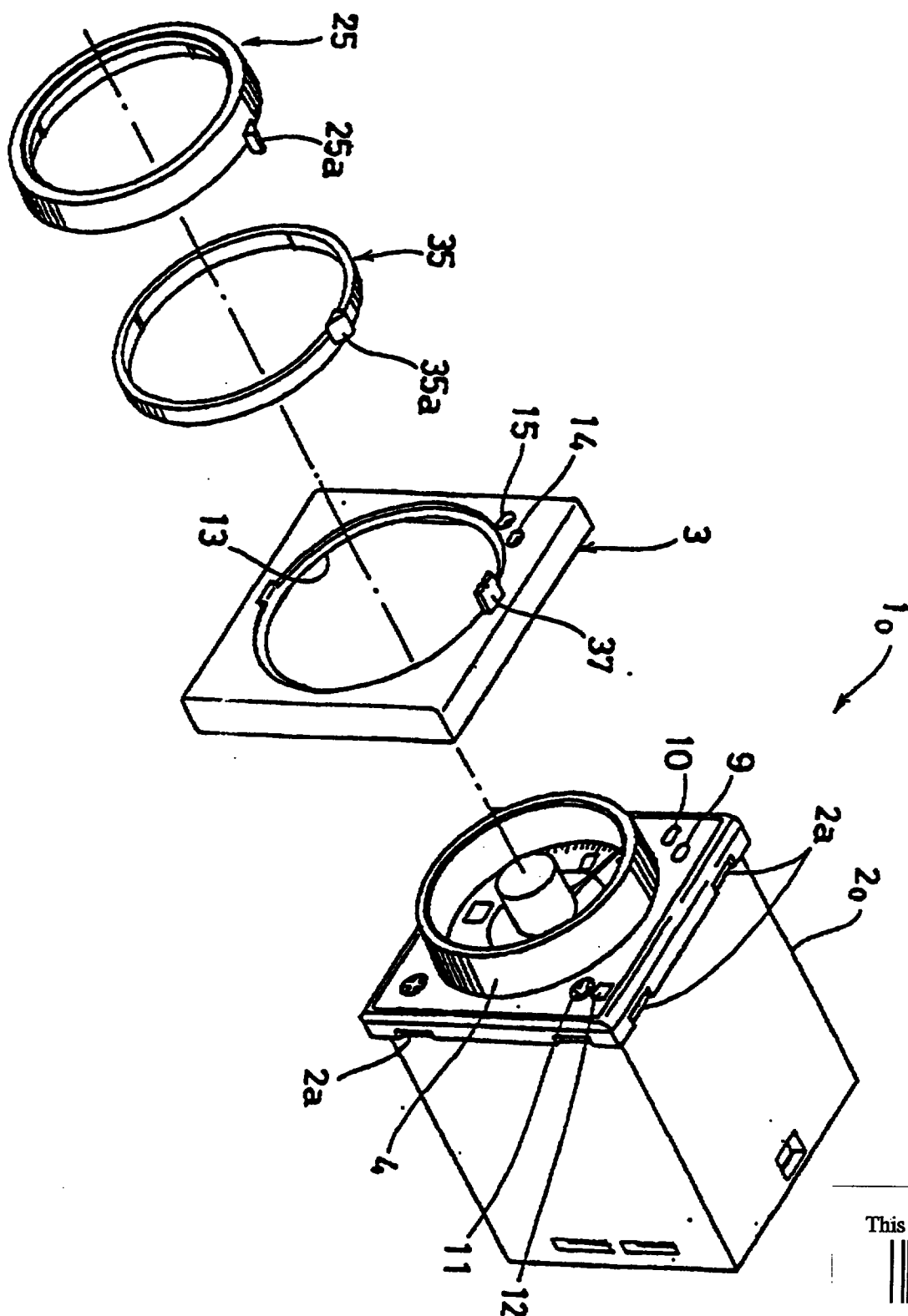


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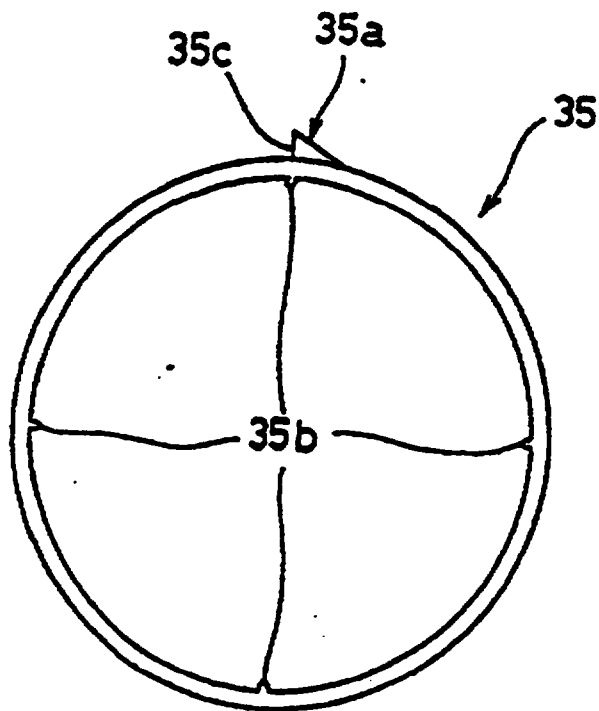


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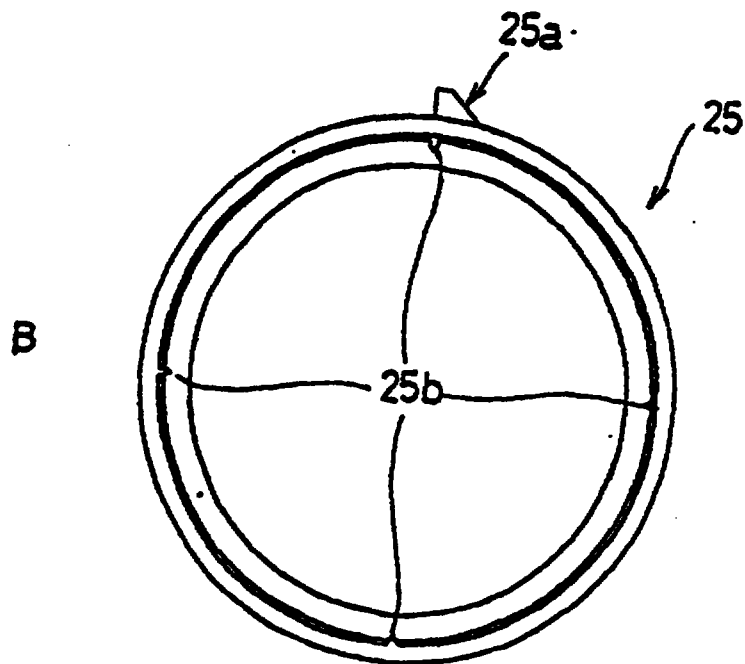
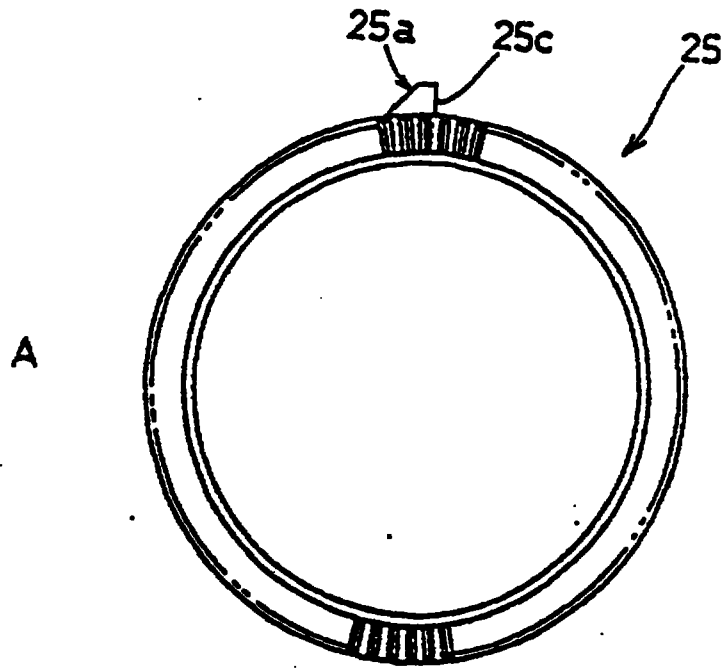


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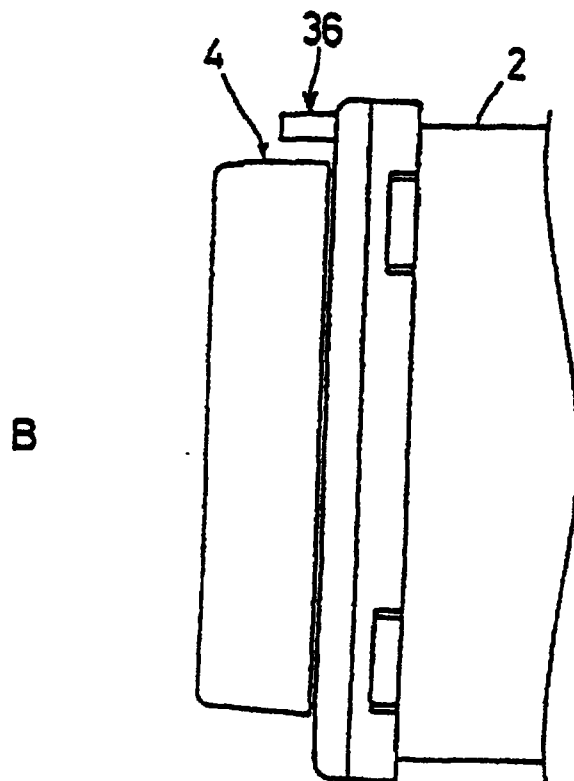
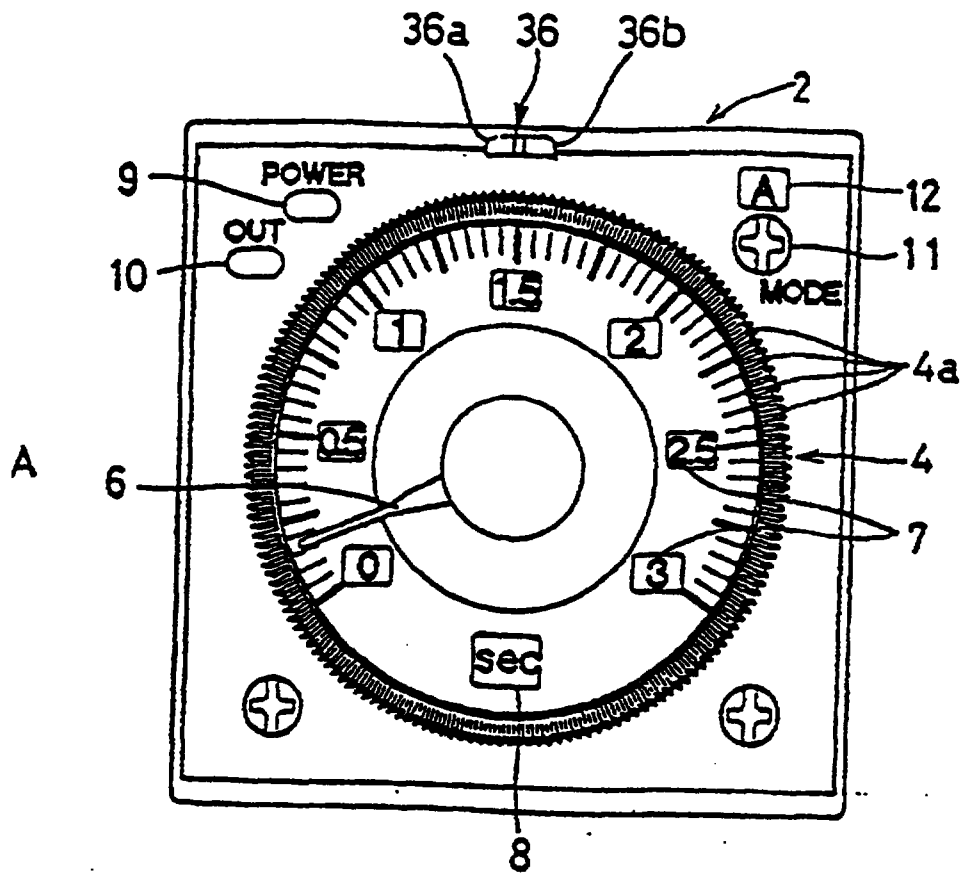


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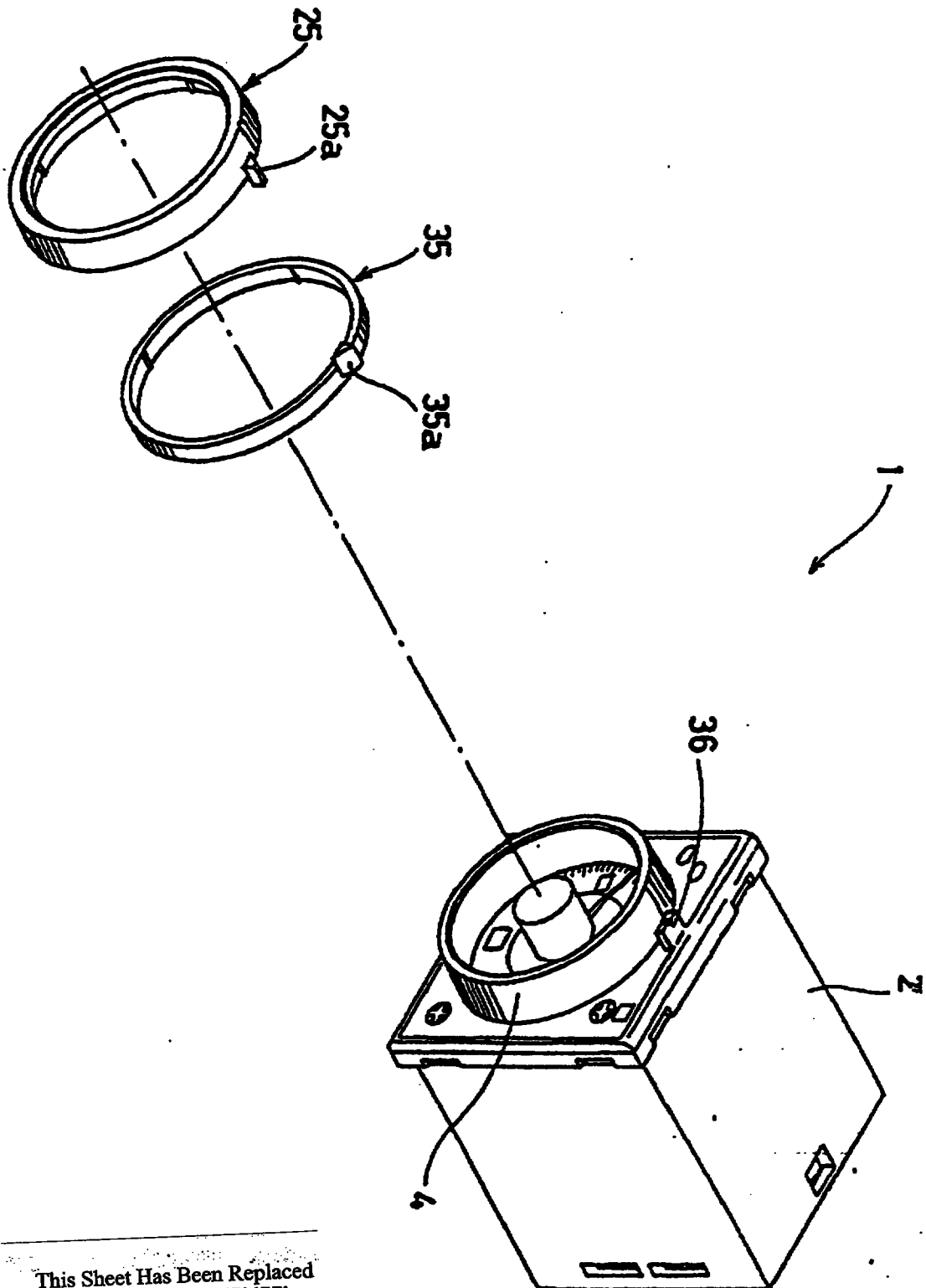


