A. F. DIXON.

SELECTING SYSTEM.

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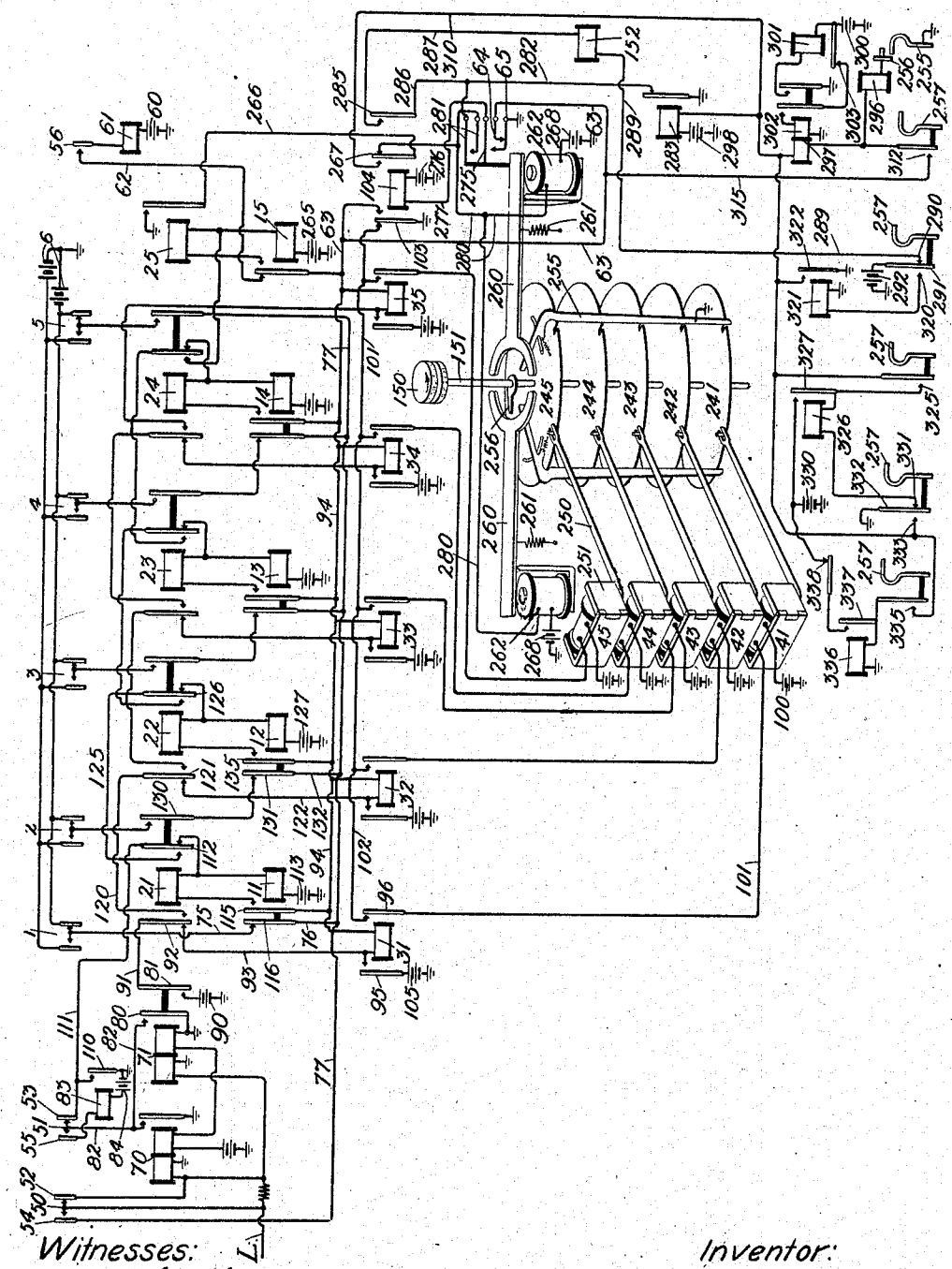
1,196,528. Patented Aug. 29, 1916.



