

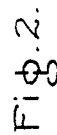
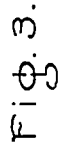
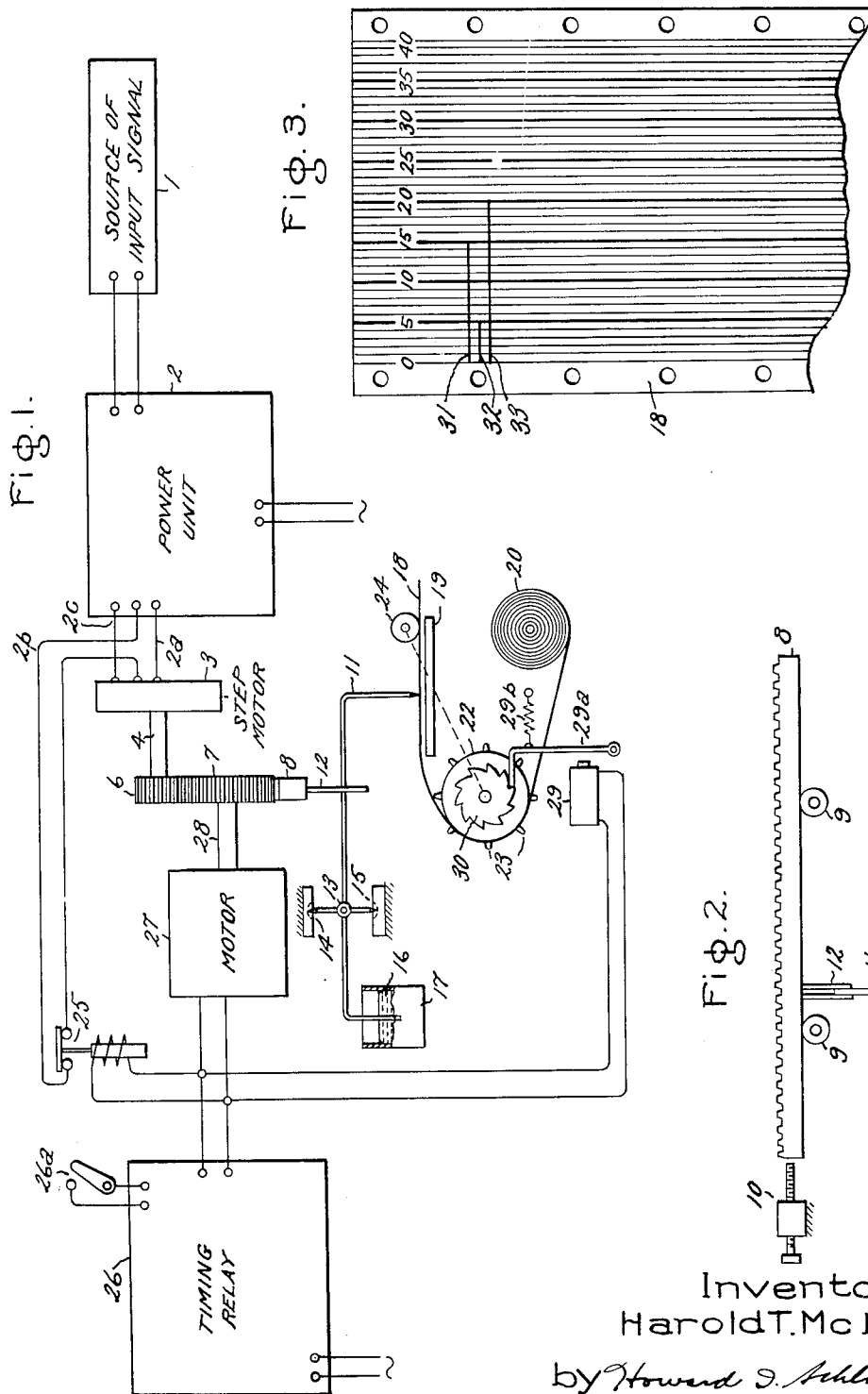
May 22, 1956

H. T. McLEAN

2,746,834

RECORDING DEVICE

Filed Sept. 17, 1953



Inventor:
Harold T. McLean,
by *Howard S. Schlansker*
His Attorney.

1

2,746,834

RECORDING DEVICE

Harold T. McLean, Troy, N. Y., assignor to General Electric Company, a corporation of New York

Application September 17, 1953, Serial No. 389,688

2 Claims. (Cl. 346—113)

My invention relates to a recording device. More particularly it relates to such apparatus which is useful in quality control work and the like.

Such devices so far as is known are so slow in their response to a signal that they are incapable of recording impulses which number over several hundred per minute. A disadvantage of the usual recorder is that impulse-initiated markings are normally made as markings on a baseline running lengthwise of the chart. Consequently, the rate of occurrence of impulses can be judged only by the number of marks per unit length of the base line and not by cursory examination.

