April 13, 1965 R. H. DEVANNEY 3,177,645

COUNTER RESET MECHANISM

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FIG. 1

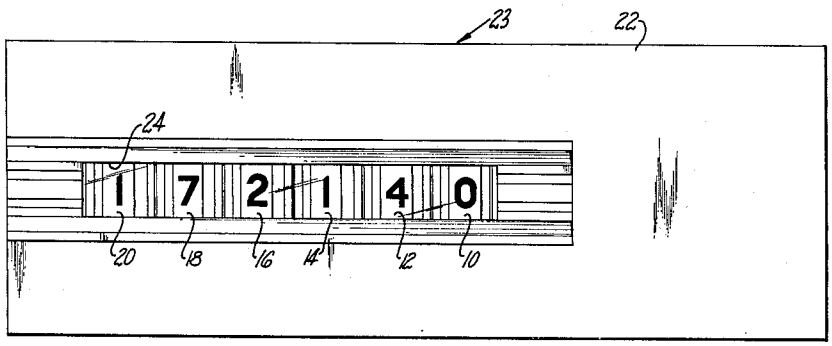


FIG. 2

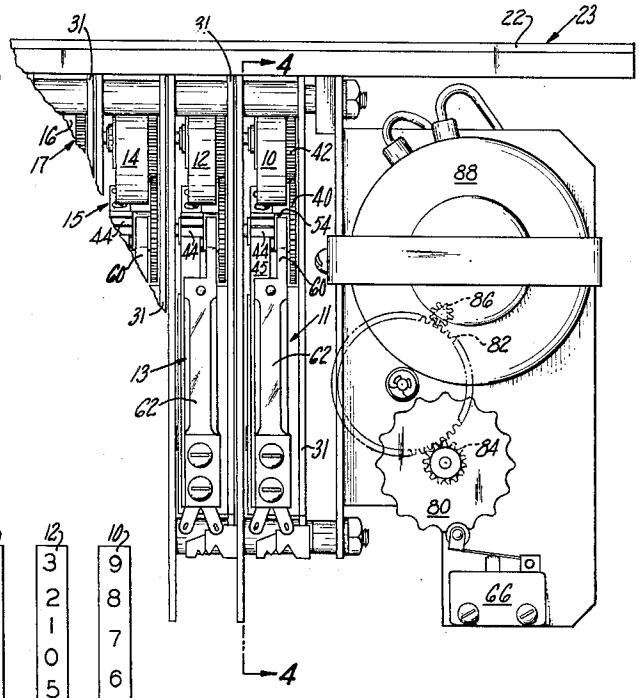
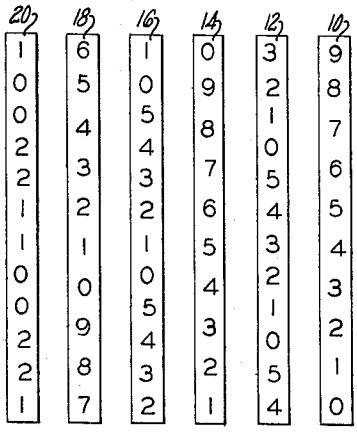


