

[54] ELECTRONIC WATCH

3,681,914 8/1972 Loewengart 58/24 R

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3,823,545.

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58/152 R, 235/156

[51] Int. Cl. G04c 3/00, G04b 19/30, G06f 7/56

[58] Field of Search 58/23 R, 34, 50 R, 85.5,
58/152 R

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UNITED STATES PATENTS

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[57] ABSTRACT

An electronic watch with an electronic display of time fed from a counting circuit via a transcoder comprises a data input device including a manual control member for transferring at least one element of displayed data by means of a logical transfer circuit. For example, a number indicated on a separate display by means of a separate counter can be selectively transferred to replace any particular number in the display of time to thereby set the time. Alternatively, an indication of a first unit of time (e.g., seconds) can be transferred to replace and thereby correct an indication of a second unit of time (e.g., hours), a supplementary impulse generator selectively accelerating the sequential indication of seconds.

3 Claims, 7 Drawing Figures

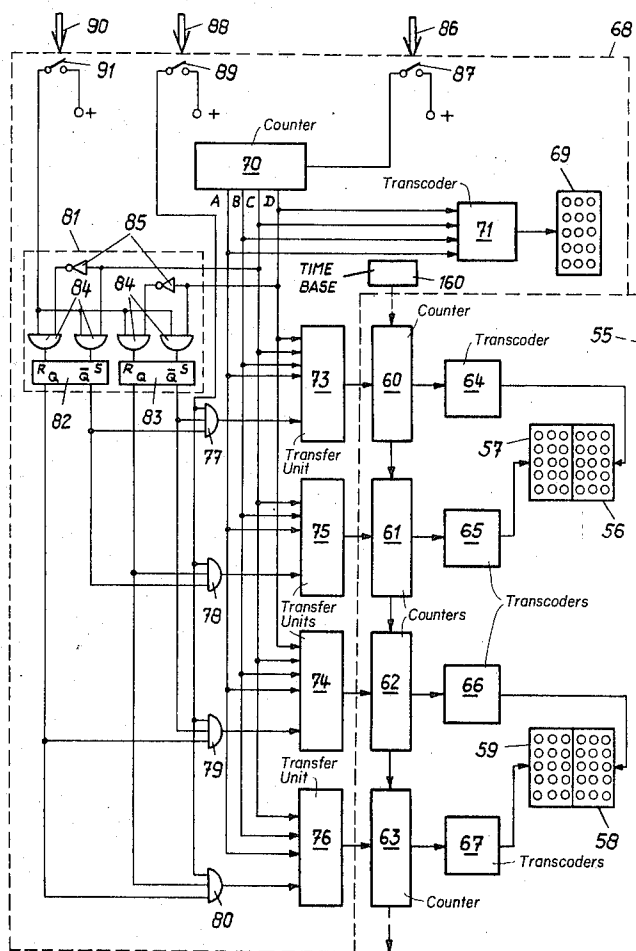


Fig. 1

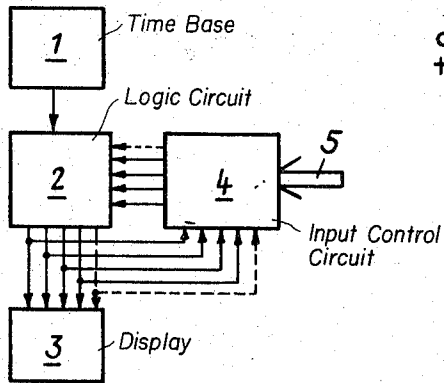


Fig. 7

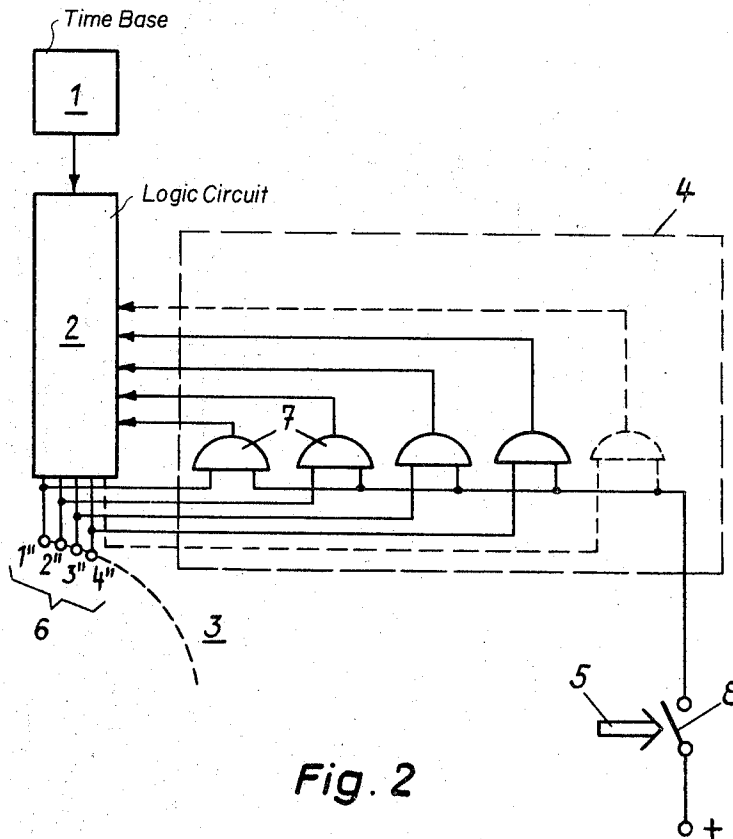
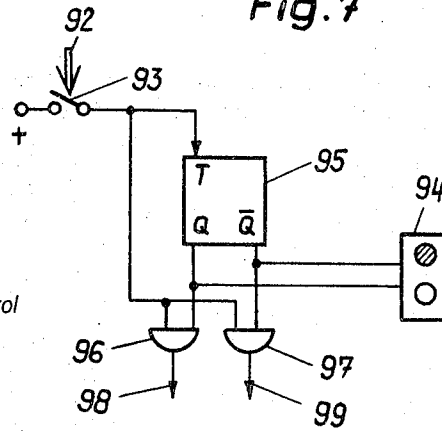