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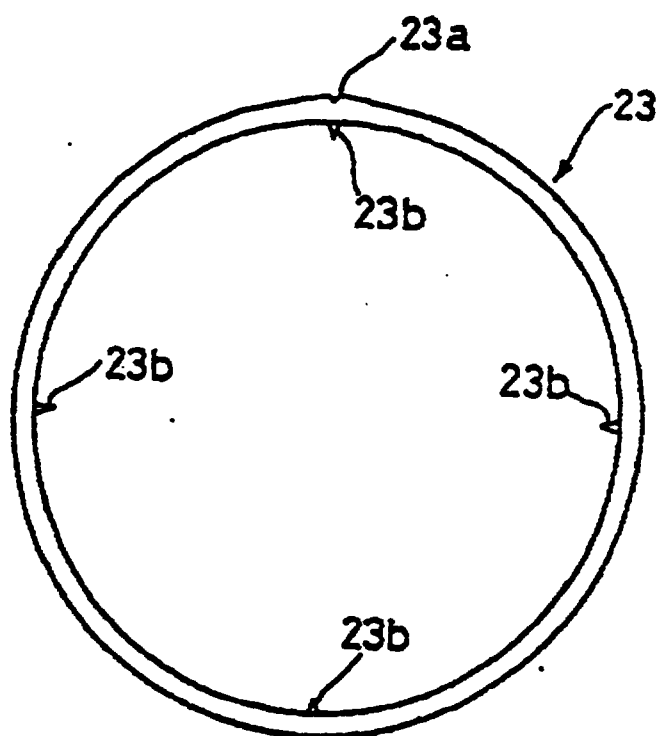


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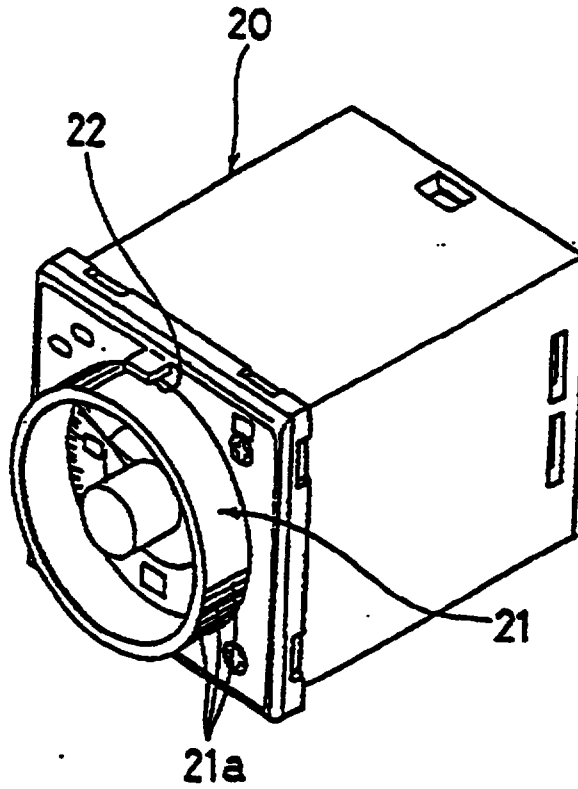


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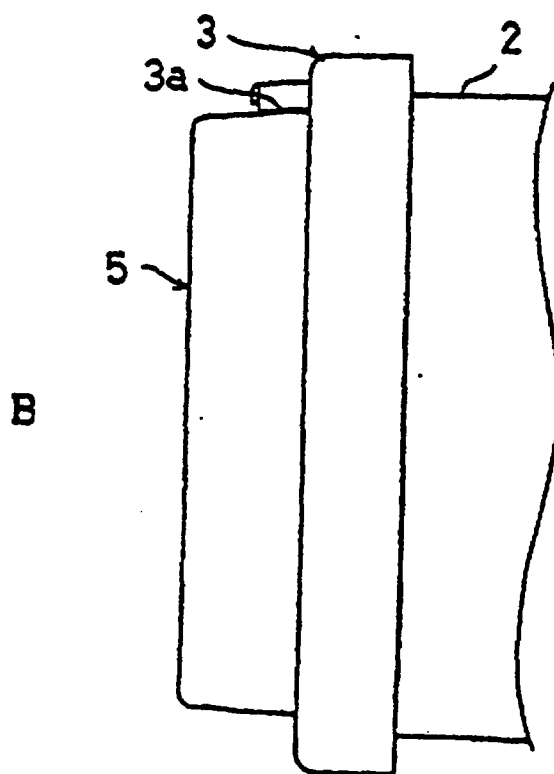
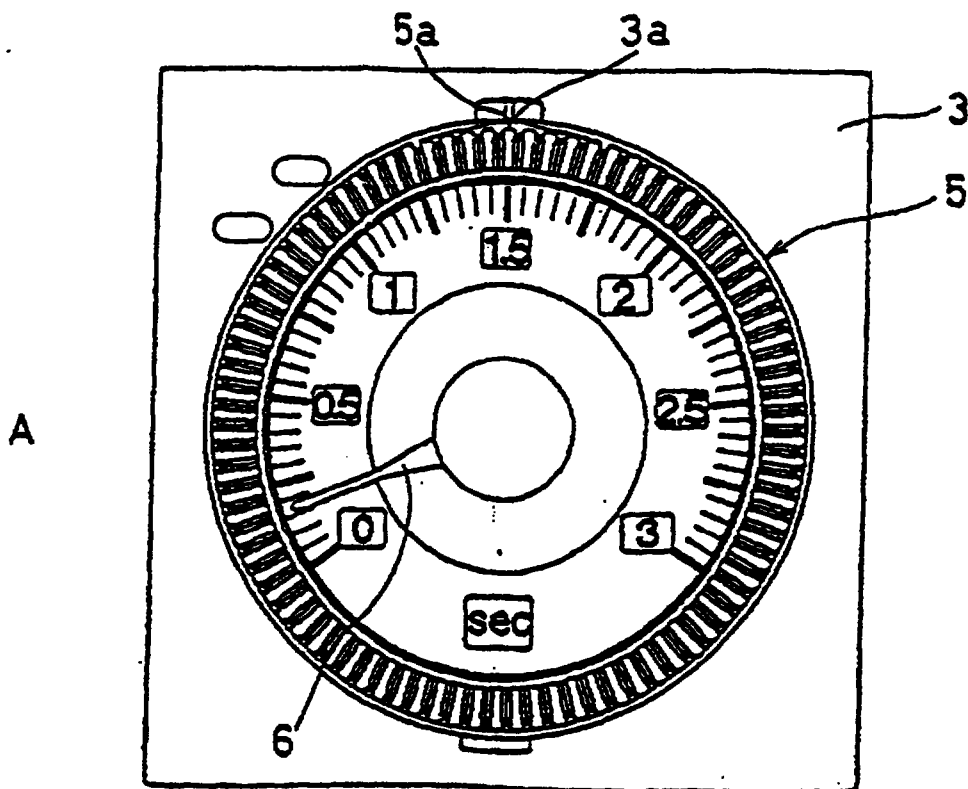


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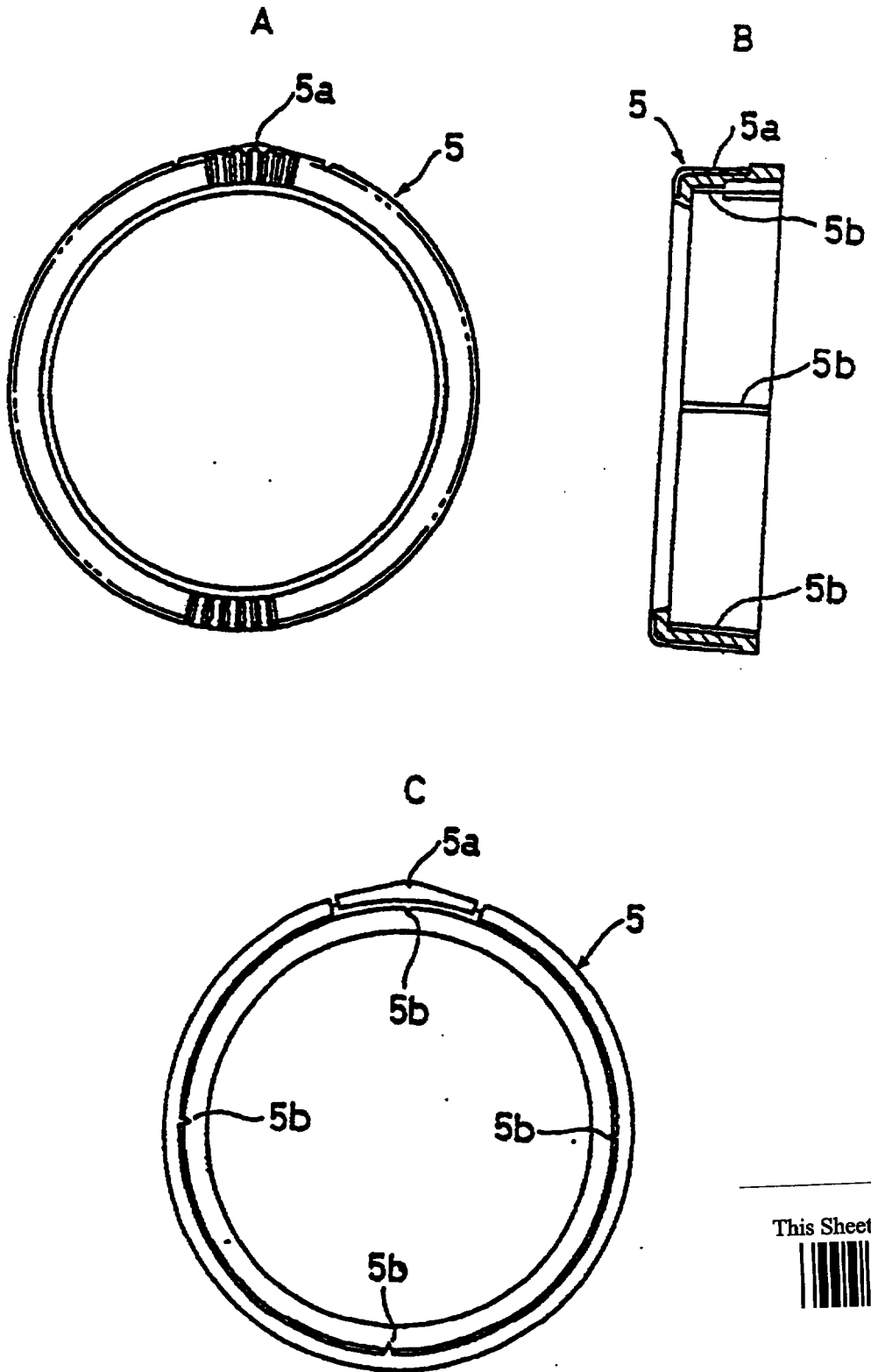


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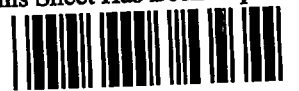


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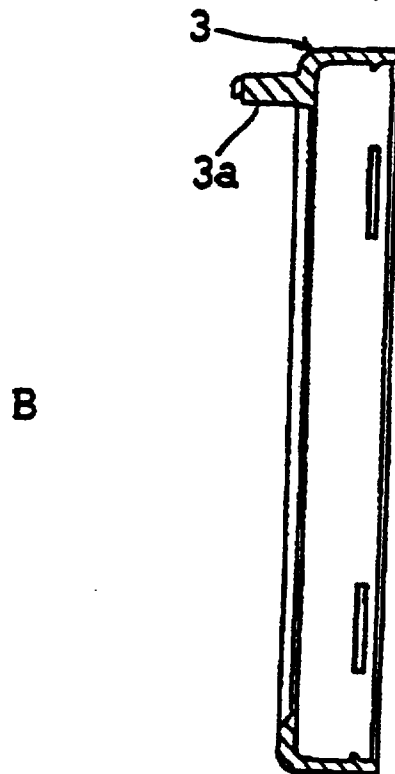
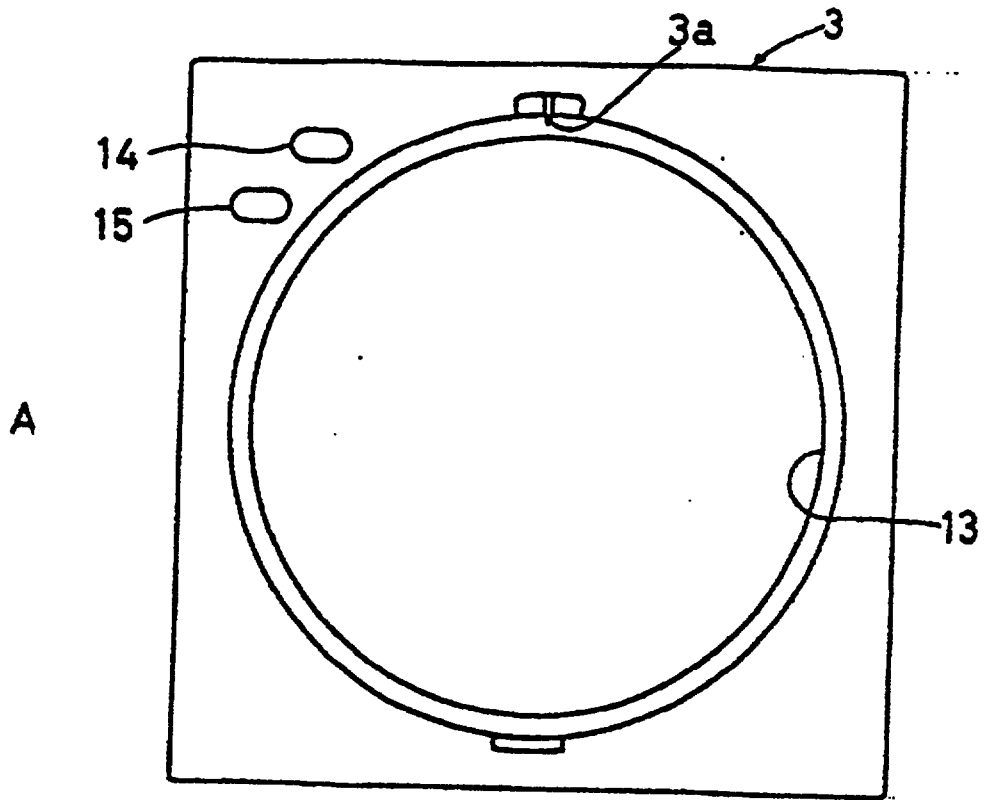


