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E. H. BRANSON

2,480,443

RECORDER ACTUATED BY ELECTRICALLY HEATED WIRES

Filed Oct. 3, 1945

2 Sheets-Sheet 1

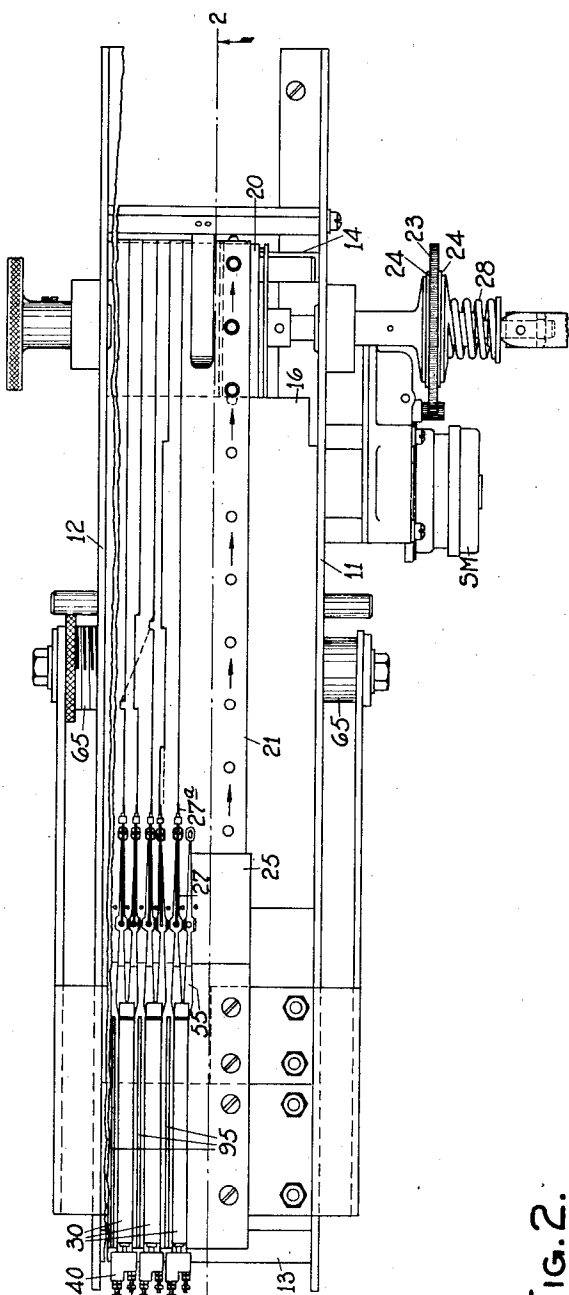
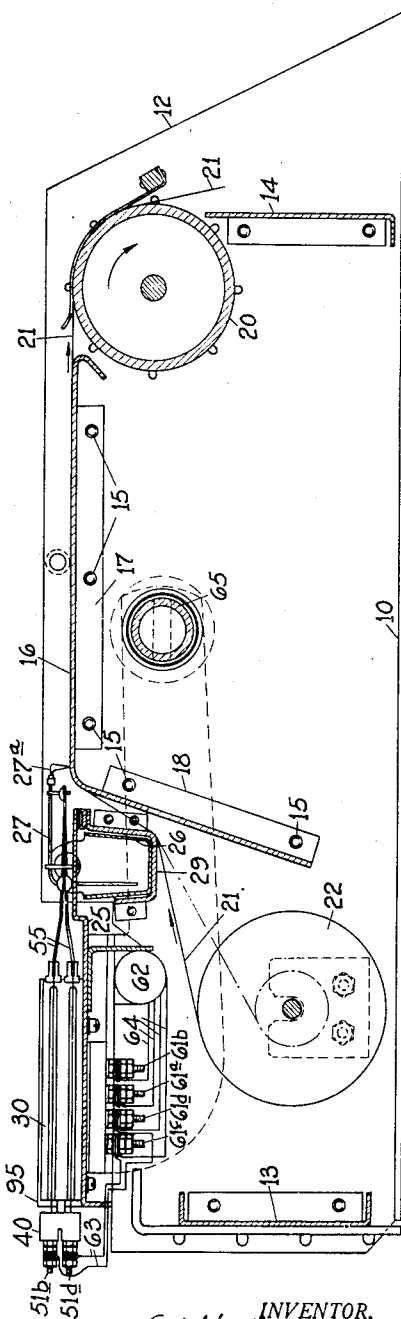


FIG. 1.

