

May 8, 1945.

L. S. ROSE

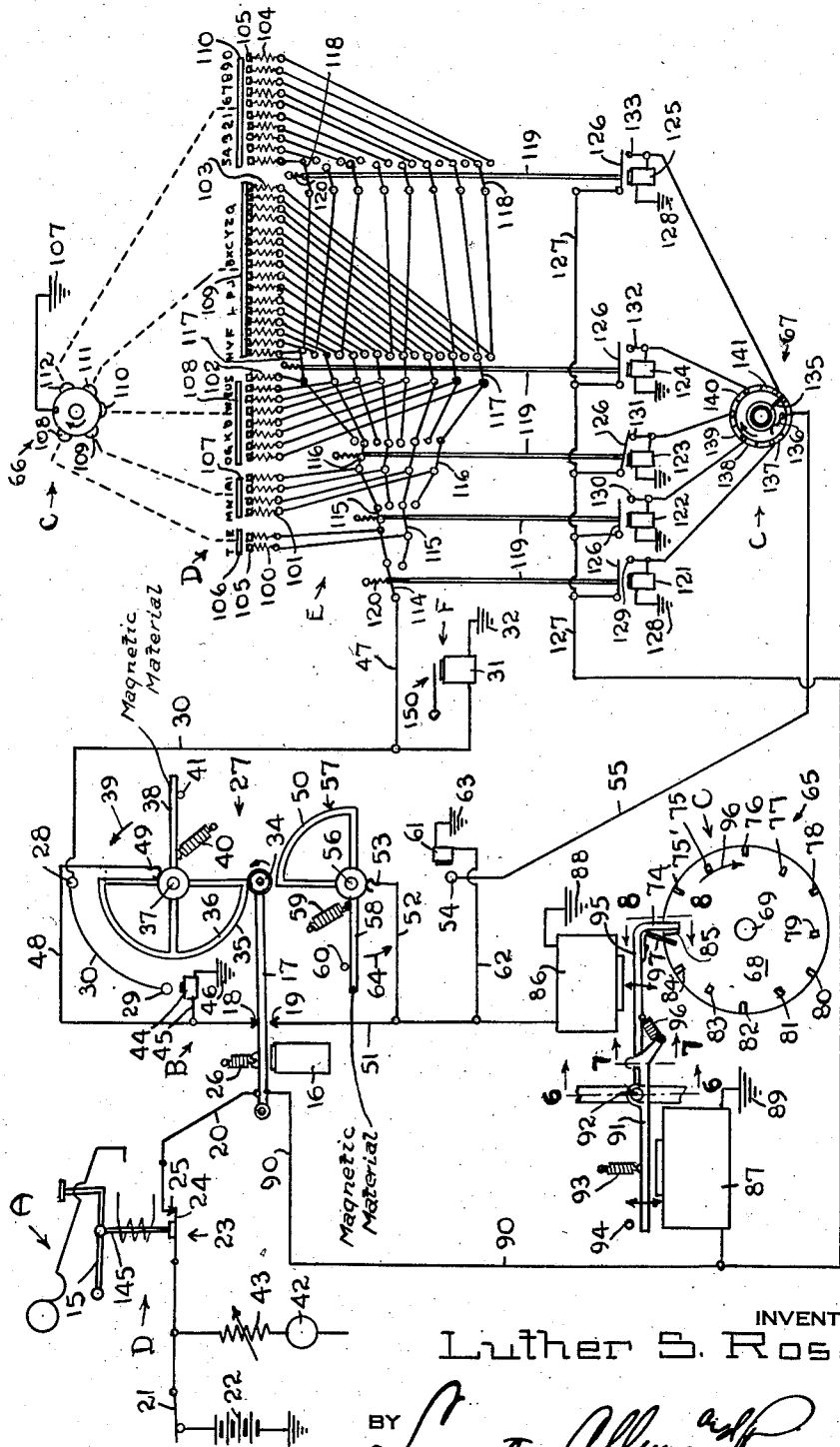
2,375,588

AUTOINTERPREGRAPH SIGNAL RECORDER

Filed Nov. 23, 1943

3 Sheets-Sheet 1

FIG. 1.



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3 Sheets-Sheet 2

FIG. 2.

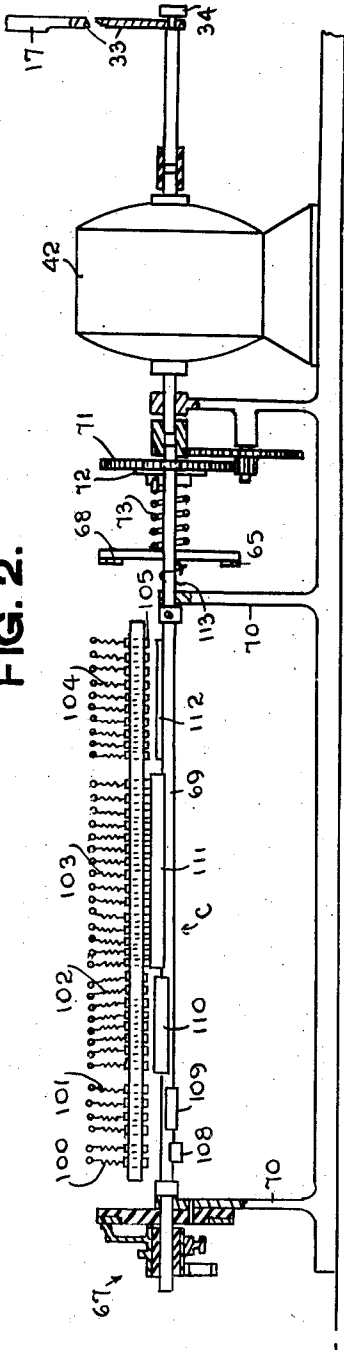


FIG. 3.

