United States Patent

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[54] PROGRAM DEVICE FOR PRODUCING TIME SIGNALS AND THE LIKE

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[52] U.S. Cl. ..... 58/150, 50/14, 139/319, 200/38 C, 200/46

[51] Int. Cl. G04b 21/08

[58] Field of Search ..... 58/14, 19, 33, 38, 149, 150; 200/38 C, 38 CA, 46; 139/319

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[57] ABSTRACT

A program device for producing time signals and the like according to a program wherein an endless tape is mounted in a cassette which endless tape is adapted to be moved frame by frame by a sprocket wheel cooperating with a clock and formed with signal producing apertures in accordance with a timetable. When an associated operation lever is received in any one of the signal producing apertures, it closes a micoswitch to render external signal producing means operative.

7 Claims, 9 Drawing Figures

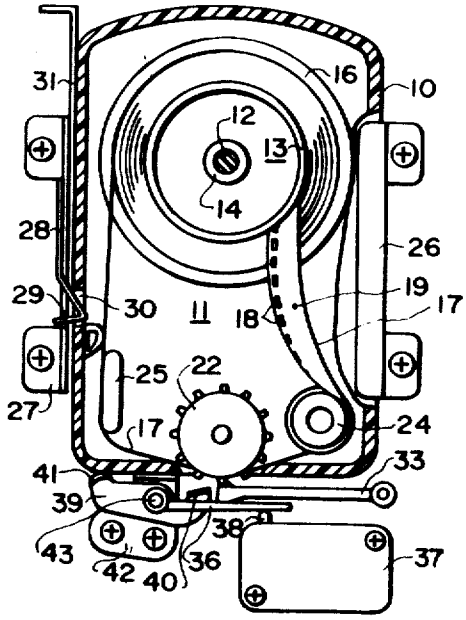


FIG. 1.

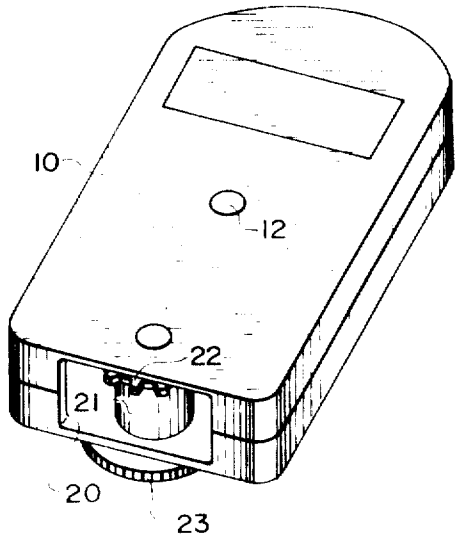


FIG. 2.

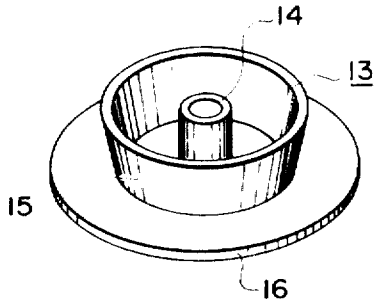


FIG. 3.

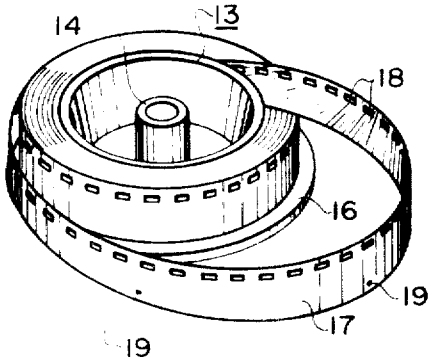
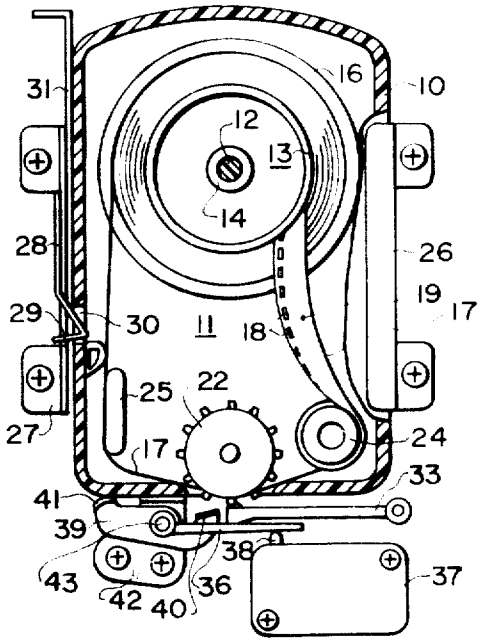


FIG. 4.



