# United States Patent [19]

Wakabayashi

[11] 3,760,581

[45] Sept. 25, 1973


[54] **ELECTRO-MECHANICAL DIGITAL WORLD CLOCK**


[76] Inventor: **Yasuo Wakabayashi,** Hairando, No. 1362-293, Hisaki-machi, F-191 Kamakura-Fushi-City, Kanagawa Prefecture, Japan



[22] Filed: **Oct. 17, 1972**

[21] Appl. No.: **298,346**

[30] **Foreign Application Priority Data**

Oct. 18, 1971 Japan ..... 46/81560

[52] **U.S. Cl.** ..... **58/42.5,** 58/50 R, 340/338

[51] **Int. Cl.** ..... **G04b 19/22,** G04b 19/30

[58] **Field of Search** ..... 58/23 R, 42.5, 50 R; 235/61.39, 92 EA; 340/166 R, 166 EL, 309.4, 309.5, 336, 338 R, 347 P, 347 SY, 373



[56] **References Cited**

UNITED STATES PATENTS

| | | | |
|---|---|---|---|
| 3,410,082 | 11/1968 | Taylor et al. | 58/23 R |
| 3,015,094 | 12/1961 | Reynolds | 340/338 P |
| 3,613,352 | 10/1971 | Giersieper | 58/395 X |
| 1,220,109 | 3/1917 | Heiny | 340/338 |



*Primary Examiner*—Richard B. Wilkinson
*Assistant Examiner*—Edith C. S. Jackmon
*Attorney*—Woodhams, Blanchard and Flynn



[57] **ABSTRACT**

An electro-mechanical digital world clock capable of indicating time of different places of the world by electrically illuminated figures. The clock comprises a first mechanism for indicating minute unit time by a figure of 0 to 9, a second mechanism for indicating ten minute unit time by a figure of 0 to 5, and a third mechanism for selectively indicating hour unit time of a selected place. The third mechanism includes a two-figured digital indicator consisting of a plurality of electric bulbs, a cylindrical rotary body making a one twenty-fourth revolution at every 1 hour, a first switching means arranged on said rotary body for selectively illuminating the electric bulbs of the two-figured digital indicator for indicating hour unit time of one place, and additional switching means arranged also on the rotary body for selectively illuminating said electric bulbs of the two-figured digital indicator for indicating hour unit time of another place.