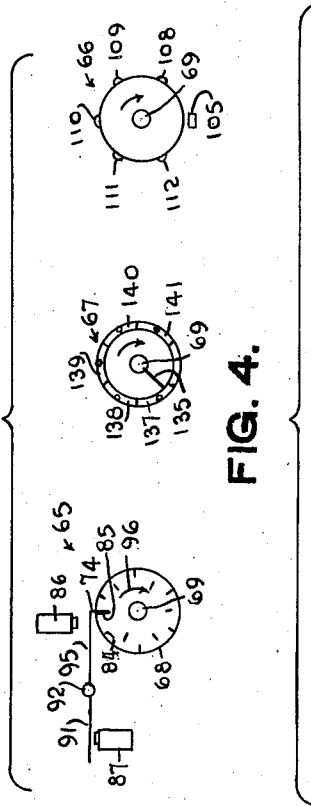


FIG. 4.

FIG. 5.

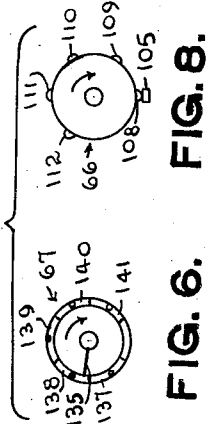


FIG. 6.

FIG. 8.

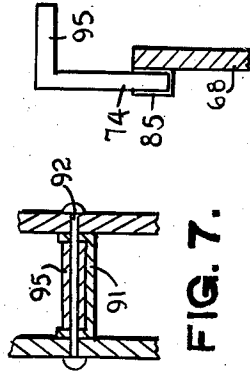
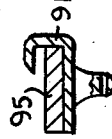


FIG. 7.



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3 Sheets-Sheet 3

FIG. 9.

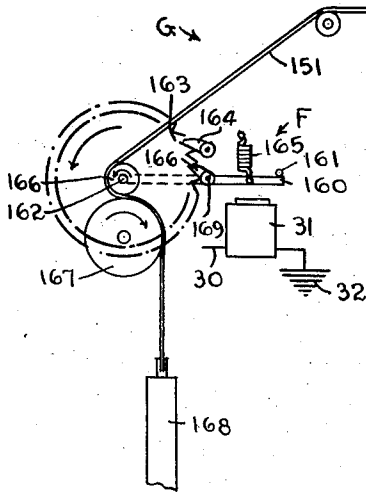


FIG. 10.

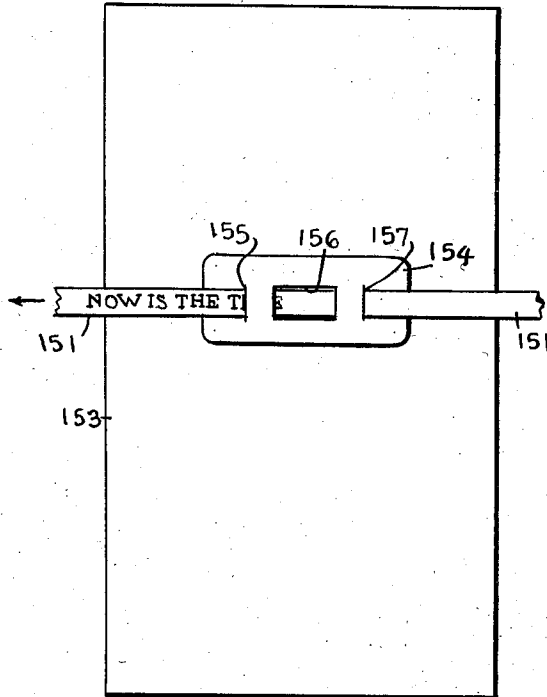


FIG. 11.

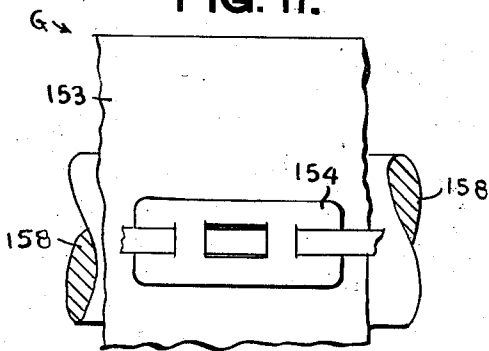
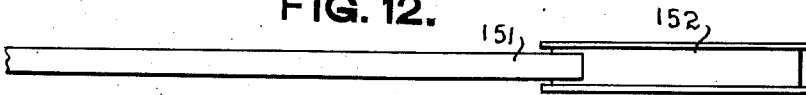


FIG. 12.



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UNITED STATES PATENT OFFICE

2,375,588

AUTOINTERPREGRAPH SIGNAL RECORDER

Luther S. Rose, San Antonio, Tex.

Application November 23, 1943, Serial No. 511,439

4 Claims. (Cl. 178—26)

This invention relates to telegraphy and more particularly to an autointerpregraph signal recorder, and is an improvement upon the printing telegraph receiver disclosed in my U. S. Patent No. 2,323,155, dated June 29, 1943.

An important object is to provide a novel telegraph system embodying means for receiving international Morse code or any code consisting of a combination of dots and dashes or, in other words, long and short electrical impulses, representing alphabetical and numerical characters, this means functioning to convert the dots and dashes into typewritten messages.

A further object is to provide a system of this character which may be used universally to decode messages, and which system is adaptable for use in wire telegraphy as well as in connection with wireless telegraphy for the translation of code signals into print.

Another object of the invention is to provide a receiving system for code messages wherein the code signals are translated into print by electro-magnetic means operable for routing the signals to proper key actuating means of a typewriter.

