

Feb. 1, 1944.

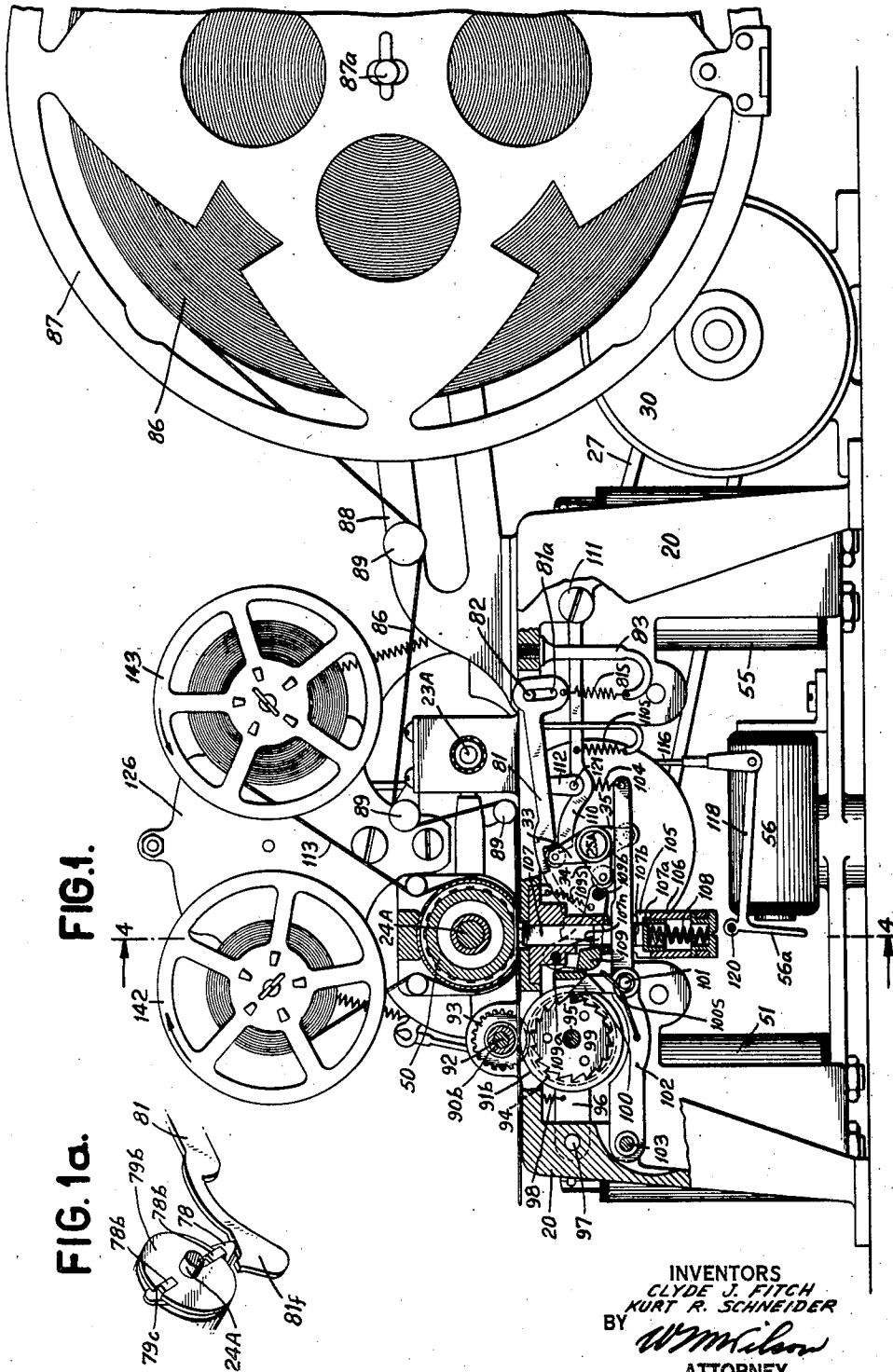
C. J. FITCH ET AL

2,340,803

TELEGRAPH PRINTER

Original Filed Aug. 24, 1940

6 Sheets-Sheet 1



Feb. 1, 1944.

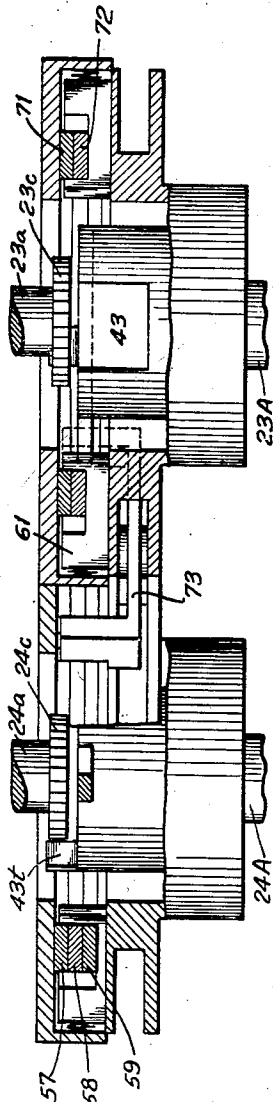
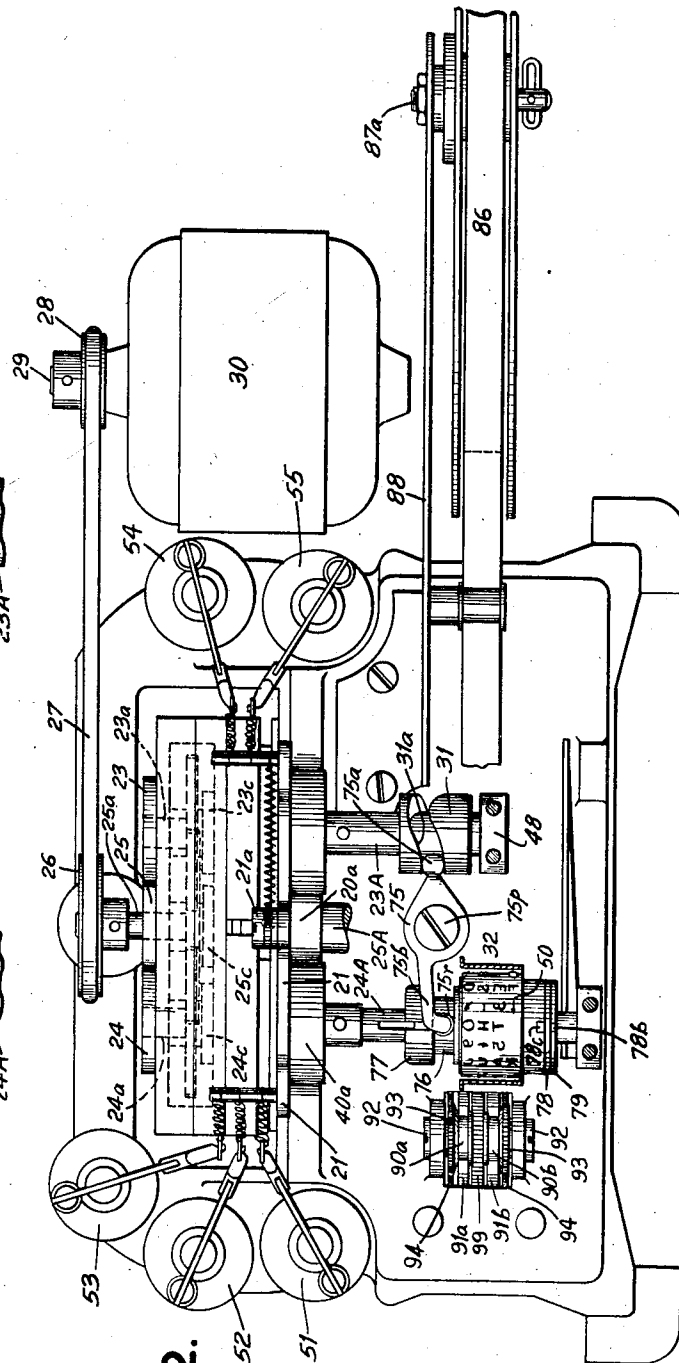
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TELEGRAPH PRINTER