**5 Claims, 8 Drawing Figures**

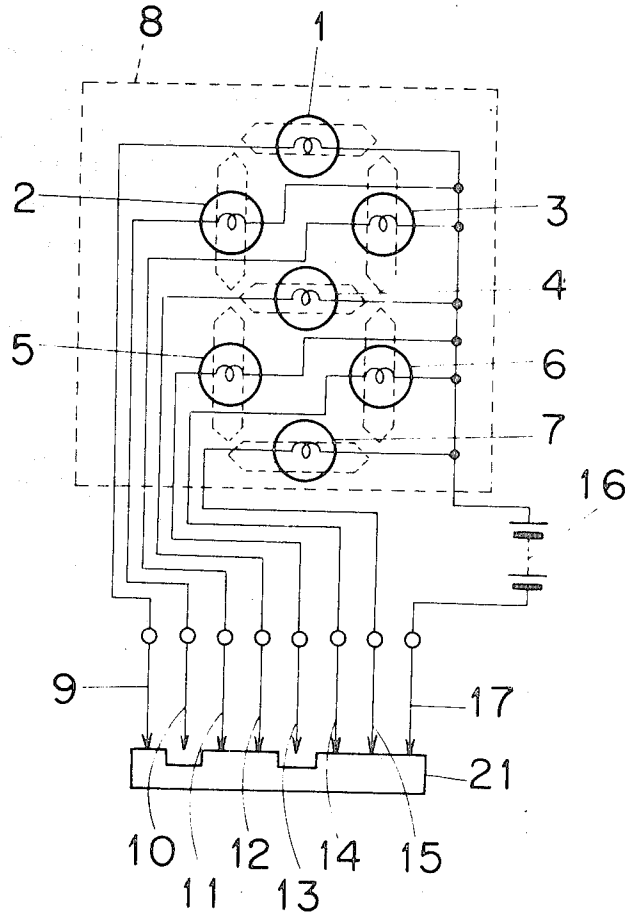


FIG. 1

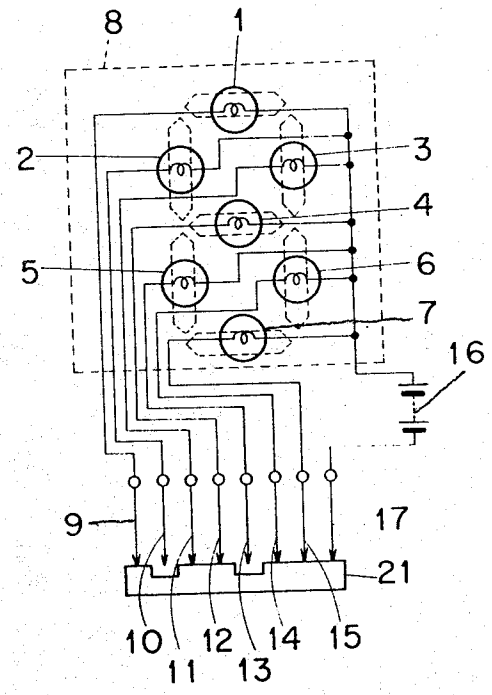

8
1
2
3
4
5
6
7
16
9
17
21
10
11
12
13
14
15

FIG. 2

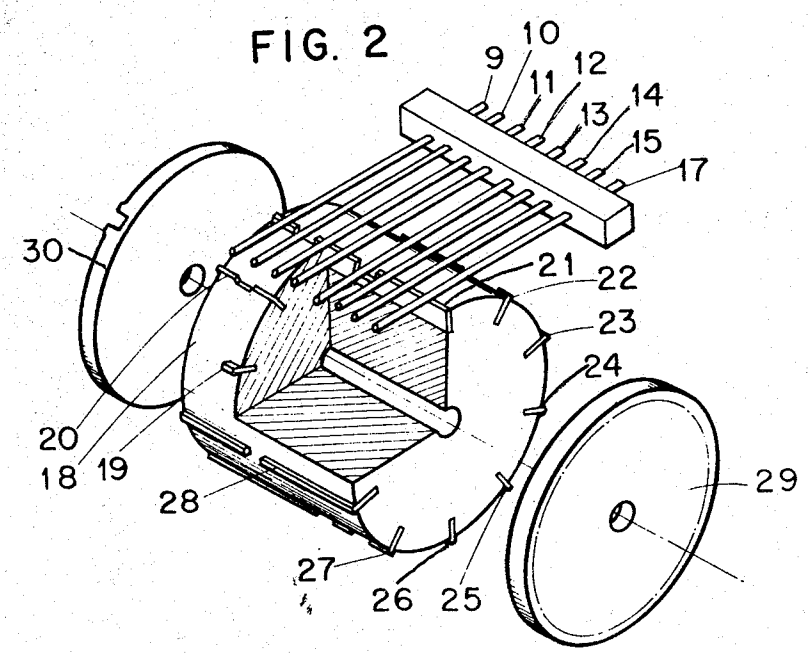

9
10
11
12
13
14
15
17
30
21
22
23
24
20
18
19
28
29
27
26
25

FIG. 3