FIG. 3



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FIG. 4

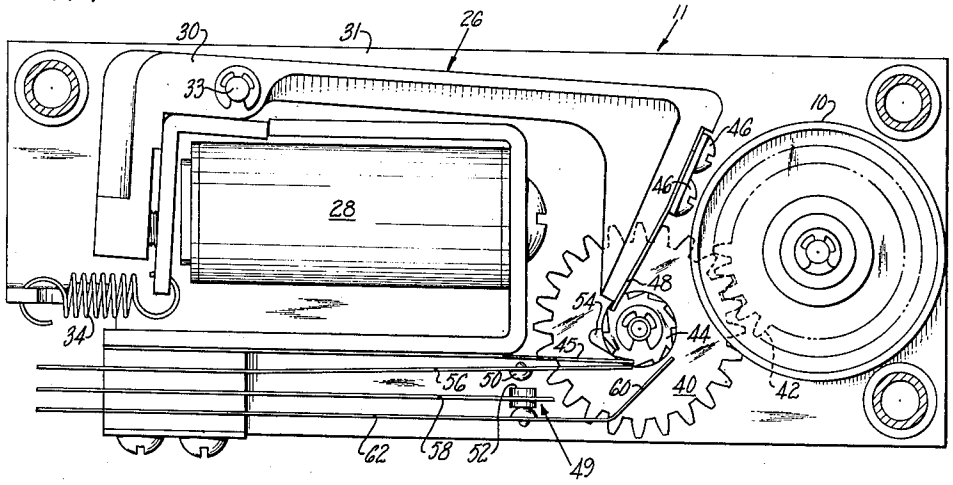


FIG. 5

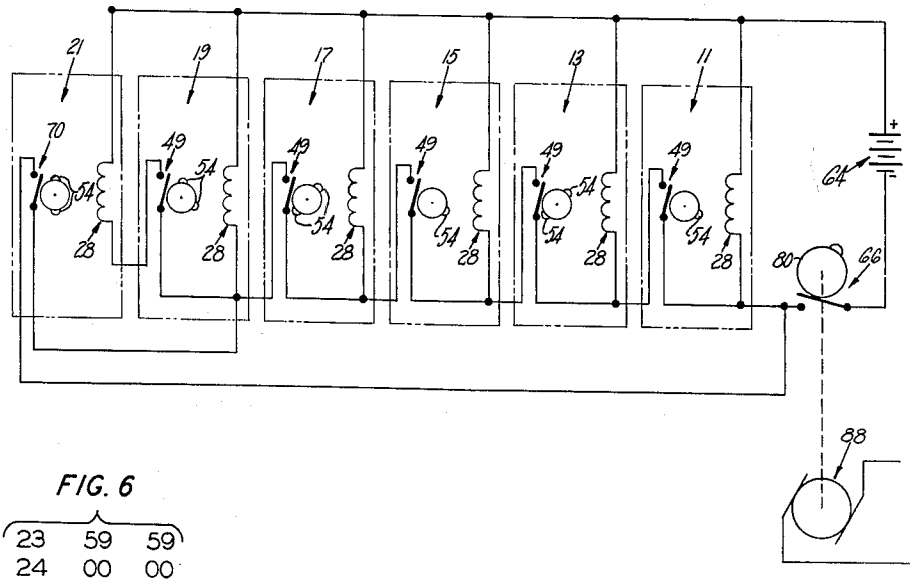


FIG. 6

23	59	59
24	00	00
25	00	01
26	00	02
27	00	03
28	00	04
29	00	05
00	00	06

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COUNTER RESET MECHANISM

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This invention relates to counters and is concerned more particularly with means for automatically resetting a counter to its zero or initial position upon registration of a predetermined count. As an example, the counter reset mechanism of the present invention has particular utility with a twenty-four hour counter-type clock for automatically zeroing or resetting the hour indicator wheels after midnight.

It is a principal aim of the present invention to provide a new and improved counter reset mechanism of the type described for automatically resetting one or more of the indicator wheels of a counter to their initial or prime positions in cooperation with the conventional advancement of the counter and at selected positions during the advancement thereof.

It is another aim of the present invention to provide a counter reset mechanism of the type described which is particularly useful with counters having electrical stepping motors for advancing the counter wheels and further having transfer switches that are selectively actuated during the advancement of the counter wheels for energizing the stepping motors.

It is another aim of the present invention to provide an improved electric clock of the counter type that will automatically reset or zero the counter indicator wheels at the conclusion of the normal time cycle, i.e., midnight, in a matter of seconds and without interfering with the accuracy of the clock.

It is a further aim of the present invention to provide a counter reset mechanism that is economical to manufacture and assemble, and which is comprised of a minimum number of compactly arranged parts providing reliability over a long period of use.

Other objects will be in part obvious and in part pointed out more in detail hereinafter.

The invention accordingly consists in the features of construction, combination of elements and arrangement of parts which will be exemplified in the construction hereafter set forth, and the scope of the application of which will be indicated in the appended claims.

In the drawings:

FIG. 1 is a front elevation view of a clock counter embodying the present invention;

FIG. 2 is a bottom plan view partly broken away of the counter;

FIG. 3 shows developments of the indicia on the counter indicator wheels;

FIG. 4 is an enlarged side elevation section view taken along the line 4—4 of FIG. 2;

FIG. 5 is a diagrammatic showing of the electrical circuit of the clock counter; and

FIG. 6 shows a table of several successive readings of the counter.