FIG. 2.



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2 Sheets-Sheet 2

FIG. 3.

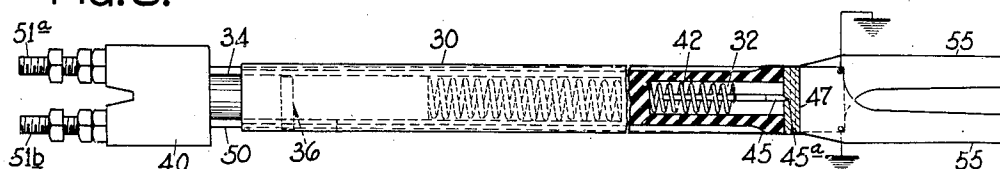


FIG. 4.

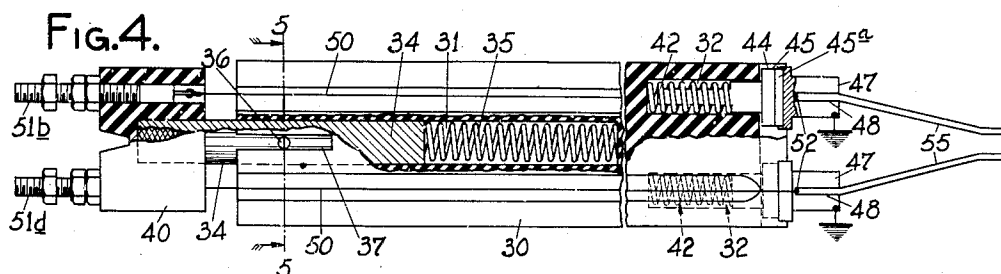


FIG. 7.

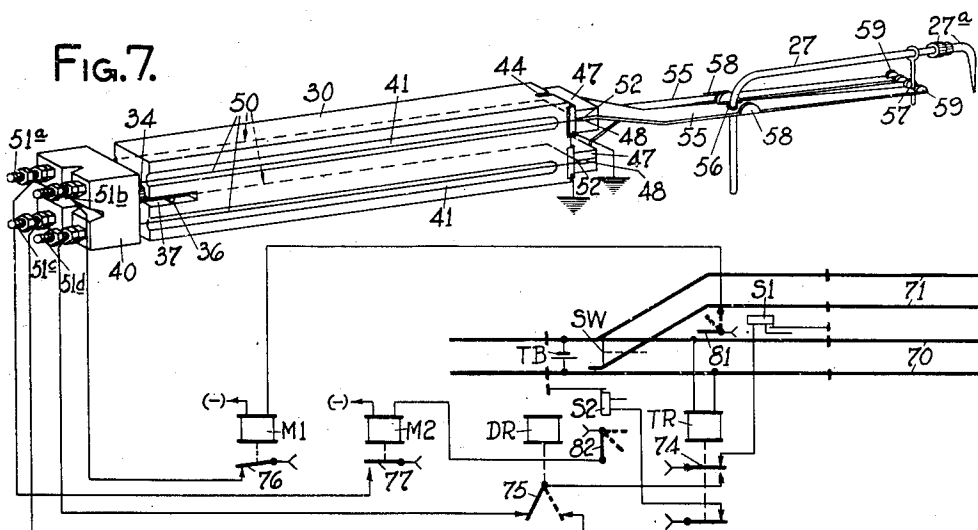


FIG. 5.

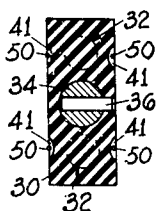
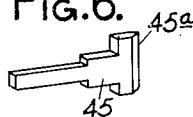


FIG. 6.



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7 Claims. (Cl. 346—76)

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This invention relates to recorders and more particularly to recorders for railway signalling systems for making records of traffic movements, signal aspects, switch positions and the like.