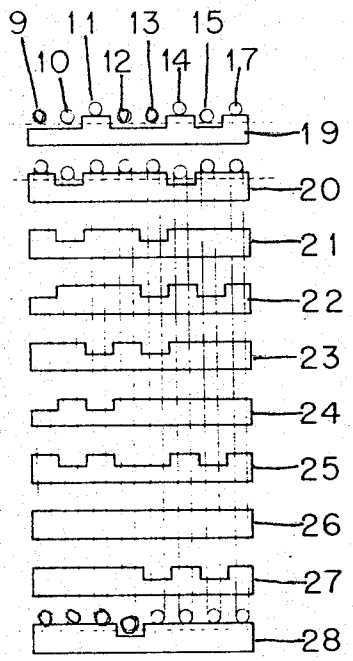



FIG. 4

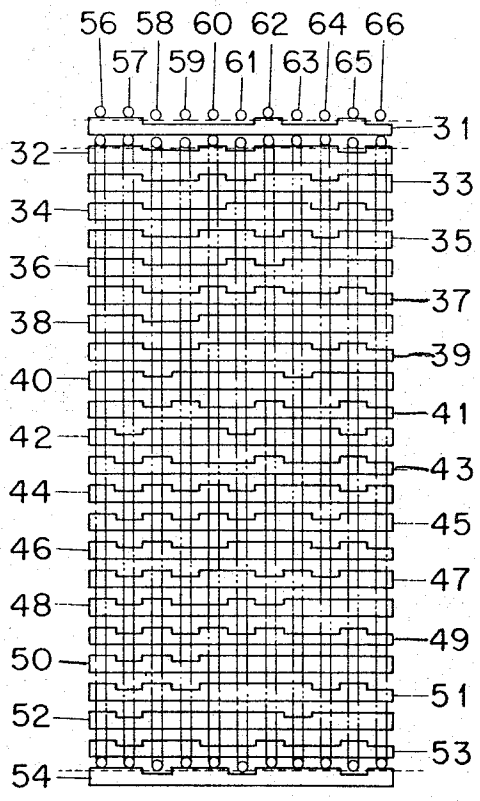



FIG. 8

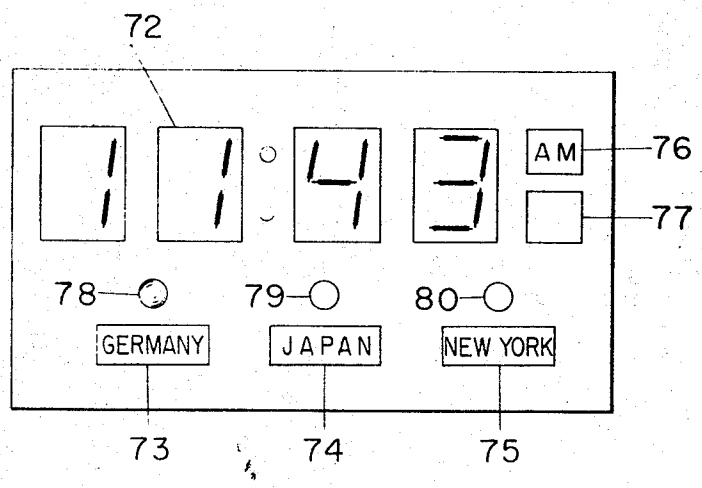


FIG. 5

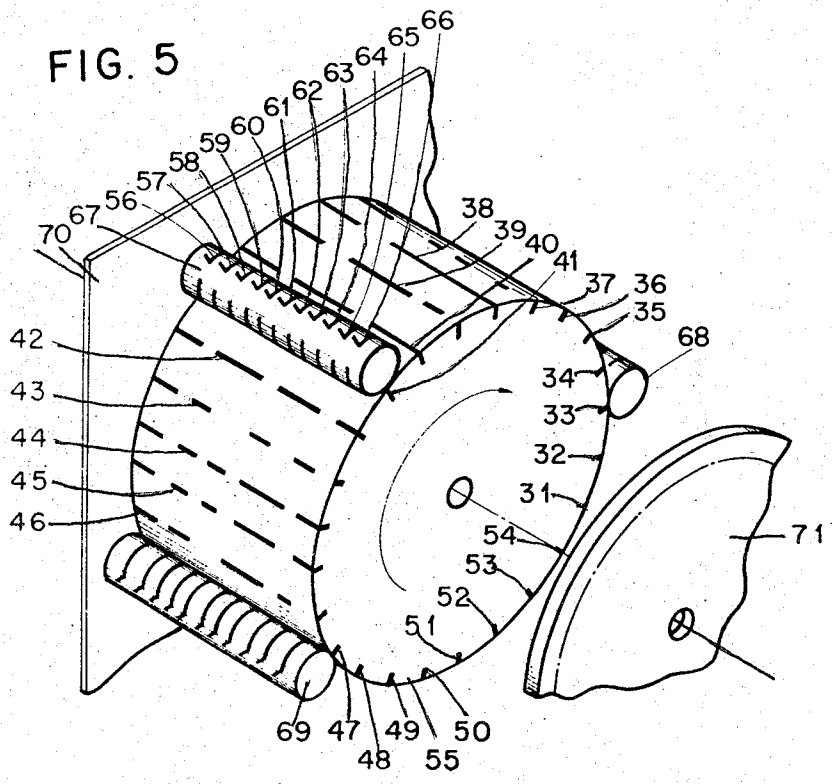

66
65
64
63
62
61
60
59
58
57
56
67
70
38
39
40
41
37
36
35
68
42
43
44
45
46
34
33
32
31
54
53
52
51
71
69
47
48
49
55
50