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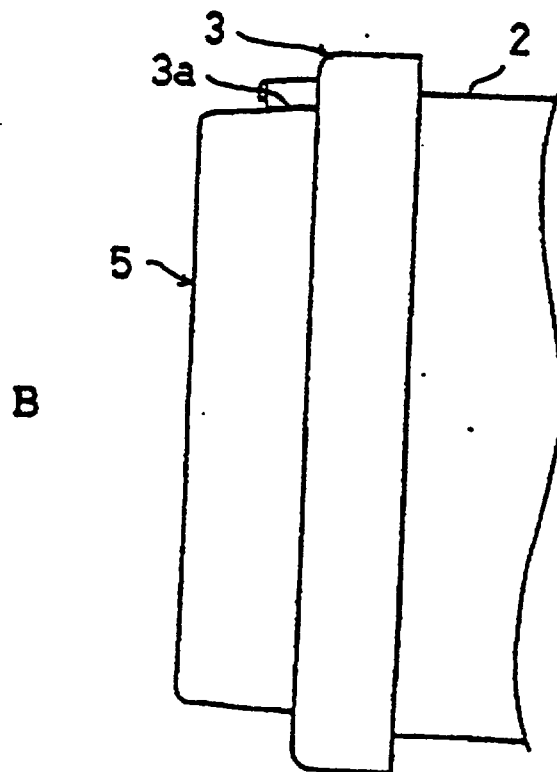
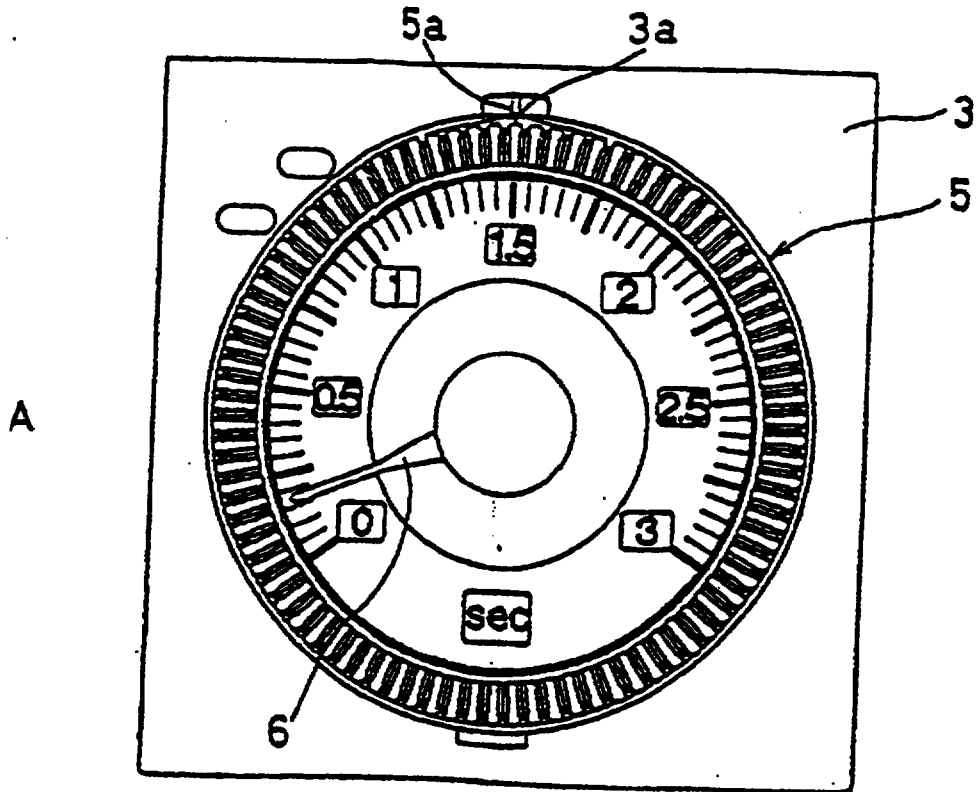


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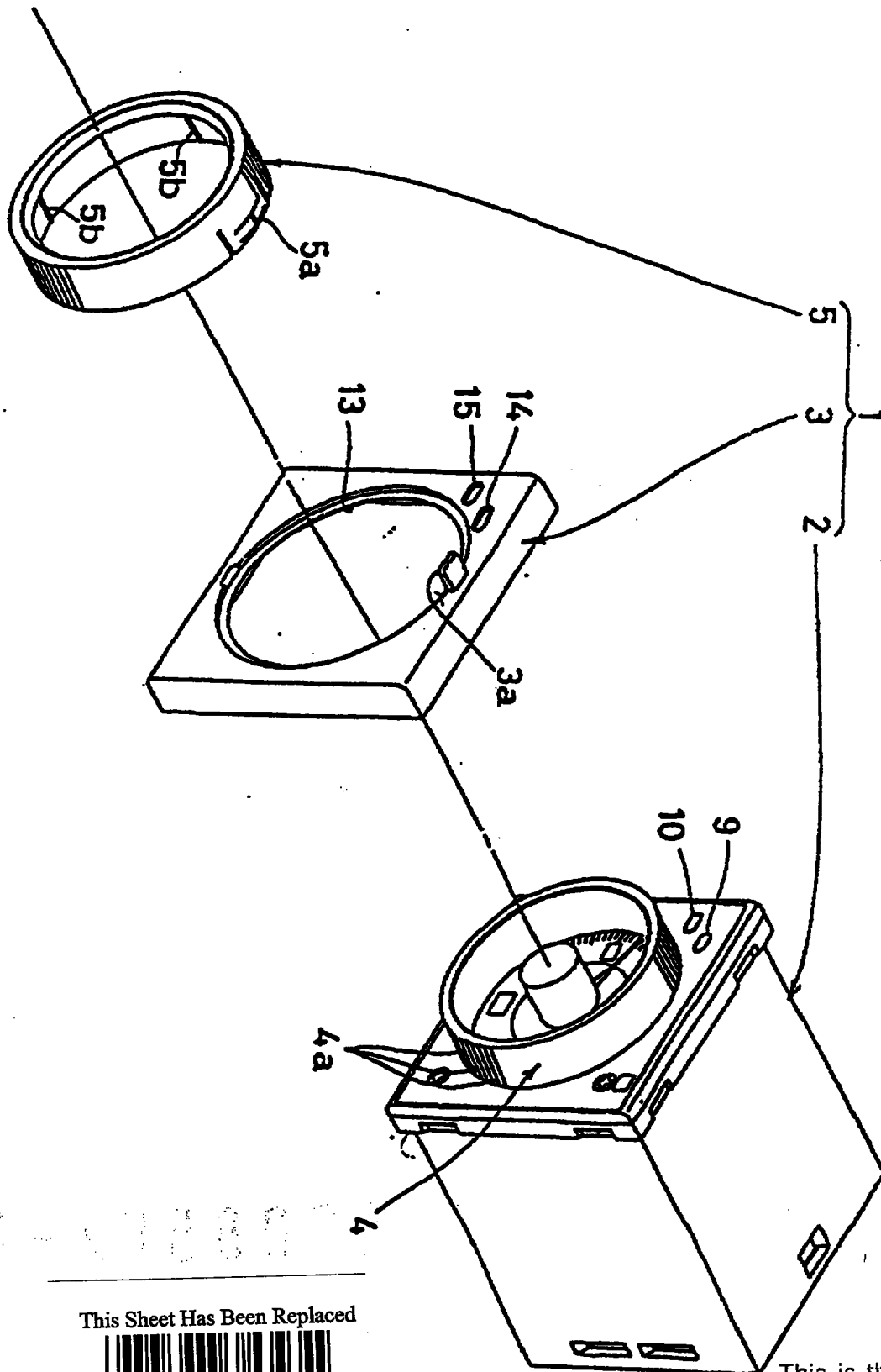


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ABSTRACT

DIAL-TYPE TIMER DEVICE

REPLACEMENT SHEETS		SG
☐ Description :	paged	to paged
☐ Claim(s) :	paged	to paged
☒ Drawing(s) :	paged <u>1/1</u>	to paged <u>1/1</u>
☒ Abstract :	paged <u>25</u>	to paged <u>25</u>
DATE OF RECEIPT		<u>6/5/97</u>

Summary

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Embodiment No.1

Objective: Our objective was improve the ease of operation of the dial on a dial-type timer on which a setting ring can be used, When that setting ring is not used.

Construction: The locking pawl which fixes the set position of the setting ring is not on the timer itself, but rather on a cover which can be mounted on that timer.

Result: The cover with the locking pawl on it is removed from the timer when the setting ring is not being used. This prevents the locking pawl from interfering with the operation of the dial.

Embodiment No.2

Objective : To make it impossible to change the settings on a dial-type timer except in a fixed range.

Construction: Two setting rings are mounted on the perimeter of the dial in such a way that they rotate as a single entity with the said dial. Each of the rings has a single molded tooth on its outer edge. A stop protrudes from the body of the timer which is contacted by the a-forementioned teeth on the setting rings mounted on the dial. When the teeth come in contact with the stop, the range of rotation of the said dial is constrained.

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☐ Description :	paged	to paged
☐ Claim(s) :	paged	to paged
☒ Drawing(s) :	paged <u>1/1</u>	to paged <u>1/1</u>
☒ Abstract :	paged <u>22</u>	to paged <u>22</u>
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ABSTRACT

DIAL-TYPE TIMER DEVICE

Effects: Two setting rings are set in positons which indicate the upper and lower limits of a dial's rotation. When these rings are mounted on the perimeter of the said dial, the settings achieved by the dial can be changed only within the range between the said upper and lower limits.

Embodiment No.3

Objective: To make it possible for a timing device to use a small a small capacity power supply, to prevent the current from varying either during timing or when timing is complete, and to make it possible to supply stable power to the time-limit circuit.

Construction: This timing device is constructed as follows. Time-limit circuit 1 and output relay 2 are connected in series. Output relay 2 and dummy resistor 7, which has virtually the same impedance as relay 2, are connected to this series circuit. Switching elements 8 and 9, which go on and off in opposite sense at a given time, are connected in parallel to dummy resistor 7 and output relay 2, respectively. These switching elements are made to switch on or off by the change of state of output switching element 5.

FIGURE 17.

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FIG 1A

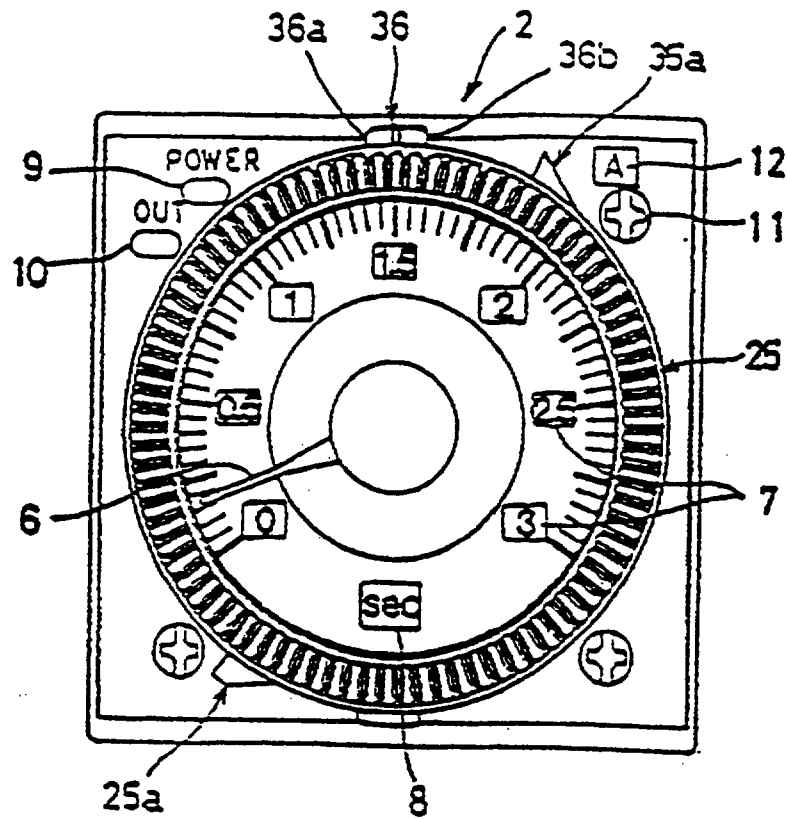
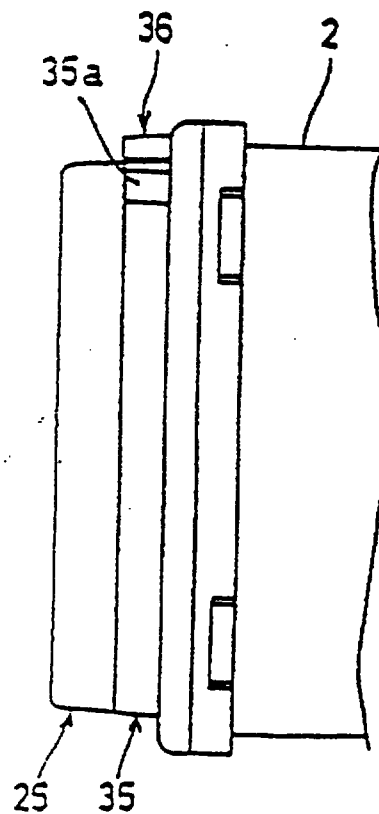


