

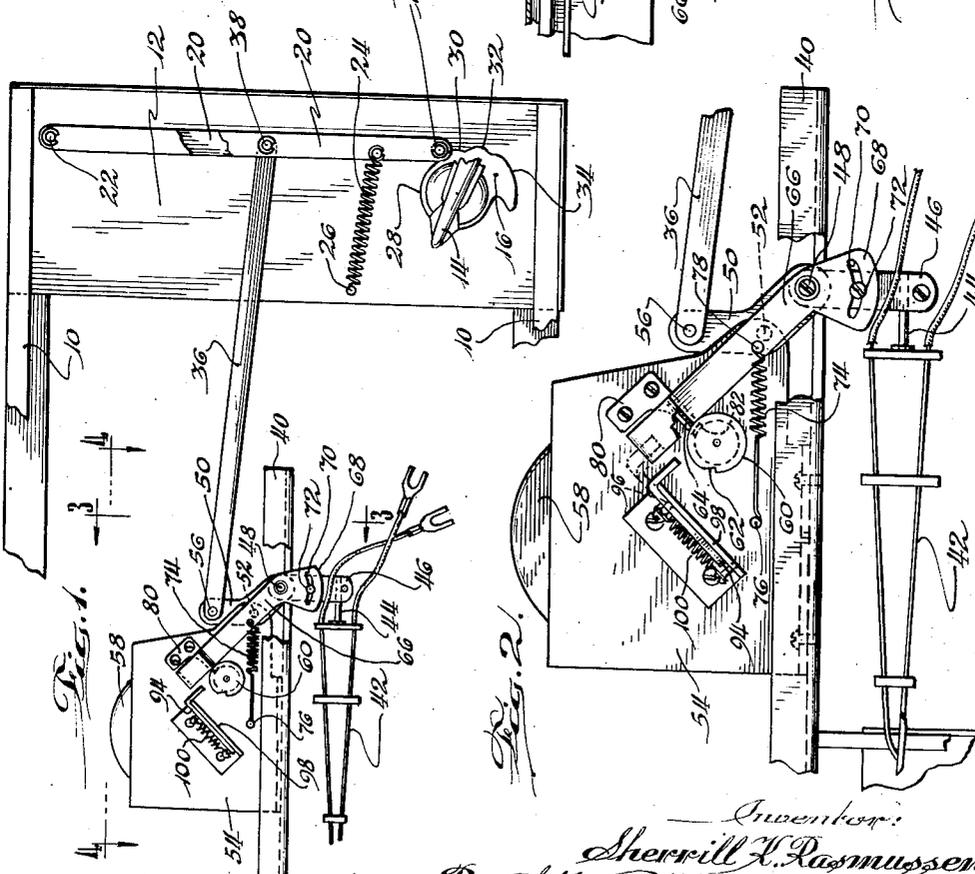
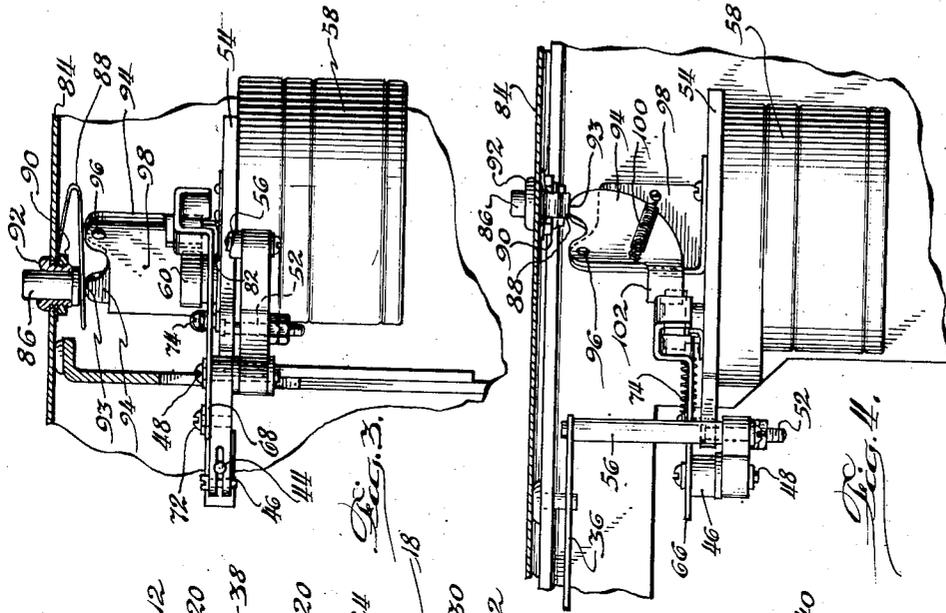
May 18, 1954