FIG. 7

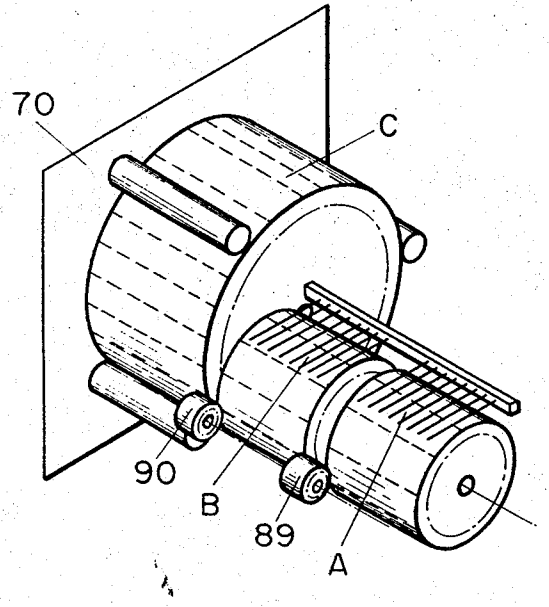
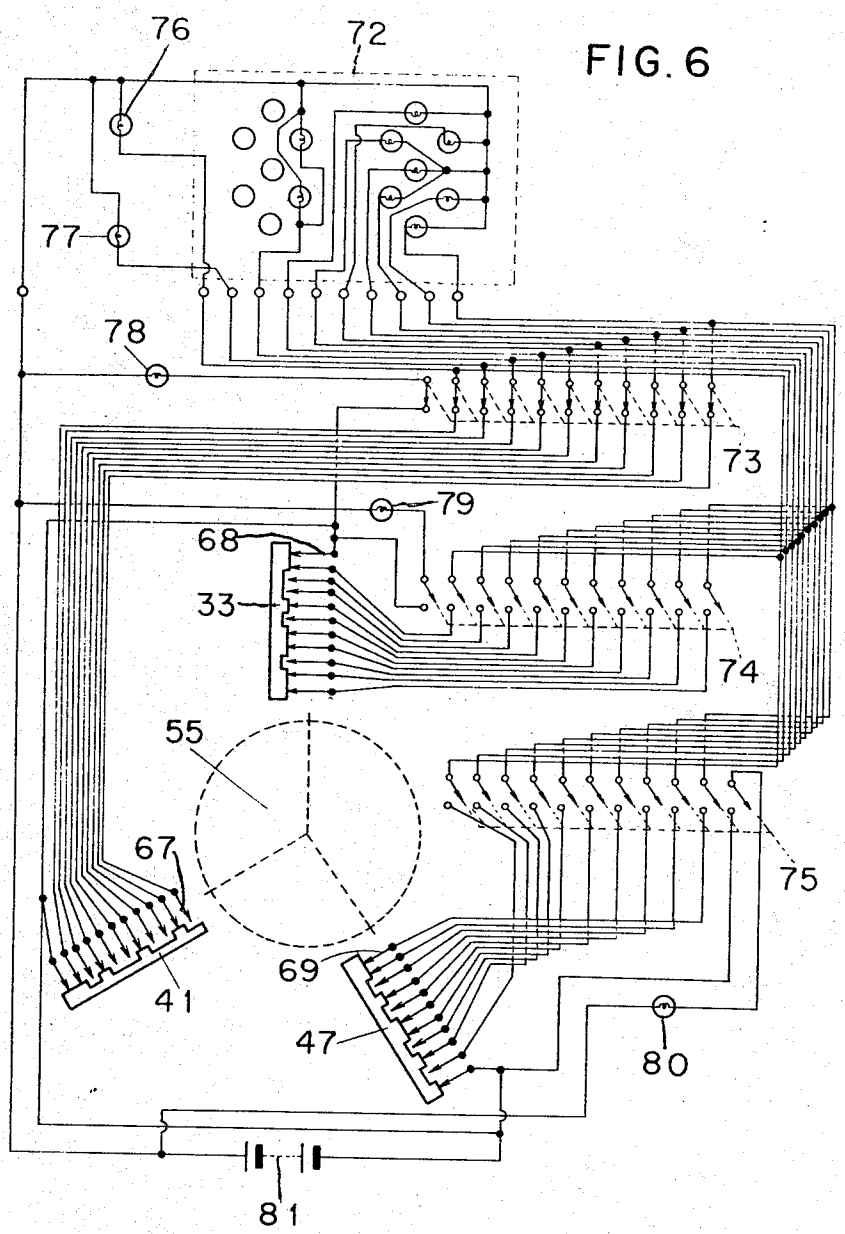

70
C
90
B
89
A

FIG. 6



# ELECTRO-MECHANICAL DIGITAL WORLD CLOCK

## BACKGROUND OF THE INVENTION

This invention relates to electric digital clocks, and more particularly to an electro-mechanical digital world clock capable of indicating time of various places of the world when required.

In the modern information-oriented world, it has become a matter of great importance and general acceptance in everyday business to have constant contact with branches and/or customers abroad by means of international telephone calls, telegram and telex. When exchanging information with a branch or a customer abroad, it is necessary to confirm the time of the country or the place in which the branch or the customer is located to ensure that the dispatched information is received at a proper time. However, in spite of the increased density of communication between the various places of the world, it has been the usual practice to use a complicated conversion table or a round time difference scale to know the time of a place which has a different standard time. Furthermore, in a large country having more than one standard time such as in the United States, business of a company having a country-wide sales network involves troublesome calculations of time difference every time when contacting branches or customers in different places.