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6 Sheets-Sheet 2



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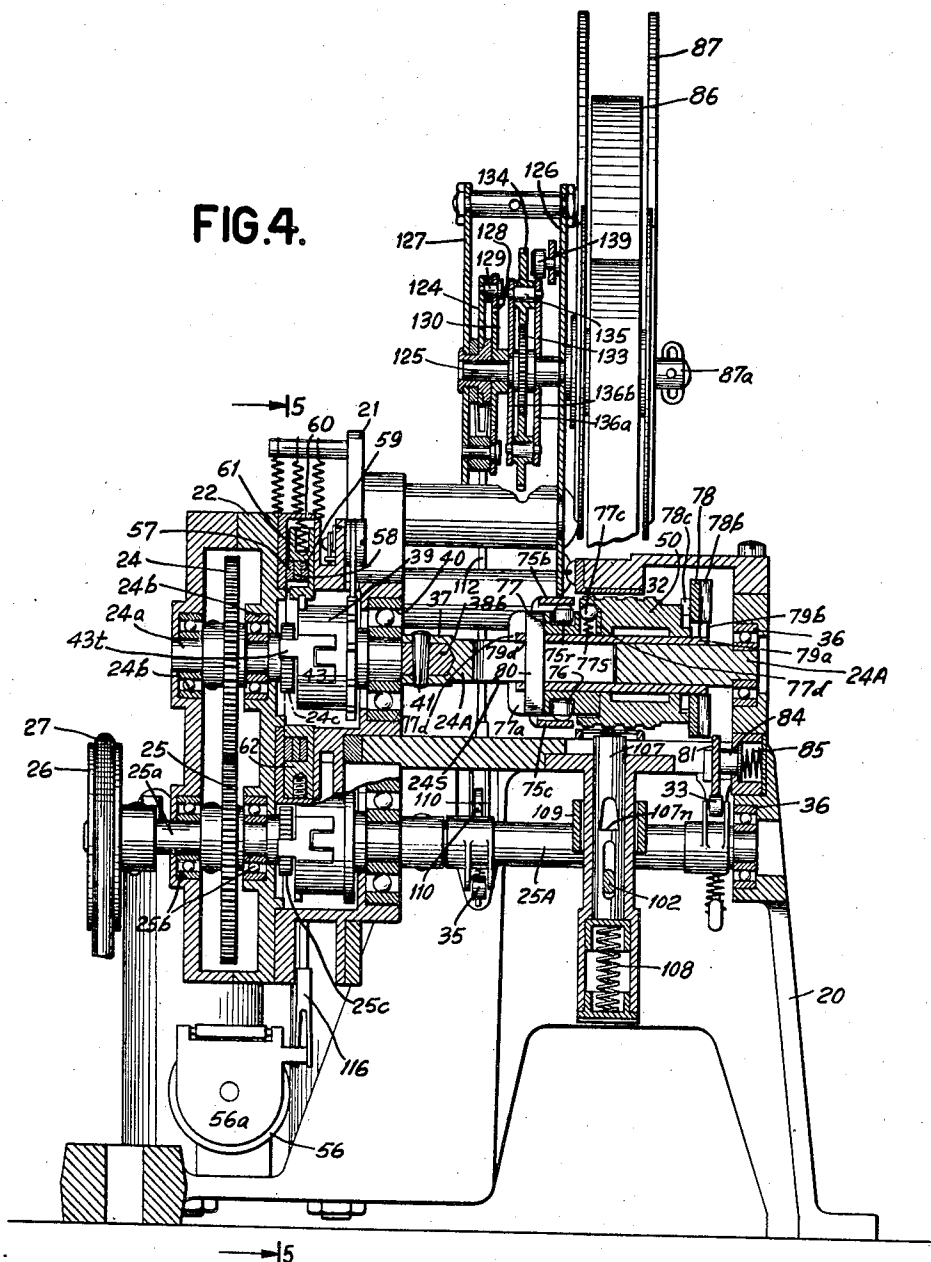
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6 Sheets-Sheet 3

FIG. 4.



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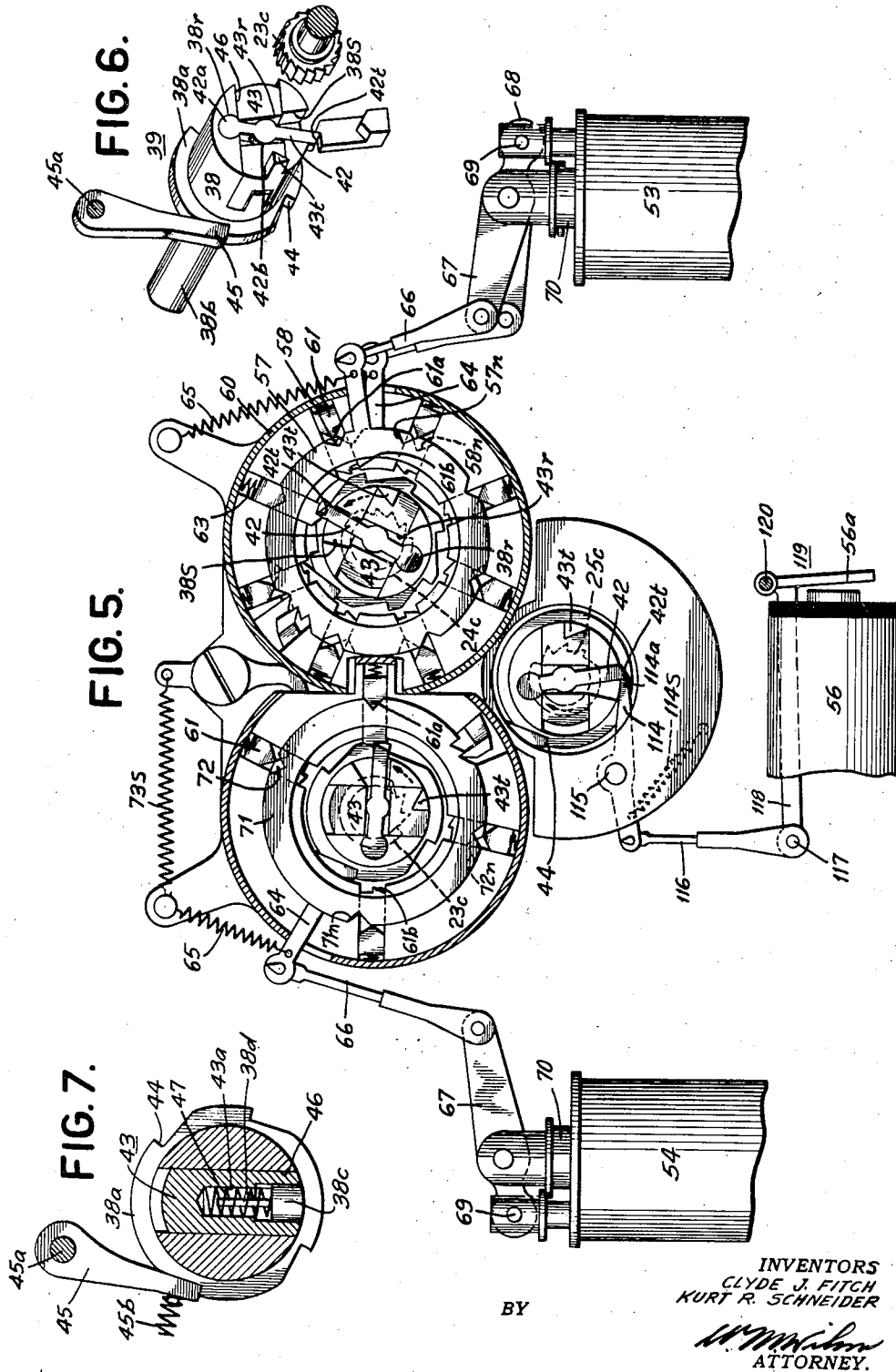
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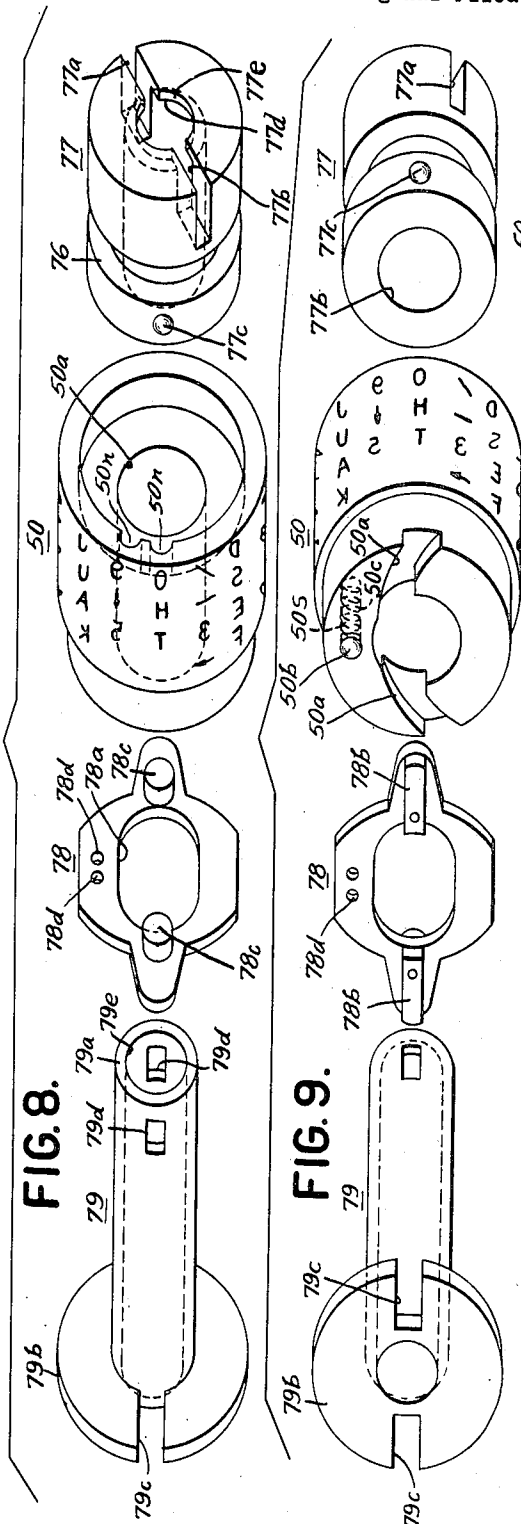
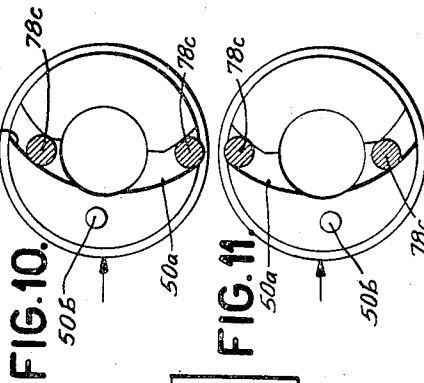
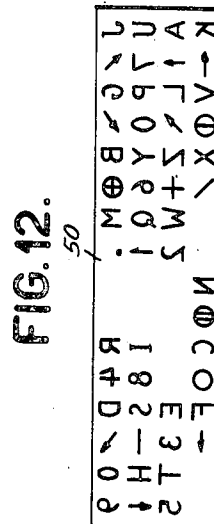
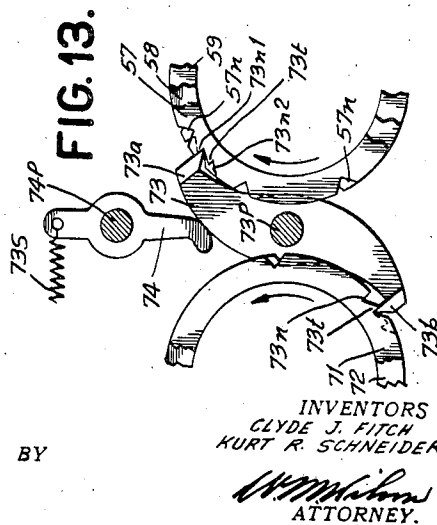
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FIG. 14.

