United States Patent

Hoffman et al.

[15] **3,651,259**

[45] **Mar. 21, 1972**

[54] KEYBOARD OPERATED TELEGRAPH TRANSMITTER USING REED SWITCHES AND MAGNETIC SHUNTS

[72] Inventors: **Ernest G. Hoffman**, Middlefield; **William P. Ryan**, Bethany, both of Conn.

[73] Assignee: **Mite Corporation**, New Haven, Conn.

[22] Filed: **Nov. 12, 1968**

[21] Appl. No.: **775,076**

[52] **U.S. Cl.** .....**178/17 C**, 340/365, 197/98

[51] **Int. Cl.** **H04l 15/12**

[58] **Field of Search**.....178/17 A, 17 C, 52, 79, 80, 178/81; 235/145, 146; 340/365; 197/98, 83, 88; 179/90 K

[56] **References Cited**

UNITED STATES PATENTS

3,430,226	2/1969	Chow et al.	340/347
3,292,125	12/1966	Berry	335/206
3,006,997	10/1961	Evensen	178/17
2,377,890	6/1945	Lang	178/4
3,297,149	1/1967	Hadley	199/18
3,296,369	1/1967	Clark et al.	178/17
2,977,413	3/1961	Howard	178/17
2,963,545	12/1960	Purzycki	178/17
2,633,223	3/1953	Zeamer	197/83
2,515,779	7/1950	Koca	197/83
1,898,777	2/1933	Kappler	197/83
1,847,151	3/1932	Watson	178/52
1,832,160	11/1931	Vischer	197/89
1,741,673	12/1929	Avery	197/83
1,333,825	3/1920	Waldheim	197/83

Primary Examiner—Kathleen H. Claffy
Assistant Examiner—Tom D'Amico
Attorney—James and Franklin

[57] **ABSTRACT**

There are five "reed switches" for a five level code, spaced apart and housed in a metal shielding compartment. A motor driven serializer or commutator having a rotatable contact arm movable over a ring of contacts is also mounted inside the shielding compartment. There are five magnets outside the compartment moved by code bars to either of two positions, the code bars being themselves moved in conventional fashion by the keys of the keyboard. One magnet position is close to its related switch, and serves to close the switch, and the other magnet position is more remote and causes opening of its switch. The magnetic differential between the two positions of the movable magnets is increased by the provision of a magnetic shunt adjacent the retracted positions of the magnets.