Recorders used for railway signalling purposes usually require a very large number of pens or other suitable marking devices arranged side by side and spaced very closely together so that the record sheet need not be unnecessarily wide. It is difficult to provide electro-responsive means suitable for operating such marking devices by reason of the close spacing required.

In view of the above and other important considerations it is proposed in accordance with the present invention to provide electro-responsive devices, preferably of the thermal type, having at least two very small dimensions, for operating the pens or other suitable marking devices in accordance with the conditions of track relays, wayside signals, switch positions or the like. More specifically, it is proposed to employ electro-responsive means of the hot wire type which are small in cross-sectional area but which are quite long and so constructed as to compensate for ambient temperature changes so that the pens or marking devices assume the same position under like traffic conditions irrespective of room temperatures. It is also proposed to so construct the recorder that all of the electro-responsive devices under consideration may be lifted up and swung out of position in order to enable a new roll of recording paper to be placed into the recorder.

Other objects, purposes and characteristic features of the present invention will in part be pointed out in the specification hereinafter and will in part be obvious from the accompanying drawings in which:

Fig. 1 illustrates a plan view of a recorder embodying the present invention;

Fig. 2 illustrates a side elevation of the recorder with many of the parts thereof illustrated in cross section, taken substantially on a line 2—2 of Fig. 1;

Fig. 3 illustrates a plan view, with portions thereof broken away, of a double electro-responsive pen operating structure of which the pens are located side by side and the electro-responsive devices are arranged one above the other;

Fig. 4 illustrates a side elevation of the ap-

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paratus shown in Fig. 3 with portions thereof cut away to illustrate parts thereof in cross section;

Fig. 5 illustrates a cross sectional view of the electro-responsive apparatus shown in Figs. 3 and 4 taken on a line 5—5 of Fig. 4;

Fig. 6 illustrates in perspective the anvil illustrated in position in the electro-responsive device in Figs. 3 and 4; and

Fig. 7 shows a double electro-responsive device in perspective and circuits for operating the same.

Structure.—Referring to Figs. 1 and 2 the recorder frame comprises a bottom plate 10 together with side plates 11 and 12, a front plate 13 and a back plate 14. A platen 15 is provided which has its side edges bent at right angles as illustrated at 17 and 18 in Fig. 2 of the drawings for the purpose of securing this platen 15 to the inside of the walls 11 and 12 of the casing, as by bolts 15. A toothed record sheet roller 20 is provided for pulling the record sheet 21 from the roller 22 across the platen 16. This toothed roller 20 is pivotally supported in side walls 11 and 12 and is driven by suitable time lapse manifesting means such as an electric or mechanical time movement. In the specific form shown this roller 20 is driven by a synchronous motor SM through the medium of suitable gearing. By this construction the record sheet will move at a rate corresponding to the passing of time so that the hours and minutes of the day may be printed directly upon the record sheet. The record sheet is of course set so that the time of day is read by reading the record sheet at that point where the pens or marking points engage the paper. A slip clutch including gear 23 driven by synchronous motor SM, plates 24 and a spring 25 pressing them together has been illustrated.

Directly in front of the platen 16, which is horizontal throughout most of its length but is bent down at both front and rear ends at an angle to form a rounded shoulder around which the record paper 21 may move, there is provided a support plate 25 which supports double unit electro-responsive devices 30. The ink well or trough 26 is supported in brackets 29 suitably secured to the sidewalls 11 and 12. This inkwell contains ink used by the pens 27, there being two pens for each double unit, that is, one pen for each electro-responsive device. On top of the plate 25 are mounted the double thermal electro-responsive

units 30 comprising essential elements of the present invention and directly below this plate 25 are supported binding posts to connect the electro-responsive devices to the control circuits all in a manner as more fully pointed out hereinafter.

