July 18, 1950 J. F. MERKEL 2,515,658

ELECTROMAGNETIC CONTROL OF RECORDING MECHANISMS

Filed July 5, 1946 2 Sheets-Sheet 1

FIG. 1.

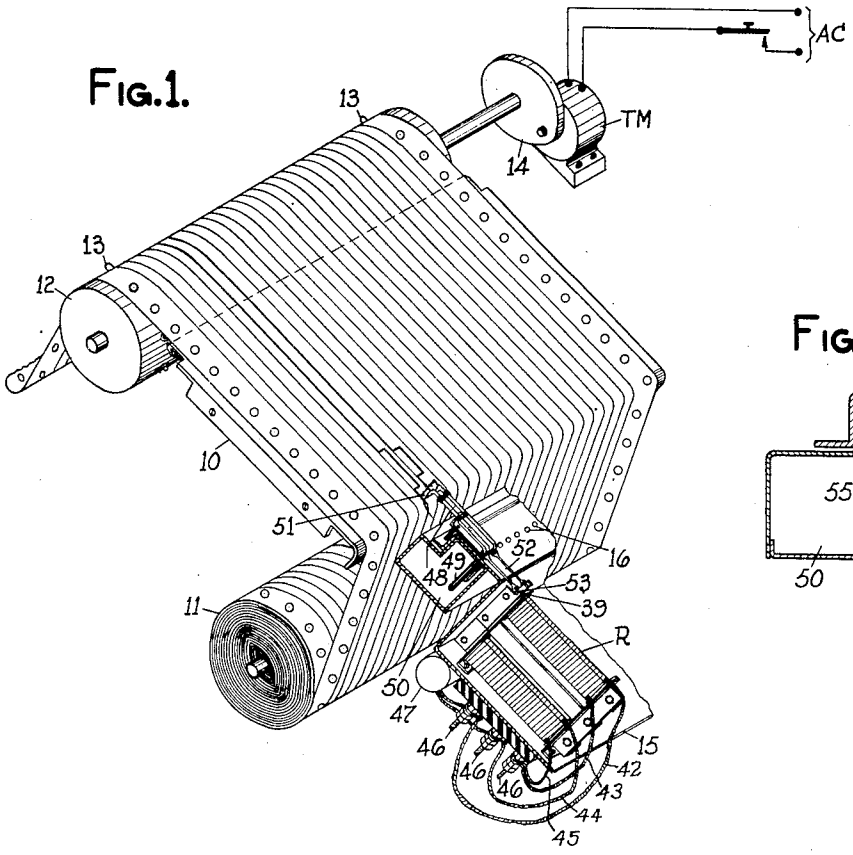


FIG. 5.

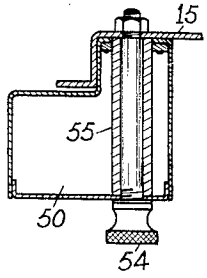


FIG. 3.

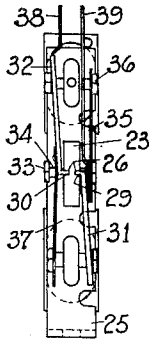


FIG. 2.

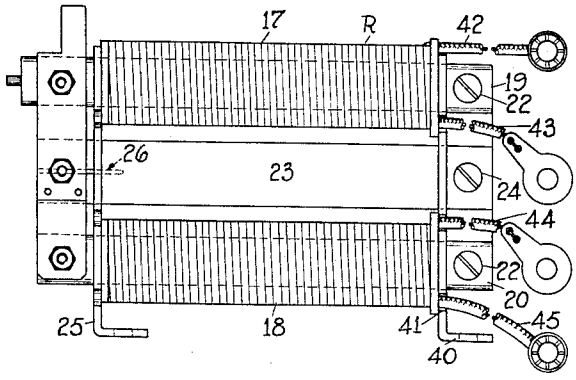
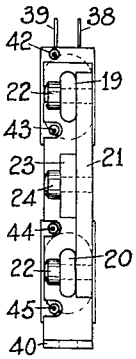


FIG. 4.



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FIG. 6.