17 Claims, 13 Drawing Figures

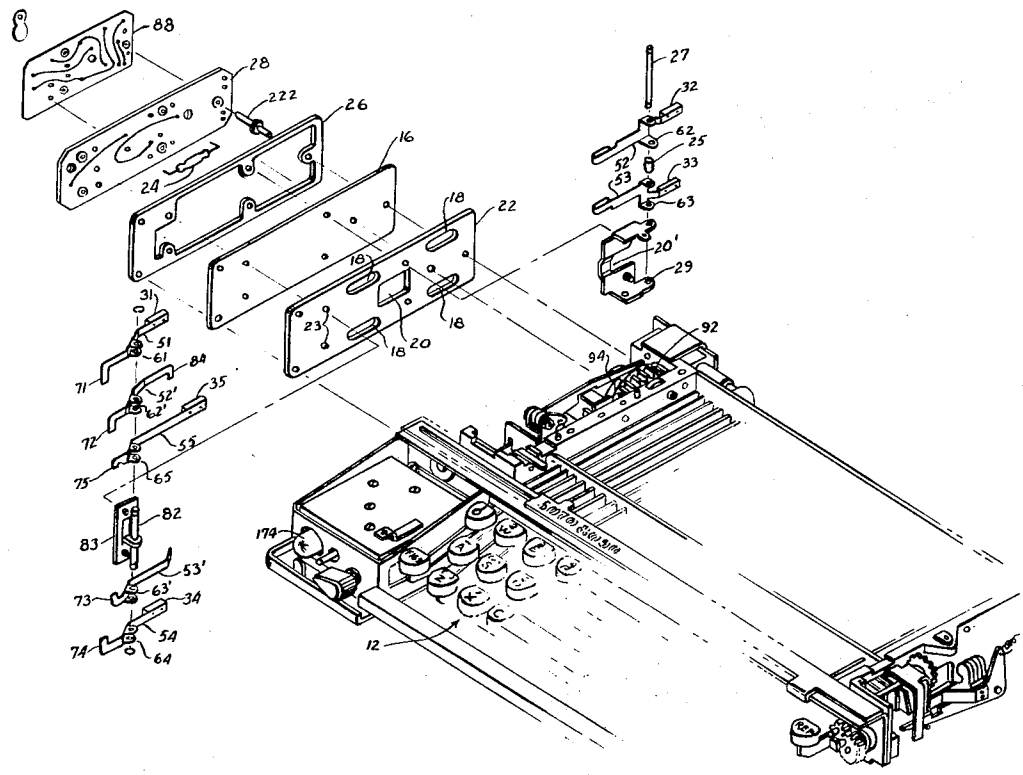


FIG. 1A

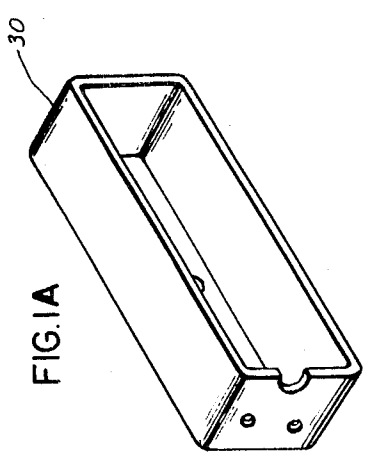


FIG. 1

INVENTORS
ERNEST G. HOFFMAN
WILLIAM P. RYAN

BY James and Franklin

ATTORNEYS

FIG. 2

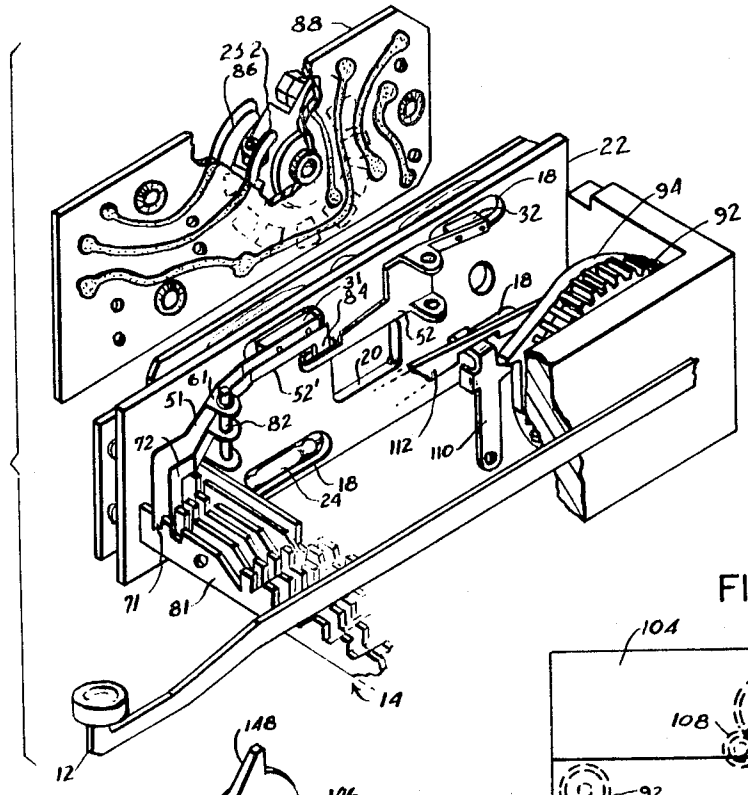


FIG. 4

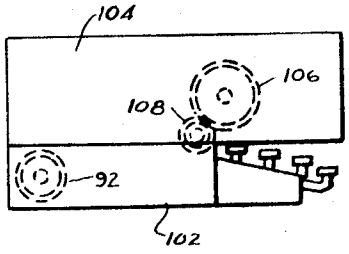
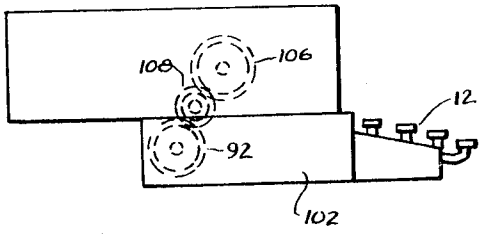