A still further and important object of the invention is to provide a code receiving and printing system of this character wherein the number of control relays is reduced to a minimum, thus providing for simplicity, low manufacturing cost, and reduced floor space.

A still further object is to provide a receiving system for code messages which may be readily associated with standard typewriters for typing the code messages into typewritten messages.

Another important object is to eliminate certain relays contained in the apparatus disclosed in my patent referred to above, and to employ, with a sensitive relay, two associated small, lightweight electro-mechanical switches.

Other objects and advantages of the invention will be apparent from the following detailed description of the invention, taken in connection with the accompanying drawings, forming a portion of this specification, and in which drawings:

Figure 1 is a wiring diagram of a preferred embodiment of the apparatus.

Figure 2 is a view of a preferred form of circuit-controlled switch means for the apparatus.

Figures 3, 4, and 5 are diagrammatic views illustrating progressive position of electro-mechanical switching devices forming parts of the circuit-controlled switch means.

Figures 6, 7, and 8 are enlarged fragmentary

transverse sections through portions of the devices of Figure 1, substantially upon their respective lines of that figure.

Figures 9 to 12 inclusive are views of portions of the character-receiving tape and operating means therefor.

In the drawings, wherein for the purpose of illustration is shown a preferred embodiment of the invention and wherein similar reference characters designate corresponding parts throughout the several views the letter A may designate a typewriting machine, receiving relay means B, electro-mechanical switching means C; key-actuating means D; switching and selector means E for association with the key-actuating means D; and spacing or operating means F for the characters-receiving means G.

The typewriting machine A may have a plurality of conventional key levers 15, operating type bars in the usual manner, the connection between these key levers 15 and the novel apparatus being armatures to be later described.

The receiving relay means B, includes a receiving relay 16, which is, preferably, a sensitive one, employed to pick up the weak signals and relay the impulses to the local circuit of the apparatus, an armature 17, associated with the relay 16, pivoted at one end and so movable between spaced contacts 18 and 19 and connected through battery lines or conductors 20 and 21 to battery 22, there being an open-circuit switch 23, having switch 24 and contact 25 interposed in the battery lines. The armature 17 is normally held in engagement with the contact 18 as by a retraction coil spring 25.

The contact 18 forms one terminal of an automatic time delay switch means 27, while the opposite terminals 28 and 29 of the switch means 27 are connected in series thru conductor 30 to the spacing electro magnet 31 into the ground 32. The switch means 27 may be considered as a control switch and is slower in action than the receiving relay 16, that is, it opens and closes the circuits at the contacts 28 and 29 only after a certain period of time has elapsed and after the circuit has been closed at contact 18 by the relay 16. This switch means 27 performs the functions of the relays 21 and 22 described in my U. S. Patent No. 2,323,155. Preferably, the switch means 27 is of as light weight as possible.

It may be well to state here that the switch means 27 is controlled by the armature 17 of the relay 16. An arm 33 (shown in Figure 2) mounted on the armature 17, and not necessarily insulated

from same, rotatably carries, at its free end, a small rotating member or wheel 34, which latter may be of rubber, fiber or leather and is free to rotate and when it is in the up position, as shown in Figure 1, it bears against the arcuate face 35 of the arm 36 of the switch means 27 in such a manner as to cause the arm 36 to rotate in a definite direction, since it is pivoted, as at 37 at its center. This causes a straight portion 38 of the arm 36, extending radially from pivot 37, to move in the direction of the arrow 39 towards the contact 28 to close the circuit, when a certain time has elapsed after the closing of the circuit at the contact 18 by the armature 17. From this, it may be seen that if this moves at a certain definite rate of speed and an electrical impulse is immediately received by relay 16, the circuit is closed at 18 only for a short time period and the moving straight portion 38 of the switch arm 36 will not have time to reach the contact 28 and, therefore, the circuit will not be closed at that point. However, if the armature 17 remains in the up position for a longer period of time, the portion 38 will have time to move around to the position where it will close the circuit at contact 28, and energize electro magnet 31. If the armature remains up for a still longer period of time the portion 38 will continue to move around in the direction of the arrow 39 towards the contact 29 and, if enough time elapses, it will close the circuit again at 29 causing the electro magnet 31 to become energized the second time and will in turn perform the same function of the relay 22 as shown in my prior patent referred to above, i. e., causing an extra space to be made, at the proper time, on the typewriter or, in other words, the same as the spacing between two sentences.

The switch arm 36 is as light in weight as possible and free to rotate approximately one half revolution, more or less, against the tension of the retraction spring 40. The instant the pressure from the wheel 34 is released, the arm 36 will automatically swing back, by the pull of the spring 40, so that the portion 38 will contact the stop 41, and the portion 38 will be free to start all over again the instant the wheel 34 makes contact with the arcuate face 35 of the switch arm 36. The wheel 34 rotates at a substantially constant speed, controlled as by the motor 42 (there being a suitable conventional flexible connection between the motor 42 and the shaft on which the wheel 34 is mounted). The speed of the motor 42 is regulated by the means 43, which may be a governor or rheostat.

If the portion 38 of the switch arm 36 should rotate past the contact 29 so that the wheel 34 would normally run off the arcuate face 35 a small electromagnet 44 (connected to the conductor 45, and grounded at 46 and energized by the battery 22 when the armature 17 makes contact or closes the circuit at the contact 18) will attract the portion 38 (constructed of magnetic material) and draw it slightly past the point where the wheel 34 would run off of the face 35 (and would continue to wear against this face). Therefore, no matter how long the armature 17 remains in the up position and the switch arm 36 rotates to a certain point, the latter will stop at the electromagnet 44 and, while the wheel 34 will continue to turn, it will not rotate against the face 35.

The arm 33 of Figure 2 is secured rigidly to the armature 17 in any way most convenient.