Referring now to the drawings in detail, there is shown a counter having six rotary indicator wheels 10, 12, 14, 16, 18 and 20 mounted coaxially within a housing, generally denoted 23, having a front cover 22 with an opening 24 for viewing individual indicia on the indicator wheels. The particular counter shown is used as a clock for displaying time through a twenty-four hour period, with the indicators 10 and 12 used to display seconds, the indicators 14 and 16 used to display minutes and the indicators 18 and 20 used to display hours; the time reading of the counter of FIG. 1 being 17 hours, 21 minutes

and 40 seconds. Referring to FIG. 3 wherein developments of the wheel indicia are shown, with the counter reading of 17 hours, 21 minutes and 40 seconds displayed by the bottom line of numerals, the lower order hours, minutes and seconds indicator wheels 18, 14 and 10, respectively, bear thereon a sequence of numeral indicia of 0 through 9, the higher order minutes and seconds indicator wheels 16 and 12, respectively, bear thereon two sequences of numeral indicia of 0 through 5 and the higher order hours indicator wheel 20 bears thereon two numeral sequences of 001122, a series of repeating numerals.

Stepping motor and transfer switch assemblies 11, 13, 15, 17, 19 and 21 are associated with the rotary indicator wheels 10, 12, 14, 16, 18 and 20, respectively, for advancing and controlling the advancement of the counter wheels. Each assembly includes an electrical stepping motor, generally denoted by the numeral 26, having an electrical solenoid 28 and an armature 30 pivotally mounted on an assembly support frame 31 by a pin 33. The armature 30 is biased in one pivotal direction, clockwise as seen in FIG. 4, by a tension coil spring 34 and is actuated in the opposite pivotal direction against the coil spring by the magnetic force created by the solenoid 28. The armature 30 is adapted to unidirectionally drive its respective rotary indicator wheel in the counterclockwise direction, as seen in FIG. 4, in step-by-step fashion through a ratchet operating finger 48 fixed to the armature by a pair of screws 46, a ratchet wheel 44, and a pair of intermeshing spur gears 40 and 42 fixed to the ratchet wheel 44 and the indicator wheel, respectively. Movement of the ratchet wheel in the opposite or clockwise direction is prevented in a conventional manner by a resilient finger pawl 45. The ratchet finger 48 is adapted for resilient engagement with the ratchet wheel 44 for single step advancement of the ratchet wheel thereby providing a clockwise step advancement of the indicator wheel in response to each pivotal oscillation of the stepping motor armature.

For controlling the actuation of the stepping motors associated with the indicator wheels 12, 14, 16, 18 and 20 there are provided for energizing each of these motors electrical transfer switches, generally denoted 49, with contacts 50 and 52 that are selectively activated with the advancement of the respective next adjacent lower order counter wheel by a cam 54 fixed for rotation with the associated ratchet wheel 44. The switch contacts 50 and 52 are mounted on resilient switch arms 56 and 58, respectively, and are selectively brought into electrical contact to activate the switch 49 by the advancement of the cam 54 into engagement with the switch arm 56. The switch 49 is deactivated upon the advancement of the cam 54 out of engagement with the switch arm 56 and the substantially simultaneous engagement of the cam with the upturned end 60 of a resilient switch backing finger 62 adapted to normally bias the resilient switch arm 58 to the position shown in FIG. 4. Each transfer switch 49 is electrically connected in series with the solenoid 28 of the stepping motor of the next adjacent higher order counter wheel, with an electrical power source generally denoted by the numeral 64, and with the transfer switch 49 associated with the next adjacent lower order indicator wheel.

A counting or stepping switch, generally denoted by the numeral 66, is connected in series with the power supply 64 and with the solenoid 28 of the stepping motor of the first or lowest order indicator wheel, and in series with the transfer switch 49 of the lowest order indicator wheel. Accordingly, with each activation of the counter stepping switch 66, the solenoid 28 associated with the lowest order indicator is energized to pivot its stepping motor armature in the counterclockwise direction, as viewed in FIG. 4. Upon deactivation of the stepping switch 66, the solenoid

28 is deenergized to enable the coil spring 34 to return the armature 30 and index the ratchet wheel to advance the indicator wheel 10. With the indicator wheel 10 in its 9 displaying position, the cam 54 associated therewith activates its respective transfer switch 49 to condition the circuit for energization of the solenoid 28 associated with the indicator wheel 12 by the subsequent activation of the stepping switch 66.