## OBJECT OF THE INVENTION

The present invention aims at eliminating the above noted difficulty and therefore it is the primary object of the present invention to provide a clock capable of indicating different standard times of various places of the world when required.

It is another object of the present invention to provide an electro-mechanical digital world clock capable of indicating different standard times of various places of the world.

Still another object of the present invention is to provide an electro-mechanical digital world clock of the nature mentioned above, which is low in manufacturing cost as compared to the electronic counterparts and which is reliable in operation and simple in construction.

A further object of the present invention is to provide an electro-mechanical digital world clock having a mechanism whereby a standard time of a different place may be indicated instead of the user's standard time distinctly in electrically illuminated large figures by pushing a corresponding button switch.

## SUMMARY OF THE INVENTION

According to the present invention there is provided an electro-mechanical digital world clock comprising:

a first mechanism having a first digital indicator consisting of a plurality of electric bulbs, and switching means arranged on a cylindrical rotary body and adapted to be operated at every 1 minute through intermittent rotation of said rotary body for selectively illuminating said electric bulbs of said first digital indicator for indicating minute unit time by figures of 0 to 9;

a second mechanism having a second digital indicator consisting of a plurality of electric bulbs, and switching means arranged on a cylindrical rotary body which is rotated by a predetermined rotational angle at every 10 minutes through gear means in association with the rotation of the rotary body of the first mechanism to operate said switching means for selectively illuminating said electric bulbs of said second digital indicator for indicating 10-minute unit time by figures of 0 to 5;

a third mechanism having a third two-figured digital indicator consisting of a plurality of electric bulbs, a cylindrical rotary body adapted to make a one twenty-fourth rotation at every 1 hour through another gear means in association with the rotation of the rotary body of the second mechanism, a first switching means arranged on said rotary body of said third mechanism for selectively illuminating said electric bulbs of said third two-figured digital indicator for indicating hour unit time of one place, and additional switching means arranged on said rotary body of said third mechanism for selectively illuminating said electric bulbs of said third two-figured digital indicator for indicating hour unit time of another place, said additional switching means being located in a relative position on said rotary body of the third mechanism which corresponds to a time difference between said one place and another place; and

selection switch means for selectively connecting said first and additional switching means of said third mechanism to a power source for indicating the time of a selected place.



## BRIEF DESCRIPTION OF THE DRAWINGS

The above mentioned and further objects, features and advantages of the present invention will become more obvious from the following description when taken in connection with the accompanying drawings, which show, for purposes of illustration only, one preferred embodiment of the invention, and wherein:

FIG. 1 is an electric circuit diagram of a first mechanism A adapted to indicate minute unit time;

FIG. 2 is a perspective view partially in section of a drum or a rotary body and its associated members forming an essential part of the first mechanism A;

FIG. 3 is a diagramatic view showing ten short-circuitting elements of different configurations used in the first mechanism A;

FIG. 4 is a diagrammatic view of 24 short-circuitting members of different configurations employed in a third mechanism C which is adapted to indicate hour unit time;

FIG. 5 is a perspective view partially in section of a drum or a rotary body and its associated members forming an essential part of the mechanism C;

FIG. 6 is an electrical circuit diagram of the mechanism C;

FIG. 7 is a perspective view showing the first mechanism A, second mechanism B and third mechanism C integrally assembled with each other; and

FIG. 8 is a diagramatic view showing a front side of an electro-mechanical digital world clock according to the invention.

## DETAILED DESCRIPTION OF THE INVENTION

Referring now to the accompanying drawings wherein like reference numerals are used throughout the various views to designate like parts, and more particularly to FIG. 1, there is shown an electric digital indicator 8 of a first mechanism A which is adapted to indicate minute unit time by figures of from 0 to 9. The