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UNITED STATES PATENT OFFICE.

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SELECTING SYSTEM.

1,196,528. Specification of Letters Patent. Patented Aug. 29, 1916.

Application filed March 19, 1914. Serial No. 825,902.

To all whom it may concern:

Be it known that I, AMOS F. DIXON, a citizen of the United States, residing at Newark, in the county of Essex and State of New Jersey, have invented a certain new and useful Improvement in Selecting Systems, of which the following is a full, clear, concise, and exact description.

This invention relates to selecting systems particularly adapted for use in printing telegraph systems of the direct or keyboard transmission type, although obviously not limited to such use.

One of the objects of this invention is to provide a system of the above type wherein the same electromagnetic devices may be utilized for transmitting and receiving selective current impulses.

Another object is to provide an improved system capable of very rapid operation by allowing the selecting and printing operations to take place simultaneously.

To the above ends a plurality of successively and coöperatively acting relays provide a succession of current impulses whose character is determined by local current control means or are affected by a remotely produced succession of impulses, and coöperate with selecting mechanism whereby the impulses formed or received effect the production of the desired results, such as the selecting and printing of characters. In combination with the above apparatus, means are provided whereby the printing of one character may proceed while the preliminary selections of the next succeeding character are taking place.

The above and other objects of this invention will be fully set forth in the following description and claims, and will be more readily understood by reference to the accompanying drawing in which the circuit arrangement is shown diagrammatically, some of the mechanism being shown in perspective to more clearly illustrate its method of operation.

The system of this invention is particularly adapted for use with the well known Baudot code of five positive and negative impulses, and preferably requires but a single line conductor with a ground return. When used as a transmitter, each key of a keyboard arranged like that of an ordinary typewriter, upon being depressed, among other things to be hereinafter described, operates a current control means by selectively transferring a characteristic combination of movable contacts, 1 to 5 inclusive, from the negative to the positive pole of a battery 6. The depression of the key likewise initiates the operation of a plurality of cut-off relays 11 to 15 inclusive, and connecting relays 21 to 25 inclusive, whereby a series of impulses is transmitted to the line and the local apparatus, the character of the impulses being determined by the location of the key contacts 1 to 5. A plurality of selecting relays 31 to 35 inclusive, forming a part of a selecting mechanism, are arranged to be actuated only on positive impulses, and these relays cause the energization of a plurality of corresponding selecting magnets 41 to 45 inclusive. These selecting magnets control the operation of mechanical selective apparatus whereby the desired character or operation is chosen. When used merely as a receiver, the line impulses effect the successive operation of the cut-off relays 11 to 15 and the connecting relays 21 to 25, the polarity thereof determining the actuation of the selecting relays 31 to 35, and consequently the selecting magnets 41 to 45.

A better understanding of the system can be obtained from a description of the selection of a specific character and the various operations, such as spacing, shifting, etc., both when acting as a combined printer and transmitter and merely as a receiving printer. Assume, for example, that the letter "F" is to be printed at the home station and impulses transmitted to effect its being also printed at a distant station, and that the combination of impulses required is plus, negative, plus, plus, negative. The depression of the "F" key of the keyboard will transfer key contacts 1, 3 and 4 from negative to positive battery. It will also transfer a pair of movable contacts 50 and 51 from fixed contacts 52 and 53 to fixed contacts 54 and 55 respectively, and a further set of contacts 56 will be closed. Contacts 50 and 51 are adapted to be thus transferred and contacts 56 to be thus closed upon the actuation of every key on the keyboard for purposes which will appear as the description progresses. The closing of contacts 56 completes a circuit from grounded battery 60, through a keyboard magnet 61, contacts 56, conductor 62, back contact and armature of cut-off relay 15, conductor 63, contacts 64