FIG 1B



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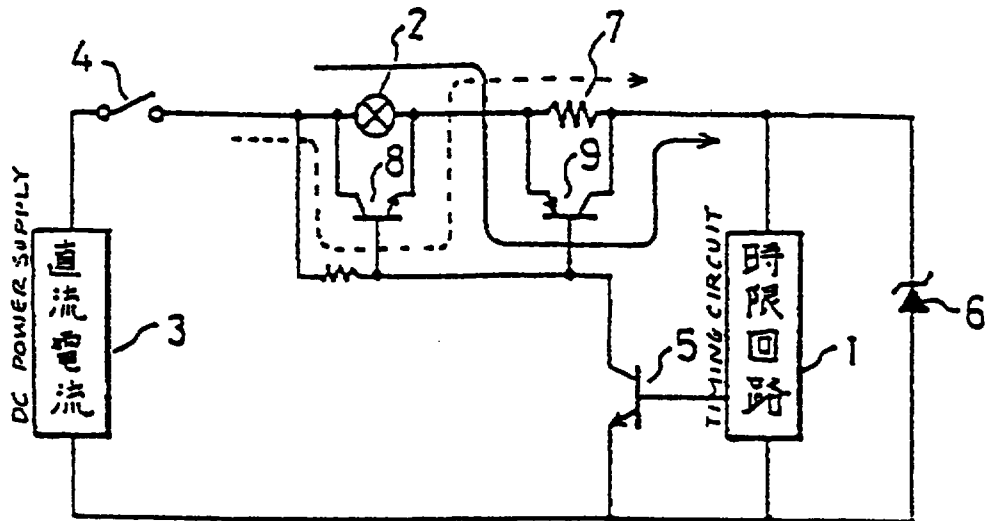


FIG 2

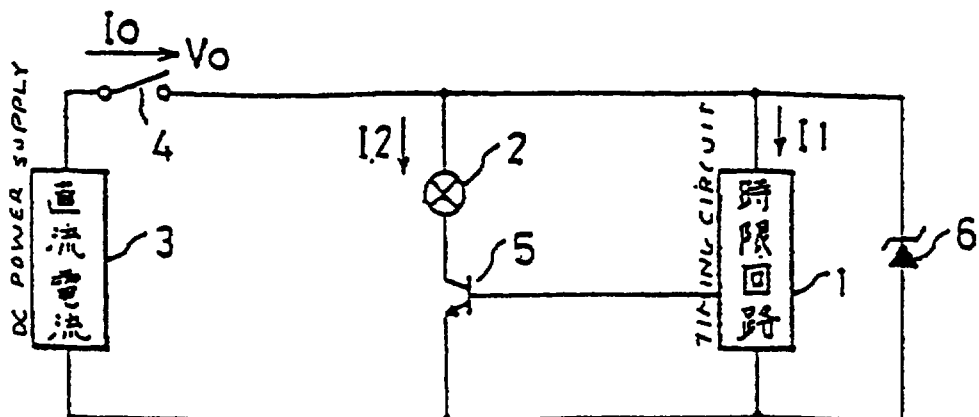


FIG 3

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FIG 4A

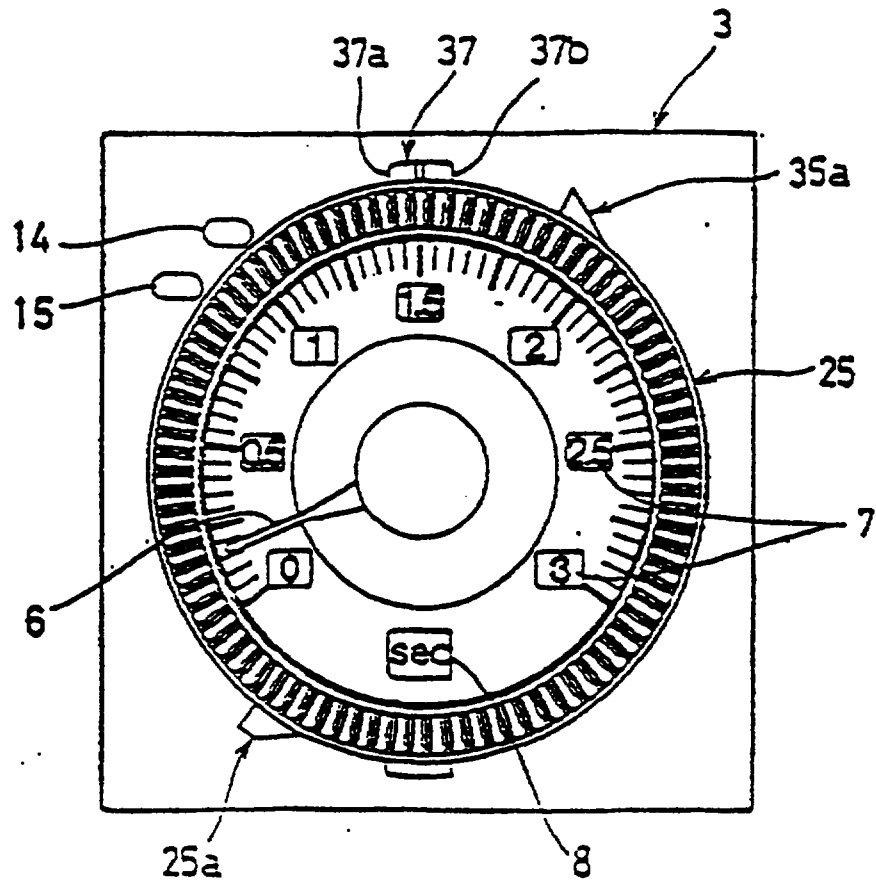
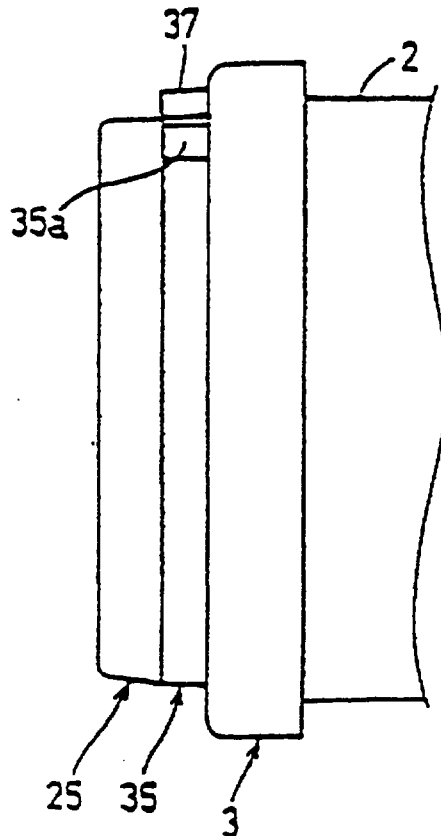


FIG 4B



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FIG 5A

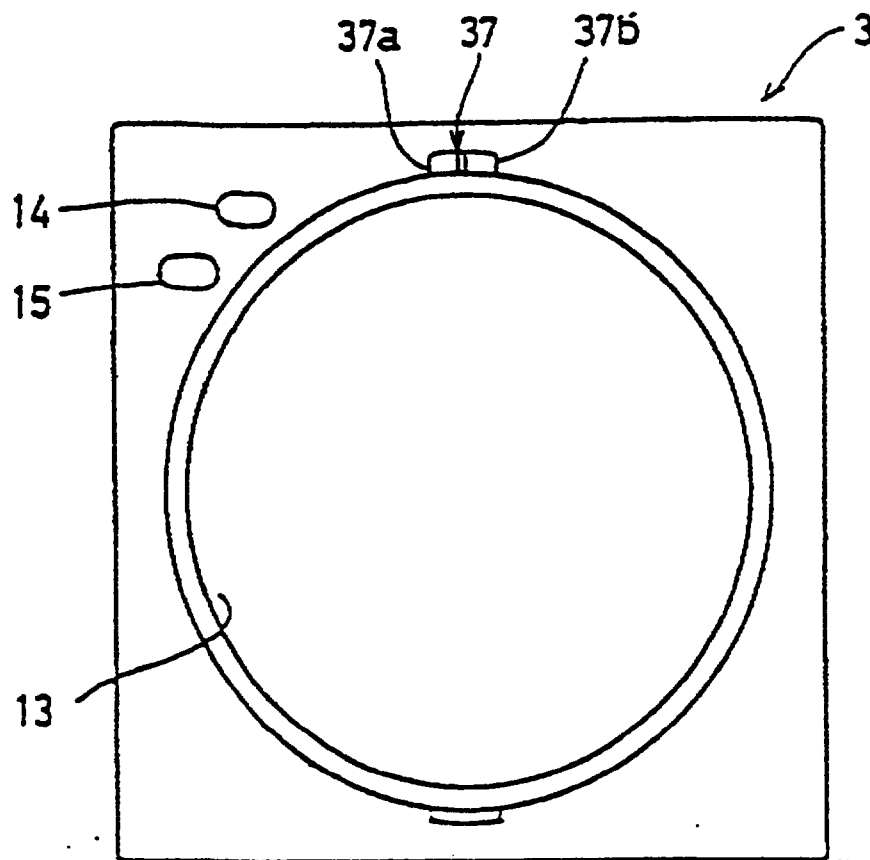
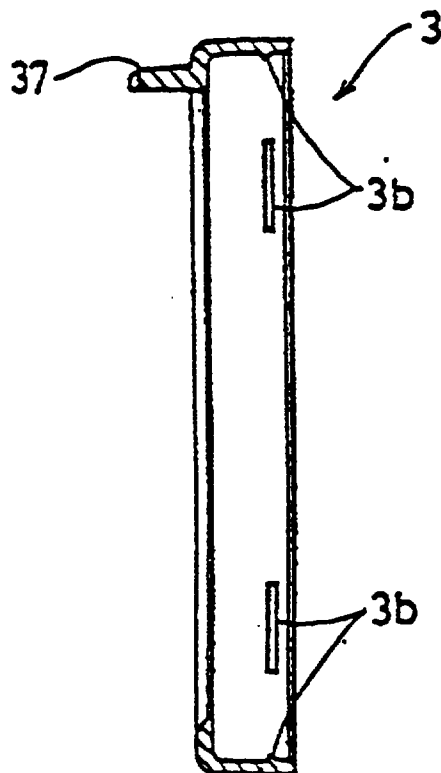


FIG 5B



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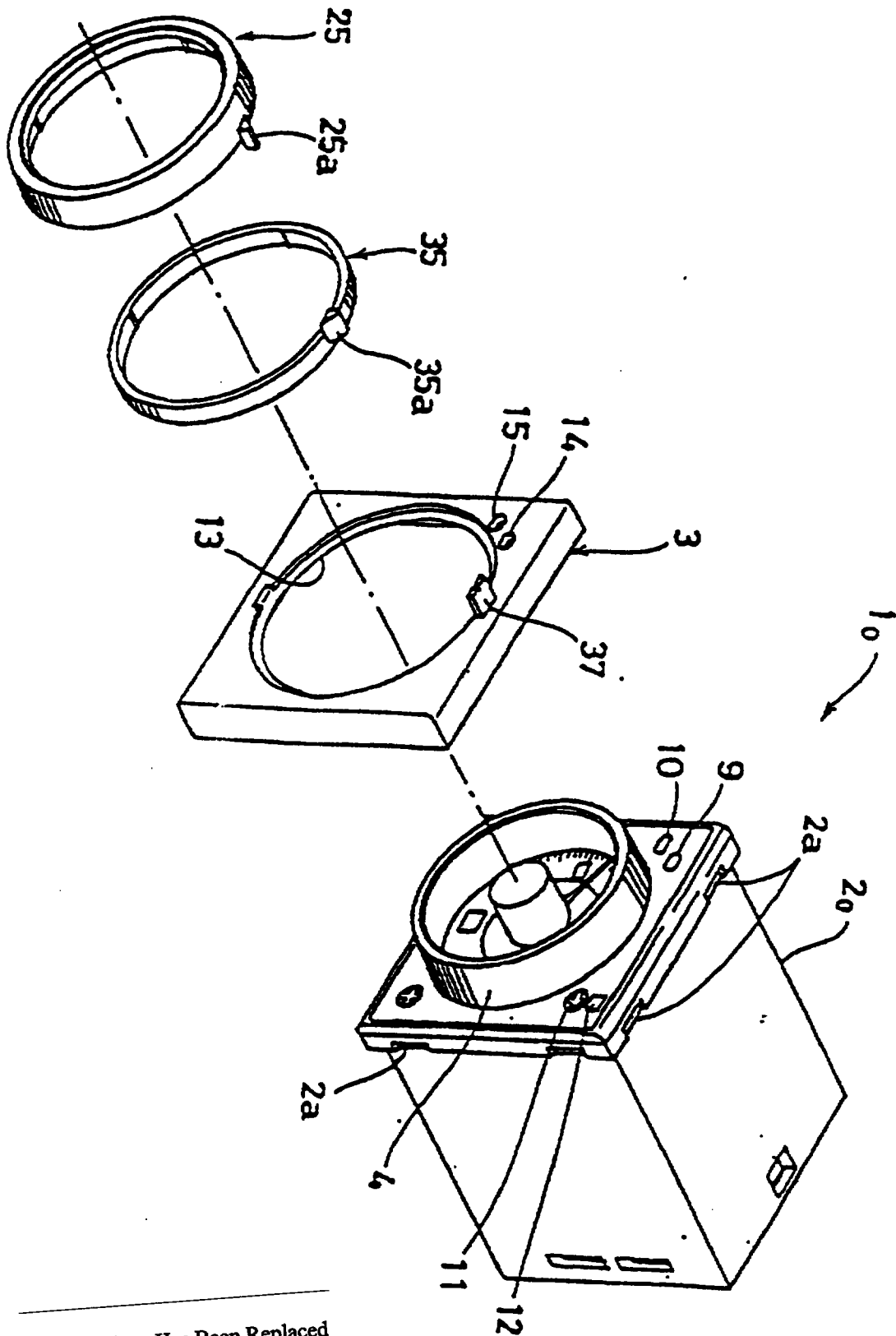