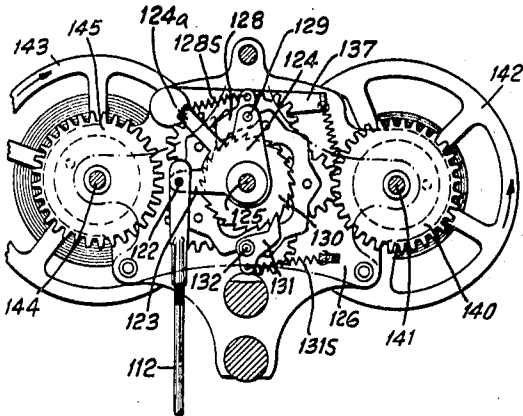


FIG. 15.

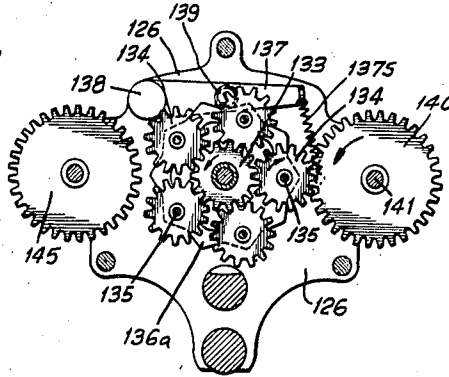


FIG. 16.

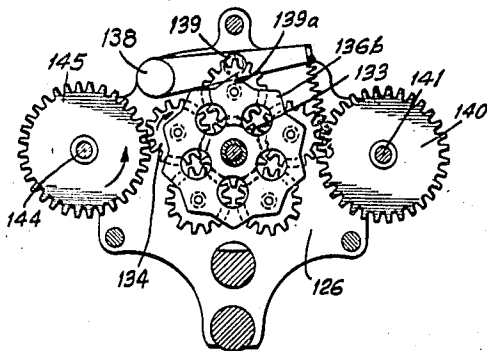


FIG. 17.

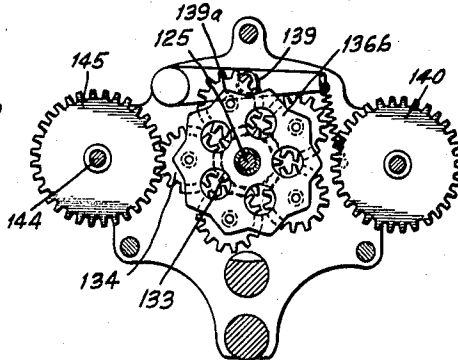
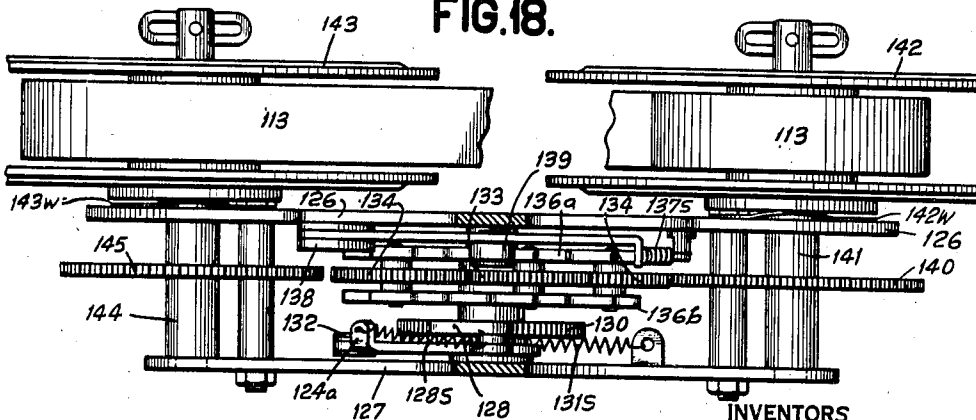


FIG. 18.



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UNITED STATES PATENT OFFICE

2,340,803

TELEGRAPH PRINTER

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Business Machines Corporation, New York,
N. Y., a corporation of New York

Original application August 24, 1940, Serial No.
354,035. Divided and this application Novem-
ber 18, 1941, Serial No. 419,572

6 Claims. (Cl. 197-49)

The present invention relates to printing telegraphy and more particularly to receiving devices for printing telegraphy wherein a message is recorded by impressing characters upon a tape.

The invention embodies a typewheel, in combination with novel shift mechanism, and is a division of applicants' copending application Serial No. 354,035, filed August 24, 1940.

One of the objects of the present invention is to provide in combination with a telegraph receiver including a typewheel, novel means for producing shift of the typewheel.

A further object is to provide novel shift mechanism comprising means movable radially of a typewheel, and means for converting said radial movement into rotative movement of the typewheel in one direction or the other.

Other objects of the invention will be pointed out in the following description and claims and illustrated in the accompanying drawings, which disclose, by way of example, the principle of the invention and the best mode, which has been contemplated, of applying that principle.

In the drawings:

Fig. 1 is a front elevation, partly in section, of an embodiment of the present invention.

Fig. 1a is a detail view illustrating the operation of elements of the shift control mechanism.

Fig. 2 is a plan view of the device of Fig. 1, with the ribbon feeding mechanism omitted.

Fig. 3 is a partial plan view of the device of Fig. 2 illustrating, on an enlarged scale, the two groups of permutation rings comprising the selector mechanism.

Fig. 4 is a sectional view, on an enlarged scale, taken on the line 4-4 of Fig. 1.

Fig. 5 is a sectional view, on an enlarged scale, taken on the line 5-5 of Fig. 4.

Fig. 6 is an exploded view illustrating the construction of one of the selector clutch mechanisms.

Fig. 7 is a sectional view illustrating details of construction of the clutch mechanism of Fig. 6.

Fig. 8 is an exploded view illustrating the construction of the elements comprising the shift mechanism.

Fig. 9 is a view similar to Fig. 8, at a different perspective, illustrating the opposite sides of the elements comprising the shift mechanism.

Fig. 10 is a diagrammatic view illustrating the manner of rotation of the typewheel during shift.

Fig. 11 is a view similar to Fig. 10 illustrating the typewheel in a shifted position.

Fig. 12 is a development of the printing surface of the typewheel.

Fig. 13 is a detail view illustrating the construction of the permutation ring interlock and release mechanism.

Fig. 14 is a side elevation illustrating the construction of the ribbon feed and ribbon reversal mechanism.

Fig. 15 is a view similar to Fig. 14, with parts omitted, illustrating the gear drive of the ribbon feed mechanism.