Both contacts 28 and 29 are connected thru

conductor 30 to conductor 47, which leads to the typing circuit which will be described later. From contact 18 a conductor 48 extends to a brush contact 49, electrically connected with the switch arm 36, and the conductor 45 is connected with the conductor 48.

The contact 19 forms one terminal of switch arm 50 through conductors 51 and 52 and brush 53. The fixed contact 54 leads to the switching means C thru line 55. This switch arm 50 and associated structure forms a slow acting switch similar to the switch arm 36 and associated structure, is pivoted as at 56, has an arcuate face 57, a straight arm portion 58, contraction coil spring 59 operatively connected to the portion 58, a stop 60 and electromagnet 61 for the portion 58. There is also provided a conductor 62 to the conductor 51 and ground 63 for the electromagnet 61. This switch arm 50 differs from arm 36 in that it operates when an electrical impulse is being received by relay 16 which causes the armature 17 to move down and the wheel 34, contacting the arcuate face 57, effects rotation of the arm 50 in the direction shown by the arrow 64 toward the contact 54. This switch operates only when an electrical impulse is being received, while switch arm 36 operates only when no electrical impulse is being received. Only one of the two switches operates at any one time. If an electrical impulse of short duration is received by the relay 16 the armature 17 moves downward making contact with contact 19 and, at the same time, the wheel 34 contacts the face 57 and starts the arm in the direction of the fixed contact 54. However, if the impulse is of a short duration only and the speed of the motor 42 is true, the arm 50 does not reach contact 54, therefore the circuit will not be completed. If an electrical impulse of a longer duration is received by the relay 16 the arm 50 will have time to reach contact 54 electrically connected to line 55.

The electro-mechanical switching means C serves to route the received signals or electrical impulses, for operation of the proper keys of the typewriter A, and embodies a ratchet or escapement means 65 operable for controlling the position of two rotating members or switches 66 and 67.

The switch 66 may be considered a group selector switch, that is, it selects the letter or character group to which the particular code group belongs, while the switch 67 may be considered a combination selector switch, as it selects the proper circuit switching combination for each particular code combination.

The ratchet escapement means 65 embodies a rotating member or ratchet wheel 68 fixed upon a metallic shaft 69 suitably journaled in a support 70 shown in Figure 2. This shaft 69 is rotated by means of a motor 42 which is connected to the shaft through a suitable train of speed reducing gears 71, to reduce the speed, and a sliding clutch 72 which latter may be any preferred form. The opposite side of the sliding clutch 72 is connected to the escapement wheel 68, by cooperation of an expansion coil spring 73. The motor may be run continuously and is connected to the shaft 69 through the sliding clutch 71 with just enough pressure to cause the spring 73 to contract sufficiently to cause the shaft 69 to turn normally when the dog or stop arm 74, to be described, is disengaged from the teeth of the escapement wheel 68.

It may be noted that, by having the spring 73

positioned as it is, the motor 42 is not required to turn as fast as it normally would do as the escapement wheel 68 does not turn continuously, but operates intermittently; therefore the spring 73 will be caused to compress to a certain tension and as quick as the dog or stop arm 74 is disengaged from the teeth of the wheel 68, the latter will immediately rotate the shaft (with the switches) thereby speeding up the action of the switches 66 and 67. This is very important in the operation of the apparatus as a whole. As shown, the ratchet wheel 68 is provided with twelve spaced apart teeth or lugs 75' and 75 to 85, the last being the starter tooth and this latter presents a greater area to the dog 74 than does the teeth 75' and 75 to 84, whereby one movement of the armature 95 will not wholly release the tooth 85 from dog 74, but a second movement of the armature 95 will effect such release, and each time the armature 95 moves upwardly to release a tooth, other than tooth 85, the wheel 68 will rotate a step, this to be explained subsequently in detail.

Rotation of the escapement wheel 68 is controlled by two relays 86 and 87 which are respectively grounded on one side as at 88 and 89. One side of the relay 87 is connected thru line 90 with the battery line 20, while one side of the relay 86 is connected thru line 51 with the contact 19. Thus, it will be seen, that operation of the escapement means 65 is controlled by the relay 16 and battery 22. It will be noted that current will flow directly from the battery 22 thru relay 87 to ground 89 and, thereby, keep the relay 87 energized until the circuit is broken in this line, as will later be seen, by the open circuiting switch 23. The relay 87 has an armature 91 pivoted as by pin 92 and spring urged as at 93 against a stop 94. There is also an armature 95 for the relay 86, pivoted by the pivot pin 92 at one end thereof and is normally spring urged against the armature 91 by a retraction coil spring 96. The dog or step arm 74 is the free end part of the armature 95. The pivot pin 92 is a pivot for both armatures and extends through a suitable stationary member, as a bearing. This arm 74 cooperates with the starter tooth or lug 85 of the escapement wheel 68 for holding the latter at a starting position, when the dog or stop arm 74 is disengaged from the ratchet teeth or lugs 75 to 84 and 75'.

When the relay 87 is energized, the dog 74 is forced up, into a position free of the lower part of the starter lug 85. Now, each time the receiving relay 16 is actuated and causes the armature 17 to engage momentarily the contact 19, a circuit will be closed thru relay 86 and cause its armature 95 to move upwardly as in Figure 4, with the dog 74 fully releasing the lug 85, so that the wheel 68 will be released and rotate one notch or step in the direction indicated by the arrow 96. Thus, when the relay 87 is energized, the wheel 68 will be rotated one tooth or lug each time an electrical impulse is received thru the relay 86. A leaf spring 97 is mounted on the armature 95. Its function is to take up shock when the tooth or lugs strike the dog 74.