FIG 6

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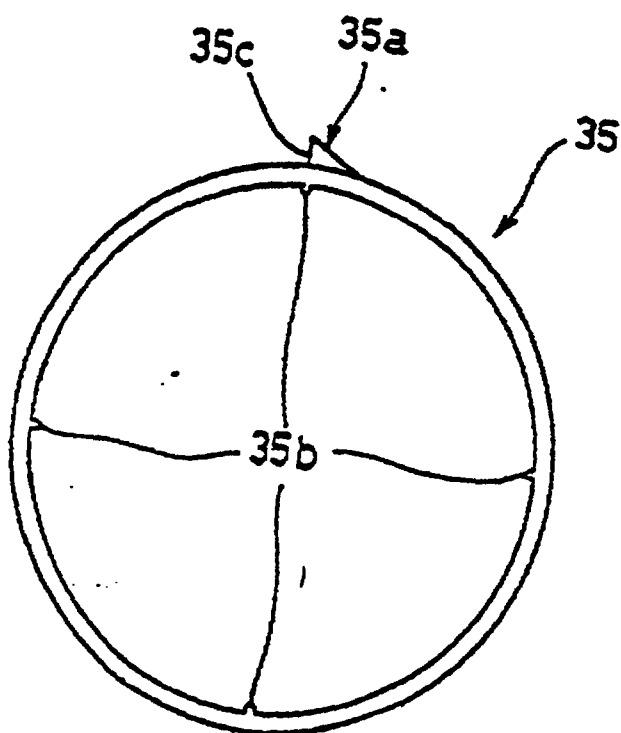


FIG 7

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FIG 8A

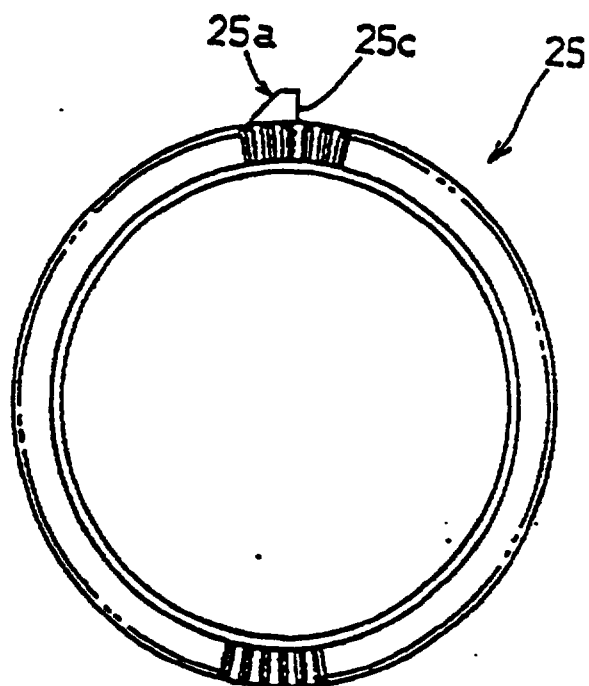
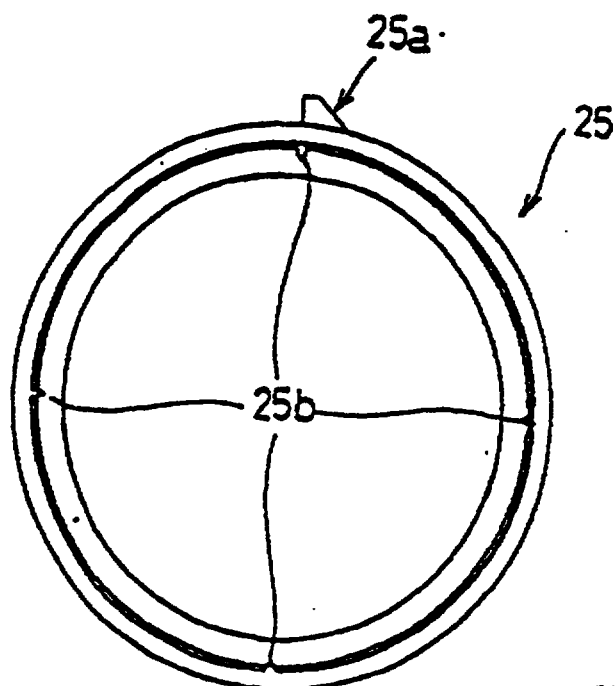


FIG 8B



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FIG 9A

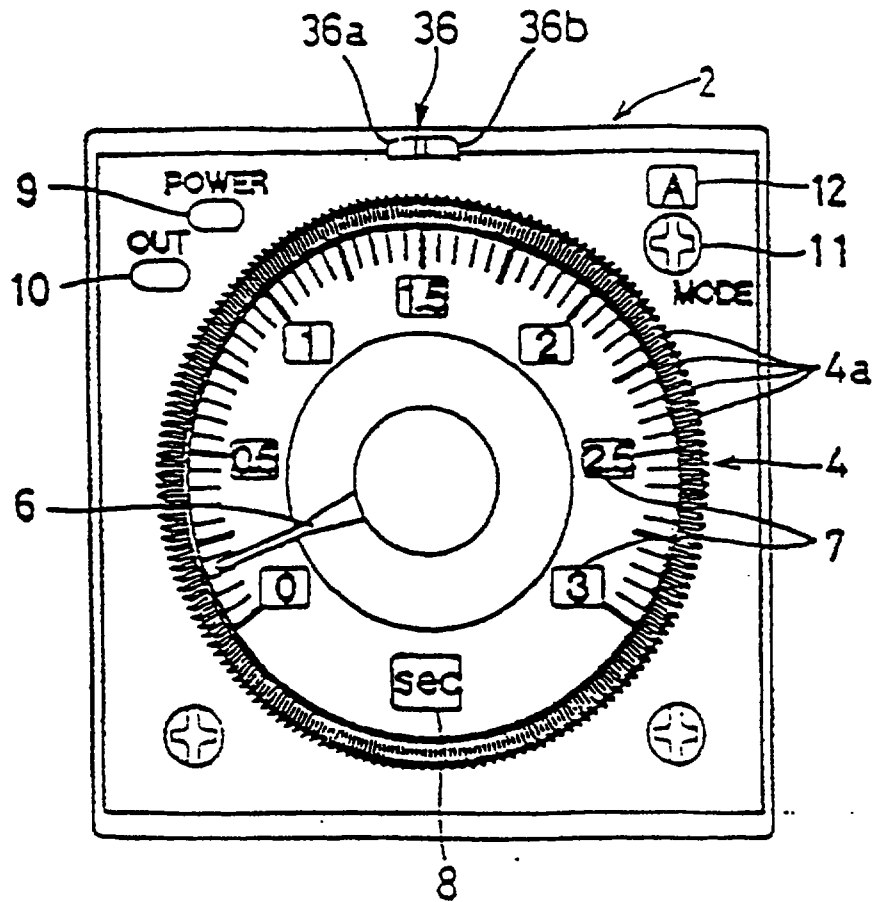
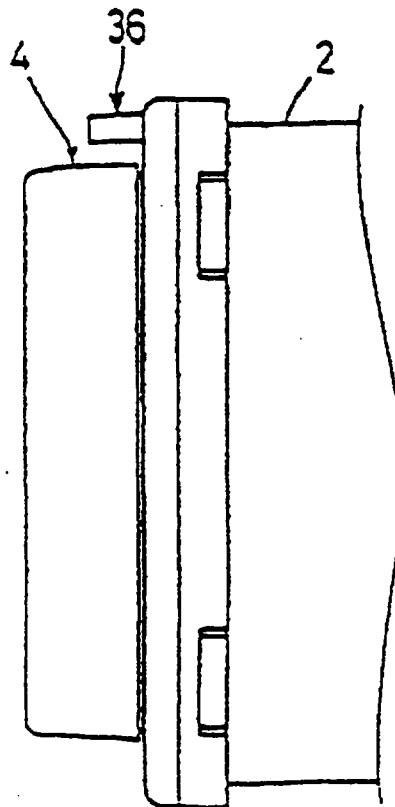


FIG 9B

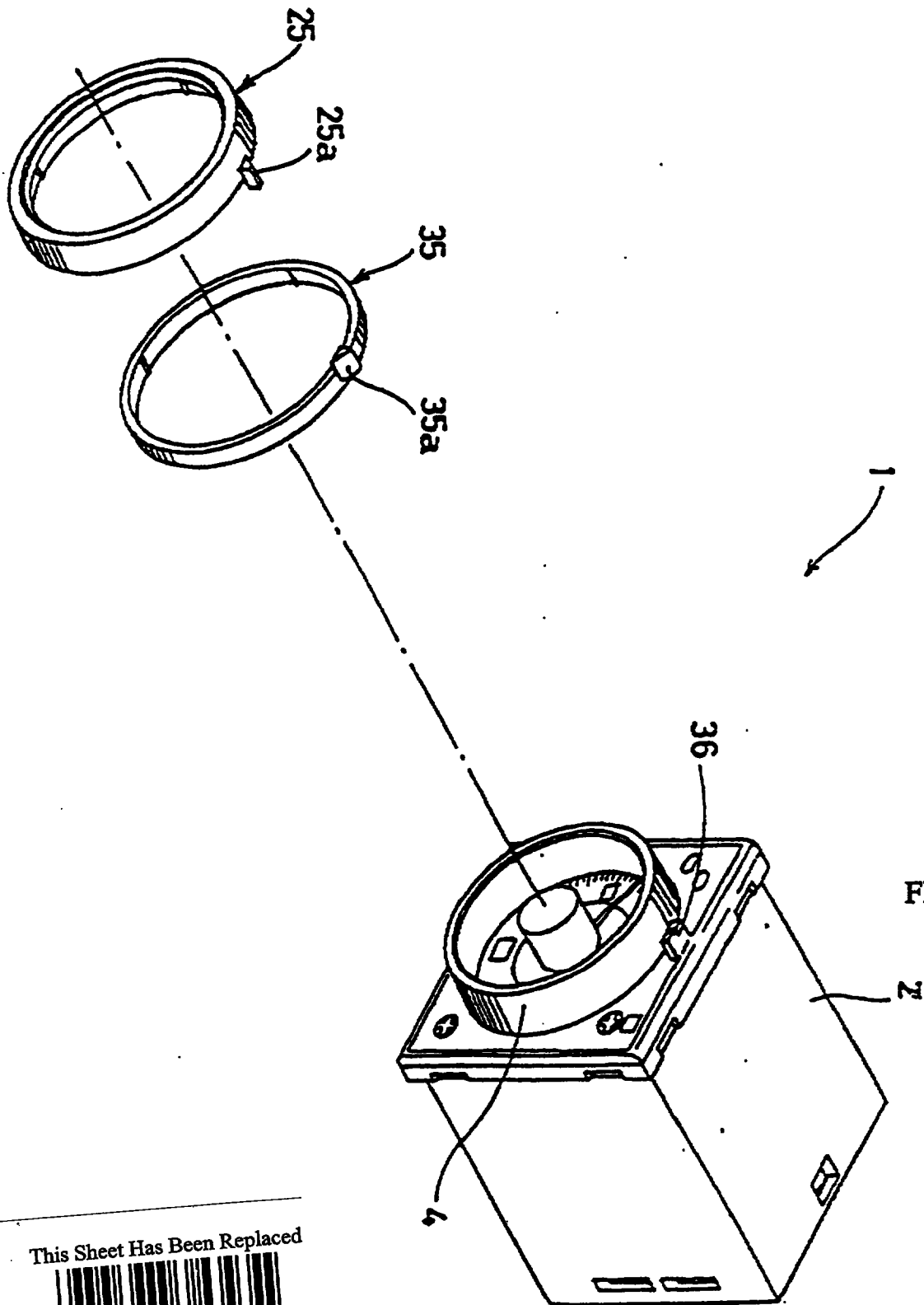


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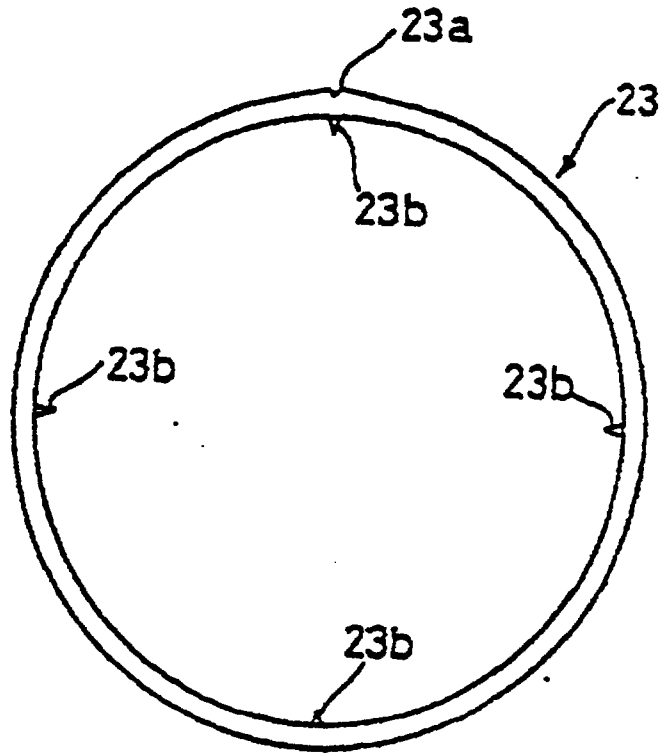


FIG 11

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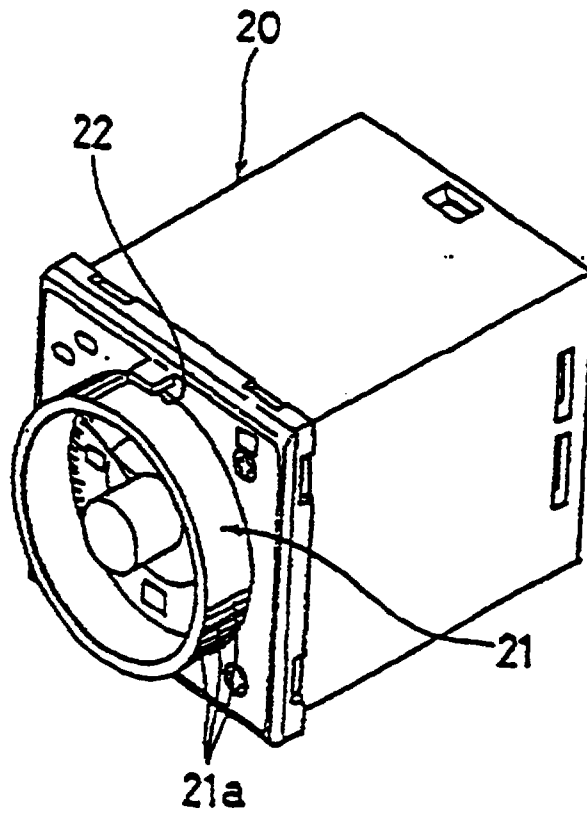