Fig. 2

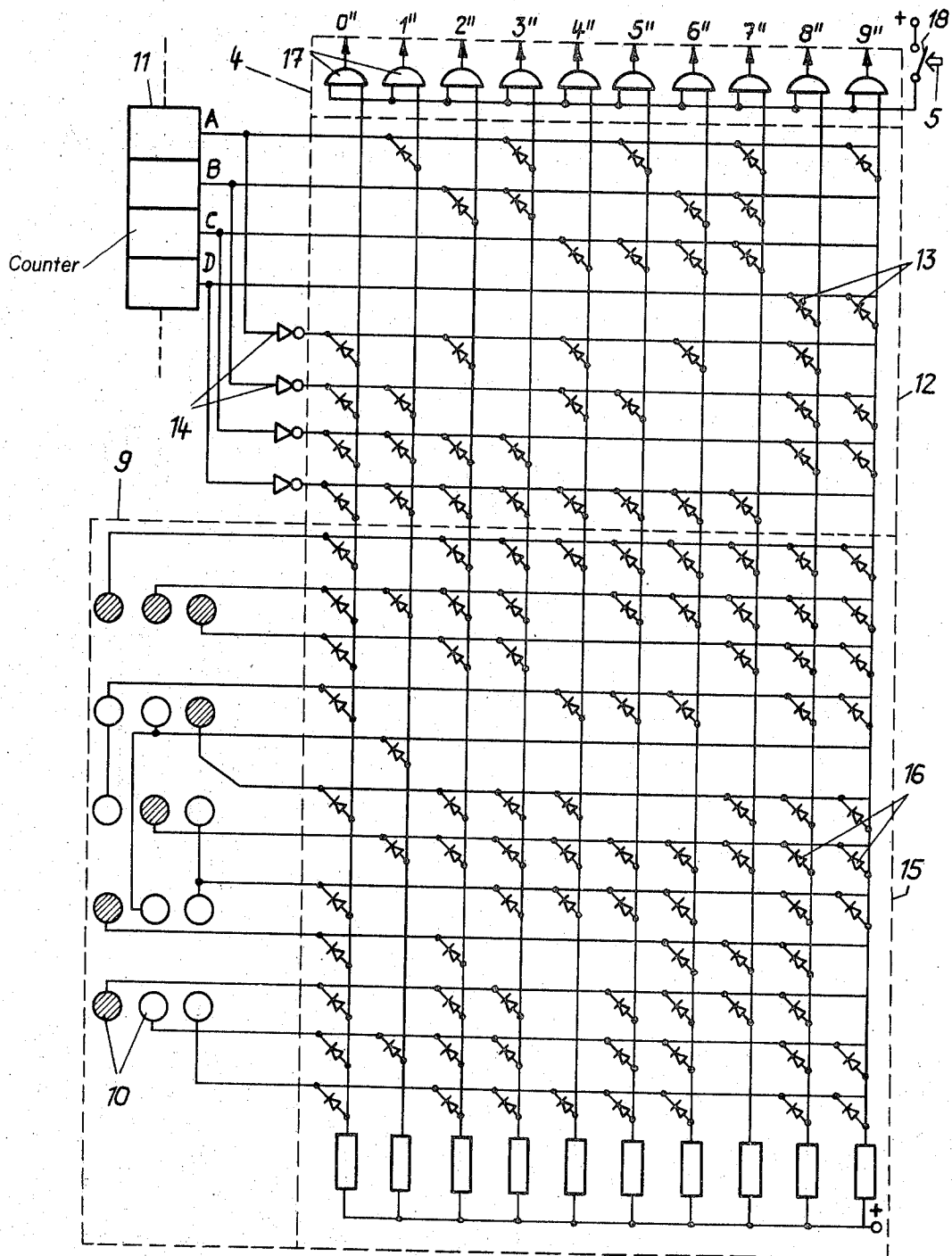


Fig. 3

Fig. 4