FIG. 3

FIG. 5



INVENTORS
ERNEST G. HOFFMAN
WILLIAM P. RYAN

BY James and Franklin

ATTORNEYS

FIG.6

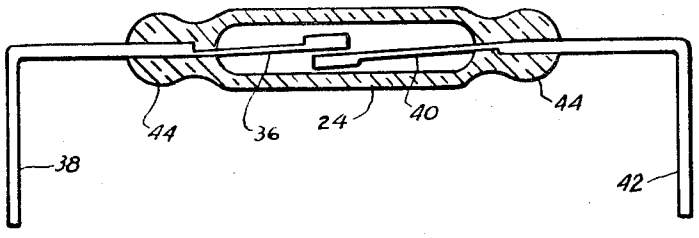


FIG.9

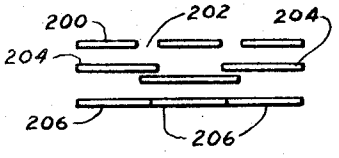


FIG.7

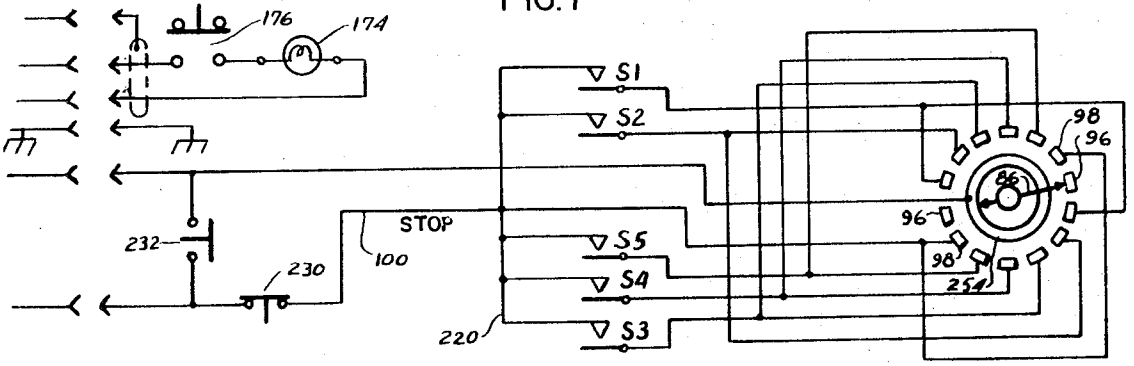


FIG.10

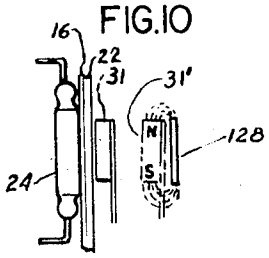


FIG.8

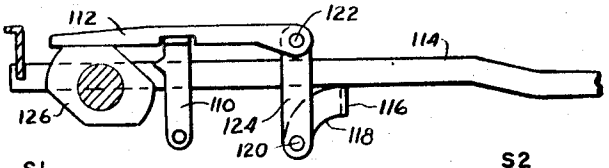


FIG.11

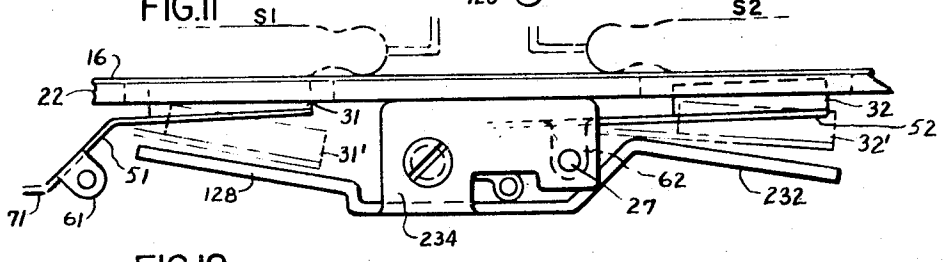
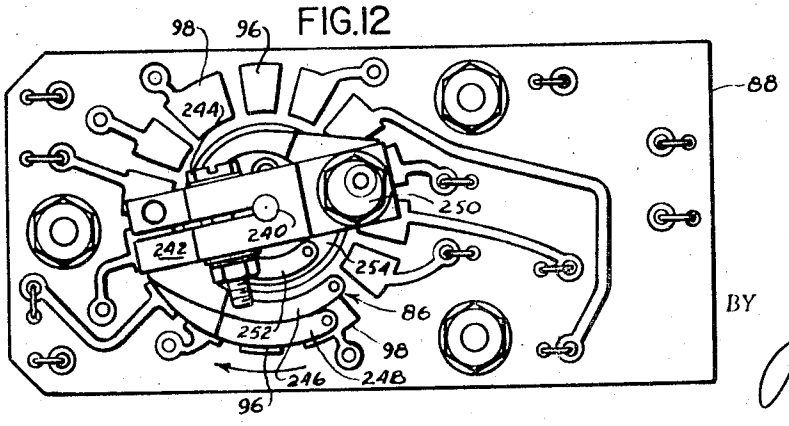


FIG.12



INVENTORS
ERNEST G. HOFFMAN
WILLIAM P. RYAN

BY James and Franklin

ATTORNEYS

KEYBOARD OPERATED TELEGRAPH TRANSMITTER USING REED SWITCHES AND MAGNETIC SHUNTS

A keyboard operated telegraph transmitter has a keyboard which sets up code bits in different combinations, one for each key. The switches or contacts for controlling these code bits are arranged for serialized transmission on a telegraph line. This may be done by motor driven cams operating contacts, or by a rotary or commutator type switching device. In either case the continuous high speed switching causes undesirable radiation and interference, which we minimize. Other objects are to reduce signal distortion, and to reduce sensitivity to vibration.

With these objects in mind, we provide a plurality of switches, preferably of a type called "reed switches," which are responsive to a magnetic field. There are five such switches for a five level code, and they are housed in a shielding compartment. A motor driven serializer having a rotatable contact arm movable over a ring of contacts also is mounted inside the shielding compartment. There are five magnets outside the compartment which are moved by code bars to either of two positions, the code bars being themselves moved in conventional fashion by the keys of the keyboard. One of the magnet positions serves to close its related switch, and the other of said magnet positions causes opening of its switch. The magnets are outside the shielding compartment, but control the switches inside the compartment. The magnetic differential between the two positions of the movable magnets may be increased while moving the magnets only a limited distance, by the provision of magnetizable shunts mounted adjacent the retracted positions of the magnets, the shunts serving to concentrate the magnetic flux and to reduce any stray magnetic field reaching the switches.

A pawl-operated ratchet mechanism is provided for step-by-step carriage feed. However, some of the keys are non-printing keys, for causing a change as between letters and figures, or for causing carriage return, or line feed, etc. Step-by-step carriage feed is not wanted when such keys are operated. To take care of this there is an extra code bar which is moved by the non-printing keys, and which serves to disable the carriage feed mechanism.

The foregoing and additional features are described in the following detailed specification, which is accompanied by drawings in which:

FIG. 1 is an exploded perspective view showing many parts of the transmitter;

FIG. 1A represents a metallic housing omitted at the upper left corner of FIG. 1 for lack of room, which housing combines with a wall shown in FIG. 1 to provide an enclosed shielding compartment;

FIG. 2 is a perspective view showing some of the parts at the left end of the transmitter;

FIG. 3 is a fragmentary perspective view showing parts of the transmitter for causing step-by-step carriage feed and an end of the line signal;

FIGS. 4 and 5 are schematic end elevations showing respectively the stowed position and the operating position of the keyboard, relative to an associated printing telegraph receiver;

FIG. 6 is a longitudinal section drawn to enlarged scale through one of the reed switches;

FIG. 7 is a wiring diagram for the transmitter;

FIG. 8 is a fragmentary view explanatory of the clutch release mechanism;

FIG. 9 is explanatory of the pulse timing sought for the transmitter;

FIG. 10 is a fragmentary view explanatory of the magnetic shunts which increase the magnetic differential;

FIG. 11 is a plan view showing how the two upper shunts are mounted; and

FIG. 12 is a view of the commutator, looking from the left of FIGS. 1 and 2.