electric digital indicator consists of, for example, seven electric segment bulbs 1 to 7 which are connected in series with respective contact arms 9 to 15. The contact arms 9 through 15 are connected to and disconnected from a power source by the cooperative action of a contact arm 17 and ten short-circuiting elements 19 to 28 which are arranged independently at an equal distance around the circumference of a cylindrical rotary body or a drum 18 as shown in FIG. 2. The rotary body 18 is held in an intermittent rotational movement in such a manner that the contact arm 17 is short-circuited by either one of the short-circuiting elements 19 to 28 when the rotary body is temporarily held in a stop position after every one-tenth revolution thereof. As seen from FIG. 3, the respective short-circuiting elements have different shapes or configurations so that the contact arms 9 to 15 are short-circuited in ten different combinations to enable the electric digital indicator 8 to indicate ten different figures of 0 to 9 by selectively lighting the seven segment bulbs every time when the rotary body 18 completes a one-tenth revolution and held in a stop position. FIGS. 1 and 2 show a case where the rotary body 18 is held in a stop position and the contact arms 9, 11, 12, 14 and 15 are short-circuited by the short-circuiting element 22 to illuminate a figure of 3 on the indicator 8 by lighting the bulbs 1, 3, 4, 6 and 7. The rotary body 18 is held in intermittent rotation by one-tenth revolution thereof per minute. In order to impart such intermittent rotational movement to the rotary body 18, a gear member 29 is fixed to one side of the rotary body 18 in close contact therewith. The gear member 29 is adapted to receive rotational movement from a small gear (not shown) held in engagement therewith. On the opposite side of the cylindrical rotary body 18, there is provided in close contact and in coaxial relationship therewith another gear member 30 of a particular shape for transmitting the rotational movement of the rotary body 18 to another rotary member at a suitable rate.

The electro-mechanical digital world clock of the present invention further comprises a similar electric segmented digital indicator of a second mechanism B which is adapted to indicate 10 minute unit time by figures of 0 to 5. The segmented digital indicator of the mechanism B is provided with a rotary body similar to the one described above in relation to the first mechanism A but the circumference of the rotary body of the mechanism B is divided into twelve equal sections or segments for illuminating successively two series of consecutive numbers of from 0 to 5 by intermittent one-twelfth revolutions of the rotary body, that is to say, the consecutive numbers of from 0 to 5 are indicated two times for every one complete revolution of the rotary body. The operating principles and construction of this rotary body are similar to the rotary body 18 of the first mechanism A except that the rotary body 18 is circumferencially divided into twelve equal sections for attaching 12 short-circuiting elements thereto instead of ten and that the rotary body is provided with different gear members, and thus detailed description in this connection is not given herein for the simplicity of explanation. Although in the present embodiment the rotary body of the second mechanism B is circumferentially divided into 12 equal sections for requirements in design, it may of course be divided into six or so.

FIG. 5 shows another cylindrical rotary body 55 circumferentially provided with twenty-four short-circuiting elements 31 to 54 which are arranged at an equal spacing and have respectively different configurations as shown in FIG. 4. A different one of the short-circuiting elements 31 to 53 is brought into contact at every one twenty-fourth rotation of the rotary body 55 with a selected number of electric contact arms 56 through 66 supported on a contact arm retaining member 67 and also with a number of contact arms supported on similar contact arm retaining members 68 and 69. The contact arm retaining members 67, 68 and 69 are secured commonly to a mounting plate member 70 provided on one side of the rotary body 55 as shown in FIG. 5. The rotary body 55 has fixed to the other side thereof a gear member 71 for receiving intermittent rotational movement from outside for making a one twenty-fourth revolution at every one hour. These contact arms forming switching means are electrically connected to a power source 81 by way of a two-figured electrical segmented digital indicator 72, selection switching means such as three button switches 73, 74 and 75 and five electric lamps 76 through 80. The lamp 76 is employed to indicate A.M. or ante meridiem. On the other hand, the lamp 77 is employed to indicate P.M. or post meridiem. The lamps 76 and 77 are connected in parallel, so that while the lamp 76 is on, the lamp 77 is off, and when the lamp 77 is on, the lamp 76 is off. The lamps 78, 79 and 80 are lit in association with the push button switches 73, 74 and 75, which are connected between the two-figured electrical segmented digital indicator 72 and the respective contact arm members 67, 68 and 69, respectively, for indicating certain selected city names. With the arrangement as shown in FIGS. 4, 5 and 6, if the rotary body 55 is driven to make a one twenty-fourth revolution on every hour, the time is indicated on the indicator 72 by the number of hour unit successively in the manner of 1 AM, 2 AM, 3 AM ..... 11 AM, 12 AM, 1 PM, 2 PM, 3 PM ..... 12 PM while the rotary body 55 makes one complete revolution.