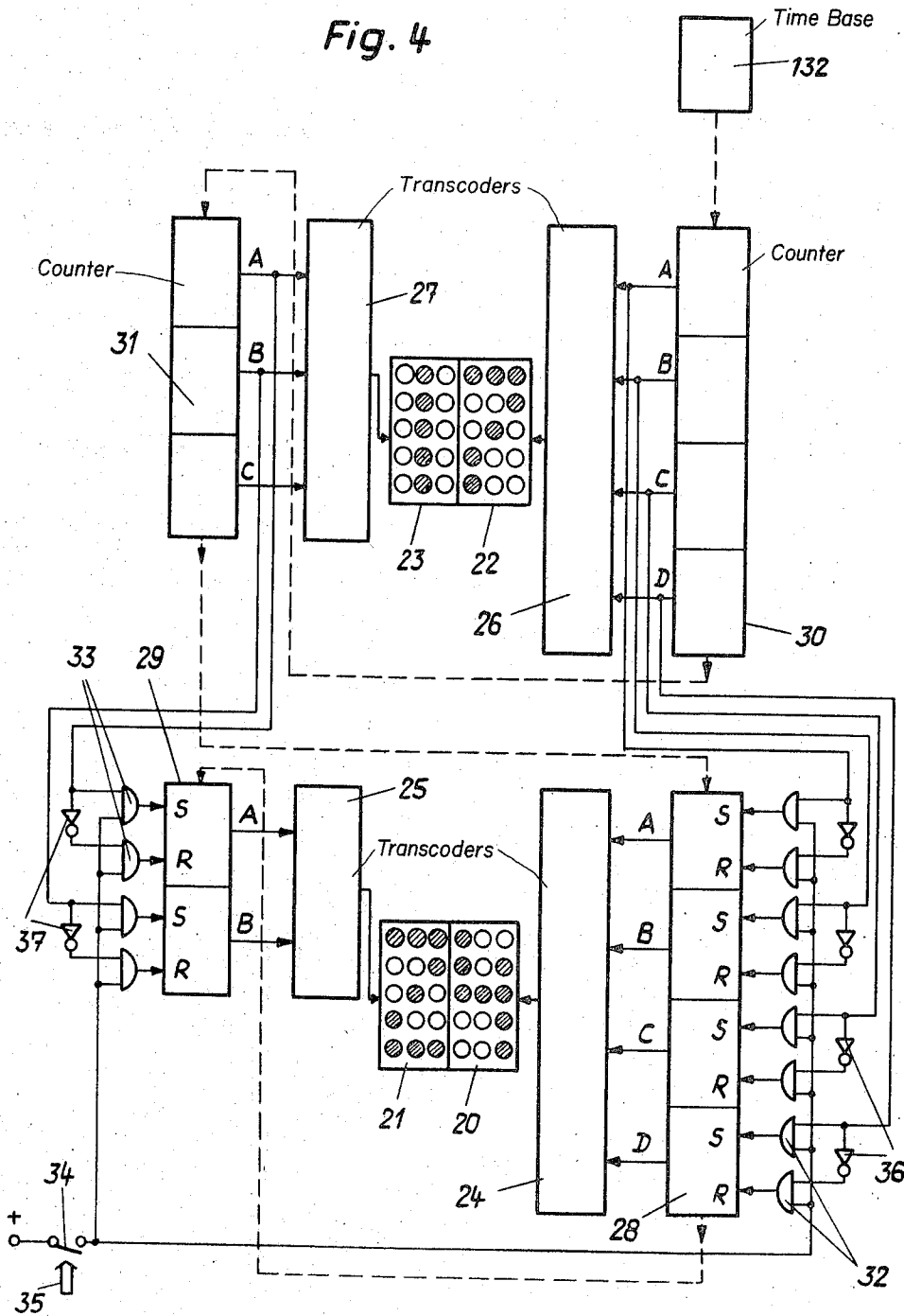


Fig. 5