and 65 to ground. Keyboard magnet 61 becomes energized and, through the agency of holding mechanisms (not shown), retains the contacts 1, 3, 4, 50 and 51 in shifted position, and contacts 56 in closed relation until the completion of the selecting operations. The shifting of contact 50 from contact 52 to contact 54 brings a pair of polarized line and control relays 70 and 71 and the main line L into communication with the current impulse controlling means. It also arranges the local selecting apparatus under the influence of these polarized relays. The transfer of contact 51 from contact 53 to contact 55, interposes impulse lengthening relay 83 between the polarized relays 70 and 71 and the cut-off relays 11 to 15. If the armatures of polarized relays 70 and 71 acted directly on conductor 111, the cut-off relays 11 to 15 might be energized and remove the key contacts 1 to 5 from conductor 77 too soon to produce an impulse of the required duration. The time element introduced by the impulse lengthening relay 83 overcomes this difficulty.

The contacts controlled by the F character key all having been arranged and locked, as hereinbefore described, positive current flows from battery 6, contact 1, conductor 75, back contact and armature 116 of cut-off relay 11, conductors 76 and 77, contacts 54 and 50, and in parallel to line L and polarized relays 70 and 71. Preferably, in order to give the best results, the branch including the relays 70 and 71 is made approximately equal in resistance to that of line L and the apparatus therein at the distant station. This arrangement gives a good electrical balance to the two parallel branches traversed by the current impulses from battery 6. It will be assumed that polarized relay 70 responds to negative currents only, and that relay 71 responds to positive currents only. Therefore, current passing over the circuit just traced will cause relay 71 to attract both its armatures 80 and 81. Armature 80 completes a circuit from ground, through conductor 82, contacts 51 and 55, impulse lengthening relay 83 to grounded battery 84, causing relay 83 to attract its armature. Armature 81 completes a circuit from grounded battery 90, conductor 91, armature 92 and back contact of connecting relay 21, conductor 93, selecting relay 31, conductors 94 and 63, and contacts 64 and 65 to ground. This circuit causes the energization of selecting relay 31, which thereupon attracts its armatures 95 and 96. The attraction of armature 96 completes a circuit from grounded battery 100, selecting magnet 41, conductor 101, armature 96, conductor 102 and back contact and armature 103 of overlap relay 104 to ground. The attraction of armature 95 completes a holding circuit from grounded battery 105, armature, front contact and winding of selecting relay 31; conductors 94 and 63 and contacts 64 and 65 to ground. This holding circuit for the selecting relay 31 insures the complete energization of the corresponding selecting magnet 41, which assists in the selection of the desired character or operation and is finally deënergized as hereinafter described.

The energization of impulse lengthening relay 83 attracts its armature 110 and closes a circuit from ground, through conductor 111, armature 112 and back contact of connecting relay 21, cut-off relay 11 to battery 113 and ground, causing the energization of cut-off relay 11. Relay 11 thereupon attracts its armatures 115 and 116. Armature 115, upon being attracted, completes a holding circuit for cut-off relay 11, through the connecting relay 21, by the following path: grounded battery 113, cut-off relay 11, connecting relay 21, front contact and armature 115, conductors 94 and 63, and contacts 64 and 65 to ground. The energization of connecting relay 21 is, however, prevented at this time due to a shunt to ground through its back contact and armature 112, conductor 111, and armature 110 of impulse lengthening relay 83. The attraction of armature 116 of cut-off relay 11 severs the circuit hereinbefore traced, from battery 6, through contact 1 to line L and polarized relays 70 and 71, cutting off the first impulse and allowing relay 71 to release its armatures 80 and 81. The retraction of armature 80 opens the circuit for relay 83, which thereupon releases its armature 110, opening the ground shunt for the previously traced actuating and holding circuit through both cut-off relay 11 and connecting relay 21, which now becomes active, causing connecting relay 21 to pull up all its armatures. The retraction of armature 81 removes battery 90 from conductor 91.