Advancement of the remaining counter wheels is provided by appropriately timed activation of the remaining transfer switches 49. Inasmuch as the indicator wheels 12 and 16 have two sequences of numerals of 0 through 5, two equally spaced transfers of the next adjacent higher order indicator wheels are provided by a pair of diametrically opposed cams 54 associated with the indicator wheels 12 and 16.

The next to highest order indicator wheel 18 has operatively connected thereto a pair of cams 54 provided for generating transfers to the highest order indicator 20 upon advancement of the indicator wheel 18 from 9 to 0 and from 3 to 4. However, inasmuch as the indicator wheel 20 has a sequence of repeating numeral indicia, there is a numeral change displayed by the wheel 20 only with the advancement of the indicator wheel 18 from 9 to 0.

A reset switch 70, similar in design and operation to the transfer switches 49, is selectively activated by a pair of cams 54 operatively associated with the highest order indicator wheel 20 upon advancement of the wheel 20 to the second number 2 in each sequence of numerals on wheel 20, such being concomitant with the advancement of the indicator wheel 18 from 3 to 4 or with the advancement of the clock from 23 hours, 59 minutes and 59 seconds to 24 hours, 00 minutes and 00 seconds. These latter clock readings are represented by the top two lines in the table of FIG. 6. The reset switch 70 is connected in a reset circuit in series with the counter stepping switch 66, the electrical power supply 64 and the solenoid 28 of the indicator wheel 18, with the result that the reset switch is adapted to condition the reset circuit for energization of the stepping motor associated with the indicator wheel 18 in relation to the advancement of the wheel 20 to its final indicia displaying position, and with the further result that the indicator wheel 18 is advanced simultaneously with the lowest order indicator 10 as the clock reads from 24 hours, 00 minutes and 00 seconds to 00 hours, 00 minutes and 06 seconds, a period of six seconds during which the reset switch is activated, as shown in the table of FIG. 6. As the transfer switch 49 associated with the indicator wheel 18 is activated in relation to the advancement of the wheel 18 from 9 to 0, that switch acts to condition the reset circuit, by advancing the wheel 20 to deactivate the reset switch, for the deenergization of the stepping motor of the wheel 18.

As shown in FIG. 2, the stepping switch 66 is intermittently activated by a cam 80 intermittently driven by an electrical motor 88 through a planetary gear 86, an idler gear 82 and a spur gear 84 fixed to the cam 80. The speed of the motor and the design of the gearing is such that the stepping switch 66 is activated at one second intervals thereby advancing the lower order seconds wheel 10 one numeral every second.

It can be seen therefore, that the present invention provides a reliable and highly effective reset mechanism for automatically and quickly indexing counter wheels to their initial indicia or prime positions and which is particularly useful with a counter having individual electrical stepping motors for advancing the counter wheels. Additionally, the present invention provides a new and unique reset mechanism that is based upon the use of a series of multiple repeating indicia on one indicator wheel and the generation of the same multiple of transfers thereto during the advancement of the next adjacent lower order indicator wheel through its indicia sequence.

As will be apparent to persons skilled in the art, various modifications and adaptations of the structure above described will become readily apparent without departure from the spirit and scope of the invention, the scope of which is defined in the appended claims.

I claim:

1. A counter comprising a plurality of number wheels of ascending order, electrically operated drive means for individually advancing the number wheels in stepwise fashion to a plurality of positions, electrical power means connected to the drive means of the number wheel of lowest order for periodically energizing said number wheel of lowest order, means associated with each number wheel of lower order for connecting the drive means of the number wheel of next higher order to said electrical power means for providing a transfer, and additional means associated with the number wheel of highest order for connecting the drive means of the number wheel of next to highest order to said electrical power means at a predetermined position of the number wheel of highest order.