Fig. 16 is a view similar to Fig. 15 illustrating the position of a star wheel just prior to ribbon reversal.

Fig. 17 is a view similar to Fig. 16 illustrating the position of the star wheel just after reversal of the ribbon feed mechanism.

Fig. 18 is a plan view on an enlarged scale illustrating the mounting of the ribbon feed and reversal mechanism.

Referring to the drawings, and more particularly to Figs. 1, 2 and 4, the printer mechanism comprises a supporting frame 20 having a vertically extending lug 20a to which is attached a plate 21 by a slotted screw 21a. Fastened to plate 21 by suitable means (not shown) is a casing including a three-section gear box 22 housing the gears 23, 24 and 25. Gears 23 and 24 are suspended above and in mesh with gear 25 (Fig. 2) by means of shafts 23a and 24a to which the gears 23 and 24 are, respectively, attached. Shaft 24a is mounted in ball bearings 24b, 24b carried by the walls of the gear box (Fig. 4), the shaft 24a carrying at one end thereof the gear 24c. Shaft 23 is similarly mounted in ball bearings carried by its section of the gear box and carries a gear 23c at one end thereof (Figs. 2 and 3).

Gear 25 which, as is seen from Figs. 2 and 4, meshes with both gears 23 and 24 is attached to the main drive shaft 25a which is mounted in ball bearings 25b, 25b supported in its section of the housing, shaft 25a carrying at one end thereof a gear 25c (Fig. 4). Fastened to shaft 25a at the other end thereof, is a pulley 26 driven by a belt 27 which in turn is driven by a pulley 28 fastened to the shaft 29 (Fig. 2) of motor 30. Gears 23 and 24 are of equal diameter which is so chosen with respect to the diameter of gear 25 as to rotate gears 23 and 24 at 1200 R. P. M. upon rotation of gear 25 at the rate of 900 R. P. M. By means of this difference in speed of rotation, the typewheel may be completely set before other functions are performed, as will be pointed out in detail later.

In axial alignment with the shaft 23a is a shaft 23A (Fig. 2) carrying a generally cylindrical ele-

ment 31 having a helical shaped cam groove 31a formed in the outer periphery thereof.

In axial alignment with the shaft 24a is a shaft 24A (Figs. 2 and 4) carrying the composite type-wheel 32, mounted on shaft 24A for rotation therewith and axial movement with respect thereto, as will be described presently.

In axial alignment with shaft 25a is a shaft 25A carrying the shift operating cam 33 (Figs. 1 and 4), print hammer operating cam 34 (Fig. 1) and the ribbon feed and reversal mechanism operating cam 35 (Figs. 1 and 4).

Shaft 24A is supported at one end in the ball bearing 36 (Fig. 4). The other end of shaft 24A terminates in a hollowed out portion 37 into which is inserted the shaft portion 38b (Figs. 4 and 6) of a clutch mechanism 39. Shaft portion 38b is supported by a roller bearing 40 (Fig. 4) enclosed in housing 40a (Fig. 2) and is fastened to shaft 24A by a pin 41 (Fig. 4). Clutch 39 is provided with a dog lift lever 42 (Fig. 6) controlled by stop members acting in conjunction with the permutation rings of the selector mechanism, in a manner to be described presently. By control of the dog lift lever 42, the clutch 39 may be stopped in various chosen rotative positions and a tooth 43t of the clutch mechanism will thereupon be disconnected from the driving gear 24c (similar to 23c, Fig. 6), all as described presently. Upon release of the dog lift lever 42, as will be presently described, the tooth 43t moves into engagement with the driving gear 24c (Fig. 5) whereby the clutch 39 will be rotated until lever 42 is again engaged by a permutation ring controlled stop member thereby positioning the clutch 39 and shaft 24A in accordance with the setting of the permutation rings which control the lever 42 of that clutch 39 pertaining to shaft 24A.

Clutch 39 pertaining to shaft 24A is an eight position clutch, generally of the type as fully described in the Patent No. 2,206,646 granted to Kurt R. Schneider, July 2, 1940, and comprising a cylindrical member 38 provided in this particular clutch with a series of eight notches such as 44 (Fig. 6) formed in a flange member 38a integral with member 38. The shaft portion 38b previously referred to, which is integral with member 38, extends into the hollowed portion 37 (Fig. 4) of shaft 24A and is attached thereto, as described above. A pawl member 45 is pivoted at 45a and is urged by a spring element 45b (Fig. 7) into engagement with flange member 38a to cooperate with a notch 44 and thus prevent back rotation of the clutch when stopped in any one of its eight rotative positions.

As is seen from Figs. 6 and 7, the face of member 38 adjacent to its gear 24c (similar to 23c, shown) is provided with a channel 46 in which is slidably mounted dog member 43 having the tooth 43t mentioned above. A support member 38c, integral with member 38, extends part way into channel 46 and is provided with a reduced portion 38d axially supporting a cylindrical spring member 47 located in a bored portion 43a formed in dog member 43, the spring member 47 constantly urging the member 43 in such a direction (to the right, in Fig. 6) so as to attempt to engage tooth 43t with the teeth of its gear 24c, similar to 23c (Fig. 6).

Dog lift lever 42, described above, extends crosswise of dog member 43 and has a generally ball-shaped end 42a (Fig. 6) fitted into a socket shaped recess 38r formed in the face of block 38 adjacent channel 46. A center portion 42b of

lever 42 engages the sides of a recess 43r formed crosswise of dog member 43; this center portion being rounded to provide rolling engagement between the sides of recess 43r and the portion 42b. The opposite end of the lever 42 is cut diagonally to form a tooth portion 42t projecting beyond the circumference of member 38. A slot 38s is formed in the face of member 38, generally at right angles to channel 46 to permit oscillation of lever 42, with respect to 38, about the ball and socket members 42a and 38r, respectively, when 42t is engaged by a stop as described later. This oscillatory movement is transferred to the dog member 43 to produce longitudinal movement thereof, against the force of spring 47 to compress the same.

The tooth shaped end 42t is held in the position as illustrated in Fig. 5, against the force of spring 47 (Fig. 7) and upon release of its tooth shaped end, lever 42 will permit dog 43 to be moved by spring 47 so as to engage tooth 43t and gear 24c, as described presently.

When tooth 43t is released upon a change in setting of the members of the permutation unit, as described later, the dog member 43 will engage its tooth 43t with gear 24c and lever 42 and member 38 will be rotated by means of gear 24c in the direction as indicated by the dash arrows in Fig. 5. Upon engagement of end 42t and a stop member controlled by the elements of the permutation unit, as described presently, the lever will be relatively moved, with respect to 38, about its ball and socket connection to the position as shown in Fig. 5, thereby disconnecting tooth 43t and gear 24c.

Back rotation of element 38 is prevented by engagement of pawl 45 with one of the eight notches 44 formed in the flange 38a of this particular clutch, thereby stopping the clutch at one of eight predetermined positions when the clutch is controlled in the novel manner as presently described.

Shaft 23A is supported at one end by a ball bearing similar to bearing 36 of shaft 24A and contained in housing 48 (Fig. 2). The other end of shaft 23A terminates in a hollowed out portion, similar to portion 37 of shaft 24A, into which is inserted a shaft portion 38b of a clutch 39, similar to that provided for shaft 24A with the exception that the flange member 38a of this clutch is provided (Figs. 5 and 7) with four notches 44 only, to prevent back rotation of this clutch member from any one of the four stop positions.

Shaft 25A is similarly supported at one end by a ball bearing 36 (Fig. 4) and is provided with a hollowed out portion similar to portion 37 of shaft 24A, into which projects a shaft portion 38b of a clutch 39 associated therewith, and similar to clutch 39 of shaft 24A, with the exception that only one notch 44 is provided in its flange member 38a to prevent back rotation at one stop position only of shaft 25A, as described presently.

Typewheel positioning

Novel means are now provided for positioning a typewheel character carrying element 50 of the composite typewheel 32. The positioning of typewheel element 50 includes three separate operations, namely, rotatively positioning the typewheel element, axially positioning the typewheel element and zone positioning of the typewheel element, which zone positioning comprises the shift function. These three operations will now be described in detail.

Rotative positioning of the typewheel

As illustrated in Fig. 2, a plurality of five magnets is provided, each responsive to one element of a 5-unit code signal. Three of the magnets 51, 52 and 53, respectively, are utilized to control permutation ring members which in turn regulate the rotative positioning of the typewheel, and the remaining two magnets 54 and 55 control the axial positioning of the typewheel, all as described presently. A magnet 56 (Figs. 4 and 5) is connected in the return line of the other five magnets and is operated upon energization of any one of these magnets, to produce tape feed, ribbon feed, printing and zone positioning, all as described presently. It is deemed obvious that magnet 56 may be independently connected for operation by a separate code signal component such as the stop component, if sequential code signal components are utilized.