Referring to the drawing, and more particularly to FIGS. 1 and 2, the keyboard operated telegraph transmitter comprises

an array of keys generally designated 12 (FIG. 1), and a plurality of collateral code bars generally designated 14 (FIG. 2). The construction may be like that disclosed in U.S. Pat. No. 2,977,413, issued Mar. 28, 1961 to Bernard Howard, and entitled "Keyboard Operated Telegraph Transmitter." As in that patent, the code bars 14 have notches with either straight or sloping sides, and are moved by the keys to either of two positions, used in different combinations. The movement is small, say a tenth of an inch. There are a plurality of spaced apart switches, each responsive to a magnetic field. The switches are disposed behind a plate 16 (FIG. 1), at locations behind and substantially registering with the four slots 18 and the center slot 20 in a mounting panel 22 made of insulating material. One of these five switches is shown in FIG. 1 at 24, between a spacer board 26, and a printed circuit board 28, but it is located against the back of plate 16 in space provided by the spacer 26.

The switches, and also a commutator (both are described later) are housed within a metallic shielding compartment. FIG. 1A shows a hollow box 30 which comprises five of the six walls of the compartment, it being open at the right. The compartment is completed by the wall 16 previously referred to, on the inside of which are located the five spaced switches. Wall 16 is made of conductive but nonmagnetic metal, e.g., copper or aluminum.

The transmitter further comprises five magnets 31, 32, 33, 34 and 35 (FIG. 1). These are moved by the code bars to either of two magnet positions, there being a magnet and a code bar for each switch. The forward magnet position brings the magnet close to the wall 16, and serves to close its adjacent switch. The other or retracted magnet position causes opening of the switch. In FIG. 1, the magnets have been spread apart, but it will be understood that the actual location is like that shown for two of the magnets 31 and 32 in FIG. 2, so that the magnets can enter or leave the slots 18 and 20 in the mounting panel 22.

The switches are preferably reed switches such as those made by Hamlin, Inc. of Lake Mills, Wis. One of these is shown to greatly enlarged scale in FIG. 6, it comprising a reed contact 36 having an external lead 38, and another reed contact 40 having a terminal 42. The contacts 36 and 40 are protectively housed in a glass capsule 42, and the leads are hermetically sealed where they pass through the glass, as shown by the two end beads 44. The body of the reed switch is less than an inch in length. The switch is usually controlled by a magnet coil surrounding the switch. The contacts 36 and 40 move toward one another when magnetic flux passes longitudinally through the switch. The particular switches here used are single pole single throw switches, with the contacts normally separated or open when not subjected to a magnetic field.

Reverting now to FIGS. 1 and 2, magnet 31 is carried at the inner end of a lever 51 pivoted on a vertical pin passing through ears 61 and having a downturned end 71. FIG. 2 shows how this downturned end 71 is received in a mating notch in one of the code bars, in this case the bar 81. Reverting to FIG. 1, magnet 32 is carried on an arm 52 pivoted at 62; magnet 33 is carried on an arm 53 pivoted at 63. Magnet 34 is carried on an arm 54 pivoted at 64. Magnet 35 is carried on an extra long lever arm 55 pivoted at 65. Lever 51 has a downturned end 71. Lever 54 has an upturned end 74.

There are two additional levers 52' and 53' which do not carry magnets. Lever 52' has a downturned end 72, and lever 53' has an upturned end 73. Lever 52' is pivoted at 62', and lever 53' is pivoted at 63', these pivots all being in alignment and mounted on an upright pin shown at 82. Pin 82 is carried by a bracket 83 which is secured to mounting plate 22 at holes 23. The same holes may serve to secure together the various plates 22, 16, 26, 28.

The downturned end 72 is received in a notch in its code bar as previously shown for end 71 in code bar 31 in FIG. 2. The upturned ends 73 and 74 are each received in a notch in a corresponding code bar, as previously described for the

downturned ends 71 and 72, except that the notches for the upturned ends 73 and 74 are in the bottom instead of the top of their respective code bars. Arm 55 also has an end 75 received in and operated by its code bar.

The levers 52' and 53' (FIG. 1) are actuating levers for magnets 32 and 33. Thus the inner end 84 of lever 52' is received in the left end of lever 52, so that when a code bar moves the end 72 to the left, the end 84 moves to the right, and this bears against lever 52, moving it to the right, thereby moving magnet 32 to the left, into slot 18 and adjacent its reed switch. Similar remark applies to lever 53' the inner end of which is received in the left end of lever 53. This construction is also shown in FIG. 2, in which the operation of magnets 31 and 32 may be contrasted, because magnet 31 is directly on arm 51, pivoted at 61, and having its downturned end 71 received in code bar 81, whereas magnet 32 is on a lever 52 which is moved by another lever 52', the left end of which is turned down at 72 to fit in a slot in its respective code bar. The end 84 of lever 52' is received in a slot formed at the left end of arm 52. In FIG. 2 the other magnet arms are not shown.

Reverting to FIG. 1, the bearing ears 62 and 63 and a spacer 25 are received on a pin 27 carried by a bracket 29 which is mounted on plate 22. Notch 20' of bracket 29 clears the window 20 in plate 22.

Magnet 35 (FIG. 1) is mounted on an arm 55 which is longer than the arms 51 and 54, the extra length being appropriate to locate the magnet at the center window, that is, in the opening 20 shown in board 22. Its physical movement toward and away from its receptive switch is therefore increased. In the example shown the magnet 35 moves about 0.30 inch, and the others move about half that amount.

The magnets and reed switches operate in unison. The five switches correspond to the five levels in a five level code. Such a simultaneous or parallel signal could be utilized through a multiple wire cable when only a very short distance is involved, but for actual telegraphy the pulses or bits controlled by the switches must be serialized for transmission in sequence, as in the Baudot Code. For this purpose the transmitter here shown has a motor driven commutator in which a rotatable contact arm shown at 86 in FIGS. 2, 7 and 12, is rotated over a ring of contacts which are printed on a printed circuit board 88. The contact arm 86 is driven by a gear 92 (FIGS. 1 and 2) through a limited rotation clutch 94, which in this case is a half revolution clutch.

