Sept. 27, 1966

S. D. HARPER

3,275,807

ELECTRICAL APPARATUS

Filed March 15, 1963

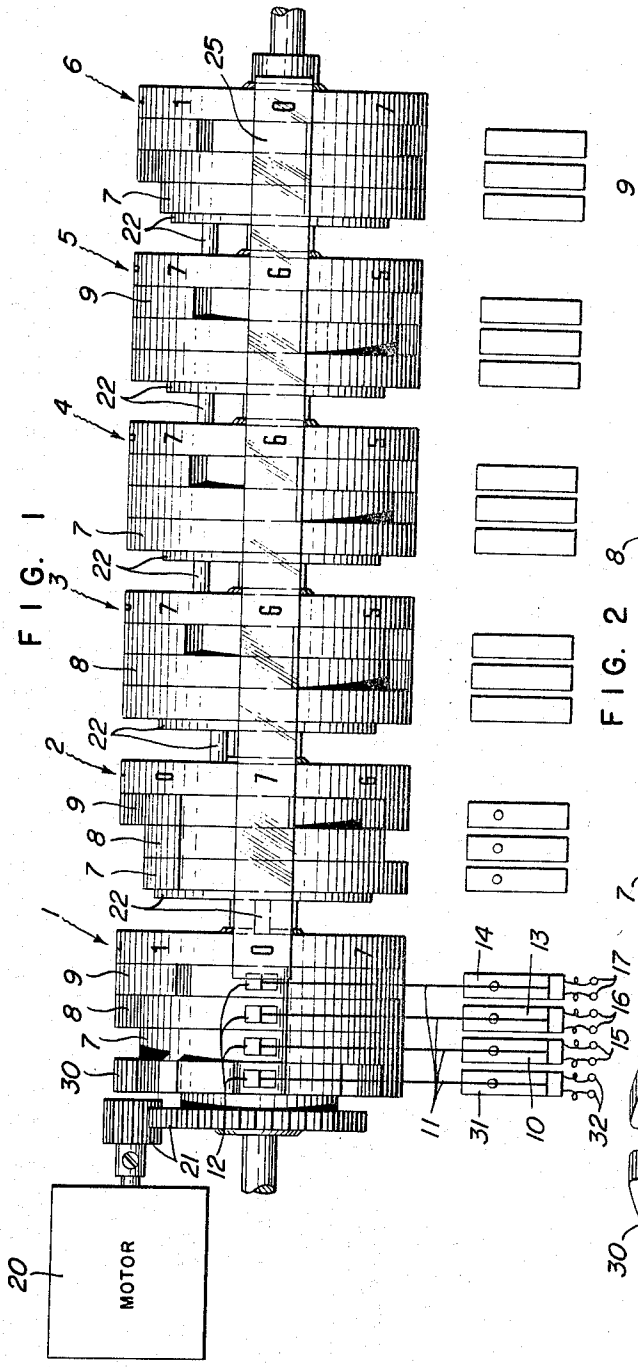


FIG. 1

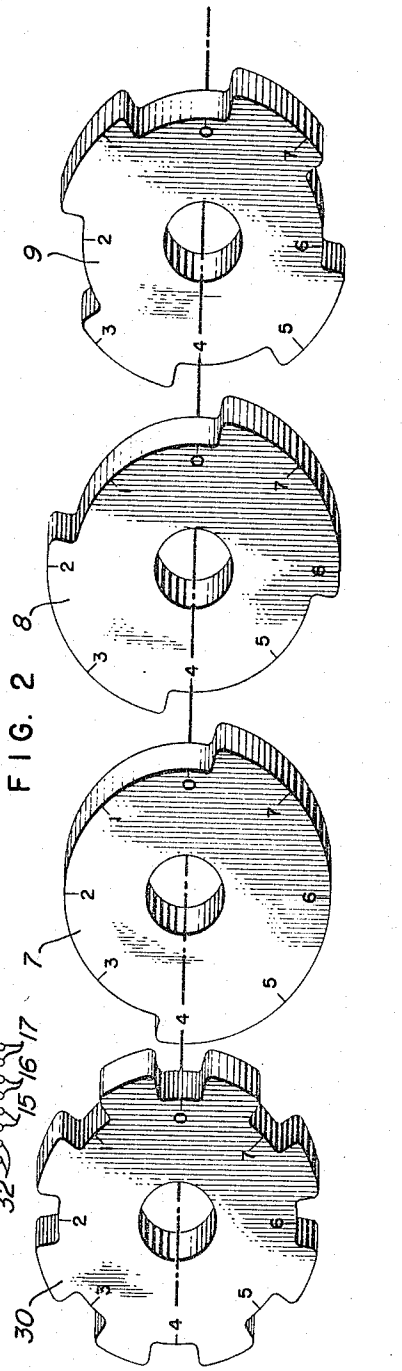


FIG. 2

INVENTOR.
SAMUEL D. HARPER
BY Arthur H. Swanson
ATTORNEY.