Referring to Figs. 3, 4 and 5, means entering into a novel combination with the respective clutches 39 are disclosed therein. That particular clutch 39 which controls the rotative positioning of shaft 24A and therefore the rotative positioning of the typewheel 50 is shown as surrounded by a plurality of three permutation selector rings 57, 58 and 59, respectively, contained within the casing 60, mounted on the side of gear box 22. These rings are maintained in position surrounding the clutch 39, by means of casing 60 and eight clutch stops 61, as shown. Each of the stops 61 is formed as a yoke having a toothed portion 61a at one end thereof bearing against the outer periphery of the three rings and another portion 61b comprising a laterally extending stop cooperating with the toothed end 42t of lever 42 when the particular stop is selected and permitted to operate by means of the different settings of the permutation rings. The eight stops are uniformly, circumferentially distributed about the rings, as disclosed in Fig. 5. Each of these stops is mounted for radial movement and is constantly urged towards the center of the rings and against the outer peripheries of the rings, by means of individual springs 63. Each of the three permutation rings is held against bodily lateral movement between the solid end of casing 60 and the mid-portion of the stops 61, the rings riding on support 62 (Fig. 4). Each of the rings 57, 58 and 59 may be rotated by means of an arm 64 (Fig. 5) extending outwardly from casing 60 and connected to an individual tension spring 65 which constantly holds the corresponding ring in one of two rotary positions. Each of the arms 64 is connected by a link 66 to one end of a lever 67 which is pivoted at its other end 68 to a point 69 and connected near its mid-point to a movable core 70 controlled by the corresponding magnet; the rings 57, 58 and 59 being thus connected to the magnets 53, 52 and 51, respectively. Upon energization of any one of the magnets 51, 52 or 53, the corresponding ring will be rotated against the pull of its associated spring 65 and will assume its second rotary position.

As shown (Fig. 4), there are three permutation rings encircling that clutch 39 which controls the shaft 24A and since each ring may be operated to any one of two positions, a total of eight permutation positions may be obtained. Each of the three rings is provided with a series of eight notches, each one respectively of the series of the respective notches being designated as 57n, 58n and 59n, which notches are formed in the outer periphery of the corresponding ring,

the notches on the respective rings being so positioned relatively to each other that a plurality of three notches, and three only, one only on each of the respective rings, will be aligned for each of the eight permutation positions of the three rings and such alignment occurs directly beneath one of the resiliently operated stops 61. The toothed portion 61a of the particular stop selected, will enter the three respective aligned notches 57n, 58n and 59n in the three rings, under the influence of its spring 63, while all of the remaining stops are held in their most remote radial position by the outer peripheries of the three rings. A different stop is, therefore, permitted to move radially inward for each of the eight permutation positions of the three rings.

Assuming that this clutch 39 was previously stopped in one position by engagement between a stop element 61 and its lever 42; upon reception of a different signal permutation which energizes at least one of the magnets 51, 52 or 53, one of the rings 57, 58 or 59 will be rotated to its second rotative position and the previously rotated rings will be reset to the first rotative position by means of their respective springs 65. Upon rotation of any one ring to its second position, a different set of notches on the respective rings will be aligned and another stop member will be newly set, and the previously set stop member 61 will be cammed out of its associated group of notches so that the lever 42 will be released from the previously set stop member thereby permitting the dog 43 to move its tooth 43t into engagement with gear 24c. The clutch 39 will thereupon be rotated until tooth 42t of lever 42 engages the laterally extending end 61b of the newly set stop member 61 which has entered the last three aligned notches of the rings 57, 58 and 59. Upon this engagement of tooth 42t and the chosen stop member 61, the dog member 43 is operated against the force of spring 47, its tooth 43t is disengaged from the gear 24c and the clutch is thereupon stopped in its new position. One of the eight notches 44 formed in the flange 38a of this clutch, will be engaged by its pawl 45 under the urge of spring 45b to thereby prevent back rotation of clutch 39. By this rotation of clutch 39, shaft 24A and typewheel member 50 will be rotatively positioned in accordance with the particular relative setting of the permutation rings 57, 58 and 59, or in other words, in accordance with the particular permutation of three of the code signal elements received. In this manner, any one of eight circumferential positions of the typewheel can be selected. As is seen from the development of the typewheel 50 (Fig. 12), there are sixteen rotative or circumferential positions. Since only eight equally spaced circumferential positions are chosen by the three permutation ring elements 57, 58 and 59, additional means must be provided for selecting the intermediate zone positions between each of the chosen eight rotative positions. As is seen from Fig. 12, the circumferential positions in each ring of characters are divided alternately into figures and letters characters, so that selection of the respective zone positions corresponds to a shift of the typewheel. The manner and mechanism for zone positioning or shifting of the typewheel will be described presently.

Axial positioning of the typewheel

The two magnets 54 and 55 (Fig. 2) and the associated permutation ring members 71 and 72 (Figs. 3 and 5), which rings are similar to rings

57, 58 and 59, described above, control the axial positioning of the typewheel. Magnets 54 and 55 control, respectively, the rotative positions of the permutation rings 71 and 72 in the same manner as magnets 53, 52 and 51 control, respectively, the rotative positioning of rings 57, 58 and 59, all as described above. Since each of the permutation rings 71 and 72 may be positioned in each of two positions, there is a total of four permutation positions possible for these two rings and one of the four stop members 61 (Fig. 5), distributed as illustrated in Fig. 5, will be aligned with a set of two notches 71n, 72n in the respective rings 71 and 72, in each of the four permutation positions of rings 71 and 72, so that the particular clutch 39 controlled by rings 71 and 72 and controlling the rotation of shaft 23A will be stopped in any one of four different rotative positions, in the same manner as described in detail with respect to shaft 24A which can be stopped in any one of its eight rotative positions. A plurality of four notches 44 (Fig. 7) cooperates with a pawl 45 to prevent back rotation in any one of these four positions.

It is to be particularly noted, that those ones of the magnets 51 to 55, inclusive, which are energized in accordance with a particular received code permutation of signal elements, do not remain energized until reception of the next character signal but these selected magnets are only momentarily energized. Consequently, the permutation selector rings must be locked in position after the momentary energization of the selected magnets, in order to prevent the springs 65 from returning the rings to their initial positions. The locking means must also be releasable in order to set the rings in accordance with a sequentially received code signal. Novel means are therefore provided for interlocking the permutation rings pertaining to the different shafts and for releasing the selectively set rings when the succeeding code signals differ.

Referring to Figs. 3, 5 and 13, an interlocking pawl 73 is pivoted at 73p and is urged in a clockwise direction by lever 74 pivoted at 74p and biased into engagement with pawl 73 by means of a spring 73s. Pawl 73 is generally S-shaped and has a tooth 73a at one end which bears on the peripheries of rings 57, 58 and 59 and has a tooth 73b at the other end which bears on the peripheries of rings 71 and 72. Each of the five permutation rings has two special notches 73n1, 73n2, formed in its outer periphery, in addition to the regular notches previously described, one of these special notches, 73n1, for example, cooperating with a pawl tooth in the initial or first position of the permutation ring and the other, 73n2, cooperating with a pawl tooth in the new or second position of the ring. The arrows in Fig. 13, indicate the direction in which the respective members of the two groups of rings are rotated upon energization of the corresponding magnet; for example, ring 57 is shown in its initial or first position and will be pulled clockwise to its second position, while ring 58 has already been pulled to its second position. Notches 73n1 and 73n2 are separated by a tooth element 73t which does not extend to the outer circumference of the ring so that when any one of the five rings is rotated from its first to its second position, the interlocking pawl 73 will be cammed counterclockwise to clear the teeth 73t to unlock the rings and to thereby permit those rings whose magnets are not energized, to return to the first position under the control of the respective springs 65 and those

rings pertaining to the magnets which are energized are permitted to remain in or to be moved to the second position whereupon the pawl teeth 73a and 73b will drop into position to lock the rings in their newly assumed positions.

With a 5-unit code, the following situation may arise. A character signal received, may require the positioning of rings 58 and 71 for example in their second positions and rings 57, 59 and 72 in their first positions while a sequentially received character signal may call for ring 71 in its second position and all of the other rings in their first positions. Under the assumed conditions, none of the rings is to be moved from its first to its second position by the sequentially received signal. In order to insure release of the rings under the conditions assumed, the rings are so mounted and operated as to overrun their finally assumed second position, when operated by the respective magnets. Thus, in the example chosen, although ring 71 is already in its second position, it will, upon reception of the sequential signal, be oscillated past this finally assumed second position a slight amount and tooth 73b of the pawl will be cammed counterclockwise (Fig. 13) and since the teeth 73t do not extend to the outer periphery tooth 73a will no longer hold ring 58 which returns to its initial position under the control of its spring 65 so that all of the rings except ring 71 will assume their original positions.

It is seen therefore, that upon oscillation of any one of the rings 57, 58 or 59, that the previously selected stop 61 will be cammed out of its cooperating notches to release lever 42 of the corresponding clutch and will allow the clutch to interconnect shafts 24a and 24A for simultaneous rotation until lever 42 is again halted by the newly selected stop. Similarly, oscillation of any one of the rings 71 or 72 will allow shafts 23a and 23A to be connected for rotation to a new position.