FIG 12

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FIG 13A

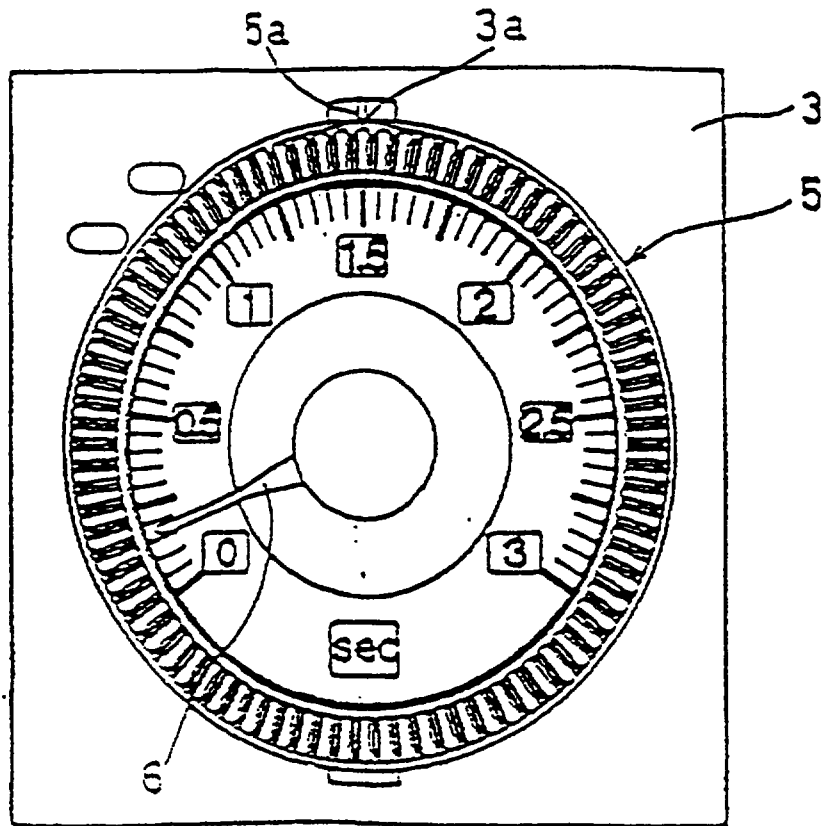
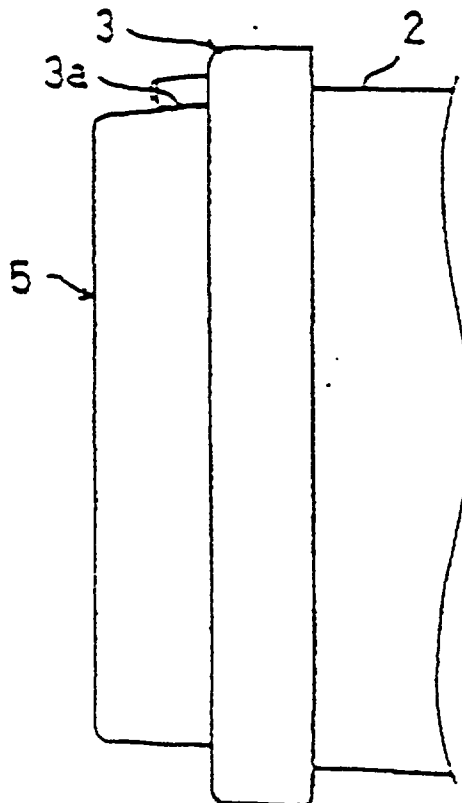
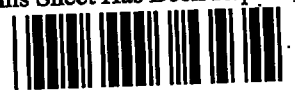


FIG 13B



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FIG 14A

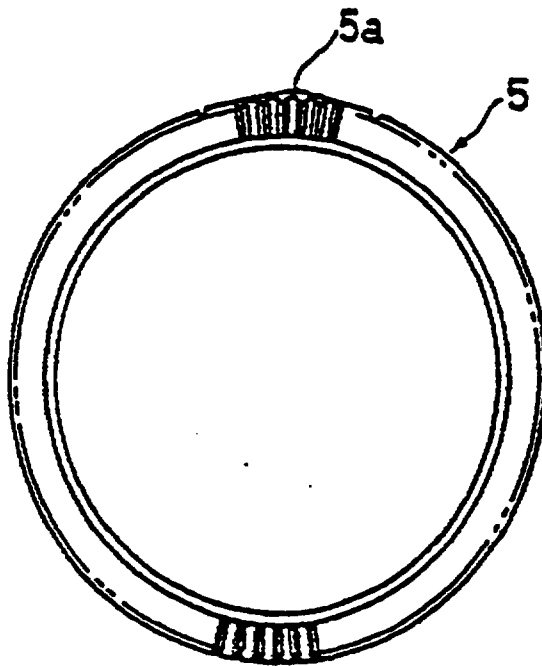


FIG 14B

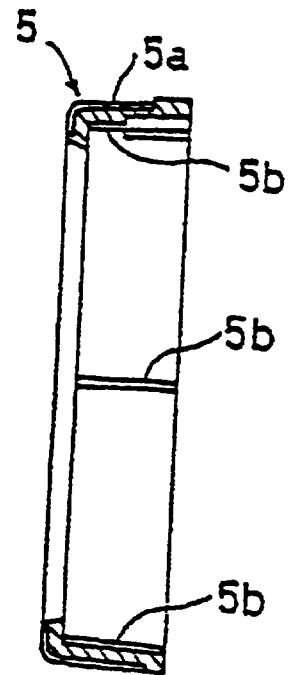
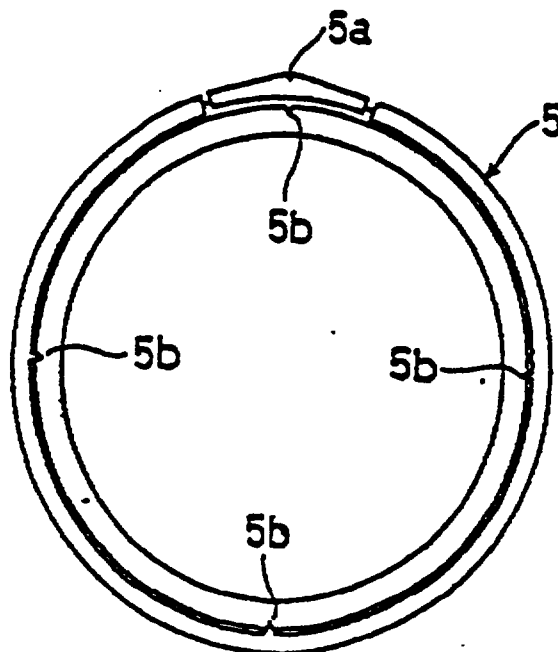


FIG 14C



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FIG 15A

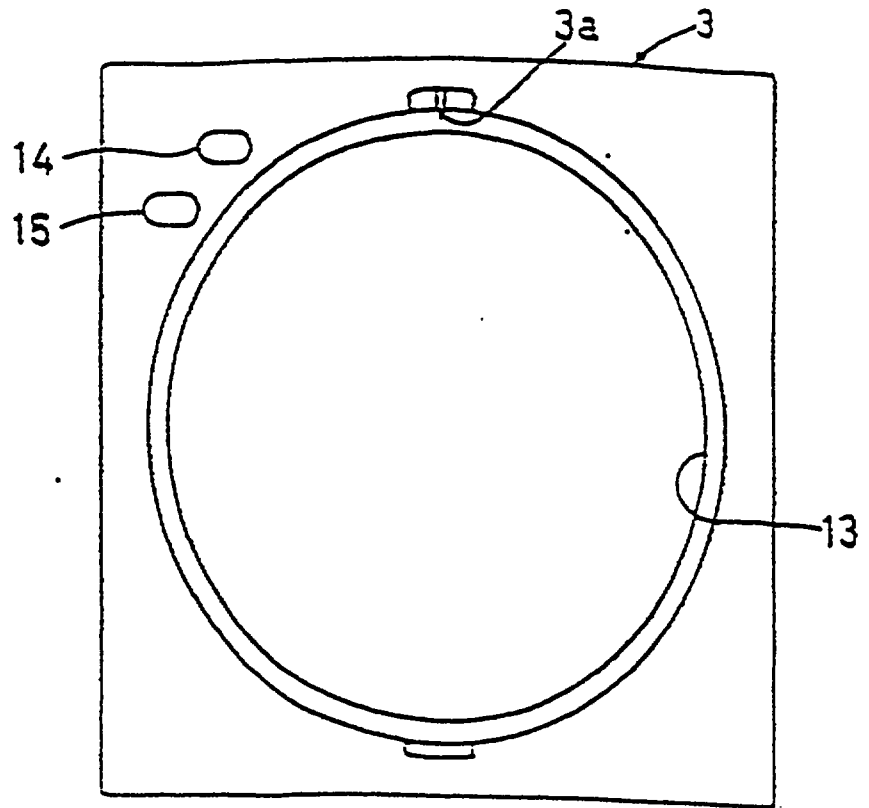
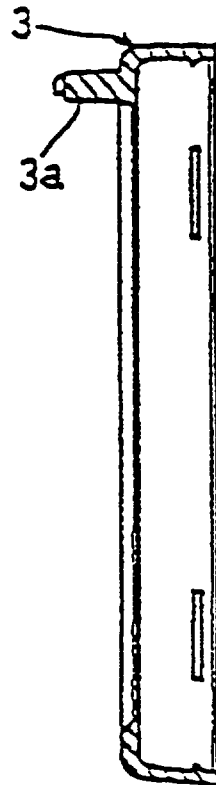


FIG 15B



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FIG 16A

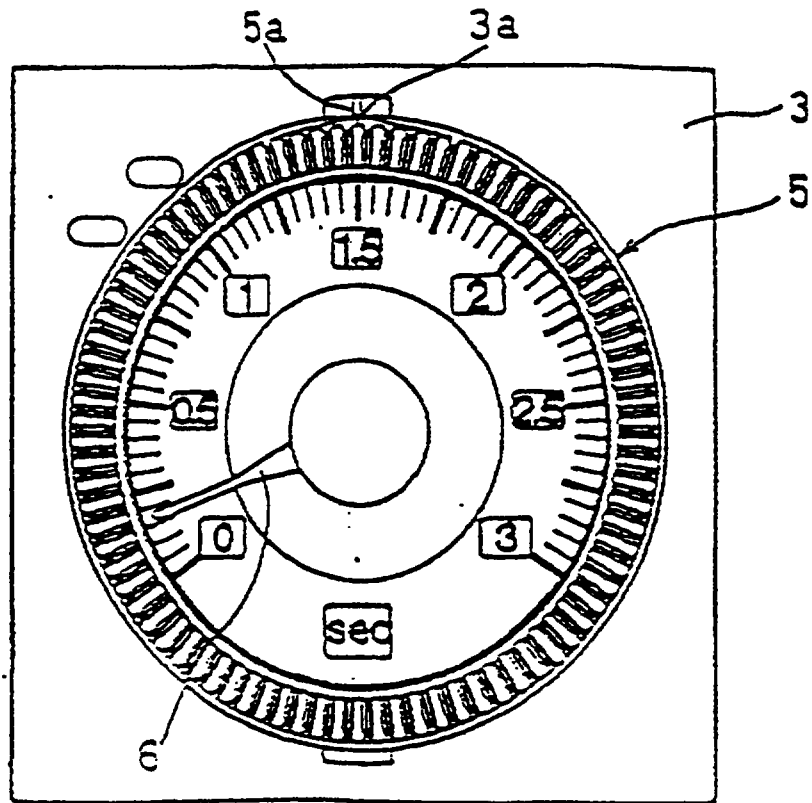
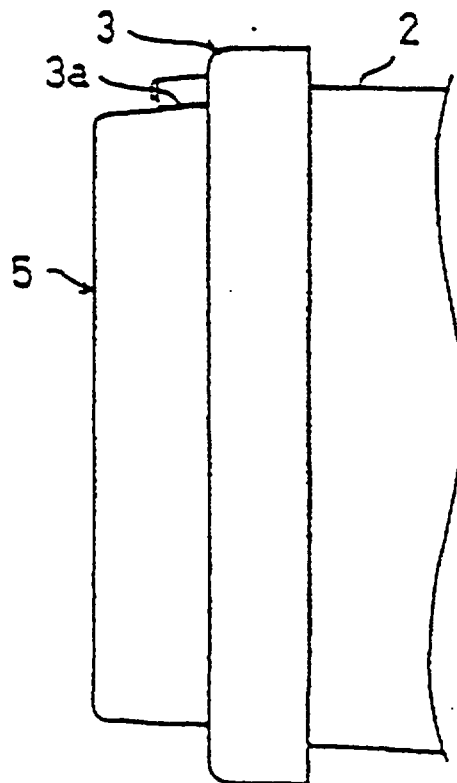


FIG 16B

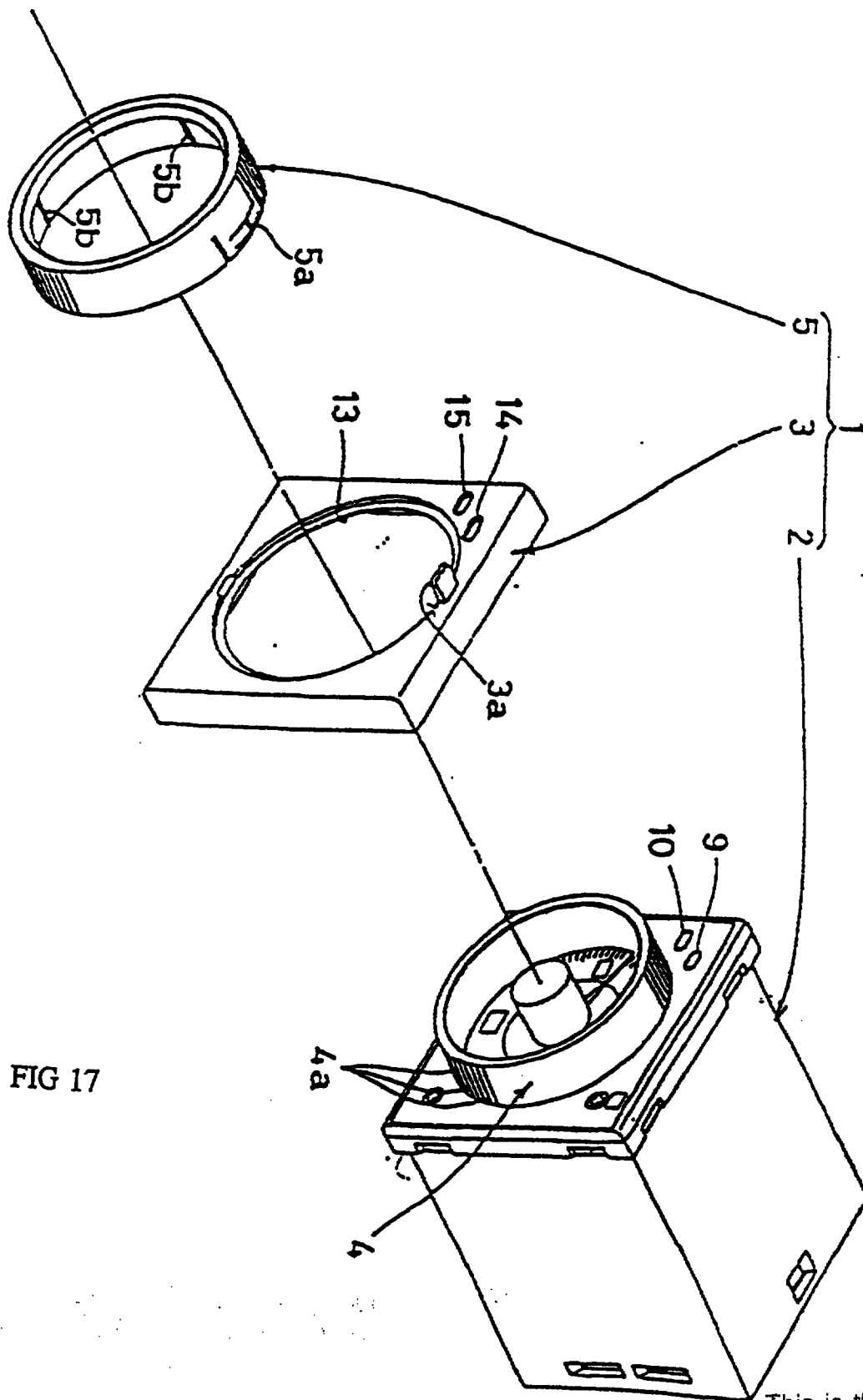


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DIAL-TYPE TIMER DEVICE

This invention relates to a dial-type timer. More specifically, it relates to a dial-type timer which employs a setting ring and is ideally suited for repeatedly setting the same operating time.