Key actuating means D includes solenoids for operating the keys of the typewriter A and are arranged in banks and are associated with selector switching means E provided for completing a circuit thru these banks in sequence. For convenience, these key-actuating solenoids will be referred to by the letters and numerals with

which they are associated. While only five banks of solenoids have been shown, this number may be increased in accordance with the number of code characters to a code group which it is desired to receive. In the arrangement illustrated, the numeral 100 represents a bank of two solenoids or electromagnets for operating the keys T and E; 101 a bank of four solenoids for operating the keys M, N, A and I; 102 a bank of eight solenoids for operating the keys O, G, K, D, W, R, U and S; 103 a bank of sixteen solenoids for operating the keys H, V, F, L, P, J, B, X, C, Y, Z and Q, four of these solenoids being extra and need not be employed unless necessary; and 104 a bank of solenoids for operating the numeral keys of the typewriter. These key-actuating solenoids are each independent of one another and are connected to separate spring contacts 105 which are mounted on an insulated strip 106 disposed longitudinally of the shaft 69.

The metallic shaft 69 is grounded as at 107 and is provided with metallic segments 108, 109, 110, 111 and 112, shown particularly in Figures 2 to 5, which are so spaced about the shaft and of such length and so related to the spring contacts 105 as to complete electrical circuits thru their respective banks of solenoids in sequence when the shaft is rotated in the direction indicated by the arrow 113 their disposition radially about the shaft being such that only one segment will contact a solenoid bank at one time. As will be seen, the segment 108 completes a circuit thru the solenoid bank 100 to ground 107; the segment 109 completes a circuit thru the solenoid bank 101 to ground 107, while the segments 110, 111 and 112 likewise complete circuits thru their respective solenoid banks 102, 103 and 104 to ground 107. Thus, only one bank of solenoids is closed to the ground 107 at any one time, the rotating switch 66 acting as a stepping switch and progressively closing the circuits to the banks of solenoids, starting with the closing of the circuit to the solenoid bank 100.

Respectively associated with the solenoid banks 100 to 104 is a series of solenoid selector or routing switches 114, 115, 116, 117 and 118 which control opening and closing of circuits to selected solenoids of the banks as is apparent from Figure 1. The switch 114 may be a single-pole double-throw switch, the switch 115 a double-pole double-throw switch, the switch 116 a four-pole double-throw switch, the switch 117 an eight-pole double-throw switch and the switch 118 an eight-pole double-throw switch. The switch blades of the switches 114 to 118 are connected to control rods or bars 119 and are held in an upward normal position by springs 120. The switch blade of the switch 114 is connected by conductor 47 to the line 30.

These selector switches 114 to 118 are respectively controlled by a series of holding relays 121, 122, 123, 124 and 125, each having an armature 126 connected to the control bar 119 of their respective selector switches. The armatures 126 are electrically connected by line 127 to the line 90 leading to the battery line 20. Each of the relays 121 to 125 is grounded at one side as at 128 and at the other side of each are respectively connected to contacts 129 to 133 which are engaged by the armatures 126. Thus the relays 121 to 125 when energized, function to operate their respective selector switches thru the control bars 119 and against the action of the springs 120. Also, when the armatures 126 are drawn down they will engage their associated contacts 129 to

133 and maintain a holding circuit thru the relay until the battery circuit is opened again.

The rotating selector switch 67 controls circuits to the holding relays 121 to 125 and embodies a rotating switch arm 135 which is fixed on, but electrically insulated from, the metallic selector switch shaft 69. This arm 135 is connected to a brush arm 136 which is, in turn, electrically connected by the line 55 to the contact 54, whereby, upon closing of the switch 50 the arm 135 will be connected to the battery line 20. The rotating switch arm 135 coacts with a series of contacts 137 to 141 inclusive, which are in turn respectively connected to the holding relays 121 to 125.

Each of the typewriter key levers 15 is provided with an armature 145 with each of which one of the key actuating solenoids is associated in a manner such as diagrammatically indicated in Figure 1. Thus, each time a character has been typed the circuit will be broken at the open circuiting switch 23.

When the circuit is broken at the switch 23, the escapement means 65 and the selector switches 66 and 67 are all returned to a starting position for proper reception of the next code group.

At this point, an example of the cycle of operation of the receiving system for the code letter "F," as used in the International Morse code, will be given. The code letter "F" consists of two dots, a dash and another dot or, as considered in electrical terms, two by an impulse of short duration, then one of longer duration and, after this, another electrical impulse of short duration, this combination of short and long electrical impulses going to make up the code combination for the letter "F."

In Figure 1 the escapement means 65 is shown in its starting position for reception of a code group, the selector switch 66 is shown at a position when the letter "F" is to be typed, while the switch arms 36 and 50 are shown in their normal positions. Upon closing of the switch 23 a battery circuit is completed thru the relay 87 to ground 29, thus energizing this relay so that its armature 91 moves to the position in Figure 3 with the dog 74 of armature 95 disengaged from the lower portion of the starter tooth 85, the dog 74, however, still engages a part of the tooth 85. Since the switches 66 and 67 are on the same shaft 69 with the ratchet or escapement wheel 68, the switch arm 135 of the switch 67 will now engage contact 137 but segment 106 of switch 66 will not have engaged the spring contacts 105 of the solenoid bank 100. It will be seen that closing of the switch 23 places the receiver in a starting position as shown in Figure 3, and all of the code groups will begin at this point.