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FIG. 5.

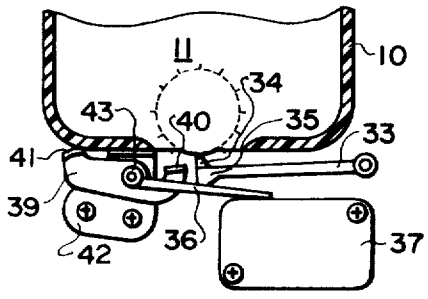


FIG. 6.

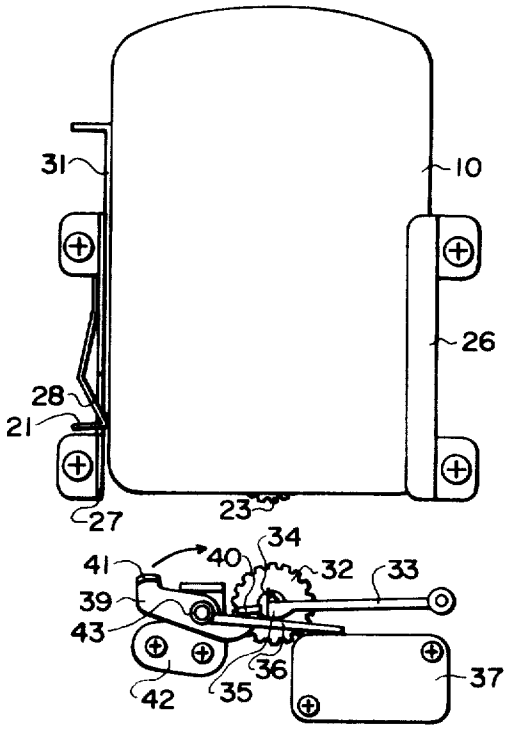


FIG. 7.

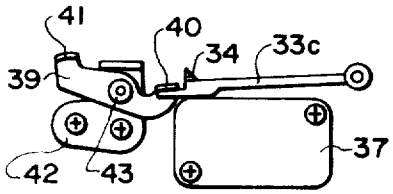


FIG. 8.

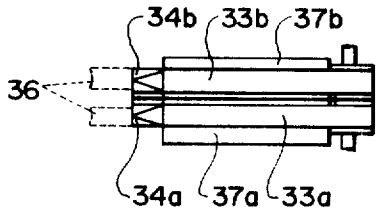
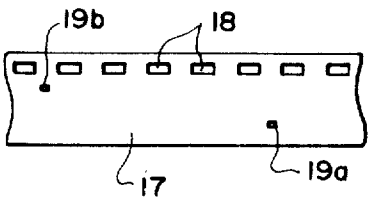


FIG. 9.



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PROGRAM DEVICE FOR PRODUCING TIME SIGNALS AND THE LIKE

This invention relates to a program device for producing time signals and the like which incorporates a cassette containing therein an endless tape or other information medium and which is adapted to cooperate with a clock for producing time signals at predetermined intervals.

Heretofore, a variety of devices has been developed and put to practical use for announcing the commencement and close of work by means of buzzer or siren or starting or shutting off machines at predetermined times. Conventional devices all have disadvantages in that they are complex in construction and large in size. This is mainly because there are 1,440 minutes in a day so that no less than 1,440 signal producing members are required for producing signals in minutes in cooperation with a clock.

In one type of device known in the art, signal producing pins are attached in suitable positions to the outer marginal portion of a disc which cooperates with a clock. The construction of this disc must have its outer marginal portions divided into 1,440 sections if one complete revolution of the disc is to represent the elapsing of one day. It will be evident that a device using such a large disc is inconvenient to handle and not suited to practical use.