PRIOR ART

Figure 1 shows an existing dial-type timer (Omron dial-type timer #3) forming the basis for the preamble of claim 1. A similar dial-type timer is known from JP-U-1635991. On the upper portion of dial 21 on the face of timer 20, locking pawl 22 protrudes from the surface of the dial. Locking pawl 22 locks setting ring 23, shown in figure 2, to dial 21. It does this by engaging in groove 23a on the outer periphery of the aforesaid setting ring 23. In this way pawl 22 fixes the position of setting ring 23.

Setting ring 23 is used to make it easier to set the timer when the same operating time is set repeatedly. It also prevents accidental missettings resulting from different workers performing the same job. On the outer periphery of setting ring 23, as discussed above, is slot 23a. On its inner periphery are pawls 23b, which engage in slots 21a on the outer periphery of dial 21 to set the operating time.

Setting ring 23 is used to set a repeated operating time as follows. Dial 21 is set to the position which corresponds to the aforementioned repeated operating time. The aforesaid setting ring 23 engages with the sawteeth on the outer periphery of dial 21 in such a way that slot 23a on setting ring 23 engages in locking pawl 22 on timer body 20.

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In this way dial 21 and setting ring 23 are made to rotate as single entity.

When dial 21 is to reset a repeated operating time, as discussed earlier, it is returned to the position in which slot 23a on setting ring 23 engages in locking pawl 22 on timer body 20. This causes the timer to be reset to the aforementioned designated position.

With an existing dial-type timer of this sort, locking pawl 22 on the upper portion of the face of the timer gets in the way when dial 21 is used without setting ring 23, making the operation difficult.

In light of the difficulties described above, the objective of this invention was to improve the ease of operation of the dial when it was used without the setting ring.

In order to achieve the objectives described above, this invention is as defined in claim 1.

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With the design described above, the locking pawl which fixes the set position of the setting ring is on a cover which is separate from the timer body. There is thus no need to have a locking pawl on the timer body, as in existing timers. When the timer is used without the setting ring, the timer body can be used by itself without mounting the cover with the pawl. The locking pawl will not get in the way when the dial on the timer body is operated.

In the following section we shall give a detailed explanation of an embodiment of this invention, with reference to the drawings.

Figure 3 is an exploded oblique view of a dial-type timer in which this invention has been implemented.

Dial-type timer 1, in which this invention has been implemented, consists of timer body 2; cover 3, which can be mounted on the face of the said timer body 2; and setting ring 5, which is mounted on dial 4 on timer body 2 when the aforesaid cover 3 is in place.

Timer body 2 has a dial 4 on its face, as described above. The outer periphery of this dial 4 is formed into grooves 4a, as can be seen in the frontal view in Figure 4(A). Dial 4 has an indicator 6 and a scale along its circumference for setting the time. It also has a number of windows 7 to display the numerals for the scale, and a window 8 to display the time unit. Along the circumference of dial 4 are POWER and OUT displays 9 and 10, operating function switch 11 and operating function display window 12. Figure 4(B) is a partial side view of the face of timer body 2.

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The structure described above is basically the same as that of the existing timer described in the example. However, the timer of this invention does not have a locking pawl on the upper portion of the face of the timer body 2 to engage in the slot on setting ring 5. The locking pawl, then, does not get in the way when dial 4 is operated, so the timer is easier to operate than the existing timer described.

Cover 3 is mounted on the face of timer body 2 when setting ring 5 is to be used. It has a round opening 13 for dial 4, and openings 14 and 15 for displays 9 and 10 on timer body 2. Cover 3 has a single locking pawl 3a molded on its face in a location corresponding to the upper portion of the face of timer body 2 when the cover is mounted on the timer body, as shown in the front view in Figure 5(A) and the cross section of a side view in Figure 5(B). This locking pawl engages in the slot on the outer periphery of setting ring 5.

Setting ring 5 engages in grooves 4a on the outer periphery of dial 4, which projects forward through opening 13 of cover 3 when the cover is mounted on the face of timer body 2. On the outer periphery of setting ring 5 is slot 5a, into which locking pawl 3a on cover 3 engages, as shown in the front view, cross sectional side view and rear view pictured in Figures 6(A), 6(B) and 6(C). In four locations on the inner periphery of setting ring 5, pawls 5b are provided, which engage in grooves 4a on the outer periphery of dial 4.

When setting ring 5 is to be used with dial-type timer 1, which has the configuration described above, cover 3 with its locking pawl 3a is mounted on the face of timer body 2. Dial 4 is then set in the position corresponding to the regular operating time. The aforesaid

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setting ring 5 is locked onto the outer periphery of dial 4 in such a way that locking pawl 3a on cover 3 engages in slot 5a on the outer periphery of the setting ring. The frontal view and partial side view pictured in Figures 7(A) and 7(B) show the setting ring locked onto the dial.

In this way dial 4 and setting ring 5 are made to rotate as a single entity. When dial 4 is to reset a repeated operating time, as discussed earlier, it is returned to the position in which locking pawl 3a on cover 3 engages in slot 5a on setting ring 5. This causes the timer to be reset to the aforementioned designated position.

The materials used for cover 3 and setting ring 5 of this invention are available in a variety of colors, so they can be chosen to match the color of the panel on which timer body 2 is mounted. This ensures an esthetically pleasing result.

With the invention described above, a cover with a locking pawl on it is mounted on the timer when the setting ring is to be used. This allows the timer to function in the same way as previous timers of this type. When the setting ring is not going to be used, the cover is removed from the timer so that the locking pawl does not interfere with the operation of the dial. The result is a timer with improved ease of operation.

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Claim

1. A dial-timer comprising:

a dial (4) for setting the operating time on its face,
a setting ring (5) engageable with said dial (4) in a
selected angular relation and having a slot (5a) provided in
the outer periphery of the setting ring (5), and

a pawl (3a) for engaging said slot (5a) to thereby fix
the rotational position of said setting ring (5), charac-
terized in that

a removable cover (3) with an opening (13) correspon-
ding to said dial (4) for being mounted on the face of said
timer is provided, and

said pawl (3a) is provided on said removable cover (3).



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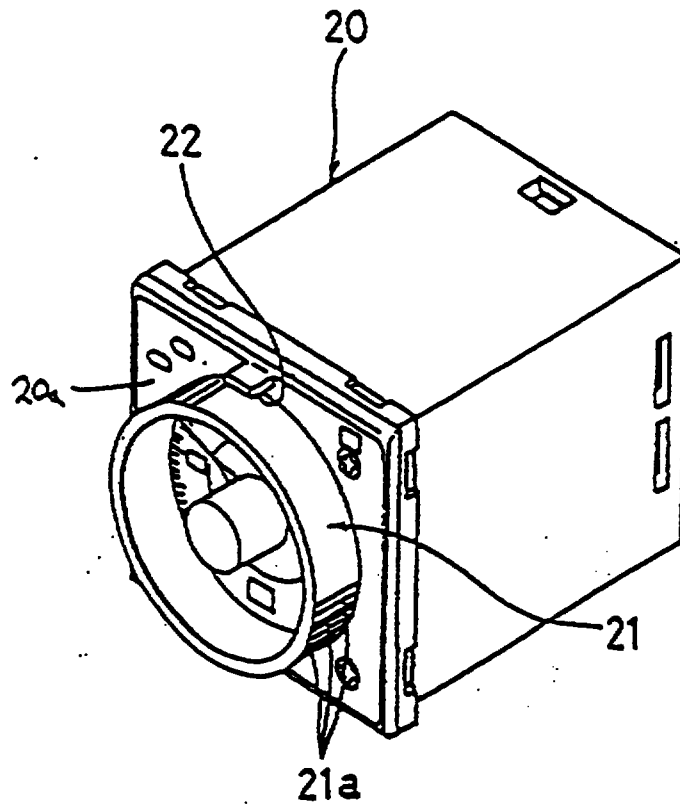


FIG.1 PRIOR ART

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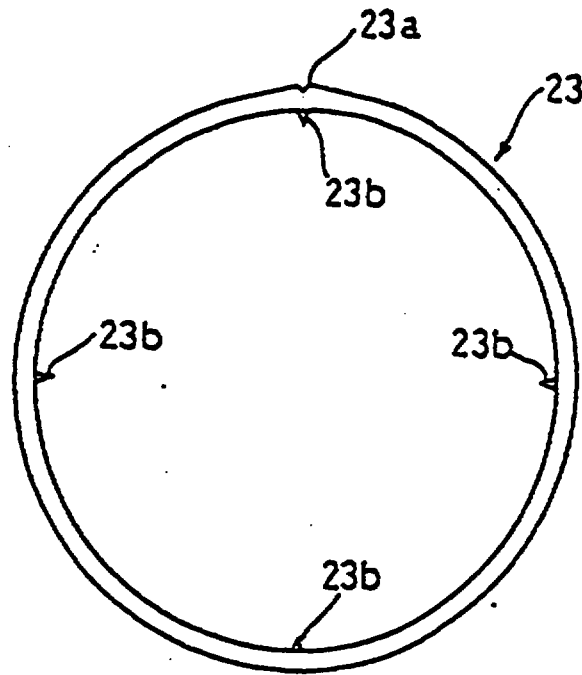