United States Patent Office 3,275,807 Patented Sept. 27, 1966

3,275,807

ELECTRICAL APPARATUS

Samuel D. Harper, Valley Forge, Pa., assignor to Honeywell Inc., a corporation of Delaware

Filed Mar. 15, 1963, Ser. No. 265,458
1 Claim. (Cl. 235—92)

This invention relates to timers. More specifically, the present invention relates to time-of-day clock timers.

An object of the present invention is to provide an improved time-of-day clock timer.

Another object of the present invention is to provide an improved clock timer for producing a time-of-day indication suitable for use by a digital computer.

Still another object of the present invention is to provide an improved clock timer for producing a binary coded time indication.

A further object of the present invention is to provide an improved clock timer which is operative to provide simultaneous electrical and visual time-of-day indications.

A still further object of the present invention is to provide a clock timer for producing a time indication suitable for a dgital computer and which is easily synchronized with the actual time-of-day.

Another still further object of the present invention is to provide an improved clock timer, with a binary coded time indication, as set forth herein, having a simplfied operation and construction.

In accomplishing these and other objects, there has been provided, in accordance with the present invention, a clock timer having a plurality of number drums coaxially arranged with intermittent driving means between each of the drums. The first drum is driven by a motor to produce a complete revolution of the drum in eight seconds. The succeeding drums are each driven by their respective intermittent drives to produce a step in their respective positions upon a complete revolution of the preceding drum. Each drum is provided with a visible impression of the numbers 0 to 7 evenly spaced on a portion of its periphery. The outer peripheral surface of each drum is also divided into three parallel tracks having predetermined cam surfaces provided thereon. Three switches are arranged to cooperate with the respective tracks on each drum. These switches are actuated by the cam surfaces to provide a different contact closure pattern for each of the aforesaid number positions on each of the drums. The total switch contact closure pattern for all of the drums is a binary coded representation of the seconds counted, or the time-of-day.

A better understanding of the present invention may be had from the following detailed description when read in connection with the accompanying drawings, in which:

FIG. 1 is a pictorial view of a clock timer embodying the present invention.

FIG. 2 is an exploded pictorial view of the typical switch operating cam surfaces found on each of the drums, shown in FIG. 1, in association with corresponding drum numbers.

In the use of digital computers, it is desirable to have available for the computer a signal representative of the actual time-of-day; i.e., real time. Thus, in process control systems, it may be necessary to control operations at specified times during the day with the control time being specified by reference to the actual time-of-day. In performing such control operations, the digital computer must have available to it, a rapidly accessible signal representative of the actual time-of-day. Preferably, such a clock should be driven independently of the computer and provide a binary coded signal for the digital computer which signal is most readily utilized by

the computer. Further, such a clock must be readily and easily presettable by a computer operator to be synchronized with the actual time-of-day. The present invention is effective to provide a time-of-day clock having a binary coded output signal suitable for use by a digital computer, and a visual indication to allow synchronization of the clock with the actual time-of-day.

Referring now to FIG. 1, there is shown a clock timer having a plurality of drums, **1** to **6**. The following discussion, while specifically directed to drum **1** is equally applicable to the other drums **2** to **6**. The numbers 0 to 7 are printed with even spacing on a portion of the peripheral surface of each of these drums. These numbers are arranged in line on one edge of the peripheral surface of a drum to provide a space on the remaining peripheral surface for three parallel tracks; e.g., tracks **7**, **8** and **9** on drum **1**. Each of the three tracks is arranged as a series of intermittent raised, or cam, surfaces which are effective to divide the peripheral surface of each drum into characterized areas.

The raised surfaces of each track are used to actuate a respective switch. Thus, on drum **1**, switch **10** cooperates with track **7** by means of a switch arm **11** and track follower roller **12**. Similarly, switch **13** senses track **8** and switch **14** cooperates with track **9**. These switches are arranged to close a circuit to represent a raised track surface and to open a circuit upon the occurrence of a depressed, or normal, track surface. The cam surfaces of the tracks are arranged to provide a unique contact closure pattern in the associated switches for each of the numbered drum positions. Switches **10**, **13** and **14** are connected to output terminals **15**, **16** and **17**, respectively, to provide selective circuit closures for apparatus connected to these terminals.