As is seen in Fig. 2, the rotative positioning of the shaft 23A under control of its four position clutch rotates the cam member 31 to any one of four different rotative positions. Upon such rotation, cam slot 31a will be rotated so that the sides of the slot can be utilized to produce movement axially of shaft 23A.

A forked lever 75 (Fig. 2) pivoted at 75p, has a ball-shaped member 75a at one end of the single arm thereof which ball rides in cam groove 31a to thereby rotate the lever 75 in a horizontal plane about pivot 75p upon rotation of shaft 23A. The forked ends 75b and 75c (Fig. 4) of lever 75 are provided with rollers 75r which engage the sides of a circumferentially extending groove 76 (Fig. 2) formed in a cylindrical member 77 comprising an element of the composite typewheel 32. Upon rotation of shaft 23A to assume any one of its four rotative positions under the control of the permutation rings 71 and 72, the cam slot 31a will move the ball-shaped member 75a, to four different positions axially of shaft 23A, to thereby oscillate lever 75 about pivot 75p to move the arms 75b and 75c laterally whereby the member 77 and typewheel element 50 are moved axially of shaft 24A to four different positions. The construction of the composite typewheel proper 50 will now be described in detail.

Referring to Figs. 2, 4, 8, 9, 10 and 11, the novel composite typewheel is shown as comprising the cylindrical member 77, mentioned above, the typewheel element proper 50, previously described, typewheel zone selection operating member 78 and sleeve member 79, all mounted on

shaft 24A. Sleeve member 79 comprises a hollowed cylindrical portion 79a provided with a flange 79b at one end thereof, having a pair of diametrically aligned slots 79c extending radially inward from the outer periphery of the flange. A pair of diametrically opposed, rectangular apertures 79d (Fig. 8) are cut through the wall of the cylindrical member 79a adjacent the opposite end thereof, from the outer periphery to the inner bore 79e.

Zone selection operating member 78 is provided with an elongated, generally elliptical opening 78a in the center thereof whereby member 78 can be mounted on the cylindrical portion 79a of member 79 for rotation therewith but at the same time be free to move radially thereof under the control of zone selecting mechanism to be described later. One face of member 78 (Fig. 9) is provided with a pair of diametrically opposed projecting lugs 78b, 78b which fit into and slide against the sides of slots 79c when member 78 is mounted in position on member 79, as illustrated in Figs. 2 and 4. The opposite face of member 78 is provided with a pair of diametrically opposed cylindrical lugs 78c, 78c (Fig. 8) which project respectively into each of the eccentric slots 50a (Fig. 9) formed in the face of the typewheel element 50 whereby the typewheel is rotated upon operation of member 78, as described presently. A pair of holes 78d, 78d are formed in one side member of member 78 which holes coact with a ball member 50b (Fig. 9) in an opening 50c formed in typewheel element 50, said ball member being urged toward the holes 78d by means of a helical spring member 50s, to maintain the member 78 in either one of the positions to which it is operated, it being noted that the holes 78d are of smaller diameter than ball 50b, so that only a portion of the ball enters one of the openings 78d, and upon movement of member 78, radially of member 79a, as described presently, the ball 50b is disengaged from one hole 78d and subsequently engaged with the other. The typewheel 50, as previously described, has a plurality of letters and figures formed in the outer periphery thereof, the sixteen axially extending rows comprising alternately figures and letters, as illustrated in development in Fig. 12, so that, upon rotation of the typewheel element to any one of the eight rotary positions produced by rotation of shaft 24A, as previously described, either a row of figures or a row of letters is selected and shift is produced by operation of member 78 to rotate the typewheel one sixteenth of a revolution, as described presently. A pair of rounded notches 50n, 50n are provided on the inner periphery of the typewheel element 50 which coact with a spring urged ball element 77c (Figs. 4 and 8) to stop the typewheel element in either one of two alternate positions. The typewheel 50 is provided with an axial bore 50a so that this element can be mounted on the cylindrical member 79a, as disclosed in Fig. 4.

Member 77 is provided with a pair of diametrically opposed slots 77a extending radially from the outer periphery thereof to the inner bore 77b, into which is inserted the cylindrical portion 79a of member 79, as shown in Fig. 4, until cylindrical portion 79a abuts end 77d provided with an opening 77e for shaft 24A. The ball shaped member 77c, previously mentioned, is located in an opening 77d (Fig. 4) and is spring urged by a helical spring 77s into engagement with one or the other of the openings 50n (Fig. 8) of the typewheel 50, depending upon the zone position

of the typewheel produced by the shift function. A rectangular pin 80 (Fig. 4), is inserted into one of the slots 77a of member 77 and passes through the rectangular apertures 79d of member 79 and through a rectangular slot 24S cut axially of shaft 24A (Fig. 4), for movement axially therein and into the other slot 77a of member 77, to connect the members 77 and 79 to shaft 24A for rotation therewith and to permit movement axially thereof. Typewheel 50 is locked to member 77 by means of spring 77s (Fig. 4) and ball 77c, for rotation therewith upon rotation thereof and moves axially of shaft 24A upon axial movement of members 77 and 79. Member 78 is held between flange 79b on one side and typewheel 50 on the other, but in one axial position of the typewheel assembly, the member 78 is moved radially, by means to be described presently, to thereby rotate the typewheel one sixteenth of a revolution to produce shift of the typewheel element.

Zone positioning or shift

Novel means are now provided for producing zone positioning or shift of the typewheel. As described above, in one axial position of the typewheel element, zone positioning, operating member 78 is so located as to be operated radially, to thereby shift the typewheel element one sixteenth of a revolution, which operation comprises the shift of the typewheel from letters to figures or vice versa, since, as is seen in Fig. 12, the axially extending rows of characters are alternately letters and figures.

Shaft 25A is provided with the operating cam member 33 adjacent one end thereof (Fig. 4) which rotates in the same plane as lever 81 (Fig. 1) having an elongated aperture 81a formed in one end thereof into which projects a pin 82 connected to the frame 20. A spring 81s is attached at one end to the lever 81 adjacent the lower end of the elongated aperture 81a and is connected at its other end to a support piece 83. Lever 81 is positioned so as to abut the button 84 (Fig. 4) spring pressed by helical spring 85 against one face of the lever 81. By means of the pivot suspension of lever 81 composed of the pin 82 extending into the elongated slot 81a, and by means of the resilient support provided by spring 81s and the spring pressed button 84, the lever 81 is protected against deformation. If for any reason, the timing between the cam 33 and the typewheel is not correct and lever 81 is raised before the typewheel assumes its extreme right hand position (Fig. 4), the resilient support of the lever 81 will prevent breakage or injury to the lever or typewheel.

Upon reception of the code signal indicative of shift, the typewheel will be moved to its extreme right hand position, as viewed in Fig. 4, with the member 78 extended off center from shaft 24A, downwardly, an amount dependent upon the eccentricity of opening 78a (Fig. 8) and with member 78 in alignment with lever 81. As shaft 25A rotates, cam 33 rides across the bottom of lever 81 and raises the free end 81f (Fig. 1a) of this lever into engagement with zone selection, operating member 78 and due to the coaction of lugs 78b and slots 79c moves the member 78 radially of the shaft 24A. Upon such radial movement, the cylindrical lugs 78c (Fig. 8) riding in the eccentric slots 50a (Fig. 9) will rotate the typewheel one sixteenth of a revolution to thereby shift from letters to figures or vice versa.

As is seen from Figs. 10 and 11 upward motion

of member 78, as viewed in Fig. 4, will move lugs 78c in slots 50a to rotate the typewheel 50. With member 78 in one downwardly extending position, the lugs 78c will be moved from the position as shown in Fig. 10 to the position as shown in Fig. 11 and the typewheel will be rotated one sixteenth of a revolution in one direction. Upon 180° rotation of shaft 24A, the opposite operating end of member 78 (Fig. 1a) will now be projecting downwardly and upon upward movement of member 78 by lever 81 the typewheel 50 will be rotated one sixteenth of a revolution in the opposite direction. It is to be particularly noted, that the letters shift and figures shift positions of shaft 24A are 180° apart so that upon reception of a letters shift signal, the typewheel is rotated from figures to letters in one direction and upon reception of the figures shift signal, the typewheel is rotated from letters to figures in the opposite direction.

Tape feed and printing

A roll of tape 86 (Fig. 4) is mounted within the tape roll support 87 attached by a bolt 87a to the arm 88 (Figs. 1 and 2) carried by the frame 20. Tape 86 unwinds from its roll and passes under and over a plurality of guide rollers 89 and finally underneath the typewheel 50 and between the feed rollers so that upon rotation of the feed rollers, as described presently, the tape 86 is fed past the typewheel element 50, and the characters of the typewheel, which are selected by the permutation selector mechanism, will be typed upon tape 86 by means of the printing mechanism to be presently described.