Referring now to Figs. 3-7 wherein these thermal electro-responsive devices have been shown more clearly, it will be seen that these electro-responsive devices are grouped in pairs. Each pair is of unitary construction and includes a single supporting block 30, preferably constructed of metal of good heat conducting quality, which has a centrally located cylindrical opening 31 extending thereinto from one end and has two similar cylindrical openings 32 extending thereinto from the other end. These latter openings are preferably located equal distances on opposite sides of the center line or axis of the opening 31. The opening 31 is provided with a piston 34 which is urged outwardly by a coil spring 35. In order to keep this piston from turning it is provided with a cross pin 36 having one end thereof extending into a slot 37 in the supporting block 30. The exposed end of this piston or cylindrical push rod 34 has secured thereto an insulating block 40. This insulating block 40 supports four binding posts 51a, 51b, 51c and 51d (Fig. 7.) As more clearly shown in Figs. 5 and 7 the supporting block 30 is provided with four grooves 41 for the purpose of receiving wires 50 as more fully described hereinafter.

In the openings 32 of block 30 are provided compression coil springs 42 which contain anvils 45, one of which has been shown in perspective in Fig. 6 of the drawings. These anvils are each provided with a knife-edge portion 45a each of which bears against its associated operating block 47. These operating blocks 47 are preferably of the general configuration illustrated and are provided with a saw slot 48 into which the junction of two thermal wires 50 extends and is secured. These wires of two such electro-responsive devices are fastened to the terminal bolts 51a, 51b, 51c and 51d secured in the insulating block 40. It is thus seen that the spring 35 bearing against the push rod or piston 34 will not only tension these four thermal wires 50 but will also urge the operating blocks 47 against their respective anvil points 45a. In practice the spring 35 is of such strength that it is capable of overcoming the tension of the two springs 42 so that the anvils 45 are pushed into the openings 32 and slots 44 to an extent where the operating blocks 47 rest fully against the end of the supporting block 30. It may be pointed out at this time that not only do the wires 50 pass through the slots 48 in the operating blocks 47 but these wires are actually soldered or welded, as shown at 52, into these slots so as to constitute both a mechanical and electrical connection between the wires 50 and the operating blocks 47. Since the supporting block 30 as well as the anvils 45 and operating blocks 47 are all preferably constructed of metal, the mid-points of all these operating blocks 47 and of the thermal wires 50 are electrically connected together through the supporting plate 25 to one terminal of a source of current (see Fig. 7). It is readily seen that if current is caused to flow from one of the terminal bolts 51a, 51b, 51c or 51d to a ground connection at the point 45a in one of the operating blocks 47, that only the wire 50 connected to that terminal bolt will be heated, and that the elongation of this heated wire will allow only one

particular spring 42 to push its associated anvil 45 outwardly against the mid-point of the associated operating block 47 to thereby cause the operating block to rotate, so to speak, on the other of its two outer edges, to thereby cause the pen holder or other suitable marking device 55 to be operated to the right or left as the case may be. It will be seen that these pen holders 55 (see Fig. 3) for each pair are shaped to lie in different vertical planes, even though their respective operating blocks 47 lie directly one over the other in the same vertical plane. Furthermore, although the operating blocks 47 lie in different horizontal planes their respective marking points lie in the same horizontal plane. By this construction two electro-responsive devices which are located one above the other may operate two pen holders lying side by side.

Referring now to Figs. 1 and 2 of the drawings it will be observed that a plurality of such supporting blocks 30 are mounted side by side but spaced from each other on the supporting plate 25 of the recorder. It will also be seen (see Fig. 2) that the pen holders or marking arms 55 are of such shape that the free ends thereof occupy the same horizontal plane. These pen holders 55 are provided with two openings 56 and 57 along the side of which are located wings 58 and 59 respectively formed by tabs of the metal bent at right angles. By referring to Fig. 7 it will be seen that the wings 58 of the bottom electro-responsive devices are projected downwardly whereas the wings 58 for the upper electro-responsive device project upwardly. All of the wings 59 are bent upwardly. The wings 58 and 59 serve to provide additional support for the penholders 55 at points where such penholders are pierced for the insertion of the marking devices 27. These openings 56 and 57 with their associated wings 58 and 59 respectively are used for holding the pen 27. Each pen is composed of a small metallic tube 27 bent substantially at a right angle to the end of which is secured an elbow-shaped writing nozzle 27a preferably constructed of glass. The holes in this tube 27 and writing nozzle 27a are of capillary size so that if this pen is once filled with ink capillary attraction will cause the ink to be lifted out of the inkwell 26 to the writing end of the nozzle 27a and to the recording strip or paper 21. The writing end of this nozzle 27a rests on the paper strip 21 so that as the roller 20 is operated by suitable clock mechanism including synchronous motor SM it will cause a straight line to be drawn on the paper when neither of the two associated thermal wires 50 has current applied thereto. If, however, current is applied to one of these two thermal wires 50 the associated operating block 47 will be tilted to the right or to the left, as the case may be, due to the elongation of this wire and cause the pen holder 55 and its associated pen 27 to be moved to the right or left, to thereby cause the line drawn on the paper strip 21 to be correspondingly shifted to indicate the happening of a particular event the recording of which is proposed.