The first drum **1** is driven by a one revolution per second, or one second, motor **20** through a gear train **21**. The gear train **21** is arranged to provide one rotation of the drum **1** in eight revolutions, or eight seconds, of the motor **20**. The drums **1** to **6** are interconnected by any suitable mechanical or electromechanical transfer mechanism **22** to provide sequential motion of the drums **2** to **6**. The transfer mechanism **22** is arranged to move a drum from one number position to another number position upon the occurrence of a complete revolution of a preceding drum. Thus, for example, the first drum **1** counts 8 seconds in one revolution, and the second drum counts 64 seconds in one revolution. The relationship is simply the base, or numbered positions on a drum, raised to the power representative of the position of the drum. For example, drum **4** counts 8^4 or 4096 seconds per revolution. Inasmuch as there are 86,400 seconds in one day, the provision of six drums will provide at total count having a capacity adequate to count the seconds in a day; i.e., 8 to the 6th power, inasmuch as the seconds which can be counted by the sixth drum is over 260,000.

As shown in FIG. 2, in an exploded representation, the three switch-actuating tracks on each drum are arranged to provide a unique switch contact closure pattern for each number position on the drum. Specifically, the pattern is a binary-coded representation of the eight numbered positions of each drum. The three switch contacts for each drum are, in effect, the binary coded positions of the binary base 2. Thus, using the first drum as an example, the first track **7** represents 2 to the first power, the second track **8** is 2 to the second power, and the third track **9** is 2 to the third power. The numbered positions 0 to 7 on the drum are represented by the combination of the binary code for each closed switch position.

For example, position 0 is represented by three open switches; and position 2, by switches **7** and **9** in an open condition while switch **8** is closed since the base 2 to the

first power is 2. Similarly, position 7 is represented by three closed switches which produce the combination of 2 to the second power, or 4; and 2 to the first power, or 2; and 2 to the zero power, or 1. The binary coded representation for 7 is decoded to 4 plus 2 plus 1. Thus, the contact pattern for the switches associated with the drums **1** to **6** is a binary code for the octal format of the numbers on the drums.

This octal representation may be viewed by means of a window **25** and translated to decimal form by any appropiate means; such as, reference to an octal-to-decimal code translating table. However, the binary code represented by the switch contacts may be read by a computer, operating with binary notation, to provide an immediate reading of the actual time-of-day in seconds. It may be noted that the drums **1** to **6** may be initially manually preset to synchronize the clock timer of the present invention with the actual time-of-day.

As a further modification of the present invention, to provide a reading for the computer only when the switch rollers have completed their motion on a cam surface to actuate their respective contacts, a synchronizing track **30** may be provided on the first drum **1**. A switch **31** is actuated by the cam surfaces of track **30**. The relationship of the tracks **30** with the other tracks **7**, **8** and **9** is such as to delay the closing of switch **31** until the switches **10**, **13** and **14** have completed their operation. Further, switch **31** is opened before each switch operation of the switches **10**, **13** and **14**. Switch **31** may be used to close a sampling line to the binary-coded contacts of the present invention whereby an output signal from the clock timer is obtained only when the switches have completed their operation.

Thus, it may be seen that there has been provided, in accordance with the present invention, a clock timer which is operative to provide a visual indication of the time-of-day while, also, providing a binary coded actual time representation suitable for use in a digital computer.

What is claimed is:

A binary-coded counter comprising a plurality of substantially cylindrical drums which are coaxially and independently rotatably supported, each of said drums having a plurality of circumferential tracks along the peripheral surface thereof, a plurality of visually identifiable representations equally spaced along one of said circumferential tracks on said peripheral surface of each said

drum, said plurality of circumferential tracks including a plurality of parallel cam-surface tracks arranged adjacent to said track of visually identifiable representations, each of said cam tracks dividing the periphery of each of said drums into a plurality of separate disc-like sections having a plurality of equal size segments comprising a succession of alternately raised and depressed surfaces, each of said cam tracks having a different number of raised surfaces whereby the equal size segments in each section are of different size relative to the segments in adjacent sections, said raised and depressed surfaces of said cam track being operative to produce a unique indication of each visually identifiable representation on a respective one of said drums, driving means for causing a first one of said plurality of drums to revolve around the axis thereof at a predetermined rate, intermittent driving means arranged to selectively drive the remaining drums in succession to advance a drum by only one visual representation upon a complete revolution of an associated preceding drum, switch means responsive to said raised and depressed surfaces of said cam tracks for each drum to produce a switch contact closure pattern representative of said unique indication produced by said raised and depressed surfaces, at least one of said drums including a separate cam surface track, and further switch means arranged to cooperate with said separate track, said cam surface of said separate track providing a synchronizing function by actuating said further switch means only during a time when said plurality of cam tracks on said drum have completed a switch actuation operation of said first-mentioned switch means associated with said plurality of cam tracks whereby spurious contact closure patterns are not produced during operation of said first-mentioned switch means.

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MAYNARD R. WILBUR, *Primary Examiner.*

DARYL W. COOK, *Examiner.*

R. C. BAILEY, J. F. MILLER, *Assistant Examiners.*