The feed rollers each comprise a pair of separate rollers 90a and 90b and 91a and 91b, respectively. Rollers 90a and 90b are rotatively mounted on stationary studs 92. Rollers 90a and 90b are each provided with a gear 93 (Figs. 1 and 2) integral therewith and meshing with gears 94, respectively, fastened to the shaft 95. Shaft 95 is rotatably carried by a lever 96 (Fig. 1) pivoted at 97 to the frame 20. The lever 96 is biased upwardly (Fig. 1) by a spring 98 so that rollers 91a and 91b are constantly urged towards the rollers 90a and 90b with the tape 86 between the respective pairs of rollers, as is seen in Fig. 1. Mounted on the shaft 95 for rotation thereof is the ratchet wheel 99 located between the rollers 91a and 91b (Figs. 1 and 2). A pawl 100 pivotally mounted at 101 on lever 102 engages a tooth of ratchet 99, and upon depression of lever 102, as described presently, pawl 100, which is constantly urged into engagement with ratchet wheel 99 by means of a spring 100s, will slide over a tooth on the wheel 99 and engage the next lower tooth of the ratchet wheel so that upon release of the lever 102, pawl 100 will rotate the ratchet wheel 99 an amount proportional to the advancement of one tooth, to in turn rotate the shaft 95 and gears 94 meshing with gears 93 integral with the rollers 90a and 90b. Since rollers 91a and 91b are integral with the shaft 95, the rollers 90a, 90b, and the rollers 91a and 91b are rotated simultaneously to advance the tape 86 past the typewheel 50.

Lever 102 as shown in Fig. 1, is mounted at one end on pivot 103 passing through frame 20. The other end of lever 102 is constantly urged upwardly by a spring element 104.

Lever 102 passes through a slotted opening 105 formed in the print hammer housing 106, fastened to frame 20 in any desired manner. A vertically reciprocable hammer member 107 is

mounted within the print hammer housing 106 (Fig. 1) and is constantly urged upwardly by means of a spring 108 pressing against the piston portion 107a of the hammer 107. A slot 107b is formed in the hammer member 107 in alignment with slot 105 and the lever 102 passes through the slot 107b so that upon downward oscillation of lever 102, it will depress the hammer 107 against the force of spring 108.

A trigger latch 109, pivotally mounted at 109a is constantly urged counterclockwise by spring 109s. As the printing hammer 107 is depressed by lever 102, latch 109 will engage a notch 107n in the printing hammer 107 to hold the hammer in cocked position until the trigger latch 109 is subsequently released.

Mounted on shaft 25A are the several cams 33, 34 and 35 previously mentioned, cooperating respectively with the levers 81, 102 and 110, cam 34 also cooperating with a cam follower 109b of the trigger latch 109, as described presently. The lever 110 is pivoted at 111 for oscillation in a vertical plane and is pivotally connected to the link 112 for feeding the type ribbon 113, as will be described presently.

As previously described, the flange member 38a, of that clutch 39 which controls the shaft 25A, is provided with a single notch 44 (Fig. 5) to prevent back rotation of the clutch upon stoppage of this clutch in its single position. The tooth shaped end 42t of the dog lift lever 42 of this particular clutch 39 (Fig. 5) is engaged and held in the position as shown in Fig. 5 to maintain the clutch 39 disengaged by means of a stop lever 114 pivoted at 115 and connected to link 116 pivotally connected at 117 to one arm 118 of a bell-crank 119 pivotally mounted at 120. Armature 56a of the magnet 56 which is connected in the return line of the magnets 51 to 55, inclusive, as previously described, forms the other arm of the bell-crank 119 (Fig. 5) so that upon energization of any magnet, the magnet 56 is energized to attract its armature 56a whereupon the bell-crank 119 is oscillated clockwise about pivot 120 to raise the link 116 and lower the free end 114a of lever 114 to thereby release the dog lift lever 42, so that tooth 42t engages the gear 25c and clutch 39 is rotated one complete revolution, prior to which time, the magnet 56 is deenergized and the spring 114s, acting through the lever 114, link 116 and bell-crank 119, restores the armature 56a to the position as shown in Fig. 5.

It is seen, therefore, that shaft 25A is rotated once for each code permutation of signal elements received. Upon rotation of shaft 25A, cam 34 (Fig. 1) will depress the lever 102 to lower the plunger 107 until the trigger latch 109 continuously urged counterclockwise by spring 109s engages the notch 107n to hold the plunger in the cocked position, as described above. As shaft 25A continues to rotate, the cam 34 will engage the cam follower 109b to release the trigger latch 109 and the spring 108 will quickly force the plunger 107 upwardly to force the tape 86 and ribbon 113 into operative relation with the typewheel character selected by the permutation selector mechanism to thereby print the selected character on the tape 86.

Ribbon feed and reversal

Novel ribbon feed and ribbon reversal mechanism are provided, as illustrated generally in Figs. 1 and 4 and specifically in Figs. 14 to 18, inclusive. As shown in Figs. 1 and 4, cam 35 mounted on shaft 25A is rotated therewith, one

complete revolution for each code permutation of signal elements received. Cam 35 cooperates with lever 110 (Fig. 1) to oscillate it about its pivot 111. Link 112 is pivotally connected to lever 110, so that as cam 35 rotates, it engages lever 110 once for each revolution of shaft 25A and raises lever 110 and the attached link 112.

Referring to Figs. 1 and 4 and to Figs. 14 to 18, inclusive, link 112 is pivotally connected at one end by pivot 121 to lever 110 and at its other end by pivot 122 to one arm 123 of a bell-crank element 124 mounted for rotation about shaft 125 journaled in plates 126 and 127, mounted on the frame 20. A pawl 128 pivoted at 129 to the bell-crank element 124 is biased against a ratchet wheel 130 by a spring 128s (Fig. 14) attached to the arm 124a of bell-crank 124 at one end, and to pawl 128 at the other. As link 112 is raised by the action of cam 35 on lever 110, the pawl 128 will be moved back one tooth on the ratchet wheel 130 attached to shaft 125, for rotation thereof. As the cam 35 releases the lever 110, spring 110s will pull downwardly on lever 110 and link 112 so that pawl 128 will advance the ratchet wheel 130 an amount proportional to one tooth movement. A locking pawl 131 pivoted at 132 on plate 126 (Figs. 4 and 14) is held in engagement with ratchet wheel 130 by a spring 131s, so that back rotation of ratchet wheel 130 is prevented. As the ratchet wheel 130 advances counterclockwise, it rotates the shaft 125 counterclockwise to thereby rotate gear 133 (Fig. 15) in the same direction. Gear 133 meshes with five small pinion gears 134 each loosely mounted on a stud 135, which studs join together the star wheels 136a and 136b loosely mounted on shaft 125. As gear 133 is rotated counterclockwise, step by step, the pinions 134 will be rotated clockwise about their respective studs. A lever 137 pivoted at 138 on plate 126 carries a roller 139 intermediate its ends, engaging the outer periphery of star wheel 136a (Fig. 18). The other end of lever 137 is constantly urged clockwise by a spring 137s connected to lever 137 at one end and to plate 126 at the other so that the roller 139 is constantly held against the outer periphery of the star wheel 136a.

As illustrated in Figs. 14 and 15, one of the gears 134 is in meshing engagement with a gear 140 mounted for rotation on shaft 141 journaled in plates 126 and 127. Shaft 141 extends through the plate 126 (Fig. 18) and carries at its end a spool 142 on which may be wound the ribbon 113. A friction washer 142w is provided between the spool 142 and plate 126 to prevent shaft 141 from turning too freely. A similar spool 143 is mounted on a shaft 144 journaled in plates 126 and 127 and attached to this shaft is a gear 146 equal in diameter to the gear 140. A friction washer 143w similar to washer 142w is also provided.

As gear 140 and spool 142 are rotated counterclockwise as viewed in Fig. 14, or clockwise as viewed in Fig. 1, the spool 142 winds up the ribbon 113 and unwinds it from spool 143. When the ribbon is entirely unwound from spool 143, since the end of the ribbon is fastened to spool 143, spool 142 and gear 140 are held against further rotation endeavored to be produced by means of pinion 134. Pinion 134, therefore (Fig. 15), walks bodily around gear 140, so that the star wheels are rotated counterclockwise despite the force exerted by spring 139s operating through the lever 137 and roller 139. As is seen by comparison of Figs. 15 and 16, the star wheels are

rotated counterclockwise, since the spring 139s is no longer strong enough to prevent rotation of the star wheels, and roller 139 thereupon rides up to the peak of a tooth 139a of the star wheel 136a, directly behind 136b, as shown in Fig. 16, and as the pinion 134 continues to walk around gear 140, the star wheels are rotated until roller 139 passes the peak or high point of a tooth 139a and due to the generally toggle arrangement the star wheels are thereupon snapped counterclockwise to bring a different pinion 134 into engagement with gear 145, while the previously engaged pinion 134 is disconnected from the gear 140, as is seen in Fig. 17. As gear 133 is rotated step by step, counterclockwise, by elevation and depression of link 112, pinion 134 in engagement with gear 145 rotates the gear 145 counterclockwise as viewed in Fig. 14 or clockwise as viewed in Fig. 1, whereby the ribbon is now wound around spool 143 and unwound from spool 142.