S. K. RASMUSSEN

2,678,867

ELECTROCARDIOGRAPH

Filed June 5, 1951



Inventor:  
Sherrill K. Rasmussen  
By Ahlberg, Thiessen & Bradolphi  
Attorneys.

# UNITED STATES PATENT OFFICE

2,678,867

## ELECTROCARDIOGRAPH

Sherrill K. Rasmussen, Milton, Wis., assignor to  
The Burdick Corporation, Milton, Wis., a cor-  
poration of Delaware

Application June 5, 1951, Serial No. 229,987

5 Claims. (Cl. 346—62)

1

The present invention relates to electrocardiographs or similar devices and is primarily concerned with an arrangement for automatically and semiautomatically marking a tape to indicate time intervals and other indicia thereon.

One of the objects of the present invention is to provide an arrangement in conjunction with an electrocardiograph mechanism which marks the tape passing through the electrocardiograph in such fashion as to indicate uniform time intervals and which further indicates which of several electrode combinations is being used and which in addition facilitates manual manipulation so as to provide sections of the tape with additional permanent code symbols of a suitable type.

Still another object is to supply an electrocardiograph with novel mechanism for automatically marking the tape passing therethrough according to uniform time intervals and which further automatically indicates upon the tape which of several electrode combinations is being used and which semiautomatically permits the marking of the tape with additional information.

In general the device of the present invention may be considered as an improvement upon a portion of the mechanism illustrated and described in the copending United States patent application of Warren E. Gilson and Sherrill K. Rasmussen, Serial No. 159,608 filed May 2, 1950, for Electrocardiograph. It may be considered therefore that an additional object is to supply novel tape marking mechanism which is an improvement over that shown in the said copending application.

Other objects and advantages will become apparent from the following description of a preferred embodiment of my invention.

In the drawings, in which similar characters of reference refer to similar parts throughout the several views:

Fig. 1 may be considered as a top view of a portion of an electrocardiograph mechanism, specifically the mechanism described and illustrated in the beforementioned copending application with the improvement of the present invention incorporated therein;

Fig. 2 is a view similar to Fig. 1 drawn to larger scale showing a portion of the mechanism of Fig. 1;

Fig. 3 is a sectional view in a vertical plane which may be considered as taken in the direction of the arrows substantially along the line 3—3 of Fig. 1; and

Fig. 4 is a vertical sectional view at right angles

2

to that of Fig. 3 and may be considered as taken in the direction of the arrows substantially along the line 4—4 of Fig. 1.

In the beforementioned copending application there is illustrated and described a novel mechanism incorporated into an electrocardiograph which, by means of a heated stylus, automatically draws a line along the edge of a tape passing through the electrocardiograph. This line is drawn in any one of four different positions in from the edge of the tape, these positions being indicated on the tape by the numerals 1, 2, 3 and 4. The stylus is connected mechanically to the shaft of a rotary tap switch which is used to shift the electrocardiograph connections electrically into several combinations. By moving the tap switch between positions 1, 2, 3 and 4, the position of the recording stylus is automatically shifted into zones 1, 2, 3 and 4 on the tape. The positions of the tap switch beyond the fourth position permit the stylus to remain in the No. 4 position as otherwise more of the tape edge would be devoted to this coding purpose than would be desirable, particularly since positions beyond the fourth are not so frequently used. By depressing a push button momentarily, however, the stylus can be deflected so as to produce a pip in the coding line. By means of this button, therefore, the operator can quickly produce one or more pips so as to record any desired useful information, for instance, some of the tap switch positions beyond the fourth.