This invention obviates the aforementioned disadvantages of the prior art. The invention has as its main object the provision of a program device for producing time signals and the like which uses as a signal producing member an endless tape or other information medium which has not hitherto been used in devices of the type described, and which is simple in construction, low in cost and adapted for use in many applications.

An important object of this invention is to provide a program device for producing time signals and the like which is constructed such that interchangeable cassettes each containing an endless tape or other information medium can be used with the device so that, when time signals, for example, are desired to be produced at different times in summer and winter, different programs for production of time signals in different manners depending on the season or the like can be incorporated in endless tapes in different cassettes, or when work is desired to be carried out by changing its operation steps, for example, the work can be programed in different manners in endless tapes in different cassettes, whereby plans can be changed readily by merely substituting a new cassette for the cassette in use.

Another object of this invention is to provide a program device for producing time signals and the like which permits to produce two or more different types of signals by using one device.

Another object of this invention is to facilitate the programming by using a commercially available 8 mm. movie film as an endless information medium.

A further object of this invention is to provide a program device for producing time signals and the like wherein safety means are provided for preventing the switch on the signal producing means from being inadvertently turned on when no cassette is received in the device.

In order to accomplish the various objects set forth above, this invention first provides a tape or other information medium wound endlessly on a spool rotatably mounted in the interior of a cassette. The tape may have a length such that it is sufficiently great to cover the operation for one day or one-half day, but it preferably has a length great enough to cover the operation for 1 day or 1,440 minutes. The tape of such length is not so great in size as will subsequently be described, because it corresponds to a movie film made up of 1,440 frames. Since such a tape is wound in roll form on the spool as aforementioned, the end of obtaining a compact overall size in a program device can be obtained.

The endless tape is formed with a large number of tape advance perforations arranged length wise of the tape in one marginal portion, the perforations being spaced from one another equidistantly, and a number of signal producing apertures arranged lengthwise and disposed adjacent the row of tape advance perforations. The teeth of a sprocket wheel cooperating with a clock through the agency of a gearing are engaged in the tape advance perforations, so that the tape is advanced frame by frame as the clock operates. In this connection, it will be evident that, if the device is set such that the tape is advanced by the sprockets wheel one frame or a distance corresponding to the spacing between two tape advance perforations in one minute, the roll of tape will be reduced in size as aforementioned. It should be noted that the endless tape used in this invention is formed with the tape advance perforations as aforementioned. This eliminates the trouble of preparing tape for exclusive use in this device and permits to use a commercially available 8 mm. movie film. The endless tape is wound on the spool of a cassette subsequently to be described, and the tape is wound such that the innermost convolution of the roll of tape is drawn out and wound on the outermost convolution of the roll of tape, so that the tape can be used continuously without requiring rewinding.

The aforementioned sprocket wheel is constructed such that a part of it extends outwardly through an opening generally formed in the bottom of the cassette. The portion of the tape engaged by the sprocket wheel is passed between the sprocket wheel and the opening so that the outer surface of the tape is exposed through the opening in the bottom of the cassette. In order that time signals may be produced by using the cassette of endless tape constructed as aforementioned, it is necessary to insert the cassette in a cassette receiving portion of the device. Disposed on the clock side of the device are a switch for operating signal producing means, an operation lever responding to the signal producing perforations to turn on said switch, and a safety lever which is effective to prevent the signal producing means from being rendered operative inadvertently when no cassette is attached to the device.

The sprocket wheel operates such that, when the cassette is inserted in the cassette attaching portion of the device, a gear mounted on the same shaft as the sprocket wheel for rotation in conjunction with the sprocket wheel is brought into meshing engagement with an intermediate drive gear on the clock side of the device, so that the sprocket wheel cooperates with the clock for angular rotation to advance the tape at a rate of one frame per minute. Simultaneously as the cassette is attached to the device, the safety lever is pushed and moved pivotally to unlock the operation lever so as to render the same free. In this state, the operation lever still keeps the switch of the signal producing means in an off position; the switch is not turned on till the forward end of the operation lever is received in one of the signal producing perforations formed in the endless tape. The operation lever is constructed such that its forward end resiliently engages the surface of the tape advanced by the sprocket wheel. The operation lever keeps the switch of the signal producing means in an off position when its forward end is maintained in contact with the planar surface of the tape without being received in any one of the tape advance perforations. From the foregoing, it will be appreciated that, by forming the signal producing apertures in the tape according to a predetermined program, it is possible to render the signal producing means operative automatically and regularly for ringing a bell, or sounding a siren to tell the time, or start and shut off a machine according to a program. It will be readily understood that the production of signals is automatically terminated when the forward end of the operation lever is released from engagement in the signal producing apertures as the tape is advanced by the sprocket wheel.

