Oct. 6, 1959 R. L. PEEK, JR 2,907,824

ELECTROGRAPHIC TRANSMITTER

Filed Oct. 23, 1957

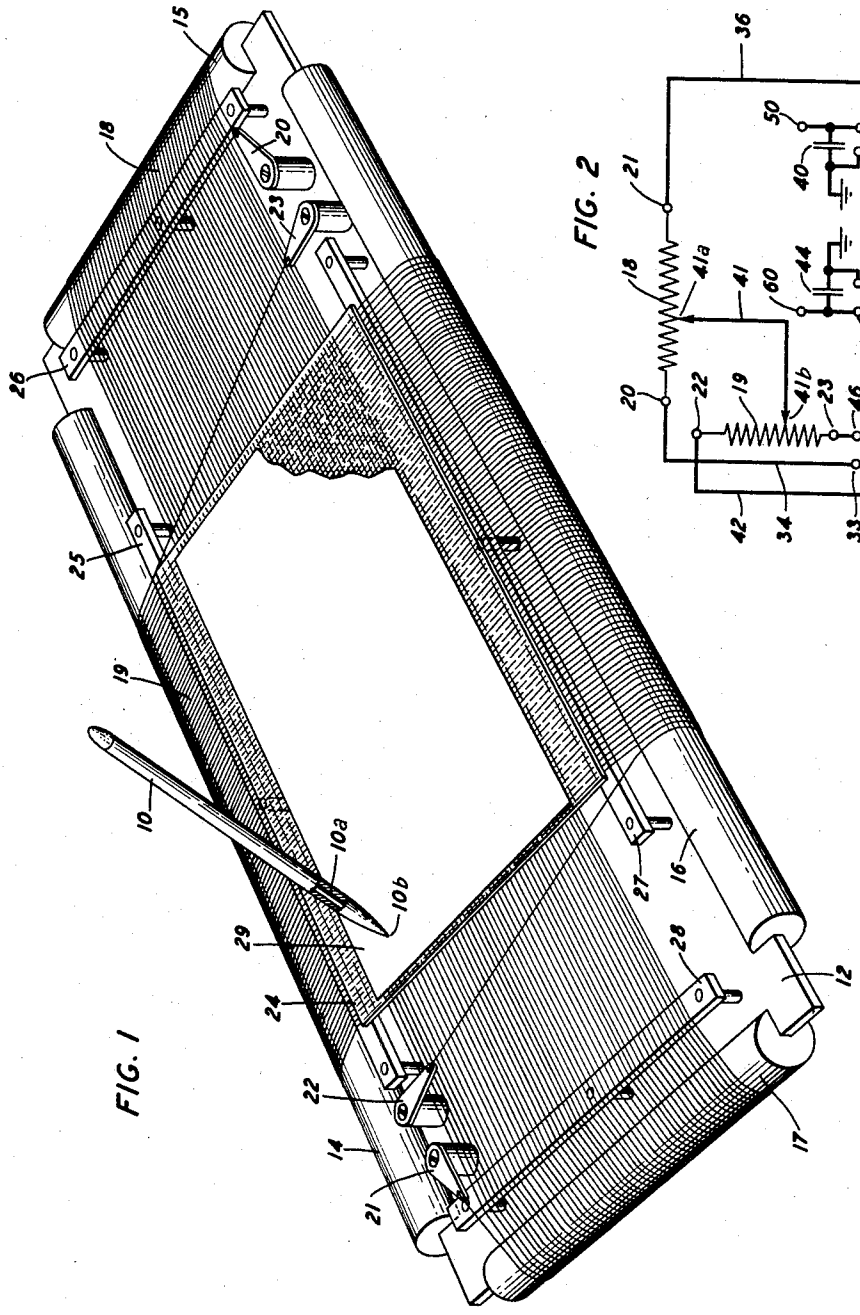

FIG. 1

FIG. 2

INVENTOR
R. L. PEEK, JR.
BY John C. Morris
ATTORNEY

United States Patent Office 2,907,824 Patented Oct. 6, 1959

2,907,824

ELECTROGRAPHIC TRANSMITTER

Robert Lee Peek, Jr., New York, N.Y., assignor to Bell Telephone Laboratories, Incorporated, New York, N.Y., a corporation of New York

Application October 23, 1957, Serial No. 691,861

9 Claims. (Cl. 178—18)

This invention relates to the electrographic transmission of images, and more particularly to a transmitter device for employment in an electrographic system.