In addition to supplying mechanism for the above purpose, the beforementioned electrocardiograph machine is also arranged so that the drive roller for advancing the tape through the machine causes the stylus to be deflected momentarily at periodic intervals, approximately once per second, so that the tape when it is taken from the machine will show on inspection intervals of one second permanently marked along its edge.

Essentially the mechanism of the present invention accomplishes a similar function with the refinement that the drive for the time interval marking portion of the device has been divorced from the tape pulling mechanism because of a belief that such a separation of functions results in more reliable time indications.

Inasmuch as the major portions of the electrocardiograph mechanism with which the present invention is associated is the same as that of the referred to copending application, no useful purpose would be served in duplicating the illustration and description of the portions of the mech-

anisms in common. The drawings and description of the present application therefore are confined to the new structure and reference may be had to the copending application referred to if additional information about the electrocardiograph machine as a whole is desired.

By referring to Fig. 1 of the drawings, which shows a portion of the mechanism beneath the cover plate of the electrocardiograph, it will be seen that among other things the device is made up of a pair of front and back horizontal frame rails 10 connected at the right hand end by a flat horizontal plate 12. Toward the front end of this plate a control knob 14 is connected to a shaft which extends vertically through the plate. This knob 14 operates a rotary tap switch, not shown but which may be of any suitable type such that it may be operated to a number of different positions with a snap action between adjacent positions. This tap switch is electrically connected in such fashion that operation of the switch from one position to another will connect different combinations of the electrocardiograph leads to the input of the electrocardiograph amplifier.

A thin flat cam 16 is mounted upon the switch shaft in a position directly below the knob 14 so that its peripheral edge bears against a small roller 18 journaled in a position between a pair of parallel arms 20 formed as metal strips. These two arms extend to a point near the opposite end of the plate 12 and there are pivoted to a pin 22 fixed in the plate 12. The ends of the arms carrying the roller 18 therefore are free to swing from right to left as seen in Fig. 1, the compound arm normally being urged toward the left under the influence of a coil spring 24 hooked at one end through aligned holes in the arms 20 in a position near the roller 18. The other end of the spring 24 is hooked through a small hole 26 in the plate 12 near its left hand edge. The roller 18 therefore resiliently follows the peripheral contour of the cam 16 and the cam is so cut that a portion thereof for a considerable circumferential length is of small diameter. This portion of the cam indicated by the numeral 28 is shown in contact with the roller 18 in Fig. 1 and will remain in contact with this roller as the switch 14 is rotated in a clockwise direction from the position shown.

Rotation of the knob 14 in a counterclockwise direction from the position shown to the next position will cause the roller 18 to ride outwardly and come to rest upon a portion 30 of somewhat larger diameter. An additional incremental counterclockwise turn of the knob 14 will likewise bring the roller 18 to rest upon a portion 32 of the cam edge still further from the center of rotation while a still further turn of the knob 14 in the same direction beyond this position will move the roller 18 outwardly still more so that it comes to rest upon a surface 34 still further from the center of rotation.

This last may be considered as the No. 1 position wherein the roller 18 is farthest from the center of rotation of the switch knob 14 whereas in the successive second, third and fourth positions the roller 18 will move inwardly toward the center of switch rotation one increment with each change of position. The switch is shown in the fourth position and it will be seen that as the switch knob 14 is rotated in a clockwise direction to positions 5, 6, 7, 8, etc., the roller 18 will remain the same distance from the center of switch rotation. Inasmuch as the roller 18 is of a diameter somewhat less than the width of the strips 20, these strips overlap the face of the cam 28

top and bottom, thereby preventing the roller slipping off the cam edge.

At approximately the mid point the arms 20 are pivoted to one end of a link 36 which lies between the strips 20 and is connected thereto by a transverse pin 38 held in position by any suitable means such as the snap ring shown.