FIG. 2 PRIOR ART

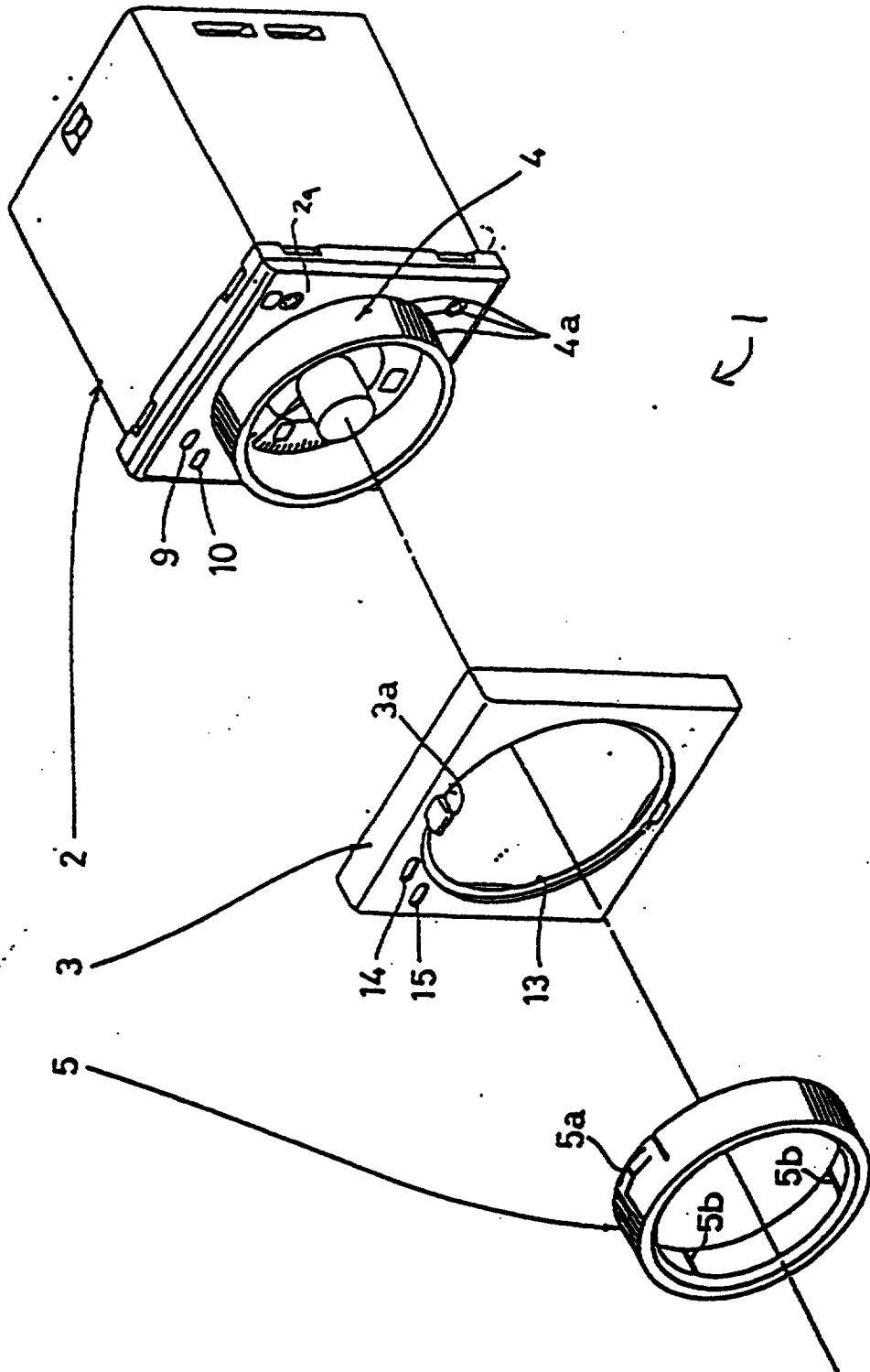


FIG.3

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FIG. 4A

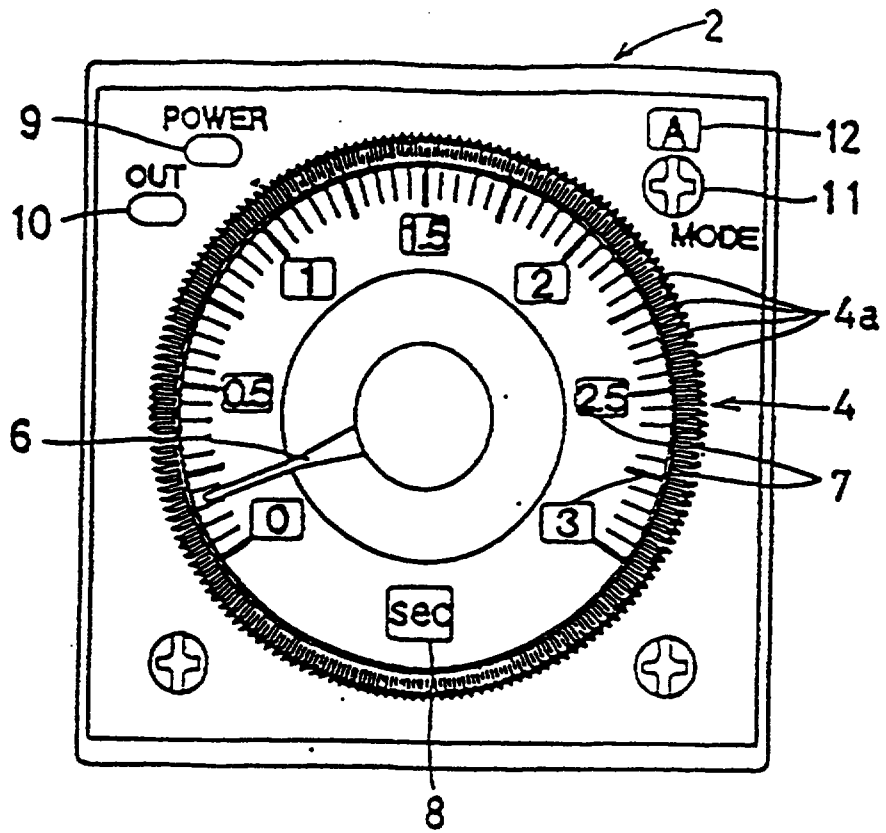
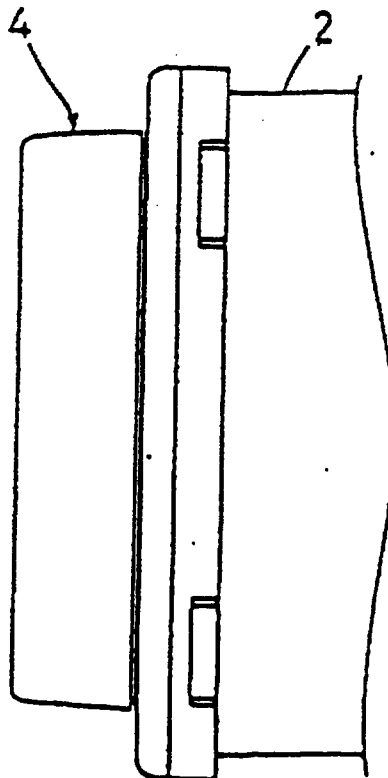


FIG. 4B



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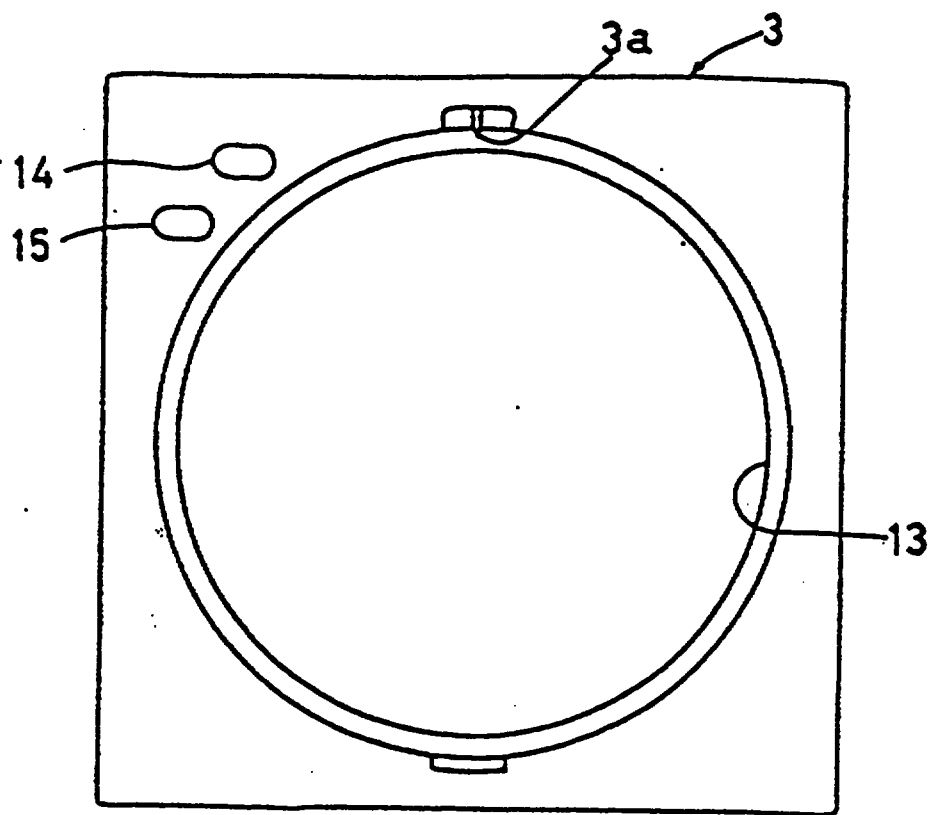


FIG. 5A

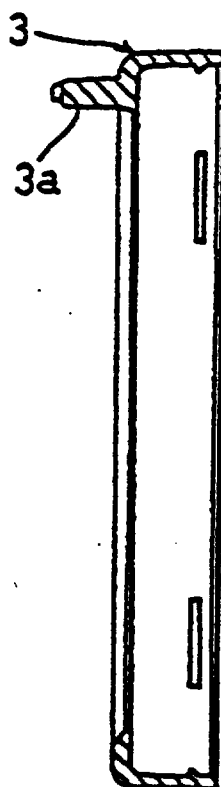


FIG. 5B

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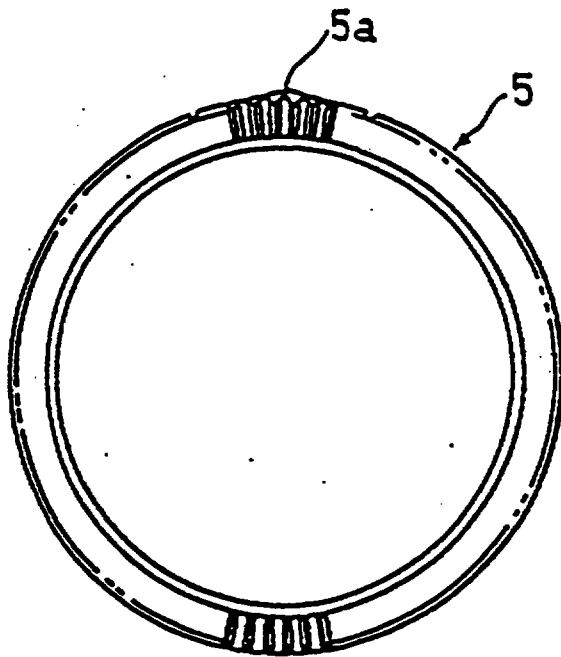


FIG. 6A

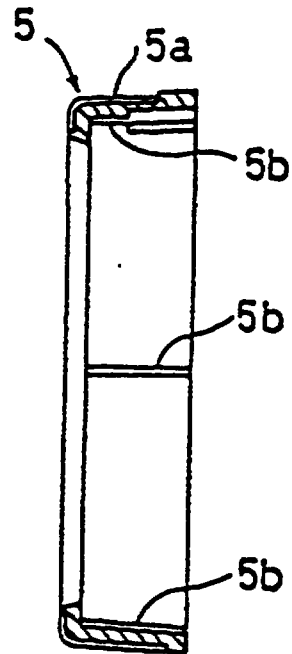


FIG. 6B

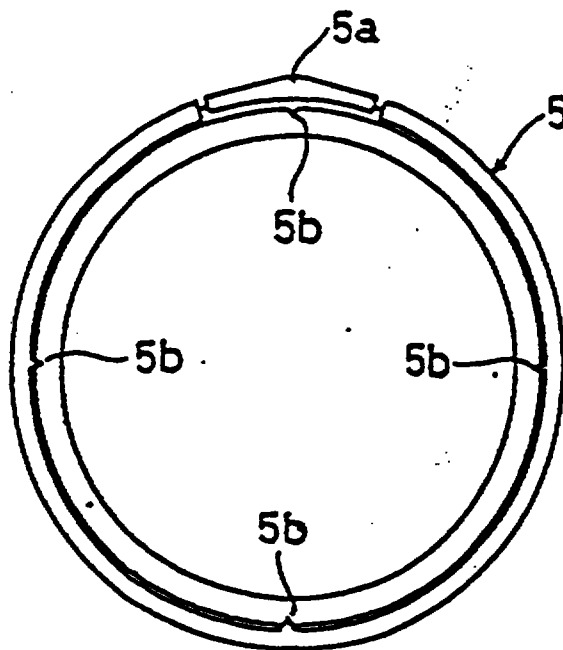


FIG. 6C

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FIG. 7A

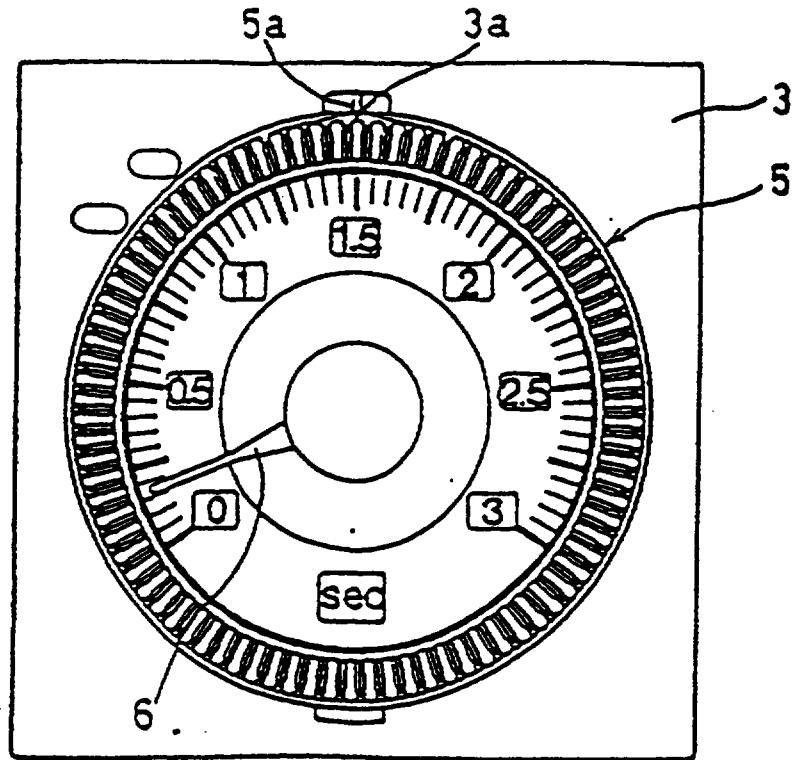
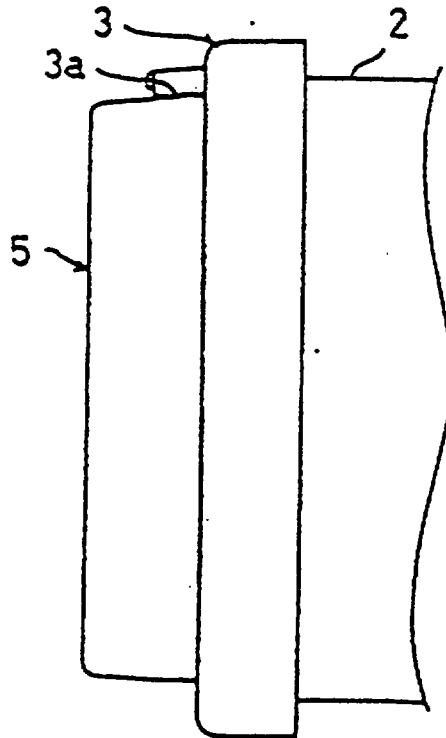


FIG. 7B



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ABSTRACTDIAL-TYPE TIMER DEVICESummary**Embodiment No.1**

Objective: Our objective was improve the ease of operation of the dial on a dial-type timer on which a setting ring can be used, When that setting ring is not used.

Construction: The locking pawl which fixes the set position of the setting ring is not on the timer itself, but rather on a cover which can be mounted on that timer.

Result: The cover with the locking pawl on it is removed from the timer when the setting ring is not being used. This prevents the locking pawl from interfering with the operation of the dial.

Embodiment No.2

Objective : To make it impossible to change the settings on a dial-type timer except in a fixed range.

Construction: Two setting rings are mounted on the perimeter of the dial in such a way that they rotate as a single entity with the said dial. Each of the rings has a single molded tooth on its outer edge. A stop protrudes from the body of the timer which is contacted by the a-forementioned teeth on the setting rings mounted on the dial. When the teeth come in contact with the stop, the range of rotation of the said dial is constrained.

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ABSTRACT

DIAL-TYPE TIMER DEVICE

Effects: Two setting rings are set in positons which indicate the upper and lower limits of a dial's rotation. When these rings are mounted on the perimeter of the said dial, the settings achieved by the dial can be changed only within the range between the said upper and lower limits.

Embodiment No.3

Objective: To make it possible for a timing device to use a small a small capacity power supply, to prevent the current from varying either during timing or when timing is complete, and to make it possible to supply stable power to the time-limit circuit.

Construction: This timing device is constructed as follows. Time-limit circuit 1 and output relay 2 are connected in series. Output relay 2 and dummy resistor 7, which has virtually the same impedance as relay 2, are connected to this series circuit. Switching elements 8 and 9, which go on and off in opposite sense at a given time, are connected in parallel to dummy resistor 7 and output relay 2, respectively. These switching elements are made to switch on or off by the change of state of output switching element 5.

FIGURE 3

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