The commutator is shown in FIG. 12, and is schematically shown in FIG. 7. The time interval for a single character is broken into seven parts, there being a "start" position 96 (open circuit) and a "stop" contact 98 (closed circuit), in addition to the five contacts for the five level code. In normal telegraphy practice the line is continuously energized when idle, a "space" bit then being indicated by the open circuit, and a "mark" bit being indicated by a closed circuit to supply a voltage to the telegraph line. In FIG. 7 the contact arm represented by arrow 86 is shown at "start" position, it being on a contact 96 which represents open circuit. The next five contacts are shown connected to the switches S1 through S5 respectively, these being the five reed switches previously mentioned. The last or stop contact 98 is connected to the stop line 100. The commutator shown in FIG. 7 has 14 contacts in all, because it operates through a half revolution, thus using seven contacts for each character.

The drive for gear 92 (FIGS. 1 and 2) may be explained with preliminary reference to FIGS. 4 and 5, and is the same as that more fully described in U.S. Pat. No. 2,977,413 previously referred to. In FIG. 4 the transmitter, generally designated 102, is shown in its stored position beneath a printing receiver 104. The receiver 104 has gearing which terminates in gear 106 meshing with an idler gear 108. In FIG. 5 the transmitter 102 has been pulled out to expose the keyboard 12 for transmission. At this time the gear 92 of the transmitter comes into mesh with the idler 108, and so is driven by gear 106. It is driven at proper synchronous speed, transmission and reception being both at the same speed. In the stored position of FIG. 4 the gear 92 is removed from gear 108, and remains idle.

Referring to FIG. 2, the gear 92 is rotated continuously, but the drive of the commutator is made intermittent by a half revolution clutch 94, which is stopped by a stop finger 110. The clutch functions as described in U.S. Pat. No. 2,977,413, the clutch being released when stop finger 110 is pulled back by a notched link 112. Referring now to FIG. 8, the depression of any key such as the key 114 shifts the code bars (not shown in FIG. 8) during about three-quarters of its downward movement. During the remaining movement the key bears against a bar 116, the ends of which are carried on arms 118 secured to a shaft 120, it being understood that the bar 116 underlies all of the keys. The notched link 112 is pivoted at 122 to the upper end of an arm 124 which is secured to an arm 118 or to the shaft 120, and thus is connected to the arms 118. This moves link 112 to the right (FIG. 8) thereby retracting the stop finger 110 and so releasing the clutch. The clutch is stopped after a half revolution, even if the key is held down, because the intermittently rotated part of the clutch turns a cam 126, which raises the notched link 112, thereby releasing the stop finger 110 to engage the next stop lug on the clutch. This action is more fully described in the aforesaid U.S. Pat. No. 2,977,413.

As previously mentioned each reed switch is closed by a magnetic field, and is opened when the magnetic field is sufficiently reduced, as by retraction of the magnet. This difference in magnetic field may be called the magnetic differential, and for safe operation the magnetic differential should exceed that needed to close or open the switch. It is also desirable, however, to limit the movement of the magnet to a small amount, comparable in order of magnitude to the movement of the code bars. To meet this desire, the magnetic differential may be enhanced by the addition of a magnetic shunt which is mounted adjacent the retracted position of the magnet, and which serves to collect and concentrate in itself the magnetic flux, thereby reducing the stray field reaching the switch.

This is illustrated in FIG. 10, in which reed switch 24 is located just inside the non-magnetic metal shield wall 16, and permanent magnet 31 moves between the dotted line position 31' and the solid line position 31. When the magnet is retracted to position 31', it reaches a shunt 128 which is made of a suitable ferrous material which does not retain magnetism. It may be soft iron or annealed silicon steel or other low hysteresis material. Shunt 128 absorbs and concentrates the magnetic flux and greatly reduces any magnetic field reaching switch 24. The magnetic differential is thereby greatly increased, as though magnet 31 had been moved a greater distance than it has in fact moved.

Four such magnetic shunts are provided, disposed at the corners of a rectangle, so that each is behind or adjacent its respective magnet. Such a shunt need not be provided for the middle magnet 35 (FIG. 1), because that magnet is on a lengthened arm 55, and is retracted a correspondingly increased distance. However, if the magnetic differential were not sufficient a shunt could also be provided for the magnet 35.

One way to mount the magnetic shunt is shown in FIG. 11. The upper switches S1 and S2 lie behind the nonmagnetic metal shield wall 16. Magnet 31 is on arm 51, pivoted at 61. Magnet 32 is on an arm 52 pivoted at 62. A single piece of metal is shaped to form the shunt 128 for magnet 31, and also the shunt 232 for magnet 32, and also a support plate 234. This may be wide enough to reach the mounting plate 22 and to thereby hold the shunts against oscillation. The plate 234 may be secured on the bracket 29 shown in FIG. 1, this bracket also carrying the pivot pin 27 for the arms of magnets 32 and 33 (FIG. 1). The support of the two lower shunts is not shown, but again these shunts may be carried by bracket 29 and/or bracket 83.

The switches are spaced relatively far apart, so that each magnet will affect only its corresponding switch, and not the

other switches. The magnets shown are made of Alnico No. 2, but other permanently magnetized materials could be used.

The step-by-step feed of the printing element relative to the paper is called "carriage feed," although in the present telegraph printers it is customary to move the hammer and type body across the paper, rather than to move the paper as in an ordinary typewriter. The carriage feed mechanism may be explained with reference to FIG. 3 of the drawing. The type body, not shown, is moved by a cable **130** which is wound on a drum **132**. This is turned by a gear **134**, turned by a pinion **136**, mounted on a shaft **138** which also carries a ratchet wheel **140**. The latter is moved by a feed pawl **142**, and is held by a check pawl **144**.