In the above instance, the 24 short-circuiting elements 31 through 54 are attached at a uniform distance around the circumference of the rotary body 55 in the manner as mentioned hereinbefore, that is to say, the short-circuiting elements are provided around the periphery of the rotary body 55 at a distance of every 15°. In the example shown in FIGS. 5 and 6, the short-circuiting element in contact with the contact arms of the contact arm retainer 68 is held in a 120° advanced position with respect to the short-circuiting element 41 short-circuiting the contact arms 56, 57, 58, 59, 60, 61, 62, 63, 64, 65 and 66 of the contact arm retaining member 67, so that the contact arms of the contact arm retainer 68 is short-circuited by the short-circuiting element 33 to indicate a time 8 hours in advance of the time indicated by the contact arms on the contact arm retainer 67. More particularly, in the arrangement shown in FIGS. 5 and 6, it is possible to indicate 11 AM by means of the contact retaining member 67 in contact with the short-circuiting member 41 or 3 AM by means of the contact retaining member 68 in contact with the short-circuiting element 33. In this manner, there always exists a time difference of eight hours between the time indicated by the contact arm retaining member 67 and the time indicated by the contact arm retaining member 68 due to relative positional differ-

ence between the contact arm retaining members 67 and 68. Furthermore, the contact arm retaining member 69 in contact with the short-circuiting element 47 which is held in a position 90° displaced with respect to the short-circuiting element 41 is capable of indicating a time 6 hours behind of the time indicated by the contact arm retaining member 67. More particularly, in the example shown, the contact arms supported on the contact retaining member 69 are short-circuited by the short-circuiting element 47 in such a combination as to indicate figures 5 PM. The relative positions of the three contact arm retaining members in the illustrated example are applicable to a case where the contact arm retaining member 67 is required to indicate the German standard time, the contact arm retaining member 68 is required to indicate the Japanese standard time and the contact arm retaining member 69 is required to indicate the New York standard time. The mechanism having the above construction is herein referred to as a third Mechanism C for the convenience of explanation.

The mechanisms A, B and C described hereinabove are assembled into one integral mechanism in the manner similar to the ordinary drum type counter mechanism and are driven through gear means including two outwardly engaging small gears 89 and 90 as shown in FIG. 7. The thus assembled whole mechanism is received in a casing having a front panel as shown in FIG. 8 together with a synchronous motor means such as a timing motor. The synchronous motor is adapted to allow the mechanism A to make a one-tenth revolution at a relatively high speed at every 1 minute for digitally indicating minute unit time from 0 to 9. At the instant when the mechanism A completes one revolution to change the figure thereof from 9 to 0, the mechanism B is driven to make a one-twelfth revolution by way of the small gear 89 to indicate 10 minute time from 0 to 5. Further, at the instant when the mechanism B completes a one-twelfth revolution to change the figure from 5 to 0, the mechanism C is driven to make a one twenty-fourth revolution by way of the small gear 90 to indicate a one step higher number of hour unit time.

Thus, when Tokyo time of 3:43 AM is indicated on the front panel of the clock by pressing the button switch 74, if the button switch 73 corresponding to the German time is pressed, the button switch 74 for Tokyo time is cut off and the German time of 11:43 AM is indicated on the front panel instaneously as shown in FIG. 8. Furthermore, if the button switch 75 for the New York time is pressed, the button switch for the German time is cut off and the New York time of 5:43 PM is indicated similarly instantaneously on the front panel instead of the German time.

With the electric digital world clock according to the present invention, it is possible to provide electric contact arm retaining members of the same construction as the retaining members 67, 68 and 69 around the circumference of the rotary body 55, so that the times of almost all the principal cities of the world may be indicated selectively on the front panel of the clock, if desired. However, for practical purposes, it will suffice to provide only several number of contact arm retainers and corresponding push button switches.

While there has been shown and described only one preferred embodiment of the present invention, it will be understood that the same is not limited thereto but is susceptible of numerous changes and modifications as known to a person skilled in the art, and therefore, it is not intended to limit the invention to the details shown and described herein but intended to cover all such changes and modifications as are encompassed by the scope of the appended claims.

What is claimed is:

1. An electro-mechanical digital world clock comprising:

a first mechanism having a first digital indicator consisting of a plurality of electric bulbs, and switching means arranged on a cylindrical rotary body and adapted to be operated at every one minute through intermittent rotation of said rotary body for selectively illuminating said electric bulbs of said first digital indicator for indicating minute unit time by figures of 0 to 9;

a second mechanism having a second digital indicator consisting of a plurality of electric bulbs, and switching means arranged on a cylindrical rotary body which is rotated by a predetermined rotational angle at every 10 minutes through gear means in association with the rotation of the rotary body of the first mechanism to operate said switching means for selectively illuminating said electric bulbs of said second digital indicator for indicating 10-minute unit time by figures of 0 to 5;

a third mechanism having a third two-figured digital indicator consisting of a plurality of electric bulbs, a cylindrical rotary body adapted to make a one twenty-fourth rotation at every 1 hour through another gear means in association with the rotation of the rotary body of the second mechanism, a first switching means arranged on said rotary body of said third mechanism for selectively illuminating said electric bulbs of said third two-figured digital indicator for indicating hour unit time of one place, and additional switching means arranged on said rotary body of said third mechanism for selectively illuminating said electric bulbs of said third two-figured digital indicator for indicating hour unit time of another place, said additional switching means being located in a relative position on said rotary body of the third mechanism which corresponds to a time difference between said one place and another place; and

selection switch means for selectively connecting said first and additional switching means of said third mechanism to a power source for indicating the time of a selected place.