It will also be appreciated that, if two or more sets of the lever mechanism and switch for the signal producing means are provided in the device and two or more rows of signal producing apertures are formed in the endless tape while different types of signal producing means such as a siren and bell, are used, or the device is connected to operation sections of different machines, it will be possible to produce different

types of signals by using only one device so as, for example, to sound a siren to tell the time and render the machine operative and inoperative.

As aforesaid, this invention is directed to a device which permits to produce time signals or other signals for rendering a machine operative and inoperative according to a program in cooperation with a clock. To permit this invention to be better understood, preferred embodiments of the invention will now be described with reference to the accompany drawings.

FIG. 1 is a perspective view of the cassette used in this invention;

FIG. 2 is a perspective view of the spool mounted in the cassette of FIG. 1;

FIG. 3 is a perspective view of the spool on which an endless tape is wound;

FIG. 4 is a front view, with certain parts being shown in section, of the cassette fully inserted in the cassette receiving portion of the device according to this invention;

FIG. 5 is a fragmentary front view, with certain parts being broken away, of the cassette of FIG. 4, showing the switch of the signal producing means in an as position;

FIG. 6 is a front view of the cassette partly inserted in the cassette attaching portion of the device according to this invention;

FIG. 7 is a front view of one example of the operation lever;

FIG. 8 is a plan view of operation lever means used when two signal producing means are incorporated in the device; and

FIG. 9 is a front view, on an enlarged scale, of the tape used in the embodiment of this invention shown in FIG. 8.

The cassette formed in box shape is generally designated **10** and comprises a spool **13** disposed in an internal portion **11** of the cassette and rotatably supported by a rotary shaft **12**. The spool **13** comprises, as shown in FIG. **2**, a support post **14** formed therein with a bore for receiving the rotary shaft **12** therein, a body **15** of an inverted cone shape and a disc **16**. An endless tape **17** is wound on the body **15**. The endless tape **17** is drawn out from the innermost convolution of the tape in roll form shown in FIGS. **3** and **4** and wound on the outermost convolution of the roll of tape. The body **15** of the inverted cone shape facilitates the drawing out of the tape.

The endless tape **17** is formed, as aforementioned, with a multitude of tape advance perforations **18** arranged in a row and disposed in one outer marginal portion thereof and disposed lengthwise of the tape, with the apertures **18** being equidistantly spaced from one another, so that a commercially available 8 mm. movie film can be used as the endless tape **17** as aforementioned. Any tape or other information medium may be used as the endless tape **17**. The endless tape **17** is formed with a plurality of signal producing apertures **19** as shown in FIG. **3** which are formed in any position as desired for rendering operative the signal producing means subsequently to be described for produce time signals or other signals at predetermined intervals. By forming the signal producing apertures **19** in suitable positions, it is possible to sound a siren for example, according to a program.

FIG. **9** shows another example of the endless tape used in this invention which is formed with two different types of signal producing apertures **19***a* and **19***b* arranged lengthwise of the tape in two rows spaced apart a small distance from each other crosswise of the tape, in addition to the tape advance perforations **18** as in the example described previously. The provision of two rows of signal producing small openings **19***a* and **19***b* permits to operate two signal producing means separately by means of a single tape or single program device by recording different pieces of information in two tracks on the tape **17**. It is to be understood that, if there are provided three signal producing means, three rows of different types of signal producing apertures will be formed in the tape to record information in three tracks. When one tape is intended to cover the operation for 1 day, it is required that the tape be formed with 1,441 perforations **18** so that the spacings between the perforations **18** or frames are 1,440 in number corresponding to the 1,440 minutes in a day; when the tape is intended to cover the operation for half-a-day, it need only be provided with 720 spacings between the perforations **18** or frames. Thus, it is necessary to adjust the rate of travel of the tape such that it is advanced one frame per minute.