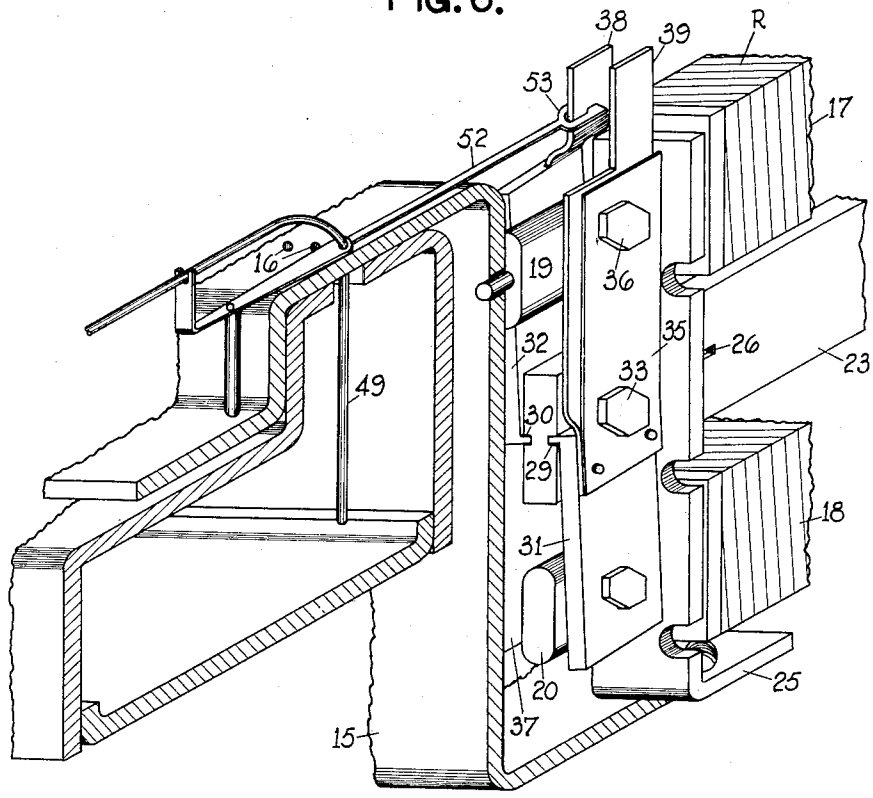


FIG. 7.

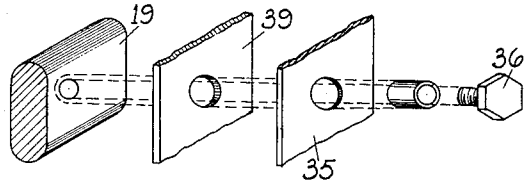


FIG. 8.

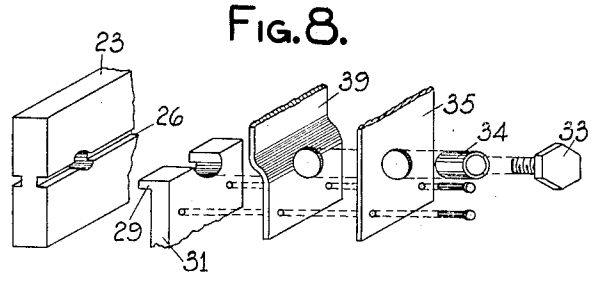
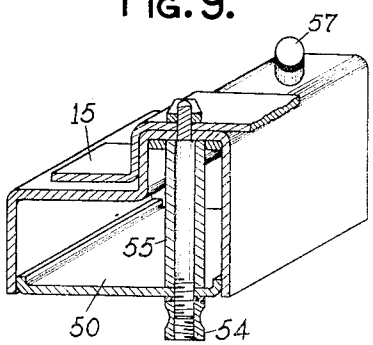


FIG. 9.



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UNITED STATES PATENT OFFICE

2,515,658

ELECTROMAGNETIC CONTROL OF RECORDING MECHANISMS

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Application July 5, 1946, Serial No. 681,451

3 Claims. (Cl. 346—49)

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This invention relates to automatic recorders, and it more particularly pertains to improvements in recorders used in connection with the dispatching of trains having pens operated by electro-responsive means.

In a recorder for centralized traffic controlling systems it is required that conditions involving the track occupancy of a large number of track sections, the conditions of the various signals along the trackway, and conditions of other traffic controlling apparatus be recorded independently on a record chart located convenient to an operator for his reference. Such a recorder is conveniently located under a transparent panel in the desk portion of a centralized traffic controlling machine. The concentration of a large number of electrically operated recorder units in a small space as required presents problems of lateral spacing of recorder units and of heat dissipation within a particular restricted area.

In view of the above and other considerations, the present invention is to be considered as providing improvements in the recorder disclosed in the prior application of Edward H. Branson, Ser. No. 619,944, filed October 3, 1945, now Pat. No. 2,480,443, dated August 30, 1949. In the recorder disclosed in that application, a maximum number of independently operated pens is provided laterally across the record chart paper by use of hot wire operated units requiring a minimum lateral spacing of the pens, each unit being effective to provide for the independent operation of two recorder pens. In view of the relatively large amount of current required by the hot wire operating units, an object of the present invention is to provide a relay operated unit, requiring no more lateral spacing than the hot wire unit, for providing the automatic operation of two independent pens, such unit having an efficient electromagnetic structure to minimize the current required and the heat required to be dissipated within the recorder.