Each of the binding posts 51a, 51b, 51c and 51d is connected by a jumper 63 to an associated binding post 61 (see Fig. 2) having a corresponding suffix and mounted below the plate 25. A cable 62 is suitably horizontally mounted below and to the supporting plate 25 with its various wires 64 fanned out and connected to the binding posts 61. This cable 62 is of sufficient length that the lifting of the supporting plate 25 about

the pivot 65 on which it is hinged is permitted by the bending of this cable 62. In other words, the entire writing mechanism including numerous supporting blocks 30 mounted on supporting plate 25 and all of the electro-responsive apparatus associated therewith including numerous pens 27 may be lifted up and swung about the hollow pin 65 as a pivot, as a result of which the various pens 27 will be lifted from the inkwell 26. This lifting of the electro-responsive mechanism and pens enables a new roll of record paper to be put on the roller 22 and threaded over the platen 16 and onto the toothed roller 20 driven by suitable clock mechanism.

It is of course now clearly understood that each electro-responsive device includes two wires 50 extending from their respective binding posts 51 to the common operating block 47. These wires are preferably resistance wires having considerable resistance and which also have a high temperature coefficient of expansion as a result of which electrical energy is not only readily converted into heat but also as a result to this heat is efficiently converted into mechanism movement. A wire suitable for this purpose is known as Nichrome wire. If one of these two wires is heated the block 47 will be operated in one direction about a vertical axis whereas if the other wire 50 of the pair is heated this block 47 will operate in the opposite direction about a similar vertical axis. From this it is readily understood that a pen holder 55 may be operated to the right or to the left from a neutral position depending upon which of its two wires 50 has electrical energy applied thereto. Furthermore, it is readily seen that each wire 50 serves as an ambient temperature correcting means for its associated wire. This is true because if room temperature changes both of the wires 50 are either elongated or contracted as is also true of the pair of wires located either directly below or directly above the pair in question and associated with the same supporting block 30, as a result of which the single spring 35 associated with all of these four wires 50 will either be compressed or elongated depending upon whether the room temperature was lowered or increased, respectively. By this construction the various pen points will make straight parallel lines on the record strip so long as no current is applied to any of the wires 50 in spite of large changes in room temperature. In other words, adequate compensation for ambient temperature has been provided for in the thermal electro-responsive devices described. These pens are spaced apart distances and operate sidewise distances such that any one of the three parallel lines each pen is capable of drawing will not overlap with lines drawn by an adjacent pen.

It will be readily apparent that the structure of the electro-responsive devices as has been heretofore set forth is such that each wire 50 can operate its associated marking device 27 in accordance with the heating of that wire, only if it is heated relative to the wire 50 connected to the opposite side of the associated operating block 47. In other words, if both wires 50 of a pair are energized so as to be heated contemporaneously, the marking device 27 associated therewith assumes its center position and fails to register either of the conditions of energization.

In view of these considerations, and in order to take advantage of the full capacity of the recorder to handle a maximum number of distinctive conditions to be recorded, it is necessary that

the conditions to be recorded be so allocated to the respective wires 50 that energy is at no time applied to both wires 50 of a pair at the same time. Thus, when the recorder is used in railway signaling practice for the purposes set forth, care must be taken in the connection of the recorder circuits to so group the circuits that there can be no error in recording due to any traffic and/or signal conditions being contemporaneously effective to energize two wires 50 of a pair at the same time.