The cassette **10** is formed at its bottom with an aperture **20**. Provided in the cassette **10** slightly inwardly of the aperture **20** is a rotatable shaft **21** which supports a sprocket wheel **22** formed on its outer peripheral surface with sprockets for engaging in the tape advance perforations **18** in the tape **17**. Mounted on the shaft **21** coaxially with the sprocket wheel **22** is a gear **23** which is disposed outside the cassette **10** to project slightly downwardly below the bottom of the cassette. FIG. **4** shows the manner in which the endless tape **17** is disposed in the cassette and the manner in which the sprocket wheel **22** engages the tape. It will be appreciated from the figure that the tape is advanced intermittently by the angular rotation of the sprocket wheel **22**. In FIG. **4**, **24** designates a tape guide roll, and **25** a tape guide wall.

In order to effect control of the sounding of the siren at predetermined times by using the cassette constructed as aforementioned, it is necessary to insert the cassette in the cassette receiving portion of the program device where the endless tape can cooperate with a clock. As shown in FIGS. **4** and **6**, the cassette receiving portion has a width which is slightly larger than the width of the cassette **10** and includes two pairs of guides **26** and **27**. The cassette **10** is guided by the guides **26** and **27** as it is inserted in the cassette attaching portion of the device from above as seen in the figures. In order to positively hold the cassette **10** in place in the cassette attaching portion, one pair of guides **27** is provided with a plate spring **28** formed with a bent forward end portion **29** which is adapted to be received in an opening **30** formed in the corresponding side of the cassette **10** disposed in the correct position in the cassette attaching portion so as to lock the cassette in place. A lever **31** is interposed between the cassette **10** and the guides **27**. If the lever **31** is pushed downwardly when it is desired to withdraw the cassette from the cassette receiving portion, the lever **31** will press downwardly the bent forward portion **29** of the plate spring **28** against the resilient force thereof to release the forward end portion **29** from engagement in the opening **30**, thereby permitting withdrawal of the cassette without any trouble.

The means for driving the sprocket wheel **22** will now be explained. Since the endless tape **17** has a length corresponding to 1,440 frames (spacings between the tape advance perforations) when it is intended to cover one day, it is required that the sprocket wheel **22** be intermittently rotated positively so as to advance the tape accurately at a rate of one frame per minute. It is essential to advance the tape in this manner in order to sound the siren to tell the time accurately. To attain the end, means are provided according to this invention to drive the sprocket wheel **22** in cooperation with a clock.

In FIG. **6**, there is provided an intermediate drive gear **32** (which is not shown in FIGS. **4** and **5**) disposed on the clock side which is adapted to come into meshing engagement with the gear **23** on the cassette side when the cassette **10** is inserted in the cassette receiving portion. By this arrangement, the sprocket wheel **22** mounted coaxially with the gear **23** on the shaft **21** can cooperate with the clock through the agency of the intermediate drive gear **32** to advance the endless tape **17** accurately one frame per minute.

The construction of the lever mechanism and switch on the signal producing means side will now be explained. In FIGS. **4** and **6**, a first operation lever **33** is pivotally supported at its base in a suitable position on the clock side and has an end portion **35** which is maintained in contact at its underside with the upper surface of a second operation lever **36** likewise pivotally supported at its base in a suitable position on the clock side. The upper end **34** of the end portion **35** is resiliently maintained in pressing contact with the outer side of the tape **17** with a small force at all times. The upper end **34** is yieldably maintained in contact with the tape **17** so as not to interfere with the movement thereof.

The second operation lever 36 normally presses against a movable member 38 of a microswitch 37 to urge the same to move downwardly to maintain the same in an off position.

The movable member 38 is urged by resilient means (not shown) to move upwardly, so that when the biasing force exerted thereon by the second operation lever 36 is removed therefrom, the movable member 38 can move upwardly to turn on the microswitch to render the signal producing means operative.