The tape of the electrocardiograph is not shown but moves longitudinally in a position between the front frame rail 10 and an intermediate partitioning wall 40. The portion 40 is approximately halfway between the two side rails 10 and is parallel thereto. Thus, the space provided for movement of the tape through the machine in a longitudinal direction is approximately half the width of the device.

Within this region a stylus 42 is so positioned as to mark upon the tape near its edge so that movement of the stylus toward the center or adjacent edge of the tape will cause a shift in the position of the line drawn thereon. Although the stylus could be of any suitable type, the one shown has an electrically heated ribbon which rests against the tape, the tape being of the heat sensitive type. A fuller description of the particular stylus used and of the tape and of the association of the two will be found in the previously referred to application.

At its rear end the stylus 42 carries a horizontally disposed pin 44 which is clamped in a drilled opening near the end of a short arm 46, the opposite end of which is pivoted to swing about a vertical pin 48. The pin 48 in turn is secured to a bell crank arm 50 near its end and projects upwardly therefrom. This second arm 50 is pivoted in turn at approximately its mid point to a vertical pin 52 fixed to a platform 54 formed as a portion of a bracket attached to the partition 40. The opposite end of the arm 50 is approximately the same horizontal distance from the pivot 52 as is the pin 48 and is connected by a vertical post 56 to the left hand end of the link 36 previously mentioned. As the knob 14 is rotated therefore so as to move the cam 28, relative to the roller 18, between the positions 1 and 4, the link 36 will be moved toward the right or left thereby rocking the arm 50 about the pivot pin 52. This, of course, moves the pivot point at the pin 48 in the opposite direction.

An electric clock-works 58 is mounted in a position below the platform 54 and is attached thereto. Its shaft passes upwardly through the platform and carries a cam disc 60 which is cylindrical excepting for a single notch or groove 62 formed across its face. The clock-works drives the cam disc 60 at a rate of one revolution per second thereby periodically bringing the notch 62 into contact with a vertical knife edge portion of a cam following member 64. This cam following member is formed as a portion of a strip or blade of metal 66 which is pivoted near one end to the pin 48 and extends outwardly therebeyond over the arm 64 so as to be in face to face contact therewith. This outward end 68 of the blade 66 is fan shaped and is provided with an accurate slot 70 with its center of curvature at the pivot pin 48. A screw 72 passes downwardly through the slot 70 and is threaded into the arm 46 so that by loosening this screw the arm 46 may be pivoted about the pin 48 relative to the blade 66 to a proper initial position and there locked by tightening the screw 72 so that thereafter the arm 46 and blade 66 move together.

The opposite end of the blade 66 passes inwardly to a point tangent to the cam disc 60

and is there bent straight upwardly across the face of the cam 60 so as to form the vertical knife edge previously mentioned which moves inwardly and outwardly of the notch 62 as the cam 60 rotates. The knife edge is urged into contact with the cam 60 by a light coil spring 74 connected between a pin 76 fixed in the platform 54 and a pin 78 attached to the blade 66 just to one side of the pivot 52 and toward the cam disc 60. Beginning at a point somewhat above the cam disc 60, the upwardly bent portion 64 of the strip 66 is bent outwardly at right angles for a short distance and thence downwardly again so that its lower edge is slightly above the top surface of the platform 54.

In order to prevent a ticking noise each time the cam follower 64 falls into the notch 62 in the cam 60 a thin spring metal stop member 80 is provided. It is shown as fastened by means of screws to the top surface of the platform 54. One edge is shaped to provide a narrow strip which extends underneath the blade 66 into a position below the disc cam 60. Its extreme end is bent upwardly so as to pass above the edge of the blade 66 which is adjacent the cam 60. This upwardly bent end, indicated at 82, is so set that the face toward the edge of the blade 66 will impinge against this edge as the cam follower 64 falls into the notch 62 before the follower touches the bottom of the notch 62. Since the action of this spring member is quite soft, it will spring slightly in stopping the movement of the blade 66, thereby insuring a quieter action than would occur if the cam follower 64 were brought to a sudden stop against the bottom of the notch 62. By enlarging one of its mounting holes, the spring member 80 can be moved inwardly or outwardly slightly before tightening the mounting screws, so as to adjust the amount of throw of the blade 66 and hence the height of the resulting pip.