Fig. 7 illustrates a typical manner of allocating the various recorder circuits so that there is never a conflict between the wires 50 of a pair. The wires 50 of the upper pair are illustrated as being energized through back contacts 73 and 74 of relays M1 and M2 respectively. The relays M1 and M2 are signal repeater relays commonly employed in practice for repeating the stop indication of their associated signals. Thus the relays M1 and M2 are respectively associated with the contacts 81 and 82 of the opposing signals S1 and S2, which signals are in turn associated with the main track 70 for governing traffic through the track switch SW which connects the track 71 to the main track 70.

The conventional control circuits (not shown) for the opposing signals S1 and S2 allow only one of such signals to be clear at a time. Thus only one of the relays M can be deenergized at a time, and therefore only one of the top pair of wires 50 can be energized at a time. For the condition of the apparatus illustrated in Fig. 7, energy is applied to terminal 51b associated with one of the wires 50 of the top pair, through back contact 73 of relay M1 because signal S1 is assumed to be clear, thus holding the circuit open for the relay M1 at contact 81.

The wires 50 of the lower pair which are connected to terminals 51c and 51d respectively are used in recording the occupancy by respective eastbound and westbound trains of the detector track section with which the relay TR is associated. Inasmuch as only a single direction of traffic can be established at a time through the detector track section, there can be no conflict in the energization of the wires 50 associated with the lower operating block 47, because at no time can energy be applied contemporaneously to the terminal posts 51c and 51d. The direction relay DR is controlled in a suitable manner (not shown), as from a control office, and its polar contact 75 selects whether the back contact 74 of the track relay TR is to be connected to terminal 51c or terminal 51d.

There are of course other combinations of connections for the recorder circuits that are satisfactory, but in using such combinations it must be considered that there is an overlapping of the signal recording controls and the track circuit recording controls for the same direction of traffic in that it is the dropping away of the track relay TR that puts a signal to stop governing entrance to the detector track section, and thus the relay TR is dropped away to initiate the recording of the occupancy of the detector track section before the signal clear recorder circuit has had time to open by the picking up of the signal repeater relay M1 or M2 that has been deenergized.

It is thus provided that each of the marking devices 27 will normally mark a continuous straight line on the record chart paper when its associated electro-responsive device is deenergized, will be operated to the right and held in that position as long as the right-hand wire 50

is energized, and will be operated to the left and held in that position as long as the left-hand wire 50 is energized. It is thus provided that records are made in accordance with passage of trains on the record receiving paper 21 as shown in Fig. 1 to convey information to the operator of a centralized traffic control machine as to the speed and delays encountered by the respective trains.

Having thus shown and described only one specific embodiment of the invention, it should be understood that the embodiment described and illustrated has been selected to facilitate the disclosure of the invention, its principle of operation, and the manner in which the invention may be practiced, rather than its scope, and has not been selected to show the exact construction necessarily employed in practicing the invention, and it should be understood that various changes, modifications and additions may be made in practicing the invention without departing from the spirit or scope thereof as long as these changes come within the scope of the following claims.

What I claim as new is:

1. An electro-responsive marking device for recorders of the type wherein a large number of marking devices are arranged side-by-side with their marking points spaced extremely short distances apart comprising; a supporting block, an operating block engaging one end of said supporting block, a wire extending along each side of said supporting block fastened to said operating block at one end and to the far end of said supporting block at the other end, a spring pressed anvil engaging substantially the middle of said operating block tending to move the middle portion of said operating block away from said supporting block, marking means fixedly secured to said operating block, and means for passing current at times through one of said wires, whereby when one of said wires is heated said anvil will operate the middle portion of said operating block away from said supporting block to an extent dependent on the temperature of the heated wire to thereby partially rotate said operating block and actuate the associated marking device.

2. An electro-responsive marking device for recorders of the type wherein a large number of marking devices are arranged side-by-side with their marking points spaced extremely short distances apart comprising; a supporting block, an operating block engaging one end of said supporting block, a wire extending along each side of said supporting block fastened to said operating block at one end and to the far end of said supporting block at the other end, a spring for applying tension to both of said wires, an anvil engaging substantially the middle of said operating block, a second spring tending to move said anvil and the middle portion of said operating block away from said supporting block, marking means fixedly secured to said operating block, and means for passing current at times through one of said wires, whereby when one of said wires is heated said anvil will operate the middle portion of said operating block away from said supporting block to an extent dependent on the temperature of the heated wire to thereby partially rotate said operating block and actuate the associated marking device.