The half revolution clutch drives a cam **146** having two diametrically opposed cam lifts **148**. These bear against a cam follower lever **150** having a hole **152** receiving a pin **154** on an arm **156** secured to a rod or shaft **158**, thus giving it a rocking motion. This is transmitted by a long tubular shaft **160** to a shaft **162** carrying pawl **142**. The pawl is on an angle lever having an arm **164** pulled by a spring **166**. When the cam lift **148** passes the follower **150** the latter rises, permitting pin **154** to rise, all in response to the pull of spring **166**, and the resulting movement causes pawl **142** to move ratchet wheel **140** a single tooth, thereby winding an increment of cable **130** on drum **132**, corresponding to the spacing from one character to the next character of the line being printed. This moves the carriage to the right, and a carriage scale **168** may be provided which also moves to the right. The movement is opposed by a long slender pull spring **170** which passes around a pulley **172** and then extends from the pulley **172** or left end to the right end of the typewriter, as shown by the lower level continuation of spring **170** to a fixed anchor post **172**.

When the end of a line is approached, say six spaces from the end, a lamp **174** (FIGS. **1** and **3**) is lighted as a warning. For this purpose a switch **176** (FIGS. **1** and **7**) is actuated by an arm **178** pulled by a rod **180**. There is a gripper **182** connected to an arm **184** carried by and moving with the carriage, until the camming part **186** of arm **184** reaches and bears against a stationary tab **188**. The position of the latter is manually adjustable with the aid of a fixed scale **190**. Tab **188** moves arm **184**, thereby tilting the gripper **182** so that it grips and pulls rod **180** instead of sliding freely along the rod, and this closes the switch **176** to light the lamp **174**.

The arm **150** moved by cam **146** may serve also at its forward end (not shown) as a lock lever to lock the code bars during serialization, even if the key rises more quickly. The action of such a lock lever is described in the aforesaid U.S. Pat. No. 2,977,413.

For carriage return both the check pawl **144** and feed pawl **142** are released, and this permits the long slender spring **170** to pull the carriage back to the left margin of the page to start a new line. The check pawl **144** is shown twice, once in its location at the ratchet wheel **140**, and again separated toward the right where it is shown separately. The key lever **193** (FIG. **3**) for carriage return carries a projecting piece **195**, shown separated from the key lever. Both parts have a hole at **191** where they are fixedly fastened together. Operation of other keys of the keyboard retracts a sixth bar **192**, only the right end portion of which is shown. This bar is like a code bar in having notches cooperating with the key levers, and for convenience may be called a sixth code bar, although only a five level code is being used.

The sixth code bar **192** (FIG. **3**) has an end portion **194** which acts as an interposer above an arm **196** to prevent the latter from moving upward, and this disables the feed pawl **142**. The sixth code bar **192** is moved to the right by the non-printing keys such as that which changes as between "figures" and "letters," or for line to line feed, or for repeat, or for carriage return.

When the carriage return key is depressed, its lever **193** moves the projecting piece **195** downward, and it bears against the arm **145** carrying the check pawl **144**, thereby releasing the ratchet wheel.

There is also a latch **197** which engages the check pawl and holds it down even if the carriage return key rises immediately. This is done in order to provide adequate time for carriage return, which takes longer than the ordinary operation of the keys. The latch **197** is biased by a spring **199**.

The operation of carriage return key **193** not only disengages the check pawl **144** as above described, but also moves the sixth code bar **192** toward the right, so that its end **194** rides above the arm **196**, thereby holding the feed pawl out of engagement with the ratchet wheel **140**, and the simultaneous disengagement of both pawls **142** and **144** permits the desired carriage return.

Thereafter the operation of an ordinary printing key retracts the sixth bar **192**, and this allows the arm **196** to rise so that the pawl **142** again engages the ratchet wheel for carriage advance. The location of the latch **197** is such that the rise of arm **196** also deflects the outboard end of latch **197**, thereby releasing the pawl arm **145**, and making the check pawl **144** again operative.

Referring now to FIG. **9**, there are successive code pulses or bits **200** with a space **202** therebetween. The existence of space **202** is called "spacing bias." In the next line the code pulses or bits **204** are shown overlapping, and this is termed "-marking bias." The bottom line shows code pulses or bits **206** which fit end to end without spacing and without overlapping, which represents an ideal transmission condition.

To help provide this the pads or contacts on the printed board of the commutator are printed accurately. Moreover, the rotating contact arm **86** of the commutator is made of two parts which are relatively adjustable to change the spread or effective width of the rotating contact. This is illustrated in FIG. **12** in which half revolution shaft **240** carries a two-part arm **242**, the main part of which is clamped on shaft **240** by a clamp screw **244**. The contact **86** has separate arms **246** and **248** which are carried by the two parts of arm **242**, and are relatively adjustable. In the present case arm **248** is movable relative to arm **246**. This adjustment is provided by an eccentric **250**, which when rotated moves the adjustable part of the arm **242** relative to the main part, thus moving contact **248** relative to contact **246**. This changes the effective width or spread of the combined contact arm **86**, and may be used to avoid either spacing bias or marking bias, as previously described in connection with FIG. **9**. Connection to external wiring is by means of a third contact arm **252**, electrically connected to contact arm **86**, and sliding rotatively on a continuous ring printed on board **88**, this ring being shown at **254** in FIG. **12**, and also in FIG. **7**.