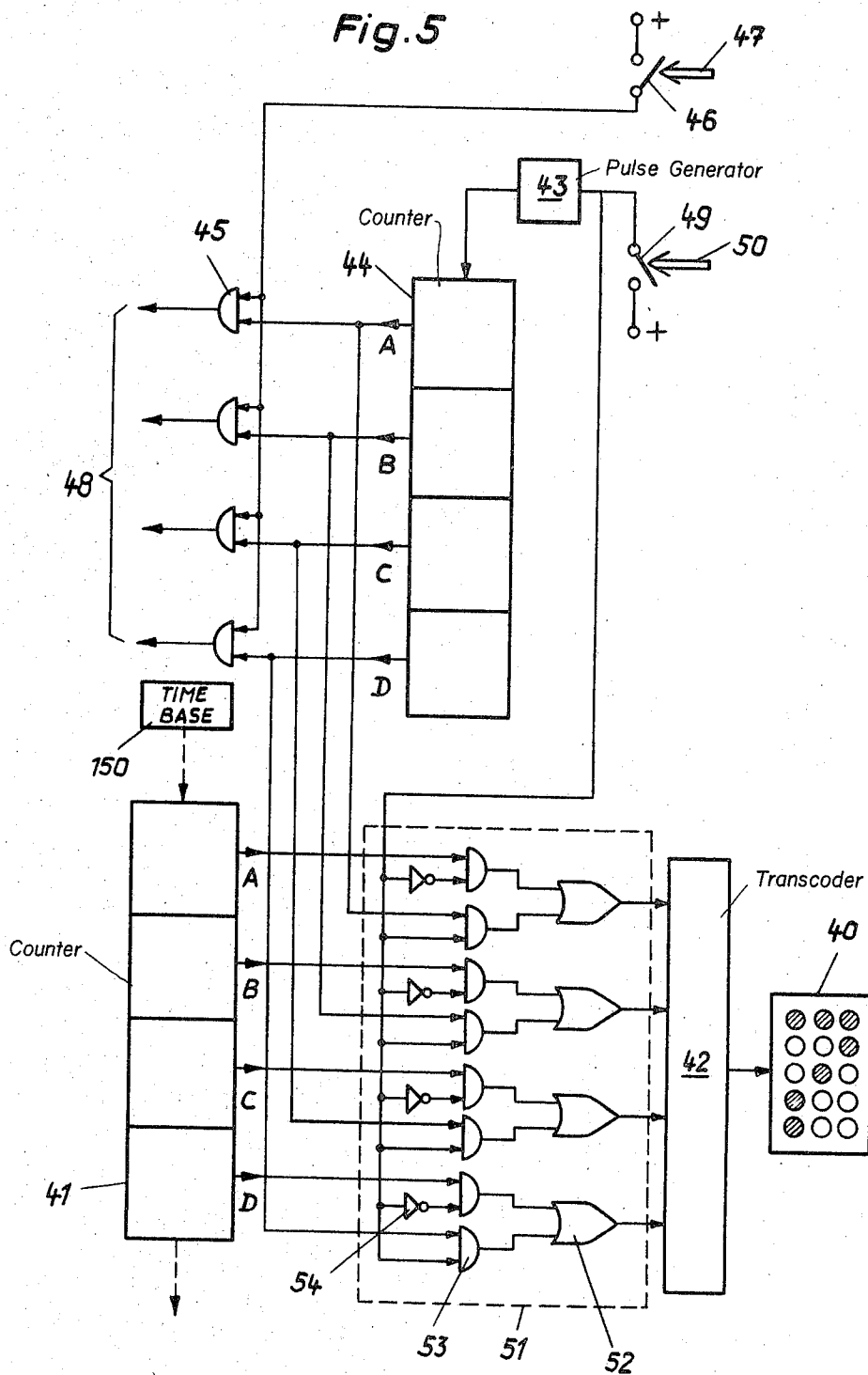
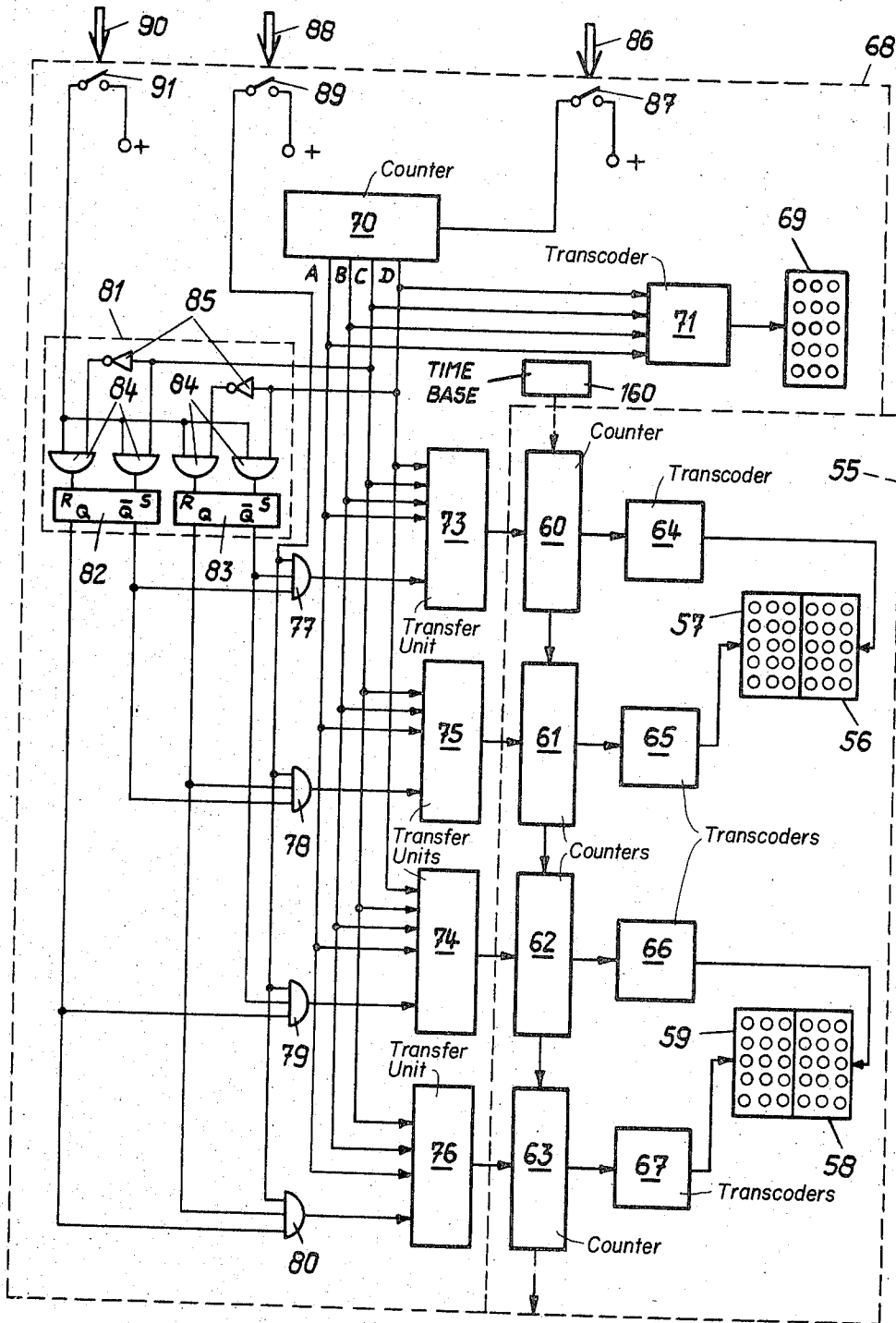