An object of my invention is to provide a simple recording apparatus which is responsive to high speed and rapidly-recurring signals.

Another object of my invention is to provide a recording device which will give an easily-read bar graph type indication of the number of signals relayed to the recorder.

Briefly, in accordance with my invention electrical impulse signals caused by the occurrence of events to be recorded are supplied to a step motor which actuates means for making a transverse incremental mark on a chart for each signal received. Means are provided for coincidentally resetting the marking means and advancing the chart after a desired period has passed or a desired number of signals have been received.

The features of my invention which I believe to be novel are set forth with particularity in the claims appended hereto. My invention will, however, be better understood from a consideration of the following description and the drawing in which Fig. 1 schematically sets forth a general plan of my invention; Fig. 2 is an elevational detail view of the rack assembly and Fig. 3 is a view of typical markings made by means of my invention on a chart paper.

As shown in Fig. 1, electrical input or impulse signals to be counted and recorded are supplied from any desired source 1 to a power unit 2 conventionally shown since such units are well-known to those skilled in the art. Power unit 2 draws its energy from an ordinary source as shown. The output of power unit 2 is utilized to energize step motor 3 through connections 2a, 2b, and 2c which turns a fraction of one rotation at each power pulse applied to it. The step motor is also shown conventionally inasmuch as such motors which react separately to impulses up to 60 and more per second are common. A typical impulse counter motor is described in Patent 2,364,421 to Bousman, assigned to the same assignee as this application. Other step motors which will accomplish this purpose are known to those skilled in the art. In order to transmit by mechanical movement or means, the electrical impulse received, the shaft 4 of step motor 3 is connected to gear 6 which in turn is in train with gear 7, the latter being in mesh with gear rack 8. Gear rack 8 is adapted to move back and forth in the plane of the gears riding on rollers 9 best shown in Fig. 2 with an adjustable stop 10 to limit its

2

movement. Marking means such as a pen or stylus 11 is attached to rack 8 by clip 12, it being understood that any usual means may be used for this purpose. Clip 12 allows limited vertical or horizontal swivelling of pen 11. This vertical and horizontal freedom of motion is provided by pivot 13 and bearings 14 and 15. When a pen is used, ink is supplied to the writing tip of pen 11 in any desired manner such as that shown wherein ink 16 is siphoned by hollow pen 11 from container 17. Other pen or marking arrangements will occur to those skilled in the art. For example, a pen or marker having a self-contained supply of marking material may be fixed directly to rack 8 thus eliminating a separate marking material source as well as the swivelling provision shown.

Chart paper 18 is fed to the marking platen or station 19 in any convenient manner to be later explained in detail. For example, chart paper 18 is adapted to be driven or propelled from roll 20 over roller 22 having teeth or projections 23 which project through mating holes in the paper. A roller 24 preferably of rubber and connected to the shaft of roller 22, as by a belt not shown, assists in feeding the chart paper.

It will be noted that one of the leads 2b from power unit 2 to step motor 3 is led through relay 25 which is normally closed. The solenoid for operating this relay is in circuit with timing relay 26, including relay switch 26a, which receives its power from a conventional source as shown. Timing relay 26 is also in circuit with a conventional motor 27 whose shaft 28 is connected to gear 7. Electrically connected to the timing relay is solenoid 29 whose armature 29a is shaped to engage with ratchet wheel 30 fixed to roller 22, the armature being under the biasing action of spring 29b.

The operation of my invention is as follows. An input signal from any desired source is supplied to power unit 2 and relayed thereby to step motor 3 whose shaft rotates a fraction of a turn in response to each signal. Gear 6 mounted on shaft 4 rotates with this shaft in turn causing gear 7 to rotate and rack 8 to advance or be driven transversely of the direction of travel of the chart paper or sheet 18 an amount which may be fixed as desired by an adjustment of the sizes and number of teeth of gear 6 and 7 relative to the motion of step motor 3. For example, if the step motor rotates $\frac{1}{16}$ of a revolution for each impulse, gear 6 has 11 teeth, gear 7 has 80 teeth, with the teeth in the gears and rack 8 being all of the same size, rack 8 and consequently marker 11 will move $\frac{1}{16}$ inch for each impulse making a mark of that length transversely on chart 18. During the motion of rack 8, the tip end of pen or marker 11, which is heavy enough relative to the other end to continuously bear against the chart paper, is pivoted vertically and horizontally as necessary at pivot 13 and bearings 14 and 15.