The pulling up of all of the armatures of connecting relay 21 performs three functions: first, conductor 91 is extended through armature 92 and front contact of connecting relay 21 to conductor 120, and from thence by back contact and armature 121 of the second connecting relay 22, conductor 122, the second selecting relay 32, conductors 94 and 63, and contacts 64 and 65 to ground; second, conductor 111 is extended through armature 112 and its corresponding front contact of connecting relay 21, to conductor 125, and from thence by back contact and armature 126 of second connecting relay 22, through second cut-off relay 12 to grounded battery 127; and third, the pulling up of armature 130 joins the second key controlled contact 2 to line L and polarized relays 70 and 71, through the back contact and armature 131 of cut-off relay 12 and conductors 132 and 77. The second impulse of

the combination is now acting on line L and polarized relays 70 and 71 and, since for letter "F" this impulse is assumed to be negative, relay 70 only will attract its armature. The armature of relay 70, pulling up, completes an energizing circuit from ground, conductor 82, contacts 51 and 55, and impulse lengthening relay 83 to grounded battery 84. Relay 83 pulls up its armature 110 and furnishes a ground for the circuit previously traced which includes the second cut-off relay 12. Relay 12 attracts its armatures 131 and 135. It will be noted that, because the second key contact 2 was not transferred to positive to effect the energization of polarized relay 71, the circuit previously traced, which included the second selecting relay 32, was not completed and consequently relay 32 and its corresponding selecting magnet 42 remain inert.

The pulling up of armature 131 of cut-off relay 12 breaks the circuit from contact 2 to line L and the polarized relays 70 and 71, and interrupts the second impulse. The attraction of armature 135 closes a holding and actuating circuit from battery 127 for cut-off relay 12 and connecting relay 22 by way of conductors 94 and 63, and contacts 64 and 65 to ground. As in the first instance, however, this circuit does not become active until relay 83 is deënergized, when the ground shunt by way of armature 126, conductor 125, front contact and armature 112 of relay 21, conductor 111 and armature 110, is opened. When this shunt circuit is opened, due to breaking of the circuit including key contact 2 and polarized relay 70 at the armature 131 of cut-off relay 12, connecting relay 22 is operated. In pulling up its three armatures, connecting relay 22 extends conductors 120 and 125 on to the third cut-off and connecting relays 13 and 23, and joins key contact 3 to line L and polarized relays 70 and 71 precisely in the same manner as the first connecting relay 21 extended conductors 91 and 111. The third impulse has now started, and since it is assumed to be positive, polarized relay 71 is again energized. The attraction of armature 80 causes the energization of the third cut-off relay 13 and the attraction of armature 81 causes the energization of selecting relay 33 and selecting magnet 43 in the same manner as that explained in connection with the first impulse. Cut-off relay 13 terminates the third impulse and connecting relay 23 starts the fourth impulse and extends the circuit connections on to the fourth pair of relays 14 and 24. The fourth impulse is then terminated, the fifth impulse is initiated, and the control is extended to relays 15 and 25. Since we assumed that the fourth and fifth impulses were respectively positive and negative, selecting relay 34 and selecting magnet 44 become operative, while selecting relay 35 and selecting magnet 45 remain inactive. It is therefore readily apparent that selecting relays 31, 33 and 34 are locked up by holding circuits passing through contacts 64 and 65, and that the corresponding selecting magnets 41, 43 and 44 are locked up by holding circuits passing through armature 103 of overlap relay 104.

Before proceeding further with the explanation of the operation of the circuit, some of the details of the mechanical selecting apparatus and printing mechanism of the printer will be described in order to insure a clear understanding of the system as an entirety. The characters are arranged in a double row on a type wheel 150 which is mounted on a rotatable shaft 151. Shaft 151 is caused, by any suitable means, to normally tend to rotate in the direction of the arrow, but except under conditions to be presently described, is prevented from such rotation by a holding pawl (not shown) under the control of a starter magnet 152.