Fig. 6



1

ELECTRONIC WATCH

This is a division of application Ser. No. 187,961, filed Oct. 12, 1971 which is now U.S. Pat. No. 3,823,545.

The present invention relates to electronic watches.

It is known to provide electronic watches without any moving parts, formed from a time base, a logical assembly for counting and transcoding impulses, and an electro-optical display device replacing the traditional hands.

On such a watch, the operations of setting the second, the minute, the hour and the date can no longer be carried out as on mechanical watches by means of a rotatable setting crown, and a separate action must be made to set each of the seconds, the minutes, the hours and the date.

Moreover, by the use of highly complex integrated circuits with a low bulk and a very low power consumption, the volume normally taken up by the mechanical and electro-mechanical parts is available for the carrying out of certain accessory functions such as a simple calculator, a simple data store or a radio receiver employing a part of the electronic and all or part of the display of the watch. However, such accessory functions must necessarily be controlled by input members, and a fundamental problem therefore arises, namely the introduction of a relatively large number of data into the watch by a simple manual actuation. It can be readily understood that it is difficult, if not impossible, to employ the arrangement used in table calculators in which each element of data is introduced by means of a specific key or push button: the necessity of adapting the dimensions of each key or push button to the dimensions of the user's fingers limits the possible number of keys or push buttons to a very low value.

An aim of the present invention is to resolve this problem.

According to the invention, an electronic watch comprises a data input device, said device comprising first circuit means for sequentially emitting data, a display device for electronically displaying the data emitted by the first circuit means, and a manual control member acting on a logical transfer circuit for controlling transfer of the displayed data.

The invention will now be particularly described, by way of example, with reference to the accompanying drawings, in which:

FIG. 1 is a block diagram of a basic arrangement of a watch according to the invention, in which the circuit sequentially emitting data and the electronic display device are also used for displaying the time;

FIGS. 2 to 4 are more detailed partial block diagrams of three specific embodiments of the basic arrangement;

FIG. 5 is a partial block diagram of another embodiment;

FIG. 6 is a block diagram of a further embodiment; and

FIG. 7 is a partial block diagram of an improvement of the embodiment according to claim 6.

The watch schematically shown in FIG. 1 comprises a time base 1 supplying impulses which are counted and transcoded by at least a part of a logic circuit 2 before being applied to an electronic display device 3. The logic circuit 2 may otherwise carry out other ac-

2

cessory functions, as mentioned earlier, such as making simple calculations, storing simple data or simply switching on and off a receiver, a personal location apparatus or a small recorder.

A supplementary circuit 4 enables introduction into the logical circuit 2 of a number of data equal to the number of different indications that can be displayed. To employ the device, it suffices to wait until the data that it is desired to introduce into the circuit 2 is displayed by the device 3 and actuate the manual control member 5 (hereinafter simply referred to as "push button") at the moment when this data is displayed.