Now, upon receipt of the first short impulse of the letter "F" at the receiving line of the relay 16, the impulse will, in turn cause the receiving relay 16 to become energized and operate the armature 17, which will be only momentarily, as this electrical impulse is of short duration. When the armature 17 is actuated by the relay 16 it engages the contact 19 and completes two circuits at the same time, one circuit being thru the relay 86 of the escapement means 65 and causing the armature 95 to be actuated, allowing the escapement or ratchet wheel 68 to be moved up only one step as shown in Figure 4. The second circuit completed by the armature 17 is from battery line 20 thru armature 17, electromagnet 61 to ground 63, thereby tending to actuate or energize the electromagnet but, in view of

the fact that the straight portion 58 is nowhere near the electromagnet 61 nothing happens unless the portion 58 moves around too far and enters the magnetic field of electromagnet 61 and is held there, in place, until the circuit is broken again at the contact 19. The relay 86 is adapted to operate quickly while the two switches 26 and 50 operate with a delaying action. The switch 50, when the speed regulator 43 is properly adjusted, will operate or close the circuit through portion 58 only when dashes are received, while the relay 86 operates on both dots, or short impulses, and dashes, or long electrical impulses. The switch 36 operates or closes the circuit electrically connected to contacts 28 and 29 only during long duration signals or during long intervals of time as between long and short impulses in a code group or combination, as for letters of the alphabet, figures and the like.

By referring to Figure 4 it will be seen that, upon actuation of the armature 95 the dog 74 has been released from the starter tooth 85, which is the starting point of all code combinations or the beginning point of each letter, and that the dog 74 has engaged the next ratchet tooth 75. The switch arm 135 of the selector switch 67 is on the segment 137 which is connected to the holding relay 121 which operates the solenoid selector switch 114, but, since the switch 50 is slow in operating and will not operate on short impulses, the circuit is not completed thru relay 121 and the switch 114 will remain in its upward or normal position.

The first dot or short impulse of "F" is followed by a space, causing relay 16 to become deenergized and the armature 17 returned by the spring 26 to make contact with the contact 18. This, in turn, connects the electromagnet 44 and switch 36 into the circuit from grounded battery 22 to line 20, armature 17, contact 18, line 14, brush 49, line 45, electromagnet 44 to ground 46.

The switch arm 36 is normally held in the position shown in Figure 1 by the spring means 40. When the armature 17 is in the up position the wheel 22 engages the arcuate face 35 in such a manner that, if the small motor 42 is operating, the wheel will, in turn, cause the straight portion 38 to start moving in the direction of the arrow 39 toward the contacts 28 and 29. Since the spaces between characters of a combination, are of short duration and equal to one dot, there will not be time for the switch 36 to reach the contacts 28 and 29 as it is slow in operation, similar to switch 50.

The circuit is now open to the relay 86, allowing the armature 95 to be pulled downwardly by the spring 96, thus releasing the tooth 75' and allowing the ratchet wheel 68 to rotate until the dog 74 engages the ratchet tooth 75. As in Figure 5, the segment 108 of the rotating switch 66 is now engaging the spring contact fingers 105 of the solenoids T and E of the bank 100 (the current reaching the ground thru shaft 69) but as the switch 36 has not completed the circuit at contact 28, neither of the solenoids in the bank 100 will be energized to operate a key of the typewriter.

The second impulse in the combination for the letter "F" is also of short duration and appears immediately following the first dot and space. Now, as before, when the second impulse is received, the relay 16 is operated which, in turn, causes the ratchet means 65 to operate, moving, in turn, the rotating switch arm 135 on the segment 138 of the switch 67 and placing the relay

122 in condition to be actuated if and when switch 50 is actuated, as the circuit is never complete until switch arm 50 has closed the circuit at contact 54 and, as the second impulse is of short duration, it will not cause the switch arm 50 to actuate, therefore the circuit is left open thru the relay 122, with the switch 116 in its upward normal position.

The second impulse is immediately followed by a space (as heretofore) and this space followed by a third impulse which is of longer duration. This will actuate the ratchet means 65 and will cause the slow acting switch 50 to rotate, closing the circuit contact 54 and causing the relay 123 to be operated from grounded battery 22, switches 21 and 23, line 20, contact 19, lines 51 and 52, brush 53, switch arm 50, contact 54, line 55, brush 136, rotating switch arm 135, segment 139 and relay 123 to ground. The relay 123 being energized, attracts its armature 126 and causes a connection to be made at the contact 131 and at the same time, moves the switch arms of the switch 166 downwardly as in Figure 1. Of course, the solenoid selector switches 114 to 118 remain in an upward or normal position for the short impulses or dots and are moved downwardly by their respective relays 121 to 125 on the long impulses or dashes of the code combination.

There is now another circuit completed from grounded battery 22, switches 21 and 23, lines 50 and 97, armature 126 of relay 123, contact 131, relay 123 to ground 128, thereby completing this circuit and keeping the relay 123 energized even after the moving contact 135 has moved to another segment of the switch 67. This circuit will therefore remain closed until the circuit is opened at the switch 23 or anywhere in series with the circuit to the battery 22.

As the third or long impulse to make up the code combination for "F" is followed by a space of short duration the armature 17 of relay 16 is returned to the position as shown engaging contact 18; also the shaft 69 has now been rotated to a position where the segment makes contact with the contact fingers 105 of the solenoid bank 102 and connects the solenoids of bank 102 to ground at 107. In view of the fact that the space following the third electrical impulse is of short duration, it will not cause the switch arm 36 to be actuated, therefore there will not be a complete circuit thru the solenoid bank 102 into ground 107 and none of these solenoids in this bank will be caused to operate.