Another object of the present invention is to facilitate the replacement of rolls of recording paper by not only raising the relay operating units to allow clearance for replacement of the rolls, but raising the inkwell along with them to prevent the possibility of trapping air in the ink tubes due to their removal from the inkwell.

Other objects, purposes and characteristic features of the present invention will be in part obvious from the accompanying drawing, and in part pointed out as the description of the invention progresses.

In describing the invention in detail reference

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will be made to the accompanying drawing in which similar reference characters are used for designating corresponding parts throughout the various figures, and in which:

Fig. 1 is a perspective view of the recorder with only those parts shown as are required for an understanding of the improvements in the recorder structure as provided according to the present invention;

Fig. 2 is an elevational view of a typical relay unit of the recorder;

Fig. 3 is a left-hand end view of the relay unit shown in Fig. 2;

Fig. 4 is a right-hand end view of the relay unit as shown in Fig. 2;

Fig. 5 is a sectional view of the inkwell showing the manner in which it is removably secured in position;

Fig. 6 is an enlarged perspective view of a portion of the recorder particularly illustrating how the recorder pens are actuated by a typical relay unit;

Fig. 7 is a perspective view with certain parts being shown in expanded relationship illustrating a typical detail of assembly;

Fig. 8 is a perspective view with certain parts being shown in expanded relationship illustrating the manner in which the armature hinges of a relay unit are held in assembly; and,

Fig. 9 is a perspective view of a section of the inkwell illustrating how it can be readily filled.

Inasmuch as this invention provides improvements in the recorder disclosed in the above mentioned application of Edward H. Branson, Ser. No. 619,944, dated October 3, 1945, now Pat. No. 2,480,443, dated August 30, 1949, reference is to be made to that application for a more complete disclosure with respect to the housing of the recorder and the manner in which the electro-responsive units are hinged for the purpose of their elevation to allow replacement of the rolls of recorder paper. Thus, it is believed sufficient for an understanding of the present invention to describe only the general structure and operation of parts of the recorder which are fully disclosed in that application and point out how the improvements provided by the present invention are applied.

The recorder comprises in general a platen 10 (see Fig. 1) secured to the recorder housing, a roll of recorder paper 11 suitably positioned in the recorder casing and fed over the platen 10 at a rate of speed comparable to the passing of time by the roller 12 having teeth 13 engaging the paper. The roller is driven by a suitable con-

stant speed mechanism such as the synchronous motor TM through a suitable gear reduction 14.

The pens associated with respective relay units are normally in alignment with respective longitudinal lines of the record chart paper, and are operated to the right of such lines in accordance with their automatic control to indicate conditions of track occupancy, conditions of the signals, and other conditions which facilitate the dispatching of trains by an operator of a centralized traffic control machine. The longitudinal movement of the record chart paper in accordance with the passage of time allows the paper to have printed thereon the time of day and therefore the conditions indicated by the operation of the respective pens are recorded as being effective at a certain time and for a particular duration of time.

The recording pens are operated by respective relay operating units such, for example, as the typical unit R shown in its operating position in Fig. 1, and shown more in detail in Figs. 2, 3, 4, and 6, each unit providing for the operation of two pens. It will be noted from the end views of Figs. 3 and 4 that the typical relay unit R occupies a minimum amount of space laterally across the record chart paper, and therefore a maximum number of relay units can be disposed in alignment laterally across a given width of record chart paper for operation of double that number of recorder pen units. A mounting bracket 15 which is hinged to be elevated for the purpose of facilitating replacement of rolls of recording paper is formed to provide a base for the mounting of the respective relay units, to extend vertically in front of the relay units to provide a means for aligning each of the units in a manner to be hereinafter described, and to extend horizontally to form a cover for the inkwell and also provide by the holes 16 locating means for the respective pen operating units.

With reference to Figs. 2 and 6, the typical relay unit R comprises upper and lower coil windings 17 and 18 respectively on the upper and lower cores 19 and 20 to provide upper and lower electromagnetic structures. The cores 19 and 20 are preferably of annular cross-section as shown in Figs. 3 and 4 to facilitate the application of the coil windings, and they are maintained at a minimum thickness in order to maintain the required minimum spacing between centers of the respective relay units. A yoke 21 of magnetic material connects the cores 19 and 20 at their right-hand ends and it is secured to the cores by the screws 22.