3. Electro-responsive means for operating the marking points of a recorder of the type wherein a large number of marking points are closely spaced in a row crosswise of a longitudinally moving record strip, comprising; a knife-edge bearing,

a block engaging said knife-edge bearing, two wires extending substantially parallel to each other from said block substantially equal distances on opposite sides of the knife edge of said bearing to a fixed support, a spring for holding said block against said knife-edge bearing through the medium of said wires, a lever projecting from said block, a marking point on the free end of said lever, and means for passing current at times through one or the other of said wires, whereby said marking point is moved sidewise in one direction if one of said wires is elongated by reason of being heated by current flowing therein and is moved sidewise in the opposite direction if the other of said wires is elongated by reason of being heated by current flowing therein.

4. In a recorder of the character described in which a plurality of records are marked simultaneously by marking devices on a record receiving member that is driven at a substantially constant speed, an electro-responsive device for actuating each of said marking devices comprising an operating block coupled to one of said devices and pivoted to rotate on a vertical axis, a wire of substantial length secured against movement at one end and having its other end secured to a point on said operating block spaced to one side of said pivot point, an anchorage for said operating block spaced to the other side of said pivot point, and biasing means effective to maintain said wire under tension at all times and actuate said operating block about its pivot point in accordance with the linear expansion of said wire.

5. In a recorder having electrically actuated marking devices for marking a plurality of continuous records on a record receiving member, an electro-responsive device for each of said marking devices comprising an operating block operatively connected to one of said marking devices and pivoted to rotate on a vertical axis, a wire of substantial length extending horizontally with respect to said axis, said wire being secured against movement at one end and having its other end secured to a point on said block spaced to one side of said vertical axis, an anchorage for said operating block spaced to the other side of said pivot point, and biasing means effective to actuate said block about its pivot point as limited by the linear expansion of said wire, said anchorage and said wire cooperating to be effective as ambient temperature correction means for rendering said operating block non-responsive to variations in temperature of said wire except when said wire varies in temperature with respect to other parts of said recorder.

6. In a recorder having a plurality of electrically actuated record marking devices for marking a plurality of continuous distinctive records simultaneously on a record receiving member driven at a constant rate of speed, an electro-responsive device for actuating each of said marking devices comprising an operating block operatively connected to one of said marking devices and having a central bearing point, a pair of laterally disposed wires secured against movement at one end and having their opposite ends secured to said operating block at opposite sides from said bearing point, and biasing means actuated longitudinally with respect to said wires against said bearing point to maintain said wires under tension irrespective of their linear expansion, whereby said electro-responsive means is effective to actuate its associated marking device to a first position when only a particular one of said wires is heated by an electric current, to a

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second position when only the other of said wires is heated by an electric current and to a third and normal position upon removal of heat from either of said wires when the other wire has no heat applied thereto.

7. In a recorder, the combination with two marking devices of an electro-responsive device for actuating said devices comprising operating blocks for the respective marking devices, a pair of laterally spaced wires of substantial equal length for operating each of said operating blocks, said wires being secured against movement at one end and being secured at the other end to spaced points on the associated operating block, a supporting block having one of its ends biased against both of said operating blocks, said supporting block normally making contact with each of said operating blocks at two spaced points, and biasing means associated with each of said operating blocks, said biasing means acting on a point substantially mid-way between said

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two spaced points to maintain said wires under tension and operate that operating block about a vertical axis formed at one of said spaced points to an extent allowed by the linear expansion of one wire of said pair with respect to the other wire of that pair.

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REFERENCES CITED

The following references are of record in the file of this patent:

UNITED STATES PATENTS

Number	Name	Date
1,858,457	Mottashed et al. ----	May 17, 1932
1,925,515	Beck -----	Sept. 5, 1933
2,002,086	Belaef -----	May 28, 1935
2,220,881	Barnes et al. -----	Nov. 12, 1940
2,327,811	McRae -----	Aug. 24, 1943
2,346,802	Walker -----	Apr. 18, 1944