Normally, the upper end 34 of the end portion 35 of the first operation lever 33 is maintained in pressing contact with the outer side of the endless tape 17, so that the movable member 38 is urged to move downwardly to maintain the microswitch in an off position (See FIG. 5). However, when the forward end 34 of the first operation lever 33 is received in one of the signal producing apertures 19 formed in the tape 17, the first and second operation levers 33 and 36 move upwardly to permit the movable member 38 of the microswitch 37 to move upwardly (See FIG. 4), so that the microswitch is turned on to automatically render the signal producing means operative, thereby sounding a siren to tell the time or render a machine operative.

It will thus be appreciated that the signal producing means can be rendered operative automatically by the program device in cooperation with a clock according to a program if the signal producing apertures 19 are formed in a proper manner in the endless tape 17. That is, if the program device according to this invention is used as a device for automatically producing time signals, then it is possible to accurately produce time signals to tell times accurately by means of a siren or bell by forming the apertures 19 in positions which correspond to the times as desired, such as the times of commencement of work, close of work, noon recess and the like.

When time signals in the form of siren sounds are to be produced, for example, it will be natural that the size of the signal producing apertures can be made considerably smaller than the tape advance perforations 18 because the duration of the signals produced need be three seconds at the shortest and ten seconds at the longest. It will be understood that, when the upper end 34 of the end portion 35 of the first operation lever 33 is released from engagement in one of the signal producing apertures 19 as the endless tape 17 is advanced by the sprocket wheel 22, the first and second operation levers 33 and 36 are pressed downwardly to depress the movable member 38 of the microswitch 37 so as to restore the microswitch to its off position again as shown in FIG. 5, thereby rendering the signal producing means inoperative.

In the embodiment described above, the program device according to this invention is adapted to produce one type of signals. In another aspect of the invention, two or more types of signals can be produced by a simple construction. This end can be attained by using a plurality of operation lever means and an endless tape of the multiple track system shown schematically in FIGS. 8 and 9. In FIG. 8, two operation levers 33*a* and 33*b* shown schematically are of the same construction as the aforementioned first operation lever 33. Two levers (shown in phantom lines) corresponding to the aforementioned second lever 36 are maintained in contact with the undersides of the end portions of the levers 33*a* and 33*b* respectively, the detailed description of the levers being omitted. The levers 33*a* and 33*b* are formed with upper ends 34*a* and 34*b* respectively which correspond to the upper end 34 of the first lever 33. 37*a* and 37*b* are microswitches corresponding to the different signal producing means, such as a buzzer and a siren, for example.

The levers 33*a* and 33*b* operate in the same manner as the first operation lever 33 except that they are received in different rows of signal producing apertures 19*a* and 19*b* as shown in FIG. 9 which are arranged to form a plurality of tracks spaced apart a suitable distance crosswise of the tape 17. Thus, this embodiment operates in the same manner as the first mentioned embodiment to produce two or more signals to actuate two or more signal producing means independently of one another in accordance with their objects by using one endless tape and one program device.

Means provided by the present invention for preventing misoperation of the program device will now be explained. Such means comprises a safety lever 39 shown in FIGS. 4 and 7. It will be evident from the foregoing description that, when the cassette 10 is moved away from the operation lever 33 or when the cassette is not yet fully inserted in the cassette attaching portion as shown in FIG. 6, the first operation lever 33 is in the same position as if it were received in one of the signal producing apertures 19 in the endless tape 17, thereby turning on the microswitch 37. The provision of the safety lever 39 is effective to prevent this from taking place. The safety lever 39 is pivotally supported coaxially with the second operation lever 36 by a shaft 43 connected to a mounting member 42 disposed on the clock side, and normally urged by a torsion spring (not shown) to move pivotally in the direction of the arrow in FIG. 6. The second operation lever 36 is not subjected to this biasing force and remains free. When the cassette receiving portion of the program device has no cassette inserted therein, a substantially L-shaped curved member 40 formed at one end of the safety lever 39 presses against the upper surface of the second operation lever 36, with a result that the movable member 38 of the microswitch 37 is pushed and moved downwardly to maintain the microswitch 37 in an off position. This is conducive to the prevention of the signal producing means from being inadvertently rendered operative.