FIG. 2 is a partial schematic view of a first specific embodiment of the arrangement of FIG. 1. In this embodiment, the display device 3 consists of 60 luminous points formed by electroluminescent lamps or diodes 6 each remaining illuminated in turn during 1 second, so as to display the second. In FIG. 2, for greater clarity, only four diodes representing the first four seconds 1'', 2'', 3'', and 4'' of the minute are shown. Of course, the watch also comprises displays of the hours and minutes, which are also not shown for the sake of greater clarity. The additional circuit 4 is formed of 60 AND logical gates 7 one of the inputs of each of which is controlled by a circuit comprising the positive pole of a voltage source, not shown, in series with a switch or contact 8 controlled by the push button 5. The other input of each of the AND gates 7 is separately connected to the control circuit of one of the luminous diodes 6. The output of each of the AND gates is separately applied to the logic circuit 2.

The described data input device will for example enable modification of the position of the counter included in the circuit 2 so as to carry out setting of the time. By means of this data input device, it is possible to introduce sixty different data by means of a single push button 5. For example, if it is desired to introduce the data corresponding to the number three the operator will wait until the luminous diode 6 corresponding to the second 3'' lights up, and then actuate the push button 5.

FIG. 3 shows a second specific embodiment of the arrangement according to FIG. 1, namely a watch with a digital display of seconds provided by two matrices 9 each comprising fifteen electroluminescent diodes 10, only one of these matrices being shown. Only the matrix displaying the units of seconds is used for the input of data, which enables the input of ten different data.

The normal circuit of the watch associated with the time display comprises a counter 11 of which only the part corresponding to the counting of units of seconds is shown, this part delivering four logical signals A, B, C, D indicating the second in binary code. In a conventional manner, this code is firstly transformed into decimal code by a matrix 12 composed of diodes 13 then into a code for controlling the fifteen diodes 10 of the matrix 9 by means of a further matrix 15 including diodes 16. In FIG. 3, the number seven is displayed by the diodes 10. The data input circuit 4 comprises 10 AND gates 17 controlled by the output of the transcoder matrix 12 and by a circuit comprising the positive pole of a voltage source in series with a switch or contact 18 controlled by means of the push button 5.

The data input circuit enables the introduction of one of the 10 data 0'' to 9'' by pressing on the push button 5 at the moment when the number of the desired data

is displayed by the matrix 9. The data 0'' to 9'' thus introduced can be used to carry out a setting of the time or for other purposes, as will be described further on.

FIG. 4 is a partial block diagram of a third specific embodiment of the arrangement according to FIG. 1, in which the introduction of data enables setting of the watch according to the time zone. The watch comprises an hours display formed by a matrix 20 of electroluminescent diodes for displaying the units and a matrix 21 for displaying the tens of hours; and a seconds display formed by a matrix 22 for displaying the units and a matrix 23 for displaying the tens of seconds.

The matrices 20 to 23 are respectively controlled by transcoders 24 to 27 with four, three or two inputs (as shown) and each with 15 outputs, only one of these outputs for each transcoder being shown. The inputs of each of the transcoders 24 to 27 are provided by the outputs A, B, C, D of four counting groups 28 to 31 with four, three or two stages, as shown, of an impulse counter fed by a time base 132. The outputs A, B, C, D of groups 28 to 31 indicate in binary code the decimal number which must be displayed by the corresponding matrix 20 to 23. Each of the stages of the counting groups 28 and 29 comprises a SET input S and a RESET input R, these inputs S and R being such that when a logical signal of value 1 and a logical signal of value 0 are respectively applied to the inputs S and R, the output takes the logical value 1, and conversely. The inputs R and S are themselves controlled by the corresponding outputs of eight AND logical gates 32 for the group 28 and four AND logical gates 33 for the group 29. One of the inputs of each of the AND gates 32 and 33 is fed by a circuit comprising the positive pole of a current source connected in series with a contact or switch 34 controlled by a push button 35. The other inputs of the AND gates 32 connected to the inputs S of the group 28 are connected directly to the corresponding outputs A, B, C, D of the group 30, whilst the other inputs of the AND gates 32 connected to the inputs R of the group 28 are connected to the corresponding outputs A, B, C, D of the group 30 via a corresponding inverter 36. The other inputs of the AND gates 33 are connected in the same manner to the outputs A, B of the counting group 31, two inverters 37 being provided for this purpose. Counters 28, 29 and inverters 36, 37 form the logic transfer circuit of FIG. 1.

To carry out a setting of the time zone, it suffices to wait until the matrices 22 and 23 display a desired indication and to press on the push button 35 so that the number displayed by these matrices is transferred to the counters 28 and 29 hence to the matrices 20 and 21. For example, if the push button 35 is actuated with the display in the state shown, the number 24 displayed by the matrices 20 and 21 will be replaced by the number seventeen displayed by the matrices 22 and 23.