Transmission system wherein graphic material is reproduced at a receiving station while being formed at a transmitting station are well known. Such systems commonly employ transmitter devices having styluses to which electrical leads or rather involved mechanical linkages are connected. These connections are frequently disadvantageous in that they interfere with the exercise of a natural writing style. Additionally, the mechanical or electrical intricacies of such apparatus are not advantageous from a manufacturing or maintenance standpoint.

An object of this invention is an improved electrographic transmitter.

More specifically, an object of the present invention is an improved electrographic transmitter which allows an operator thereof to exercise a completely natural writing style.

Another object of this invention is an easily manufactured and highly reliable electrographic transmitter.

A still further object of the present invention is a magnetically-operated electrographic transmitter.

These and other objects of this invention are realized in an illustrative transmitter device wherein two crossed resistive windings are positioned in parallel adjacent planes. Advantageously, only the bottom winding is of a magnetic material. Accordingly, when a permanent magnet stylus is moved over the surface of the non-magnetic or upper winding, portions of the lower or magnetic winding are attracted into contacting relationship with elements of the upper winding.

A switching device and a source of potential are included in the arrangement of the transmitter for alternately switching the source from the circuit of one winding to that of the other, thereby producing transmitter output voltages proportional to the coordinates of position of the stylus.

Accordingly, a feature of this invention is an electrographic transmitter comprising two crossed resistive windings arranged in parallel adjacent planes, one only of the windings being of a magnetic material, a permanent magnet stylus adapted to be moved over the other of said windings to bring elements of the adjacent windings into intimate contact with each other, a source of potential, and associated circuitry for connecting the source to the windings to produce output voltages proportional to the coordinates of position of the stylus.

Thus, the principles of the present invention are directed to a magnetically-operated electrographic transmitter unit having a free stylus. The unit produces output voltages which can be transmitted to a receiver unit to control there the movements of another stylus or writing instrument in correspondence with the movements of the free stylus at the transmitter. Alternatively, the output voltages provided by the unit can be applied to a long-persistency cathode ray tube to produce on the face thereof a reproduction of the transmitted material.

A complete understanding of this invention may be gained from a consideration of the following detailed description in conjunction with the attached drawing, in which:

Fig. 1 is a perspective view of a magnetically-operated free stylus electrographic transmitter device illustrative of the principles of the present invention; and

Fig. 2 is a schematic representation of the transmitter device of Fig. 1, and also includes a depiction of a switching assembly adapted to be combined therewith.

The structure shown in Fig. 1 includes a free stylus member **10**, i.e., a stylus member having neither an electrical nor a mechanical connection extending thereto. The member **10** may advantageously comprise a rod-shaped permanent magnet having an ink-holding bore **10***a* extending along the axis thereof and a ballpoint element **10***b* contained in a tapered end thereof. Thus, the stylus **10** may advantageously take the form of a ballpoint pen the tapered end of which concentrates the flux of the permanent magnet at the writing tip of the member **10**.

Also shown in Fig. 1 is a sheet member **12** over each edge of which is pressed a slotted bar element. The bar elements **14**, **15**, **16** and **17** and the sheet member **12** comprise the frame assembly of a transmitter device illustratively embodying the principles of this invention.

The noted components of the frame assembly may be made of an insulating material, or, alternatively, may be made of metal and then coated with a suitable insulating material.

The transmitter shown in Fig. 1 further includes lower and upper conductive windings **18** and **19**, respectively. The lower winding or grid **18** is of a magnetic material and is wound in tension over the bar elements **15** and **17**, while the upper winding or grid **19** is of a non-magnetic material and is wound in tension over the bar elements **14** and **16**.

High tension is used in winding **19** so as to position each turn of this winding nearly rigidly in a common plane. A moderate tension is used in winding **18**, which permits each turn to be deflected when attracted by the stylus and which suffices to restore it to its normal position when not so attracted. The length of winding **18** is materially greater than the lengthwise dimension of the writing surface, in order to reduce the variation in the force required to deflect this winding with variation within the length of the writing surface of the point deflected (i.e., the location of the stylus).

The ends of the winding **18** are respectively connected to terminal members **20** and **21**, and the ends of the winding **19** are respectively connected to terminal members **22** and **23**.

Advantageously, the windings **18** and **19** should lie in parallel planes with a small separation between them. To aid in realizing this objective, leveling bars **25**, **26**, **27** and **28** are provided. The bars **26** and **28** are positioned under the bottom winding **18**, and the bars **25** and **27** are positioned under the top winding **19**. The leveling bars are secured to the sheet member **12** by screw elements the range of adjustment of which allows the windings to be accurately positioned in closely adjacent parallel planes.