2. A counter comprising a plurality of number wheels of ascending order, electrically operated drive means for individually advancing the number wheels in stepwise fashion to a plurality of positions, electrical power means for connection to the drive means for periodically energizing the drive means, means associated with one number wheel of lower order for connecting the drive means of the number wheel of next higher order to said power means at a plurality of the positions of said one number wheel, and additional means associated with the number wheel of next higher order for connecting the drive means of said one number wheel to said power means at a predetermined position of the number wheel of next higher order.

3. A counter comprising a plurality of number wheels of ascending order, electrically operated drive means for individually advancing the number wheels in stepwise fashion to a plurality of positions, one number wheel of higher order having a sequence of groups of repeating indicia, electrical power means for energizing said drive means, first switch means for conditioning the drive means of said one number wheel for operation by said power means, means associated with a second number wheel of lower order for actuating said first switch means at a plurality of positions of said second number wheel, second switch means for conditioning the drive means of said second number wheel for operation by said power means, and means associated with said one number wheel actuating said second switch means at a position of said one number wheel displaying the last indicia in one of the groups of repeating indicia.

4. For use with a counter having a plurality of indicia bearing members advanced from initial indicia displaying positions providing an initial reading of the counter through intermediate indicia displaying positions to final indicia displaying positions providing a final reading of the counter, a reset mechanism for indexing at least one of the members to an initial indicia displaying position upon advancement of the counter through its final reading comprising, electrical motor means operatively connected to the counter for indexing said one member, reset control means for energizing the electrical motor means including an electrical circuit having first and second electrical switches, means operatively connected to the counter activating the first switch in relation to the advancement of the counter to its final reading, and means operatively connected to the one member activating the second switch in relation to the advancement of the one member to an initial indicia displaying position, said reset control means being conditioned for energizing the motor means by activation of the first switch and conditioned for deenergizing the motor means by activation of the second switch.

5. For use with a counter having a plurality of indicia bearing members of ascending order advanced from initial indicia displaying positions providing an initial reading of the counter through intermediate indicia displaying

positions to final indicia displaying positions providing a final reading of the counter, a reset mechanism for indexing one of the members other than the last order member to an initial indicia displaying position upon advancement of the counter through its final reading comprising, electrical motor means operatively connected to the counter for indexing said one member, electrical circuit means including an electrical switch activated for energizing the electrical motor means, switch operating means operatively connected to a second member of higher order than said one member activating said switch in relation to the advancement of said second member to a final indicia displaying position, said switch operating means deactivating said switch in relation to the advancement of said second member to an initial indicia displaying position whereby resetting of the one member is initiated in relation to the advancement of the counter through its final reading and terminated in relation to the advancement of said second member to an initial indicia displaying position.

6. For use with a counter adapted for displaying a reading sequence and having a plurality of rotary members of ascending order each bearing a sequence of indicia thereon with the first order member adapted to be advanced from an initial indicia displaying position providing in part an initial reading of the counter through a plurality of intermediate indicia displaying positions to a final indicia displaying position providing in part a final reading of the counter and with transfers generated for advancing the remaining rotary members from initial indicia displaying positions providing in part the initial reading of the counter through intermediate indicia displaying positions to final indicia displaying positions providing in part the final reading of the counter, a reset mechanism for indexing one of the rotary members other than the last order rotary member to an initial indicia displaying position upon advancement of the counter through its final reading comprising, electrical motor means operatively connected to the counter for indexing said one rotary member, electrical circuit means including an electrical switch activated for energizing the motor means, means operatively connected to a second rotary member of next higher order than said one rotary member activating said switch in relation to the advancement of the counter to its final reading position and deactivating said switch in relation to the advancement of said second rotary member to an initial indicia displaying position, and means providing at least two transfers of said second rotary member with advancement of said one rotary member through a complete sequence of indicia, said second rotary member bearing a sequence of repeating indicia whereby resetting of the one rotary member is initiated in relation to the advancement of the counter to its final reading and is terminated in relation to the advancement of the second rotary indicator to an initial indicia displaying position.