The use of the display of seconds for the sequential indication of data to be selected has the disadvantage of obliging the user to wait for a desired indication of the second before carrying out selection. This time can be up to 59 seconds for the embodiments according to FIGS. 2 and 4. Moreover, a time interval of only 1 second is available for giving the selection order. These drawbacks can be remedied by providing an accelerated sequential indication of the data to be transferred

by means of a supplementary manual control member.

FIG. 5 is a partial block diagram of another embodiment in which a frequency generator and an auxiliary counter are provided to accelerate the introduction of data. The normal time display of the watch comprises a matrix 40 of electroluminescent diodes controlled by a counting group 41 with four stages, via a transcoder 42. A time base 150, similar to time base 132 (FIG. 4), supplies input pulses to counting group 41. The matrix 40 is intended to display the minutes for example, the other matrices not being shown. The data introduction device comprises an auxiliary impulse generator 43 and an auxiliary counter 44. The four binary outputs A, B, C, D of the counter 44 are respectively applied to one of the inputs of four corresponding AND logical gates 45 the other inputs of which are controlled by a circuit comprising the positive pole of a voltage source in series with a switch or contact 46 controlled by a push button 47. The data 48 emitted at the outputs of the four AND gates 45 are applied to the logic circuit 2, not shown, for example with a view toward carrying out a setting of the time indicated by the watch, or changing the content of a register part of an auxiliary calculator. Actuation of the auxiliary generator 43 is controlled by a circuit comprising the positive pole of a voltage source in series with a switch or contact 49 controlled by a push button 50. The latter circuit also controls a selector 51 with two positions and four channels comprising four OR logical gates 52, eight AND logical gates 53 and four inverters 54.

In normal operation, that is to say when the two switches 46 and 49 are open, the generator 43 is inoperative and the selector 51 transmits to the transcoder 42 the binary outputs A, B, C, D of the counter 41, which binary outputs are transcoded into the decimal system by the transcoder 42 and displayed by the matrix 40. When the push button 50 is actuated, the generator 43 is put into operation and the state of the selector 51 is modified so that the outputs A, B, C, D of the counter 44 are applied to the transcoder 42 and displayed by the matrix 40. When the desired decimal number is displayed by the matrix 40, the push button 50 is relaxed and the push button 47 is actuated so as to emit output data 48 representing in binary code the number which had been displayed by the matrix 40. Hence, the rate of sequential indication of the data to be transferred is no longer one number per second; however, it is necessary to provide a supplementary push button.

As a variant, it would be possible to provide an additional push button enabling adjustment of the frequency of the generator 43 by changing the value of one of the elements determining its frequency, for example by means of a pressure-sensitive element such as a piezo-transistor. This push button could alternatively be combined with the push button 50 so that only two push buttons are required.

In another variant, the generator 43 could be eliminated, and a step by step control of the counter could be carried out by actuation of the push button 50 to close the switch 49.

To increase the possibilities of use of the data input device, data can be combined to form a more evolved data. For example, the operator could introduce a first data representing one of several possible orders or commands, and then introduce a second data repre-

senting a numerical value attached to the given order.

FIG. 6 shows an embodiment of watch in which the second, the tens of seconds, the minute, and the tens of minutes can be selectively set by firstly introducing a first data indicating which of these four operations it is wished to carry out, and then introducing a second data indicating the corrected value.

The normal time indicating device 55 comprises a matrix 56 for displaying the seconds, a matrix 57 for displaying the tens of seconds, a matrix 58 for displaying the minutes, and a matrix 59 for displaying the tens of minutes, these matrices being controlled from corresponding counters 60 to 63 through transcoders 64 to 67 respectively. A time base 160 supplies input pulses to counter 60 and thus to counters 61 to 63, similar to the operation of time bases 150 (FIG. 5) and 132 (FIG. 4). The device 68 for setting the time comprises a display matrix 69 which does not form part of the time display. This matrix 69 is controlled by means of an independent counter 70, through a transcoder 71. The counter 70 moves forward step by step by means of a push button 86 controlling a switch or contact 87. The set of four binary outputs A, B, C, D of the counter 70 is applied to a transfer block 73 controlling the counter 60 for the units of seconds and to a transfer block 74 controlling the counter 62 for the units of minutes, whilst only the binary outputs A, B, C of the counter 70 are applied to the transfer blocks 75 and 76 controlling the counters 61 and 63 for the tens of seconds and the tens of minutes respectively. In practice, since these latter counters do not provide for the display of any number greater than five, the binary output D of the counter 70 is not required. These transfer blocks 73 to 76 also comprise a control input respectively actuated by an AND logical gate 77, 78, 79, 80 each with three inputs. These transfer blocks 73 to 76 transfer to the corresponding counter 60 to 63 the data at the outputs A, B, C, D of the counter 70 when a control impulse is emitted by the corresponding AND gate 77 to 80. The transfer blocks 73 to 76 can be formed in the same manner as the device with AND gates 33 and inverters 37 of FIG. 4. The time setting device also comprises a memory 81 formed of two RS type flip-flops 82, 83 and a logical input comprising four AND gates 84 and two inverters 85. The RS flip-flops 82 are such that a signal of logical value 1 applied at R makes $Q = 0$ and $\bar{Q} = 1$, and a signal of logical value 1 applied at S makes $Q = 1$ and $\bar{Q} = 0$.