The overlapping portion of the windings **18** and **19** defines the writing surface of the transmitter unit. This surface may advantageously be covered by a thin sheet **24** of non-magnetic material of sufficient stiffness to form a firm surface when supported by the tensioned winding **19**.

One specific illustrative embodiment of the present invention includes a member **10** formed from a rod of permanently magnetizable material. The embodiment further includes a sheet member **12** and bar elements **14**,

15, 16 and 17 of aluminum, anodized and enameled to provide insulating surfaces. The bottom winding of the embodiment is of a high permeability low retentivity magnetic material, and the top winding is of a non-magnetic material. The materials of the two windings 18 and 19 are chosen so that the resistances of the windings are approximately equal.

In actual operation a sheet of paper 29 may advantageously be placed over the aforementioned non-magnetic sheet 24 so that an operator may observe what he is writing with the ballpoint stylus member 10.

Movement of the stylus 10 over the above-described writing surface causes elements of the bottom or magnetic winding 18 to move into contacting relationship with elements of the top or non-magnetic winding 19, such contact being within a small region immediately below the location of the point of the stylus.

In rapidly moving a stylus member across the writing surface of an illustrative embodiment of the present invention, it is observed that each attracted element of the bottom winding is subjected to a force component that tends to move the element in a direction transverse to the desired direction of motion. In other words, an element may be attracted toward an adjacent wire of the same winding as well as toward a wire element of the other winding. This wire interference or shorting together of adjacent turns may result in poor reproduction of the transmitted material. To obviate this difficulty, insulating strips or walls (not shown) may be placed between adjacent turns of the attracted winding, thereby largely restricting motion of these turns to that in the desired direction and completely eliminating the noted interference.

Referring now to Fig. 2, there is shown a schematic representation of an illustrative transmitter device. There also is shown one manner in which the device may be connected to associated circuitry so that each point of contact between the lower and upper windings is translated into two characteristic voltages.

A direct current source 30, the negative terminal of which is grounded, has its positive terminal connected to an armature element 31*a* of a switching relay which also includes armature elements 31*b* and 31*c*. A lead 34 connects a terminal 33 to the terminal 20 to which, as noted above, one end of the bottom winding 18 is secured. The other end of the winding 18 is secured to the terminal 21, and a lead 36 interconnects the terminal 21 and the armature element 31*c*, which element 31*c* is shown in contact with a terminal 37. A lead extends from the terminal 37 to ground, and another lead extends to a capacitor 40 and then to an output terminal point 50 and another terminal point 48.

The contact that the free stylus member 10 effects between the windings 18 and 19 is represented in Fig. 2 by a lead 41. The lead 41 is shown as the link between two points 41*a* and 41*b*, the actual contact points between the windings 18 and 19, respectively.

One terminal 22 of the top winding 19 is connected by a lead 42 to the armature element 31*b*, which element 31*b* is shown in contact with a terminal 43. The terminal 43 is connected to an output terminal 60 and is also connected through a capacitor 44 to ground and a terminal 47.

With the switching relay in the position shown in Fig. 2, an output voltage appears from the output terminal 60 to ground. This voltage is proportional to the location of the contact point 41*a* in the potentiometer 18, and hence to one coordinate (e.g., the "*x*" coordinate) of the position of the stylus 10.

When the relay is operated, the armatures 31*a*, 31*b* and 31*c* move into contact with the terminals 46, 47 and 48, respectively. In this operated position, there appears from the output terminal 50 to ground a voltage which is proportional to the location of the terminal 41*b* of potentiometer 19, and hence to the other coordinate (e.g., the "*y*" coordinate) of the stylus position. The charge on condenser 44 maintains the voltage on terminal 60 at approximately the value it had during the preceding interval. Thus, it is seen that in a given interval of time, determined by the switching rate of the relay, two output voltages corresponding to the coordinates of the position of the free stylus 10 are provided by the herein-described electrographic transmitter. Advantageously, the switching rate of the relay is chosen so that good resolution of the transmitted material is obtained when the stylus is moved over the crossed sheets at high writing speeds.

The output terminals 50 and 60 may be connected by a transmission line to a receiving device, including, inter alia, a long-persistency cathode ray tube. The impedances from the terminals 50 and 60 to ground should advantageously be high compared to the impedances of the windings 19 and 18, respectively.

It is, of course, to be understood that a number of other suitable switching or circuit arrangements, either mechanical or electrical, may be devised to replace the above-described switching means. For example, copending application Serial No. 631,138, filed on December 28, 1956, in the name of W. Koenig, Jr., discloses a circuit arrangement which might be combined with the herein-described magnetically-operated windings to produce output voltages of the type desired.