The top 84 of the case indicated in Figs. 3 and 4, is provided with a push button 86 which passes through the cover and is held upwardly by a leaf spring 88. This leaf spring which is generally of hairpin shape, is clamped to the cover at one end by a nut 90 which secures the grommet 92 through which the push button passes. The push button therefore is an integral portion of the cover and may be removed with the cover. The lower end of the push button or rather the portion of the spring immediately below the push button bears against the edge at 93 of a small metal plate 94 which is supported in a vertical position. This plate 94 is pivoted in face to face relation by means of a pin 96 to a vertical bracket plate 98 at a point spaced from the portion in contact with the lower end of the knob 86. The bracket 98 is secured to the platform 54 by screws or other suitable means. A coil spring 100, one end of which is connected to a pin or screw fastened to the pivoted plate 94 while the opposite end is secured to the fixed plate 98, swings the member 94 around the pivot pin 96 so as to hold the upper edge 93 of the plate 94 against the lower end of the button 84. The lower forward end of the plate 94 is shaped to provide a tab 102 which is bent at right angles across the edge of the fixed plate 98 so that swinging movement of the plate 94 under the influence of the spring 100 is limited by the back face of the tab 102 acting as a stop when it is brought against the vertical edge of the fixed plate 98. The forward face of the tab 102 is positioned to be adjacent the end of the blade 66 and is on the same side of the blade as the cam 60. When the button 86 is

pressed so as to swing the plate 94 about the pivot pin 96, thus causing the face of the tab 102 to swing outwardly, this face impinges against the edge of the strip 66 and pivots it slightly about the pin 48.

It is apparent, therefore, that the operator's act of momentarily depressing and releasing the button 86 will swing the blade 66 and arm 46 about the pin 48 so as to cause a sharp upward pip in the line drawn by the stylus 42. This is in contrast to the sharp pips drawn by the stylus in a downward direction when the cam following portion 64 falls into the notch 62.

The stylus 42 draws a straight line as the tape advances with this line being momentarily interrupted to form sharp downward pips once each second while at any time one or more upward pips in the line may be formed by the operator simply through the act of momentarily depressing the button 86 one or more times. The position of the straight line drawn by the stylus 42 is determined by the setting of the knob 14 because in the different positions of this knob the roller 18 will be at different positions with respect to the axis of the knob 14 and thus the link 36 will be moved toward the right or left. Movement of the link acting through the pin 56 swings the arm 50 about the pivot pin 52 so as to change the position of the pin 48 about which the blade 66 and arm 46 pivot. Thus movement of the knob 14 from the position shown one notch in a counterclockwise direction will move the roller 18 toward the right thus drawing the link 36 and post 58 to the right. This rocks the arm 50 about the pin 52 so as to swing the pivot point 48 to the left. The end of the arm 46 attached to the stylus therefore is moved in a clockwise direction about the pivoting point formed where the knife edge 64 contacts the edge of the cam 60 with the result that the marking end of the stylus will be moved upwardly slightly.

From the above description it will be seen that the arrangement is such that the stylus 42 will draw a straight line near the edge of a recording tape passing through the machine and the position of this line is automatically shifted upwardly or downwardly as the knob 14 is rotated between four different switch positions. It is apparent also that in all four of these positions the electric clock driven cam 60 will produce a sharp downward pip once each second. Also if electrode combinations are used which are not coded by the line being drawn in one of the four regular positions, these additional combinations can be marked by depressing the button 86 in any code sequence chosen by the operator. Also since the coding pips formed by depressing the button 86 are directed upwardly, there is little possibility of confusing the coding pips with the timing pips.