Arranged concentrically with shaft 151 and placed one above the other are five selecting disks 241 to 245 inclusive, associated respectively with the selecting magnets 41 to 45. Each of the disks 241 to 245 has a notched periphery and each is adapted to be moved through a small angle by its corresponding selecting magnet 41 to 45 through the agency of an arm 250 interconnecting the disk and its associated magnet armature 251. There is one notch in each of the disks corresponding to each vertical line of characters on the type wheel 150 and an additional notch for each operation such as spacing, line feeding, etc., which it is deemed desirable to have the apparatus perform. Each vertical line of notches corresponding to a vertical line of characters on the type wheel is provided with a pivoted L-shaped spring-tensioned type selecting lever 255 which is adapted, under certain conditions to be hereinafter explained, to engage with a stop arm 256 carried by the type wheel shaft 151. The vertical lines of notches representing other operations than type selections are also provided with spring-tensioned levers 257 adapted to control circuit connections, whereby the proper electromagnetic devices for performing the desired function are energized as hereinafter described. Thus, whenever one or more of the disks are moved by their corresponding magnets, a continuous vertical line of notches will be presented to one of the type or operation selecting levers and the spring thereof may, under conditions to be presently explained, force the inner end of the corresponding lever upwardly into a position to engage the rotating arm 256 or to cause the engagement of the proper circuit connections. The type wheel may thereby be arrested in a position to pre-

sent any desired character to the printing platen, or the proper electromagnetic devices may be set in motion to space, feed the paper, shift the type wheel, reset the paper carriage or accomplish any of the other desirable operations. The type selecting levers 255 and the operation selecting levers 257 are normally held out of engagement with the selecting disks 241 to 245, and, after the completion of a cycle of operations, are restored to their normal position by a pair of release levers 260. Release levers 260 have centrally projecting circular-shaped portions adapted to engage and depress the selecting levers under the tension of springs 261. When release magnets 262 are energized, in a manner to be hereinafter explained, however, the magnetic attraction overcomes the tension of springs 261 and the centrally projecting portions of the release levers 260 are elevated, releasing the selecting levers, one only of which, due to its coincidence with a line of notches in the selecting disks, may move a sufficient amount to perform its function.

Returning now to the sequence of operations, it will be readily understood that selecting disks 241, 243 and 244 have been moved by their corresponding selecting magnets 41, 43 and 44 and are held in this position, while disks 242 and 245 remain in normal position. The moving of disks 241, 243 and 244 has caused the presentation of a complete vertical row of notches before the proper type selecting lever 255 and the mechanism is ready to cause the stopping of the type wheel so that letter "F" may be presented to the paper and impressed thereon.

It will be noted that cut-off relay 15 and connecting relay 25, unlike the other cut-off and connecting relays, are provided each with only one armature. The armature of cut-off relay 15 pulling up opens the circuit previously traced through the keyboard holding magnet 61 and all of the actuated key contacts of the current control means are returned to normal. The consequent shifting of contact 50 from contact 54 to contact 52 opens the path for the negative impulse from battery 6, through contact 5, and the fifth impulse ceases. Thereupon relays 70 and 83 are deënergized, opening the ground shunt for the circuit from battery 265, including both cut-off relay 15 and connecting relay 25, and connecting relay 25 is energized. The attraction of the armature of connecting relay 25 closes a circuit from ground thereat, conductor 266, back contact and armature 267 of overlap relay 104, and in parallel through both release magnets 262 to grounded battery 268. Release magnets 262 thereupon cause the elevation of the centrally projecting portions of release levers 260, allowing the springs of the selecting levers 255 and 257 to start their respective levers in the performance of their function. Only one selecting lever, however, viz. that representing the character "F", has a continuous row of notches presented thereto and this lever only is allowed to raise its inwardly projecting end in position to engage the arm 256 when the shaft is allowed to rotate. The movement of one of the release levers 260 likewise causes contact 65 to be separated from contact 64 and to engage contact 275. This breaking and making of contacts performs two functions. First, it removes the ground connection from all of the holding circuits, hereinbefore traced, for the operated selecting relays 31 to 35 and their corresponding selecting magnets 41 to 45, allowing the relay armatures to return to normal. The armatures of the selecting magnets also tend to return to normal but the one selecting lever which has been forced into the line of notches prevents the return movement of the selecting disks and consequently of the armatures 251 until released after the printing or other operation has been performed, as hereinafter described. Second, it completes a circuit for the overlap relay 104 from grounded battery 276, overlap relay 104, conductor 277 and contacts 275 and 65 to ground. Overlap relay 104 thereupon attracts its three armatures 103, 267 and 285.