The above-described embodiment of the present invention can be easily modified in a number of ways by those skilled in the electromechanical arts. For example, gold plating the windings 18 and 19 and encasing them in a dustproof container member are techniques well calculated to improve the performance of the basic transmitter unit.

Also, it is to be understood that although a particular form of winding construction has been described and illustrated herein, any winding configuration that provides parallel adjacent elements may readily and satisfactorily be incorporated into an illustrative embodiment of this invention.

Additionally, it is to be understood that each of the crossed windings of an illustrative embodiment of this invention may be of a magnetic material. Such an arrangement will not, however, usually be favored, for the interposition of a magnetic winding between the stylus and the attracted or movable winding introduces a shielding effect that reduces the attraction between the free stylus and the attracted winding to an appreciable extent. In view of this, emphasis herein has been placed on a transmitter device wherein one only of the windings is of a magnetic material.

Thus, the specifically described illustrative embodiment is a magnetically-operated free stylus transmitter device which is easily manufactured and adjusted. Additionally, the device is easily maintained, for it exhibits almost complete freedom from wear conditions. The only motion therein (aside from the motion of the stylus along the writing surface) is the magnetically-induced elastic deflection of the turns of the bottom winding.

It is to be understood that the above-described arrangements are only illustrative and not restrictive of the principles of the present invention. Other basic arrangements and modifications thereof may be devised by those skilled in the art without departing from the spirit and scope of the invention.

What is claimed is:

1. An electrographic transmitter device comprising two crossed windings positioned in closely adjacent parallel planes, one only of said windings being of a magnetic material, and a permanent magnet free stylus member, whereby elements of the magnetic winding are attracted into contacting relationship with elements of the non-magnetic winding as the stylus member is passed over that portion of the surface of the non-magnetic winding which overlaps the magnetic winding.

2. An electrographic transmitter device comprising two crossed windings positioned in closely adjacent parallel planes, the lower of said windings being of a magnetic material, a thin firm sheet of non-magnetic material positioned over the upper or non-magnetic winding, and a magnetized free stylus member adapted to be moved over the overlapping portion of said non-magnetic sheet.

3. An electrographic transmitter device comprising two crossed windings positioned in adjacent parallel planes, one only of said windings being of a magnetic material, and a magnetized free stylus writing instrument, said instrument being adapted to be passed over the overlapping portion of the non-magnetic winding.

4. In combination, two crossed windings positioned in closely adjacent parallel planes, at least one of said windings being of a magnetic material, and permanently magnetized stylus means for attracting portions of the magnetic winding into contacting relationship with portions of the other winding.

5. In combination, two crossed windings positioned in adjacent parallel planes, at least one of said windings being of a magnetic material, permanently magnetized writing means for attracting elements of the magnetic winding into contacting relationship with elements of the other winding, and circuit means for translating each point of contact between said windings into characteristic voltages.

6. An electrographic transmitter comprising two windings arranged in parallel adjacent planes, one of said windings being of a magnetic material, a permanent magnet stylus adapted to be moved over the other of said windings to bring elements of the adjacent windings into intimate contact with each other, a source of potential, and associated circuitry for connecting said source to said windings to produce voltages proportional to the coordinates of position of said stylus.

7. In combination, a rectangular insulated sheet, a slotted bar pressed over each edge surface of said sheet, a winding supported by each two parallel bars, one only

of said windings being of a magnetic material, the overlapping portion of said windings defining a writing surface, and permanently magnetized writing means for attracting elements of the magnetic winding into contacting relationship with elements of the other winding, whereby each different point of position of said writing means on said writing surface causes contact between a different set of said winding elements.

8. Means for translating the movement of a magnetized stylus over a plane surface into voltages corresponding respectively to the coordinates of successive locations of the stylus with respect to a datum point on said surface comprising crossed windings having respective plane portions of parallel conductors in spaced juxtaposition to each other and to the plane surface, the winding portion further from said surface being of a magnetic material, whereby crosspoints of said windings are successively brought into mutual contact upon passage of the stylus over said surface, a power source, and means for connecting said source to said windings.

9. Means for translating the movement of a magnetized stylus over a plane surface into voltages corresponding respectively to the coordinates of successive locations of the stylus with respect to a datum point on said surface comprising crossed plane grids, each grid including spaced parallel conductors, said grids being arranged in spaced parallel relation to each other and to said surface, the conductors of one grid being of magnetic material for attraction by the stylus into contact with the other grid at crosspoints of said grids corresponding to the positions of the stylus, a power source, and means for connecting the source to said grids.

References Cited in the file of this patent

FOREIGN PATENTS

326,089	Germany	Sept. 3, 1918
588,043	Great Britain	May 13, 1947