2. An electro-mechanical digital world clock as defined in claim 1, said switching means of said first mechanism comprises short-circuiting elements having different configurations and arranged at equal distances around the circumference of said rotary body, and contact arm members connected respectively to said electric bulbs and adapted to be brought into and out of contact with said short-circuiting elements for selectively illuminating said electric bulbs of said first indicator for indicating minute time by figures of 0 to 9;

said switching means of said second mechanism comprises short-circuiting elements arranged at equal distance around the circumference of said rotary body, and contact arm members connected respectively to said segmented electric bulbs and adapted to be brought into and out of contact with said short-circuiting elements for selectively illuminat-

ing said electric bulbs of said second indicator for indicating 10 minute time by figures of 0 to 5; and said first switching means of said third mechanism comprises 24 short-circuiting elements arranged at equal distance around the circumference of said rotary body of said third mechanism and contact arm members connected respectively to said electric bulbs of said third two-figured digital indicator and adapted to be brought into and out of contact with said twenty-four short-circuiting elements for selectively illuminating said electric bulbs of said third indicator for indicating hour unit time of said one place, and said additional switching means of said third mechanism comprises contact arm members connected respectively to said electric bulbs of said third two-figured digital indicator and adapted to be brought into and out of contact with said 24 short-circuiting elements for selectively illuminating said electric bulbs of said third indicator for indicating hour unit time of said another place.

3. An electro-mechanical digital world clock as defined in claim 1, wherein said selection switch means includes a first button switch inserted between said electric bulbs of said third digital indicator and the respective contact arm members of said first switch means of said third mechanism, and a second button switch inserted between said electric bulbs of said third digital indicator and the respective contact arm members of said additional switch means of said third mechanism.

4. An electro-mechanical digital world clock as defined in claim 3, further comprising two paralelly connected lamps for illuminating letters of AM and PM in accordance with the rotation of the rotary body of said third mechanism.

5. An electro-mechanical digital world clock as defined in claim 1, wherein said third mechanism further comprises a further additional switching means arranged on said rotary body of said third mechanism for selectively illuminating said electric bulbs of said third two-figured digital indicator for indicating hour unit time of a third place, said further additional switching means being located in a relative position on said rotary body of the third mechanism which corresponds to time differences with respect to said first switching means and first additional switching means.

* * * * *

# UNITED STATES PATENT OFFICE

# CERTIFICATE OF CORRECTION

Patent No. 3,760,581 Dated September 25, 1973

Inventor(s) Yasuo Wakabayashi

It is certified that error appears in the above-identified patent and that said Letters Patent are hereby corrected as shown below:

Column 6, line 51, before "said" insert -- wherein --; line 59, after "minute" insert -- unit --. Column 7, line 2, after "minute" insert -- unit --. Column 8, line 8, "paralelly" should read -- parallelly --.

Signed and sealed this 1st day of October 1974.

(SEAL)
Attest:

McCOY M. GIBSON JR.
Attesting Officer

C. MARSHALL DANN
Commissioner of Patents

FORM PO-1050 (10-69)

USCOMM-DC 60376-P69
U.S. GOVERNMENT PRINTING OFFICE : 869-930

# UNITED STATES PATENT OFFICE
# CERTIFICATE OF CORRECTION

Patent No. 3,760,581 Dated September 25, 1973

Inventor(s) Yasuo Wakabayashi

It is certified that error appears in the above-identified patent and that said Letters Patent are hereby corrected as shown below:

Column 6, line 51, before "said" insert -- wherein --; line 59, after "minute" insert -- unit --. Column 7, line 2, after "minute" insert -- unit --. Column 8, line 8, "paralelly" should read -- parallelly --.

Signed and sealed this 1st day of October 1974.

(SEAL)
Attest:

McCOY M. GIBSON JR.
Attesting Officer

C. MARSHALL DANN
Commissioner of Patents

FORM PO-1050 (10-69)

USCOMM-DC 60376-P69
U.S. GOVERNMENT PRINTING OFFICE : 869-930