Disposed between the cores 19 and 20 and parallel thereto is a magnetic shunt 23 common to both upper and lower electromagnetic structures, such shunt being secured to the yoke 21 by the screw 24 at its right-hand end and by being tightly fitted through an opening near the center of the bracket 25 at its left-hand end. The magnetic shunt thus assembled is common to both upper and lower electromagnetic structures in that it completes magnetic circuits of low reluctance for operation of the armatures associated with the respective upper and lower electromagnetic structures. In this manner there is formed effectively two U-shaped magnetic circuits, one governed by energization of winding 17, and the other governed by the energization of winding 18. The magnetic structures of each relay unit are disposed one above the other to maintain minimum lateral spacing of the relay units, and by the use of the magnetic shunt which is common to both structures, a minimum elevational spacing is required for each relay unit as compared to the elevational spacing that would be required if the upper and lower magnetic circuits were required to have entirely independent electromagnetic structures. At the left-hand end of the magnetic shunt, a longitudinal slot 26 is formed in each side of the shunt for the purpose of hinging the armatures 31 and 32 which are located on opposite sides of the cores and actuated by the respective upper and lower electromagnetic structures.

With reference to Fig. 3, the side extensions or projections 29 and 30 of the armatures 31 and 32 respectively are retained within the slots 26 of the shunt 23 by the screw 33 extending through such armatures. The screw 33 is provided with suitable spacers 34 for allowing sufficient free movement of the armatures 31 and 32 in accordance with the energization and deenergization of the respective electromagnetic structures 18 and 17 with which they are associated.

Each of the armatures is biased away from the core of the electromagnetic structure with which it is associated by a leaf spring of non-magnetic material secured to that armature. More specifically, the leaf spring 35 is secured to the armature 31 near its hinge, and it is formed to provide a bias against the head of the screw 36 to bias the armature 31 to a position to the right of the core 20 except when it is attracted to such core by the energization of the winding 18. Similarly, the biasing leaf spring 37 is secured to the armature 32 for biasing that armature away from the core 19.

A pen operating lever of non-magnetic material is suitably secured to each of the armatures for providing operation of the respective pen operating units. With reference to Fig. 3, the lever 38 extends upwardly and is secured to the upper end of the armature 32 to be operated to the right when that armature is attracted by energization of the relay winding 17, while the pen operating lever 39 is secured to the armature 31 near its hinge and extends upwardly adjacent to the left-hand side of the core 19 when the lower winding of the relay unit is deenergized. Upon the energization of the lower winding 18 of the relay unit, the attraction of the armature to the core actuates the pen operating lever 39 to the right to cause operation of the pen operating unit with which such lever is associated. Obviously, the pen operating lever should be of non-magnetic material so as to be unaffected by the energization of the upper winding 17 of the relay unit R.

The brackets 25 and 40 of non-magnetic material are suitably secured to the opposite ends of the relay unit R and they are used to provide a means for securing the relay unit R to the mounting bracket 15. The supporting brackets 25 and 40 are formed to be inserted over the ends of the respective cores and the magnetic shunt in assembly, and slots 41 are formed at suitable positions to provide guides for the wires 42, 43, 44 and 45 extending outwardly at the right-hand end, or back, of the relay unit and connected to wire terminals 46 suitably secured in insulating material at the bottom of the mounting bracket 15. Only three terminals per relay unit are generally required as illustrated because one terminal can generally serve as a common return for the energization of both windings 17 and 18. Wires extending from the respective terminals 46

to sources of energy for operation of the respective relay units are preferably formed in a cable 47 extending across the recorder transversely with a slack loop in the cable to allow for the elevation of the relay units for changing the recorder paper.

With respect to the structure and operation of the pen units, it will be noted that such units are provided of a similar structure to that fully disclosed in the above mentioned application of E. H. Branson, to which reference is to be made for disclosure in detail as to their operation. It is believed sufficient for the present disclosure to point out that the pen operating unit 48 which is positioned by the pen operating lever 38, for example, comprises an ink tube 49 extending through a hole 16 in the supporting bracket 15 into the inkwell 50, a quill 51 secured at the left-hand end of the ink tube, and a lever 52 pivoted about the point of insertion of the ink tube 49 into the inkwell 50 having a bifurcated end 53 for engagement with the operating lever 38 so as to cause the quill 51 of the pen to be operated to the right in accordance with the energization of the winding 17 of the relay unit R associated with the pen operating lever 38 to cause the movement of such lever to the left. The quill 51 of the pen unit 48 is automatically restored upon deenergization of the winding 17 by the leaf spring 37.