The fourth and last impulse of the code combination for the letter "F" follows a space of short duration and causes the ratchet means 65 to be actuated as before, which, in turn, moves the contact arm 135 of the switch 67 to the segment 140 and the segment of the switch shaft 69 into engagement with the spring contacts 105 of the solenoid bank 103. This position of the contact arm 135 is before the last impulse has been completed and the segment 111 is at the end of the last impulse and after the receiving relay 16 is de-energized. As stated, the contact arm 135 is now making contact with the segment leading to relay 124, but this relay 124 cannot be caused to actuate until the circuit is closed by the slow acting switch 50, therefore, the relay 124 will not operate the selector switch 117 on the fourth impulse as it is of short duration and the armature 17 of relay 16 has now been returned, breaking connection at the contact 19. The armature 17 when returned to the position shown making connection with the

contact 18 completes the circuit to the switch arm 36 (which is slow in operation) this circuit including battery 22, switches 21 and 23, armature 17, contact 18, brush 49 and switch arm 36. A circuit thru the solenoid bank 103 is now open only at the point between the arm 36 and the contact 28.

As the time elapsed after the fourth and last impulse is greater than the spacing time between any of the electrical impulses for that combination (this spacing time being equal to one dash) the switch arm 36 will complete the circuit at contacts 28 and 29. At contact 29 a circuit will be completed from contact 29 thru contact 28, line 30, solenoid 31 to ground 32. This solenoid 31 is employed to cause the typewriter to make spaces, therefore spaces are made on the typewriter, regardless of whether a letter has been typed or not.

Upon actuation of the switch arm 36, there is a circuit closed (at line 47) and completing the circuit thru one of the key-actuating solenoids, causing only one letter (F, in this case) to be typed on the typewriter. This circuit is completed as follows: thru switch 114 and along the wire to uppermost switch 115 (of Figure 1) (as segment 103 is not active the circuit is not completed thru solenoid bank 103) thence thru the uppermost switch 115 and along the wire therefrom to uppermost switch 116 (of Figure 1) as segment 109 is not active the solenoid bank 104 will not be actuated) thence through the uppermost switch 116 and along the wire therefrom to uppermost switch 117 (of Figure 1) as the segment 110 is now connecting the bank of solenoids 103 thru the shaft 69 to ground 107. Therefore, solenoid controlling the key "F" will actuate that key, causing that letter to be typed.

The open-circuiting switch 23 is adapted to open momentarily each time a key of the typewriter has been operated, and while shown, in Figure 1 for convenience only, as being operated by the armature 145 one of the solenoids, this switch is intended to be associated with the spacing bar mechanism of the typewriter whereby the switch 23 will be opened each time that a letter or character is typed or a space made. As will be seen, when the switch 23 is opened all circuits of the receiver will be open circuited, except the motor circuit. This results in actuations as follows: First, the relays 121 to 125 will have been cleared and their switch actuating armatures returned by the springs 120 to normal positions. Next, the ratchet or escapement wheel 68 is caused to rotate in the direction of the arrow 96 to a normal position as in Figure 1, so that it will be ready to start at the beginning (dog 74 holding starter tooth 85) for another letter. Opening of the switch 23 opens the circuit to the relay 87 whereby its armature 91 is pulled up by the spring 93. The armature 95 being pivoted at 92 withdraws the dog 74 from engagement by the teeth of the escapement wheel 68 so that the wheel 68 and shaft 69 are free to turn, whereby the switches 66 and 67 are returned to a normal or starting position. The starter tooth 85, when it engages the dog 74, causes the ratchet wheel 68 to be stopped at the position shown in Figure 1. As the switch 23 is opened only momentarily (until the typewriter key has been returned to normal) the relay 87 is again energized and attracts its armature 91, whereby the dog 74 releases the lower portion of the tooth 85 but engages the upper part of this tooth, as in Figure 3. With reference to

Figure 3, all of the code groups begin at this point with the switch arm 135 of the switch 67 always on segment 137 during the first impulse (as in Figure 4) and the segment 108 of the switch 66 always engages the contacts 105 of the solenoid bank 106 at the end of the first impulse as in Figure 5.

If the code combination for a certain letter consists of three impulses the segment 110 of the switch 66 will always engage the contacts 105 of the third solenoid bank 102 at the end of the combination.

If the letter consists of a combination of four electrical impulses the segment 111 will make connection with the fourth solenoid bank 103 at the end of the code combination (and so on for any code letter group) while the contact arm 135 of the switch 67 always makes connection with the segment for the proper relay 121, etc., depending upon the impulse received, so that the relay will be actuated when the switch 50 operates.

After the letter "F," or any other letter has been typed, the switches all returned to normal and the circuits closed again, the armature 17 of relay 16 engages contact 18 and connects switch 36 into the circuit thru brush 47 and, if no electrical impulses immediately follow the first code group, the arm 38 will be caused to move toward the contact 28 and, as no circuit is completed thru any of the solenoid banks but is completed thru the spacing coil 31 to ground 32, when the arm 38 engages the contacts 28 and 29 to close the circuit, no letter will be typed but a space will be made as between two words in a sentence. Then, if still no further electrical impulses are received by relay 16 the switch 36 will have had time to open the circuit at 27 and will, in turn, cause the arm 38 to continue to move in the direction of the arrow 39 toward the contact 29 and, completing the circuit again, momentarily make and break the circuit to the spacing coil 31, and causes another space to occur, the same as between the end of one and the beginning of a new sentence. From this it will seen that letters will be spaced, words will also have the correct spacing between them, and also the correct spaces will occur between sentences as in any ordinary typed letter.

The spacing mechanism F' for the character-receiving means represented diagrammatically in Figure 1 at 150 is presented in more detailed form in the Figures 10 to 13 inclusive, in which the character-receiving means G is shown as a tape 151 on which the message is to be typed, the tape 151 being in a roll, housed in a slotted container 152 similar to a conventional typewriter ribbon roll housing. Typing paper 153, if desired is provided with a sticker 154 made of material strong enough to guide the tape (preferably a piece of fabric gummed on one side and slotted as shown at 155, 156 and 157). This, in turn, may be gummed to the paper 153 and used as a guide. It is only necessary then to place this sheet of paper 153 around the typewriter roller 158 as shown in Figure 11 and secure the roller 158 to the desired position so that the type bars will strike near the center of the slot 156. This may be done by using the marginal stops on the typewriter or any other means available, since the typewriter carriage may be set to stop at most any position by using the stops, and the typing bars will continue to strike in the same position while the tape will be moved one space each time a letter is typed.