In respect to assembly of the parts of the transmitter the terminals of the reed switches are preliminarily bent as shown in FIG. **6**. The leads **38** and **42** pass through the open space in spacer **26** (FIG. **1**) to the printed circuit boards, where they are appropriately connected by solder to the contacts of the commutator at one end, and at the other end to a common connection or bus shown at **220** in FIG. **7**. The boards shown spaced apart in FIG. **1** are brought together and secured by appropriate fasteners and spacers such as that indicated at **222** (FIG. **1**). The shielding case shown in FIG. **1A** is slid into position from the back, that is from the upper left corner of the parts when viewed in perspective as in FIG. **1**.

Mechanical features of the keyboard not described in detail above, may be assumed the same as shown in U.S. Pat. No. 2,977,413. Thus the code bars may have special lock slots for a repeat key, and they may have other lock slots for a lock lever to hold the code bars even if the key rises before the entire character has been transmitted. The lock means may be provided at the forward end of lever **150** shown in FIG. **3**.

The switch shown at **230** in FIG. **7** corresponds to the "-break" switch **120** in the patent, and the switch shown at **232** in FIG. **7** corresponds to the "send-receive" switch **122** in the patent. The switch shown in **176** in FIG. **7** controls the signal light **174** which indicates the end of a line, as previously explained in connection with FIG. **3**.

In FIG. 7 the lowermost two wires at the left end are the signal wires. The next higher wire is shown grounded, and is for grounding the shielding previously referred to, along with the chassis, etc. No power supply is shown for the signal lines, the signal power being put on the signal lines by the circuitry of the transmitter in which the keyboard is used, or from an external piece of equipment. The keyboard furnishes what may be referred to as "dry contacts" only.

In the foregoing description it has been assumed that the code is a five level code such as the Baudot code. However, there are other codes, and if the code were a six level code, the keyboard would have six code bars, and would move six magnets outside the shielding compartment, to control six reed switches inside the shielding compartment. There would be a seventh bar, corresponding to bar 192 in FIG. 3. The commutator would have two additional contacts, there being eight contacts in each half revolution to take care of start, stop, and the six code bits.

It is believed that the construction and operation of our improved keyboard operated telegraph transmitter, as well as the advantages thereof, will be apparent from the foregoing detailed description. The keyboard is relatively insensitive to vibration, because the reed switches are designed to withstand vibration, and the commutator mechanism is inherently insensitive to vibration. There is low signal distortion because the commutator uses printed contacts, and these may be laid out in large size with great accuracy, and then reduced and reproduced by photographic means, so that good accuracy is built into the commutator.

The desired switching usually is made at very low voltages and currents in order to help avoid the generation of noise radiated from the keyboard, which may harm other transmissions being sent locally, or which in military use may reveal the location of the transmitter. In this new keyboard the shielding protects against radiation caused by the switching, so that there is no interference with radio frequency signals, and no radiation to be detected by sensitive listening equipment. Moreover, the shielding protects the apparatus from outside noise and signals, which might otherwise distort the signal being transmitted.

It will be apparent that while we have shown and described the improvement in a preferred form, changes may be made without departing from the scope of the invention.

We claim:

1. A keyboard operated telegraph transmitter comprising an array of keys, a plurality of code bars moved by said keys to either of two positions used in different combinations, a plurality of spaced apart switches each responsive to a magnetic field, and a plurality of magnets moved by said code bars to either of two magnet positions, there being a magnet and code bar for each switch, one of said magnet positions serving to close its related switch, and the other of said magnet positions causing opening of the said switch, and magnetic means effective to deflect the magnetic field of a magnet away from its associated switch when said magnet is in said other magnet position.

2. A transmitter as defined in claim 1, further comprising a motor driven code serializer having a rotatable contact arm movable over a ring of contacts, said switches being connected to said contacts, and said arm providing the serialized output.

3. A transmitter as defined in claim 1, in which the switches are reed switches and in which the magnets are small permanent bar magnets disposed approximately parallel to the reed switches and movable laterally toward or away from the switches.

4. A transmitter as defined in claim 1, in which the switches are housed in a shielding compartment, and are mounted adjacent a wall of said compartment which wall is conductive but not magnetic, and in which the magnets are movable outside the said wall to control the switches shielded inside the wall.

5. A transmitter as defined in claim 4, further comprising a motor driven code serializer having a rotatable contact arm movable over a ring of contacts, said switches being connected to said contacts, and said arm providing the serialized output.

6. A transmitter as defined in claim 5, in which the switches are reed switches and are mounted parallel to the aforesaid shielding wall, and in which the magnets are small permanent bar magnets disposed approximately parallel to the reed switches and movable laterally toward or away from the switches.

7. A transmitter as defined in claim 1, in which said magnetic means comprises temporarily magnetizable shunts mounted adjacent the positions of the magnets when they have been moved away from the switches, which shunts reduce the magnetic field then reaching the switches, thereby increasing the magnetic differential relative to the physical motion of the magnets.

8. A transmitter as defined in claim 1, in which there is a pawl-operated ratchet mechanism for step-by-step carriage feed, and in which some keys are non-printing keys, and in which there is an extra bar means movable like a code bar by the non-printing keys, operatively connected to said pawl, and effective when moved to disable the pawl of the carriage feed mechanism.

9. A transmitter as defined in claim 3, in which there are temporarily magnetizable shunts mounted adjacent the positions of the magnets when they have been moved away from the switches, which shunts reduce the magnetic field then reaching the switches, thereby increasing the magnetic differential relative to the physical motion of the magnets.

10. A transmitter as defined in claim 2, in which the rotatable contact is made up of two parts, with means to adjust the spread or position of one part relative to the other in order to afford adjustment of pulse time with a view to limiting or eliminating spacing bias and marking bias.