The pulling up of armature 103 provides a new ground connection for the energizing circuits of selecting relays 31 to 35 which heretofore included conductors 63 and 94. It also removes the ground connection for the holding circuits of selecting magnets 41 to 45 so that, until the overlap relay 104 is deënergized, as hereinafter described, even the energization of the selecting relays cannot cause the energization of the corresponding selecting magnets. It will, therefore, be readily apparent that the apparatus having once chosen and operated a selecting lever 255 or 257 to hold the selection mechanically, and the overlap relay 104 having become energized, the selecting relays 31 to 35 may be again actuated singly or in combination to select the next character or operation without interfering with the set up of the one preceding. When overlap relay 104 is deënergized and its armature 103 returns to its back contact, all of the selecting magnets 41 to 45 whose selecting relays 31 to 35 have been energized by this second set of impulses will be provided with an operating and holding circuit, as hereinbefore described. This overlapping of the selecting and completing of the various operations allows the attainment of a very high speed. The separation of armature 267 of overlap relay 104 from its back contact breaks the operating circuit previously traced for the release magnets 262. These magnets are, however, not deënergized at this time for, upon their energization, they established a

holding circuit for themselves from grounded battery 268, magnets 262, conductors 280, contact members 281, conductor 282, and back contact and armature of a clear-out relay 283 to ground. The function performed by a circuit prepared by the engagement of armature 267 with its front contact will be presently explained. The attraction of a third armature 285 closes a circuit from ground at armature of clear-out relay 283, conductors 282 and 286, armature 285 and front contact of overlap relay 104, conductor 287, starter magnet 152, conductor 289, closed contacts 290 and 291 and grounded battery 292. This causes the starter magnet 152 to withdraw the holding pawl heretofore referred to and shaft 151 begins to rotate in the direction of the arrow. This rotation continues until the stop arm 256 engages the elevated end of the "F" selecting lever 255, whereupon it ceases with the type wheel 150 in position to print the letter "F." The engagement of stop arm 256 and the "F" selecting lever 255 closes a circuit from ground, through printer magnet 296, operating winding of space-lock relay 297, clear-out relay 283 to grounded battery 298. Printer magnet 296, space-lock relay 297 and clear-out relay 283 now become active. Printer magnet 296, by means of a suitable platen (not shown), forces the paper against the type wheel printing the character. Space-lock relay 297, in pulling up its armatures, closes a divided circuit from grounded battery 300, through a spacer magnet 301 and its own holding winding 302. Spacer magnet 301 becomes active and, by means of suitable mechanisms (not shown) effects the spacing of the paper to present a clean surface to the printing platen. It also opens the holding branch of the parallel circuit just traced at the contact points 303, which causes the space-lock relay 297 and consequently spacer magnet 301 to become deënergized in case the contact between stop arm 256 and the selecting lever 255 has been broken, which is usually the case, because of the action of clear-out relay 283. It will be noted that the printing and paper spacing operations are initiated at the same time, but, due to the heavier and slower apparatus required to effect the spacing, the printing takes place first. The energization of clear-out relay 283 opens the previously traced holding circuit of the release magnets 262, whereupon their release levers 260, under the tension of springs 261, depress all of the type and operation selecting levers 255 and 257 including the one engaging stop arm 256. This allows the displaced disks and selecting magnet armatures to return to normal. Contacts 281 are returned to normal or separated condition, while contact 65 engages contact 64 and is separated from contact 275. The engagement between contacts 64 and 65 takes place prior to the separation of contacts 65 and 275 in order that any holding circuits which may have been formed by a subsequent selection of relays 31 to 35 may not be interrupted. The separation of contacts 65 and 275 deënergizes overlap relay 104, whose three armatures returning to normal again provides a ground connection for any selecting magnet whose corresponding relay has been energized, reestablishes a partial circuit for the release magnets 262 which may be completed at the armature of connecting relay 25, and opens the energizing circuit of starter magnet 152. The letter "F" has now been printed, a clean surface of paper provided for the next character, and the printer apparatus returned to normal ready to set up the next selection provided by selecting relays 31 to 35.