It will thus be seen that marker 11 in response to each impulse received by the device will make an incremental transverse mark which, as shown in Fig. 3 by lines 31, 32, and 33, develops into a bar graph. A graduated chart as shown permits a direct reading from the chart of the number of impulses received. Any desired number of impulses may be recorded in one transverse line or bar on chart 18, the step motor and gear train characteristics and the size of the paper being taken into consideration.

The rack 8 may be reset to its original or zero position and the chart paper advanced coincidentally in any of a number of ways depending on the use to which the counter is to be put. Thus, if electrical conducting defects in capacitor paper are being counted and it is desired to know the number of defects in say 100 feet of paper, switch 26a may be conventionally actuated any number of times from one upward by each 100 foot

length of paper so long as when the 100 feet or desired mark is reached the timing relay 26 is actuated. If finite or discontinuous articles are being inspected switch 26a may be closed by each article passing an inspection station. Thus, timing relay 26 can be designed or fixed to provide a resetting signal after any number of articles has passed, for example, fifty. With the apparatus set up to provide an impulse signal for each defective item each bar on the chart shows the number of defective articles in fifty at a glance. Alternatively relay 26 may be actuated by mere expiration of a chosen time, devices for such timing being well-known in the art.

When switch 26a has been actuated the proper number of times to trip timing relay 26, the latter supplies current momentarily to motor 27 at shaft 28 to operate gear 7 and return rack 8 to its initial or original position. The surge of current is timed by relay 26 say for one-quarter of a second to just permit the return of rack 8. When current is supplied to motor 27, normally closed relay 25 is also opened in order that impulse signals will not be received by the step motor during the approximately one-quarter second period when the rack 8 is being repositioned. Also during this same short period of time current is supplied as shown to solenoid 29. This causes armature 29a to engage a tooth in ratchet wheel 30 advancing chart paper 18 a desired amount to provide a clear space for the marking of a new bar graph thereon.

From the above it will be seen that I have provided means for rapidly and visibly recording the impulse signals so that the number received during any desired period of time or over the occurrence of a number of events may be readily determined from observation of bar graph such as lines 31, 32, and 33 of Fig. 3.

I have further provided means in connection with the above means for rapidly returning the rack and marking means to zero position and to simultaneously advance the chart paper after any chosen period.

My invention, while not limited to such use, is particularly adaptable to quality control work wherein it is desired to know the number or proportion of articles being manufactured which vary from an accepted norm in order that action may be taken as indicated. Thus in inspecting paper for electrically conductive areas or other defects, suitable apparatus is arranged to signal such defects to my invention. By arranging the apparatus to reset each 100 feet, for example, the number of defects in this length of paper may be read directly off chart 18. Should the number of defects exceed that allowable means which occur to those skilled in the art for providing a visual or audible signal for stopping a process when the allowable number of defects is exceeded so that appropriate action may be taken. In

the same manner, inspection of finite and separate articles may be carried out.

While I have described certain definite means by which my invention may be carried out, it is to be understood that I desire to protect all those modifications thereof which do not depart from the spirit or scope of the following claims.

What I claim as new and desire to secure by Letters Patent of the United States is:

1. In a recording device for recording a series of events an electrical power unit adapted to receive a signal denoting the occurrence of each event, means comprising a step motor electrically connected to said power unit for transmitting the signal as a mechanical movement through its shaft, gear means connected to said shaft to transmit its movement to a gear rack in mesh with said gear means, marking means attached to said rack for making an incremental transverse mark on a chart adjacent thereto in response to each signal, means comprising a motor connected to said gear means and actuated by a timing relay for returning said rack and said marking means to their original position after a desired number of marking operations, and means in circuit with said timing relay for advancing said chart coincidentally with the operation of said motor, said means comprising a solenoid operated armature in mesh with a ratchet wheel on the chart supply roll.

2. A recording device for recording a series of events comprising an electrical power unit adapted to receive a signal upon the occurrence of each event, means comprising a step motor electrically connected to said power unit for transmitting said signal through the movement of its shaft, gear means connected to said shaft to transmit its movement to a gear rack engaged with said gear means, marking means attached to said rack for making incremental transverse marks on a chart adjacent thereto in response to the occurrence of each event, means comprising a motor connected to said gear means and actuated by timing means for returning said rack and said marking means to its original position after a desired time, and means in circuit with said timing means for coincidentally advancing said chart, said advancing means comprising a solenoid-operated armature engaged with a ratchet wheel on the chart supply roll.

References Cited in the file of this patent

UNITED STATES PATENTS

1,156,226	Herz	Oct. 12, 1915
1,253,438	Stevens et al.	Jan. 15, 1918
1,637,852	Brandenburg	Aug. 2, 1927
1,907,096	Angus	May 2, 1933
2,034,806	Giffin	Mar. 24, 1936
2,628,498	Smith	Feb. 18, 1953