Similarly, as described above, if the ribbon should snarl or catch or should in any manner exert a force so as to prevent rotation of the spool upon which the ribbon is being wound, an automatic reversal of the ribbon feed will ensue.

Due to the two simultaneous rotations of the pinions 134, that is, clockwise rotation of these pinions about their studs and counterclockwise or bodily rotation thereof about shaft 125, there will be no jamming of the gears during shifting of the gear frame when one of the pinions 134 is coming into mesh (Figs. 15 and 16) with the previously disengaged one of the two gears 140 and 145. Since there is always a positive connection between the driving means and at least one of the ribbon spools during ribbon feed reversal, it is impossible for the gear frame to be halted at the dead center of the toggle arrangement while characters are being printed.

Novel ribbon reversal means are therefore provided which automatically and expeditiously produce ribbon reversal whenever such a reversal is necessary.

General operation

While the operations of the various elements of the complete mechanism have been given in connection with the respective individual descriptions, a brief description of the operation of all elements of the device will now be presented in order to clarify the novel coaction of the relative parts in producing a unitary result, namely, printing of characters on a tape in response to code signal permutations received, each permutation being representative of a character to be printed or a function to be performed.

Upon reception of the five signal elements comprising a code permutation, certain of the magnets 51, 52, 53, 54 and 55 (Fig. 2) will be energized. Upon energization of any one of the magnets 51, 52 or 53, the permutation rings 57, 58 and 59 (Fig. 5) will be relatively rotated to align certain of the notches 57n, 58n and 59n so that a chosen stop element 61 will be permitted to enter the aligned notches. As the rings are operated to permit the chosen stop element to enter these aligned notches, the previously selected stop element is cammed out of its notches by the rotation of any one of the rings and the associated clutch 39 will thereupon engage and will rotate until the chosen stop element engages the toothed end 42t of the clutch dog lift lever 42. Shaft 24A is thereupon rotated to a position dependent upon the particular permutation of signal elements controlling the magnets 51, 52 and 53.

Similarly, magnets 54 and 55 are energized selectively, by the received code signal permutation and permutation rings 71 and 72 (Fig. 5) will be relatively rotatively positioned, to permit entry of a stop element 61 into the newly aligned notches 71n and 72n. The associated clutch 39 will be thereupon rotated until the newly selected stop is engaged by dog lift lever 42 and shaft 23A will be rotatively positioned in accordance with the particular permutation of code signal elements controlling solenoids 54 and 55.

Rotation of shaft 23A oscillates the arm 75 (Fig. 2) to axially move the typewheel 50 to one of four axial positions to select one ring of characters.

Rotation of shaft 24A as described above will rotate the typewheel element 50 to one rotative position so that the particular character from the selected ring of characters will be selectively positioned with respect to hammer 107 (Fig. 4). Upon energization of any signal receiving magnet, the magnet 56 (Figs. 4 and 5) which is in the return circuit of all the magnets 51 to 55, inclusive, will be energized. The particular clutch 39 controlled by magnet 56 has only one rotative stop position, so that shaft 25A is rotated one complete revolution and one revolution only, for each code signal permutation received.

As shaft 25A rotates its one full revolution the cams 33 (Figs. 1 and 4), 34 (Fig. 1) and 35 (Figs. 1 and 4) will be rotated.

Since shafts 23A and 24A are rotated at 1200 R. P. M. while the shaft 25A is rotated only at 900 R. P. M., regardless of which stop elements are selected, the shafts 23A and 24A will be halted by the time shaft 25A has completed three quarters of a revolution.

If the code signal received is representative of the shift function, the typewheel element 50 will be moved to the right of the position as illustrated in Fig. 4 until it assumes its extreme right hand position under control of the rotating shaft 23A, cam slot 31a and oscillating lever 75 (Fig. 2). In the extreme right hand position, the shaft 24A will be rotatively positioned in either one of two positions separated by 180°, dependent upon whether the figures shift function or the letters shift function is desired. In this extreme right hand position of the typewheel 50, the radially slidable element 78 (Figs. 8 and 9) will project off-center downwardly (Fig. 4) and as cam 33 rotates, the element 78 is radially actuated by lever 81 (Fig. 1a) to produce rotation of the typewheel 50 for one sixteenth of a revolution to thereby produce shift, this function being performed during the last quarter revolution of the shaft 25A. In this position of the typewheel, there are no characters opposite the hammer 107 so that no character is printed upon tape 86.

When the typewheel 50 is axially and circumferentially positioned so as to align a character with the printing plunger or hammer 107, the rotation of shaft 25A will first rotate the cam 34 (Fig. 1) to depress the lever 102 about its pivot 103 to in turn depress the hammer 107 against the force of spring 108 until the latch 109 engages notch 107n in hammer 107 and the latch is maintained in position by means of the spring 109s. Also while lever 102 is being depressed, the pawl 100 slips back one tooth on the ratchet wheel 99 and upon release of lever 102 by the continued rotation of cam 34, spring 104 will raise the lever 102 and pawl 100 will advance the ratchet wheel 99 to rotate the rollers 91a and 91b, and rollers 90a and 90b to thereby

advance the tape. As the shaft 25A continues to rotate, cam 34 engages the cam follower 109b to release the latch 109 and the hammer 107 will thereupon force the tape 86 and the ribbon 113 against the chosen aligned character of typewheel 50 (Fig. 1) to print the selected character.

While shaft 25A is rotating, cam 35 will engage the lever 110, to raise the link 112 (Fig. 14) to thereby rotate one of the spools 142 or 143 to wind up the ribbon on one spool and to unwind it from the other, as described above. When the ribbon is completely unwound, the ribbon feed reversal mechanism will automatically reverse the direction of winding as previously explained.

Novel shift producing means are therefore provided for producing shifting of the typewheel in a simple and effective manner.

While there has been shown and described and pointed out the fundamental novel features of the invention as applied to a single modification it will be understood that various omissions and substitutions and changes in the form and details of the device illustrated and in its operation may be made by those skilled in the art, without departing from the spirit of the invention. It is the intention, therefore, to be limited only as indicated by the scope of the following claims.

What is claimed is:

1. In a printing telegraph receiver, a shaft, a typewheel mounted on said shaft for rotation with respect thereto, a member mounted on said shaft for movement radially thereof, and cooperating means on said radially movable member and said typewheel for converting radial movement of said member into rotation of said typewheel.

2. In a printing receiver, a typewheel, means for rotatably and axially positioning said typewheel, and means for producing shift of said typewheel comprising a lever having an elongated slot therein, a pivot projecting into said slot for oscillatably mounting said lever, resilient means moving said lever to engage one extremity of said slot with said pivot, means for rocking said lever, means cooperating with said lever in one axial position of said typewheel to produce shift of said typewheel, and means resiliently abutting against a side of said lever and cooperating with said slot and resilient means for non-rigidly mounting said lever.

3. In a printing telegraph receiver, a shaft, a typewheel assembly including a hollow, first cylindrical character bearing member mounted on said shaft for axial and rotative movement with respect thereto, a pair of indentations formed on said member and located at different circumferential portions thereof, a second cylindrical member mounted on said shaft and interfitted within said first member, a resiliently-urged member in said second member and urged into one or the other of said indentations dependent upon the relative rotative positions of said first and second members, a shift producing member mounted on said shaft for movement radially thereof, means on said shift producing member cooperating with said first member to produce rotation of said first member upon radial movement of said shift producing member, and means on said shift producing member cooperating with resilient means on said first member to retain said shift producing member in its radially shifted position.

4. In a printing telegraph receiver, a shaft, a

typewheel assembly including a hollow cylindrical member mounted on said shaft for rotation with respect thereto, a radially slidable member mounted on said shaft, a slotted cylindrical member mounted on said shaft adjacent to said slidable member, means on said slidable member cooperating with the slots on said cylindrical member to restrain said slidable member to movement of translation, and means on said hollow member cooperating with means on said slidable member to convert said motion of translation into motion of rotation of said hollow member.

5. In a printing telegraph receiver, a typewheel, means for rotatively positioning said typewheel, means for axially positioning said typewheel, shift means comprising a radially movable member continuously engaged with, and axially movable with, the said typewheel, means opera-

5 tive in a single predetermined axial position only of said typewheel for actuating said movable member, and coacting means on said member and said typewheel for converting radial movement of said member into rotative movement of said typewheel when the latter is in the said predetermined axial position.

10 6. In a printing telegraph receiver, a typewheel, means mounting said typewheel for axial and rotative movements, a slidable member continuously cooperating with the said typewheel, said member being carried by said mounting means and constrained thereby to movement radially thereof, and cooperating means on said typewheel and member for converting radial movement of said member into rotation of said typewheel.

15
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