Having described my invention in connection with one embodiment thereof, it being appreciated that modifications and variations may be made therein without departing from the scope of the invention, what I claim as new and useful and desire to secure by Letters Patent of the United States is:

1. In an electrocardiograph having mechanism for pulling a tape and switching means movable to a plurality of positions for connecting said electrocardiograph to a plurality of electrode combinations, the improvement which comprises a stylus positioned for drawing a line near one edge of the tape, an adjustable arm secured at one end to said stylus, a pivot supporting said arm at a mid point thereof, cam means for moving

the opposite end of said arm as said cam means rotates so as to swing said arm about said pivot, a clock motor connected for rotating said cam means, a cam operated by said switching means, and linkage means operated by the last said cam for shifting the position of said pivot and hence the position of the line drawn by said stylus depending upon the position of said switching means.

2. In an electrocardiograph having mechanism for pulling a tape and switching means movable to a plurality of positions for connecting said electrocardiograph to a plurality of electrode combinations, the improvement which comprises a stylus positioned for drawing a line near one edge of the tape, an adjustable arm secured at one end to said stylus, a pivot supporting said arm at a mid point thereof, cam means for moving the opposite end of said arm as said cam means rotates so as to swing said arm about said pivot, a clock motor connected for rotating said cam means, a cam operated by said switching means, linkage means operated by the last said cam for shifting the position of said pivot and hence the position of the line drawn by said stylus depending upon the position of said switching means, and manually actuated means for momentarily moving said arm for momentarily displacing said stylus.

3. In an electrocardiograph having mechanism for pulling a tape, an electric switching means movable to a plurality of positions for connecting said electrocardiograph to a plurality of electrode combinations, the improvement which comprises a stylus positioned for drawing a line near one edge of the tape, an adjustable arm secured at one end to said stylus, a pivot supporting said arm at a mid point thereof, a disc cam with a notch therein for moving the opposite end of said arm when a portion of said arm falls into said notch so as to swing said arm about said pivot, spring means for urging said arm against said cam, a clock motor connected for rotating said cam, resilient means for stopping the inward movement of said arm into said notch before the arm strikes the bottom of said notch, a second cam connected for rotation with said switching means, and linkage means operated by said second cam for shifting the position of said pivot and hence the position of the line drawn by said stylus depending upon the position of said switching means.

4. In an electrocardiograph having mechanism for pulling a tape, an electric switching means movable to a plurality of positions for connecting said electrocardiograph to a plurality of electrode

combinations, the improvement which comprises a stylus positioned for drawing a line near one edge of the tape, an adjustable arm secured at one end to said stylus, a pivot supporting said arm at a mid point thereof, a disc cam with a notch therein for moving the opposite end of said arm when a portion of said arm falls into said notch so as to swing said arm about said pivot, spring means for urging said arm against said cam, a clock motor connected for rotating said cam, resilient means for stopping the inward movement of said arm into said notch before the arm strikes the bottom of said notch, a second cam connected for rotation with said switching means, linkage means operated by said second cam for shifting the position of said pivot and hence the position of the line drawn by said stylus depending upon the position of said switching means, and manually actuated means for momentarily moving said arm for momentarily displacing said stylus.

5. In an electric recording instrument having motor driven mechanism for pulling a tape and electric switching means movable to a plurality of positions for connecting the recording instrument to a plurality of input circuits, the improvement which comprises a stylus for drawing a line within a certain zone on said tape, means for carrying said stylus, means forming a pivot for the last said means, an independent clock motor connected for periodically swinging the carrying means about said pivot to give a marking impulse to said stylus, variable position means operated by said electric switching means and adapted to move into one of several positions depending upon the position of said switching means, means operated by said variable position means for shifting the position of said pivot and hence the position of the line drawn by said stylus depending upon the position of said electric switching means, and manually actuated means for momentarily displacing said carrying means to give an additional manually controlled marking impulse to said stylus.

#### References Cited in the file of this patent

##### UNITED STATES PATENTS

Number	Name	Date
621,994	Dey et al. ....	Mar. 28, 1899
1,322,148	Sprague .....	Nov. 18, 1919
2,118,081	Grisdale .....	May 24, 1938

##### FOREIGN PATENTS

Number	Country	Date
473,199	Canada .....	Apr. 24, 1951