In case, for any reason, on the printing of a character the stop arm 256 on the type wheel shaft fails to engage the elevated selecting lever 255, the apparatus cannot be permanently tied up because of the failure of the clear-out relay. Under these conditions the subsequent pulling up of connecting relay 25 completes a circuit from ground at its armature, conductor 266, armature 267 and front contact of overlap relay 104, conductor 310 and clear-out relay 283 to grounded battery 298. Clear-out relay 283 is thereupon energized and performs the functions it should have performed at the printing of the last character and only one character has been lost, viz., that which was to have been printed when the stop arm 256 failed to engage selecting lever 255.

If it is desired to move the paper carriage without printing a character, as in the case of a space between words, a combination of impulses minus, minus, plus, minus and minus will be prepared. Only key contact 4 will be transferred from minus to plus and, as in the case of the production of letter "F", impulse lengthening relay 83 and polarized relays 70 and 71 assisted by cut-off relays 11 to 15 and connecting relays 21 to 25 will cause the production of the necessary five impulses to be imparted to line L and will also effect the actuation of the required selecting relays 31 to 35 and their corresponding selecting magnets 41 to 45, (in this case only the relay 34 and magnet 44). Selecting disk 244, only, will be moved, which will cause the presentation of a continuous row of notches before the operation selecting lever 257 adapted to effect the closing of space contacts 312. The energization of the last connecting relay 25 causes the operation of release levers 260 in the manner previously described, whereupon the space contacts 312 are closed by the lever 257 and the overlap relay 104 actuates its armatures.

Armature 103 connects its ground through the front contact of overlap relay 104, conductors 63 and 315, contacts 312, operating winding of space-lock relay 297 and clear-out relay 283 to grounded battery 298. Space-lock relay 297 effects the movement of the paper through spacer magnet 301, as previously described, and the action of clear-out relay 283 starts so soon and is completed so rapidly that the previously traced holding circuit for release magnets 262 and the operating circuit for the starter magnet 152 are broken before the starter magnet 152 can actuate its holding pawl, and consequently the type wheel shaft does not rotate.

In order to feed the paper from line to line, a combination of impulses is produced which will effect such a movement among disks 241 to 245 that the selecting lever 257 which controls contact 291 will be actuated. Upon the operation of release magnets 262, contact 291 will be separated from contact 290 and will engage contact 320. This change of contacts causes the energization of feed magnet 321 which controls mechanism (not shown) for feeding the paper and an armature contact 322 for completing a circuit for the clear-out relay 283. It also opens the circuit for the starter magnet 152 so that the type shaft will not rotate. This precaution, to prevent the rotation of the type wheel, is advisable in connection with the paper feeding, for the mechanism performing this function is comparatively heavy and sluggish and the clear-out relay 283 might not receive energizing current soon enough to cause the deënergization of release magnets 262 and starter magnet 152 before the starter magnet had released the type wheel shaft.

As previously pointed out, the characters appear in a double row on the type wheel, the upper row being normally in printing position. When it is desired to print some character from the lower row, a combination of impulses is first produced which will cause the lifting of the type wheel. Such a combination of impulses controls selecting disks to effect the closing of contacts 325, whereupon the shifting magnet 326 is energized. Magnet 326, by means of mechanism (not shown), lifts the type wheel and, by armature contact 327, establishes a holding circuit for itself from battery 330, contact 327, shift magnet 326 to ground by way of unshift contacts 331 and 332. The apparatus is cleared out and returned to normal in the same manner as heretofore described for the spacing operation without affecting this holding circuit. The type wheel is therefore held in shifted position and subsequent characters will be printed on the lower row until a combination of impulses is formed to unshift the wheel. These impulses cause the transfer of contact 332 from 331 to 333, opening the holding circuit for shift magnet 326 and closing a circuit for the clear-out relay 283. The paper carriage may be returned to the starting end of a line by causing the closing of contacts 335. This energizes the carriage return magnet 336, whereupon means (not shown) produce the required result. Carriage return magnet 336 provides itself with a holding circuit from battery 330 and armature contact 337, which circuit is broken at contact 338 when the paper carriage reaches the limit of its return travel.