11. A keyboard operated telegraph transmitter comprising an array of keys, a plurality of code bars moved by said keys to either of two positions used in different combinations, a plurality of spaced apart switches each responsive to a magnetic field, and a plurality of magnets moved by said code bars to either to two magnet positions, there being a magnet and code bar for each switch, one of said magnet positions serving to close its related switch, and the other of said magnet positions causing opening of the said switch, said switches being housed in a shielding compartment, and being mounted adjacent a wall of said compartment which wall is conductive but not magnetic, said magnets being movable outside the said wall to control the switches shielded inside the wall, a motor driven code serializer having a rotatable contact arm movable over a ring of contacts, said switches being connected to said contacts, said arm providing the serialized output, a pawl-operated ratchet mechanism for step-by-step carriage feed, some of said keys being non-printing keys and an extra bar means movable like a code bar by the non-printing keys, operatively connected to said pawl, and effective when moved to disable the pawl of the carriage feed mechanism.

12. A keyboard operated telegraph transmitter comprising an array of keys, a plurality of code bars moved by said keys to either of two positions used in different combinations, a plurality of spaced apart switches each responsive to a magnetic field, and a plurality of magnets moved by said code bars to either to two magnet positions, there being a magnet and code bar for each switch, one of said magnet positions serving t close its related switch, and the other of said magnet positions causing opening of said switch, a motor driven code serializer having a rotatable contact arm movable over a ring of contacts, said switches being connected to said contacts, said arm providing the serialized output, a continuously rotating motor driven shaft, said shaft being drivingly connected to said rotatable contact through a limited rotation clutch, means responsive to the depression of a key for engaging said clutch, and means for automatically disengaging said clutch after a given rotation of said rotatable contact corresponding to the transmission of the number of code bits comprising one

character, a clutch stop finger, said means for engaging said clutch comprising means to release said clutch stop finger and said means for disengaging said clutch comprising a cam driven by said motor driven shaft and operatively connected to said clutch stop finger release means, said rotatable contact comprising two parts, with means to adjust the spread or position of one part relative to the other part in order to afford adjustment of pulse time with a view to limiting or eliminating spacing bias and marking bias.

13. A keyboard operated telegraph transmitter comprising an array of keys, a plurality of code bars moved by said keys to either of two positions used in different combinations, a plurality of spaced apart switches each responsive to a magnetic field, and a plurality of magnets moved by said code bars to either of two magnet positions, there being a magnet and code bar for each switch, one of said magnet positions serving to close its related switch, and the other of said magnet positions causing opening of the said switch, said switches being reed switches, said magnets being small permanent bar magnets disposed approximately parallel to the reed switches and movable laterally toward or away from said switches, a plurality of temporarily magnetizable shunts mounted respectively adjacent the positions of said magnets when they have been moved away from said switches, said shunts being effective to reduce the magnetic field then reaching said switches, thereby increasing the magnetic differential relative to the physical motion of said magnets.

14. A keyboard operated telegraph transmitter comprising an array of keys, a plurality of code bars moved by said keys to either of two positions used in different combinations, a plurality of spaced apart switches each responsive to a magnetic field, and a plurality of magnets moved by said code bars to either of two magnet positions, there being a magnet and code bar for each switch, one of said magnet positions serving to close its related switch, and the other of said magnet positions causing opening of the said switch, said switches being housed in a shielding compartment, and being mounted adjacent a wall of said compartment which wall is conductive but not magnetic, said magnets being movable outside the said wall to control the switches shielded inside the wall, a motor driven code serializer having a rotatable contact arm movable over a ring of contacts, said switches being connected to said contacts, said arm providing the serialized output, said rotatable contact comprising two parts, with means to adjust the spread or position of one part relative to the other in order to afford adjustment of pulse time with a view to limiting or eliminating spacing bias and marking bias.

15. A keyboard operated telegraph transmitter comprising an array of keys, a plurality of code bars moved by said keys to either of two positions used in different combinations, a plurality of spaced apart switches each responsive to a magnetic field, and a plurality of magnets moved by said code bars to either of two magnet positions, there being a magnet and code bar for each switch, one of said magnet positions serving to close its related switch, and the other of said magnet positions causing opening of the said switch, a plurality of temporarily magnetizable shunts mounted respectively adjacent the positions of said magnets when they have been moved away from said switches, said shunts being effective to reduce the magnetic field then reaching said switches, thereby increasing the magnetic differential relative to the physical motion of said magnets.

16. A keyboard operated telegraph transmitter comprising an array of keys, a plurality of code bars moved by said keys to either of two positions used in different combinations, a plurality of spaced apart switches each responsive to a magnetic field, and a plurality of magnets moved by said code bars to either of two magnet positions, there being a magnet and code bar for each switch, one of said magnet positions serving to close its related switch, and the other of said magnet positions causing opening of the said switch, said switches being housed in a shielding compartment, and mounted adjacent a wall of said compartment which wall is conductive but not magnetic, said magnets being movable outside said wall to control the switches shielded inside said wall, said switches being reed switches mounted parallel to the aforesaid shielding wall, and said magnets being small permanent bar magnets disposed approximately parallel to the reed switches and movable laterally toward or away from said reed switches, a pawl-operated ratchet mechanism for step-by-step carriage feed, some of said keys being non-printing keys, and an extra bar means movable like a code bar by the non-printing keys, operatively connected to said pawl, and effective when moved to disable the pawl of the carriage feed mechanism.

17. A transmitter as defined in claim 16, further comprising temporarily magnetizable shunts mounted adjacent the positions of the magnets when they have been moved away from the switches, which shunts reduce the magnetic field then reaching the switches, thereby increasing the magnetic differential relative to the physical motion of the magnets.

* * * * *