Although Figure 9 shows a preferred form of tape operating means F any other means may be employed which will be suitable for the purpose. As a message is being typed the armature 160 is drawn or pulled down by the magnet 31 from the stop 161. This armature is attached or pivoted as at 162 to the center of the ratchet wheel 163. During the downward movement of the armature 160, the pawl 164 prevents the ratchet wheel 163 from rotating backwards. When the electromagnet 31 becomes de-energized the contraction coil spring 165 pulls the armature upward and against the stop 161 and, at the same time, this rotates the ratchet wheel 163 a certain distance, equal to a typewriter space since the armature 160 is also provided with a pawl 166 which engages the teeth of the ratchet wheel, as in Figure 9. This causes the tape 151, which is contacting the peripheries of the wheels 166 and 167, to move the distance of one typewriter space. Any suitable means, as a weight 168 or a conventional take up may be provided to keep the tape 151 taut. There is, of course, a second pawl 166 pivoted, as at 169 to the armature 160 adapted to engage the teeth of the ratchet wheel 163, as is apparent so that, when the armature 160 moves downwardly upon energization of the electromagnet 31, the pawl 166 will ride over the teeth, but the pawl 164 will hold the ratchet wheel 163 against rotation except when the armature 160 moves upwardly.

By combining the sensitive relay 16 with the two small and light electro-mechanical switches 36 and 50 I have eliminated the three relays 21, 22 and 40 disclosed in my previous Patent No. 2,323,155 and have, at the same time, decreased the weight, as the motor normally used in the code receiving section, is used to operate the switches 36 and 50 in the present application. By using this switching arrangement, a more practical and reliable method of analyzing the incoming code signals is provided, particularly separating the long electrical impulses from the short impulses.

The electro-mechanical switching means, or stepping switch, employed in my prior patent referred to above, is now presented in a practical form. A more rapid development of the switching operation, with less motor speed and power is provided for, permitting the use of a smaller motor requiring less space and weight and, by using a small speed regulated motor for the driving power for the switches 36 and 50 a more accurate and dependable speed regulation for synchronizing the electro-mechanical analyzing switches with the incoming code signal, is obtained, with elimination of the relays such as 21, 22, and 40 forming a part of the assembly disclosed in the prior patent.

Various changes may be made to the form of the invention herein shown and described without departing from the spirit of the invention or scope of the following claims.

What is claimed is:

1. In an autointerpregraph signal recorder, a receiving circuit including a receiving relay responsive to dot and dash code signal impulses; a local circuit separate from the first circuit, a normally open, slow-acting dash switch, and a normally open slow-acting time interval switch, both in the local circuit, each including a switch arm having a pivoted portion provided with accurate face and a contact, means between said relay and switches for closing them, including an armature, pivoted at one end and responsive to

said relay, a rotating member carried by said armature and alternately contacting the arcuate face of each switch; electromagnetic means for moving said arcuate faces out of contact with said rotating member independently of said armature and after said switches have closed; a printing circuit controlled by the time-interval switch and including selector switch means; and circuit selector means controlled by the dash switch for operation of the selector switch means.

2. In an autointerpregraph signal recorder, a receiving circuit including a receiving relay responsive to dot and dash code signal impulses; a local circuit separate from the first circuit, a normally open, slow-acting dash switch, and a normally open slow-acting time-interval switch, both in the local circuit, each including a switch arm having a pivoted portion provided with an arcuate face and a contact, the arcuate face of said time interval switch being greater in length than the length of the face of said dash switch; means between said relay and switches for closing them, including an armature, pivoted at one end and responsive to said relay, a rotating member carried by said armature and alternately contacting the arcuate face of each switch; a printing circuit controlled by the time-interval switch and including electromechanical switching means, said electro-mechanical switching means including rotating members; and a single means for rotating all of said rotating members.

3. In an autointerpregraph signal recorder, a receiving circuit including a receiving relay responsive to dot and dash code signal impulses; a local circuit separate from the first circuit, a normally open, slow-acting dash switch, and a normally open slow-acting time-interval switch, both in the local circuit, each including a contact, a switch arm having a pivoted portion provided with an arcuate face and a contact of magnetic

material; means between said relay and switches for closing them, including an armature pivoted at one end and responsive to said relay and a rotating member carried by said armature and alternately contacting the arcuate face of each switch; separate means to disengage each of said arcuate faces from said rotating member upon the closing of said switches, each of said last named means including an electro-magnet disposed in the path of travel of the switch arm with which it is associated, each electro-magnet being in said local circuit; a printing circuit controlled by the time-interval switch and including selector switch means; and circuit selector means controlled by the dash switch for operation of the selector switch means.

4. In an autointerpregraph signal recorder, a receiving circuit including a receiving relay responsive to dot and dash code signal impulses; a local circuit separate from the first circuit; a normally open, slow-acting dash switch, and a normally open slow-acting time-interval switch, both in the local circuit, each including a switch arm having a pivoted portion provided with an arcuate face and a contact arm, and said time-interval switch having a pair of spaced apart fixed contacts, disposed in the path of travel of the contact arm of said time-interval switch and a lead connecting said fixed contacts means between said relay and switches for closing them, including an armature, pivoted at one end and responsive to said relay, a rotating member carried by said armature and alternately contacting the arcuate face of each switch; and a printing circuit controlled by the time-interval switch and including electro-mechanical switching means, and a character spacing means; said lead extending to said character spacing means.

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