In addition to the first push button 86 controlling a switch or contact 87 to carry out the step by step advance of the counter 70, the time setting device comprises a second push button 88 controlling a switch or contact 89 for the excitation of one of the inputs of each of the four AND gates 77 to 80, and a third push button 90 controlling a switch or contact 91 for the excitation of one of the inputs of each of the AND gates 84.

The operation of the device is as follows:

For each of the four orders which can be carried out, a code number is attributed according to the following table:

- | | |
|---|-------------------------------------|
| 0 | correction of the units of seconds; |
| 1 | correction of the tens of seconds; |
| 2 | correction of the units of minutes; |
| 3 | correction of the tens of minutes. |

After having displayed on the matrix 69 by means of the push button 86 whichever of the numbers 0 to 3 corresponds to the order that it is desired to carry out, the button 90 is actuated, the effect of which is to register this number in the memory 81.

By once more actuating the push button 86, a decimal number which it is desired to register in the counter 60-63 corresponding to the preceedingly given order is displayed on the matrix 69. It then suffices to actuate the push button 88 to transfer the data of the counter 70 to the said one of the counters 60-63.

FIG. 7 is a partial block diagram of an improvement of the input device according to FIG. 6, in which the two push buttons 88 and 90 are replaced by a single push button 92 actuating a switch or contact 93. The data input device comprises a supplementary display matrix 94 with two diodes, controlled by a T-type flip-flop 95 (two state counter). The outputs Q and $\bar{Q}$ of the flip-flop 95 change state each time that the button 92 is lifted up, the state of the flip-flop or counter 95 being displayed by the matrix 94. The device also comprises two AND gates 96 and 97 whose outputs 98 and 99 respectively replace the two push buttons 90 and 88 of FIG. 6. By applying on the button 92, the logical state 1 is alternatively imposed on the outputs 98 and 99, which thus behave the same as when the push buttons 88 and 90 of FIG. 6 are actuated alternatively.

The data input device according to the different preceeding embodiments thus enables setting the time of a watch in the most general sense of the term. It additionally enables, by the use of more or less advanced logical systems, but which are available with present day integrated circuit techniques, other operations to be carried out. For example, for the adjustment of the running or timekeeping of the watch, in order can be given to modify the division ratio at the beginning of the counting chain by a certain number of parts per million (ppm).

The device also makes possible the provision of certain new functions in a watch, such as:

Momentary use of the display of the watch for the display of other data, for example the atmospheric pressure, the acceleration undergone by the wearer, or the wearer's pulse rate.

An elementary calculator: the numbers and the operations to be carried out being introduced as for the time setting data.

Other accessory functions such as a personnel location apparatus, a radio receiver, or a dictaphone, which are controlled by orders introduced by means of the device.

What is claimed is:

1. An electronic watch, comprising:

a time base;
an electronic display means;
a logic circuit having an input coupled to an output of said time base and an output coupled to an input of said display means, said logic circuit including a first counting circuit and transcoding means coupling the output of said first counting circuit to said display means;

data input means coupled to a further input of said logic circuit for selectively transferring data signals to said further input, said data input means comprising
a pulse generator,

7

first manual control means for controlling the out-
put of said pulse generator, and
a second counting circuit coupled to the output of
said pulse generator;
second manual control means coupled between the 5
output of said second counting circuit and said fur-
ther input of said logic circuit for selectively trans-
ferring data from said second counting circuit to
said logic circuit; and
a selection circuit coupled to said first counting cir- 10
cuit and said transcoding circuit for selectively
controlling the display of the outputs of said first
and second counting circuits on said display means.

2. Data input apparatus for use in an electronic watch 15
having a time base, a logic circuit, an input of which is
coupled to an output of said time base, and an elec-
tronic display means coupled to an output of said logic
circuit, said apparatus comprising:
a counting circuit;

8

manual control means coupled to the input of said
counting circuit for manually stepping said count-
ing circuit;
further display means for displaying the output of
said counting circuit;
memory means for storing an output of said counting
means in the form of logic instructions; and
data transfer means coupling the output of said
counting means to a further input of said logic cir-
cuit, said data transfer means being further coupled
to and controlled by the output of said memory
means, wherein data is transferred from said count-
ing means to said logic circuit as a function of the
logic instructions stored in said memory means.

3. Apparatus according to claim 1, comprising sec-
ond manual control member means which, when actu-
ated, transfers the data displayed by said further display
means to said memory means.

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