When the impulses for operating the printer do not originate at the local keyboard, but are received from the line L, the operation is in all respects similar to that hereinbefore described except, of course, the key contacts 1 to 5, 50, 51 and 56 are undisturbed and the impulse lengthening relay 83 remains inactive. The incoming impulses directly energize polarized relay 70 or 71, depending upon whether they are negative or positive, secure the sequential operation of cut-off and connecting relays 11 to 15 and 21 to 25 respectively, and control the selecting relays 31 to 35 and selecting magnets 41 to 45.

What is claimed is:

1. A selecting system comprising a current control means, a transmission line, and a plurality of relays acting invariably in the same sequence coöperating with said means and associated with said line to produce a succession of impulses for said line or be operated by a succession of impulses over said line.

2. A selecting system comprising a selecting mechanism, current control means, a transmission line, and a plurality of relays acting invariably in the same sequence cooperating with said selecting mechanism and said means to produce selections from impulses over said line and to produce a succession of impulses for said line.

3. A selecting system comprising local current control means, a transmission line, a plurality of sequentially acting relays cooperating with said means and said line, and an electromagnet and apparatus made operative by current supplied by said means or said line and coöperating with said relays to cause said relays to produce a succession of current impulses for said line or operate through a succession of impulses over said line.

4. A selecting system comprising current-control means, a plurality of polarized relays controlled by said means, and a series of relays operating sequentially under the control of said polar relays and coöperating with said means to produce a selective succession of current impulses.

5. A selecting system comprising a plurality of type selecting levers from which

one is to be selected, means for effecting such selection, a plurality of key contacts to control the action of said means, a plurality of connecting relays successively causing said contacts to become active, and a plurality of cut-off relays successively causing said contacts to become inactive, said cut-off relays controlling the action of said connecting relays.

6. A selecting system comprising current control means, a pair of control relays connected in parallel, and a plurality of relays acting successively under the influence of said control relays for producing a succession of selective current impulses whose character is determined by said means.

7. A selecting system comprising a transmission line, a plurality of connecting relays acting successively to effect the transmission of current to said line, a plurality of cut-off relays acting successively to effect the interruption of the flow of current to said line, a polarized relay controlling the action of said connecting relays, and means for controlling the character of the current flowing in said line and the action of said polarized relay.

8. A selecting system comprising a selecting mechanism, a transmission line providing a succession of current impulses, a group of relays operating sequentially, and a second group of relays coöperating with the relays of the first group and each depending upon the operation of all of the preceding relays of its group for causing the line impulses to effect the operation of said mechanism.

9. A selecting system comprising a selecting mechanism, a group of relays operating sequentially, and a second group of relays all of which operate sequentially with the relays of the first group to control each selective operation of said mechanism upon the receipt of all combinations of series of current impulses.

10. In a selecting system the combination of a plurality of members from which one is to be selected, selecting means for effecting the selection of such member, clear-out means for causing the restoration of said selecting means, circuit connections for said clear-out means controlled by said member, and emergency circuit connections for said clear-out means independent of said member.

11. A selecting system comprising current control means, a plurality of sequentially acting relays coöperating with said means to produce a succession of current impulses, and means coöperating with said relays to lengthen the duration of the impulses so produced.

12. A selecting system comprising a selecting mechanism, a transmission line providing a succession of current impulses, a plurality of relays acting successively and coöperating with said mechanism and electromagnetic means coöperating with said relays to lengthen the duration of the line current impulses.

In witness whereof, I hereunto subscribe my name this 17th day of March A. D., 1914.

AMOS F. DIXON.

Witnesses:
E. EDLER,
NANON E. TUTHILL.