7. A counting device comprising a plurality of rotary indicators of ascending order having indicia thereon for displaying a reading sequence, a plurality of electrical stepping motors operatively connected for advancing the rotary indicators respectively, a reset switch operatively connected to the counter for activation in relation to the rotary position of the last order rotary indicator, transfer switches operatively connected to the counter for activation in relation to the rotary positions of the remaining rotary indicators, a counting switch electrically connected with the stepping motor of the first order rotary indicator for controlling the advancement thereof, first circuit means electrically connecting the transfer switches with electrical stepping motors of next higher order indicators for energizing the stepping motors in relation to the rotary position of the next lower rotary indicators, and second circuit means electrically connecting the reset switch with a stepping motor of one of the rotary indicators other than said last order rotary indicator whereby the first order indicator is advanced by the counting switch, the remaining rotary indicators are advanced by the transfer switches, and said one rotary indicator is additionally indexed by the reset switch.

8. In a counting device of the type having a plurality of rotary indicators of ascending order each bearing a sequence of indicia and adapted to be advanced from initial indicia displaying positions providing an initial reading of the counter through intermediate indicia displaying positions to final indicia displaying positions providing a final reading of the counter thereby displaying a reading sequence, and wherein the final reading of the counter is displayed in part by an intermediate indicia in the sequence of one of the rotary indicators, the improvement comprising electrical motor means for indexing said one rotary indicator, electrical circuit means for energizing the electrical motor means, means operatively connected to a second rotary indicator of higher order than said one rotary indicator activating the electrical circuit means in relation to the advancement of said second rotary indicator to a final indicia displaying position and deactivating the electrical circuit means in relation to the advancement of said one rotary indicator to an initial indicia displaying position.

9. For use with a counter adapted for displaying a reading sequence and having a plurality of rotary members of ascending order each bearing a sequence of indicia thereon, with the first order member adapted to be advanced from an initial indicia displaying position providing in part an initial reading of the counter through intermediate indicia displaying positions to a final indicia displaying position providing in part a final reading of the counter and with transfers generated for advancing the remaining rotary members from initial indicia displaying positions providing in part the initial reading of the counter through intermediate indicia displaying positions to final indicia displaying positions providing in part the final reading of the counter, a reset mechanism for indexing one of the rotary members to an initial indicia displaying position upon advancement of the counter through its final reading comprising, an electrical stepping motor operatively connected to the counter for indexing said one rotary member, reset control means for energizing the electrical stepping motor including an electrical circuit having reset switch means and stepping switch means, said reset switch means upon activation conditioning the electrical circuit for energization of the stepping motor by the stepping switch means, means operatively connected to the counter activating the reset switch means in relation to the advancement of the counter to its final reading, and means providing cooperative activation between the stepping switch means and the advancement of the counter.

10. A clock counting device for displaying time comprising a plurality of rotary indicators of ascending order each bearing a sequence of indicia thereon, the last order and next to last order rotary indicators bearing indicia for displaying the tens and units of hours respectively, a plurality of electrical stepping motors operatively connected for advancing the rotary indicators respectively, a reset switch operatively connected to the counter for activation in relation to the rotary position of the last order rotary indicator, transfer switches connected for activation in relation to the rotary positions of the remaining rotary indicators, a counting switch electrically connected with the stepping motor of the first order rotary indicator for controlling the advancement thereof, first circuit means electrically connecting the transfer switches with electrical stepping motors of next higher order indicators for energizing the stepping motors in relation to the rotary positions of the next lower rotary indicators, and second circuit means electrically connecting the reset switch with the stepping motor of said next to last order rotary indicator whereby the first order rotary indicator is advanced by the counting switch, the remaining order rotary indicators are advanced by the transfer switches and the next

to last rotary indicator is additionally indexed by the reset switch.

11. A counter device comprising a pair of rotary indicators of lower and higher order each bearing a sequence of indicia thereon for displaying a reading sequence, the higher order indicator being adapted for advancement from an initial indicia displaying position providing in part an initial reading of the counter to a final indicia displaying position for providing in part a final reading of the counter, the indicia sequence on said higher order rotary indicator being a series of multiple repeating indicia, means providing the same multiple of transfers of the rotary indicator of higher order upon advancement of the rotary indicator of lower order through its sequence of indicia, and reset means for resetting the indicator of lower order to an initial indicia displaying position in

relation to the advancement of the higher order indicator through its sequence of indicia, said reset means including means indexing said lower order indicator to an initial indicia displaying position, and means activating the indexing means in relation to the advancement of the higher order indicator to a final indicia displaying position.

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