With reference to Fig. 5, a suitable mounting means is shown for removably securing the inkwell 50 to the underside of the mounting bracket 15 at each end of the recorder. The thumb screw 54 is shown as passing upwardly through a tube 55 suitably secured within the inkwell 50 to secure the inkwell beneath the pen locating holes 16 in the mounting bracket 15. By the extension of the inkwell 50 slightly beyond the bracket 15 as shown in Fig. 9, the inkwell can be readily filled by removal of the filler cap 57.

Having thus described an automatic train recorder of a specific type as one embodiment of the present invention, it is desired to be understood that this form is selected to facilitate in the disclosure of the invention rather than to limit the number of forms which the invention may assume, and it is to be further understood that various adaptations, alterations and modifications may be applied to the specific form shown to meet the requirements of practice without in any manner departing from the spirit or scope of the present invention except as limited by the appending claims.

What I claim is:

1. A multiple pen recorder for movable record chart paper comprising, a plurality of closely spaced pens pivotally supported for individual lateral movement in the plane of the record paper, a plurality of operating units each actuating independently two adjacent pens, said operating units being narrow and arranged in a bank side by side, each operating unit comprising a narrow elongated magnetic structure having two outside cores and a center core disposed in a plane generally perpendicular to said plane of movement, a coil on each outside core, two armatures pivotally supported on the center core at one end and laterally movable about an axis in the plane of said cores, a yoke of magnetic material connecting said center core at its other end to the ends of said outside cores, spring means biasing said armatures separately to their retracted positions, and an operating connection between each armature and its associated pen, said operating connection for one armature where it extends adjacent the other armature including an element of non-magnetic material, the magnetic circuits for both of said armatures including said center core and except for their operating air-gaps being of low reluctance to prevent material leakage of flux from one magnetic circuit to another, whereby energization of one coil to operate one pen does not cause operation of an adjacent pen.

2. A multiple pen recorder for movable record chart paper comprising, a plurality of closely spaced pens supported for individual lateral movement in the plane of the record paper, a plurality of operating units each actuating independently two adjacent pens, said operating units being narrow and arranged in a bank side by side, each operating unit comprising a narrow elongated magnetic structure having two outside cores and a center core disposed in a plane generally perpendicular to said plane of pen movement, a magnetic yoke connecting said cores at one end, said center core having a short slot on its opposite sides near its free end, a coil on each outside core, two armatures each having side extensions engaging said respective slots of said center core, screw threaded means for retaining said armatures with their extensions in their respective slots, said armatures being movable about an axis in the plane of the cores of the operating unit, spring means biasing said armatures separately to their retracted positions, and an operating connection between each armature and its associated pen, said operating connection for one armature where it extends adjacent the core for the other armature including an element of non-magnetic material, said magnetic yoke and cores constituting magnetic circuits for said armatures having said center core in common but such magnetic circuits being otherwise isolated to prevent operation of either armature by leakage flux when the coil for operating the other armature is energized.

3. A multiple pen recorder for movable record chart paper comprising, a plurality of closely spaced pens supported for individual lateral movement in the plane of the record paper, a plurality of operating units each independently actuating two adjacent pens, said operating units being narrow and arranged in a bank side by side, each operating unit comprising a narrow elongated magnetic structure having two outside cores and a center core disposed in a plane generally perpendicular to said plane of movement, a magnetic yoke for interconnecting said cores at one end of the unit, a coil on each outside core, two armatures pivotally supported on said center core on opposite sides of said unit, one armature being located adjacent the center core and one outside core, and the other armature being located adjacent the center core and the other outside core, both being laterally movable about an axis in the plane of said cores, a leaf spring of non-magnetic material rigidly attached to each of said armatures and extending to the outside core adjacent the other armature, screw threaded means attached to each outside core on the opposite side thereof from the adjacent armature and engaging the leaf spring connected to the armature on that side of said cores to provide an adjustable stop to determine the degree of bias applied to each armature normally tending to move it towards its retracted position, and an operative connection between each armature and its respective pen, said operative connection for one armature where it extends past the outside core

for the other armature including an element of non-magnetic material, the magnetic circuits through said armatures including said center core in common with portions of said magnetic yoke and the respective side cores to prevent operation of either one of said armatures by leakage flux when the coil for operating the other armature is energized, whereby the energization of either coil of the operating unit to actuate its associated pen does not cause operation of the adjacent pen even though the operating unit includes magnetic circuits having a center core in common.

JOSEPH F. MERKEL.

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

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