When the cassette 10 is inserted in the cassette receiving portion, a pressed portion 41 formed at the other end of the safety lever 39 is pressed by the bottom of the cassette 10 so that the safety lever 39 is pivotally moved about the shaft 43 from a position shown in FIG. 6 to a position shown in FIG. 4, thereby releasing the second operation lever 36 from locking engagement with the bent member 40. This renders the first and second operation levers 33 and 36 free, so that the microswitch 37 is not turned on thereafter unless the forward end portion 34 of the first operation lever 33 is engaged in one of the tape advance apertures 19.

It is to be understood that two safety levers (not shown) are provided in the embodiment shown in FIG. 8 for the two sets of operation levers respectively.

The embodiment shown in FIG. 7 will now be explained. In the embodiments described above, the first and second operation levers 33 and 36 are used as a set of operation levers. This is intended to cause the microswitch 37 to operate smoothly by enlarging the action of the first operation lever 33 by the second operation lever 36. In the embodiment of FIG. 7, the second operation lever 36 is eliminated and only one operation lever 33*c* is used for turning on and off the microswitch. In this case, the bent portion 40 of the aforementioned safety lever 39 is adapted directly to come into and released from engagement with the end portion of the operation lever 33*c* as shown.

From the foregoing description, it will be appreciated that the program device of the cassette type according to this invention is simple in construction, reliable in performance and easy to handle. This invention permits to use a commercially available 8 mm. film as an endless tape by forming therein a plurality of signal producing apertures in accordance with a timetable for producing time signals in the form of sounding of siren or producing signals to render a machine operative and inoperative at predetermined times. If such endless tape is contained in a cassette and the cassette is inserted in the cassette receiving portion of the program device, then it is possible to produce signals as programmed. Furthermore, if a plurality of cassettes each containing an endless tape formed with signal producing perforations arranged to meet the requirement of a particular program, and one of such cassettes may be selected and used for adopting a new program for sounding a siren or rendering a machine operative and inoperative depending on the season or the type or work required to be done. The program device according to this invention has many applications.

While the present invention has been described in some detail with reference to preferred embodiments thereof, it is to

be understood that the invention is not limited to the particular forms of the device shown and described, and that many modifications and changes may be made therein without departing from the spirit and scope of the Invention.

I claim:

1. Apparatus for generating time signals, and the like, at predetermined intervals, which comprises:

a cassette having an endless information storage medium contained therein, said medium having a plurality of medium-advancing perforations disposed at uniform intervals along at least one edge thereof;

a plurality of signal-producing apertures in said medium at predetermined positions therealong;

a toothed sprocket wheel, rotatably mounted to said cassette, the teeth thereof engaging the perforations in said medium;

gear means, engaging said sprocket wheel and connectable to the shaft of a chronometer, for advancing said medium, in synchronism with the passage of time in said chronometer;

switch means, connected to external signal-producing apparatus, for generating said time signals; and

lever means, having a forward end in pressing engagement with said medium, for sensing the presence of said signal-producing apertures, and a rear end, in engagement with said switch means, for energizing said external signal-producing means when one of said apertures is sensed.

2. Apparatus according to claim 1, further comprising:

safety means, connected to said lever means, for preventing accidental closure of said switch means when said apparatus is energized without said cassette being inserted therein.

3. Apparatus according to claim 2, wherein said signal-producing apertures are functionally arranged in a plurality of separate and distinct rows in said medium, and said apparatus further comprises:

a corresponding plurality of switch means, lever means, and safety means, the ends of said lever means engaging with respective ones of said rows of signal-producing apertures, whereby a plurality of signal-producing apparatuses can be rendered operative separately and independently of one another.

4. Apparatus according to claim 1 wherein said lever means comprises:

a first lever having one end thereof in pressing engagement with said medium to sense said signal-producing apertures; and

a second lever, mounted for engaging said switch means, said second lever amplifying the action of said first lever as said first lever moves inwardly of the apertures of said medium.

5. Apparatus according to claim 1 wherein said information storage medium comprises a motion picture film.

6. Apparatus according to claim 1 including a chronometer for engagement with said gear means, said chronometer intermittently advancing said medium, one frame at a time, in synchronism with the passage of time in said chronometer.

7. Apparatus according to claim 1, wherein said medium is 8 mm movie film.

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