Nov. 25, 1947. L. DEVAUX 2,431,314

PRINTING TELEGRAPH SYSTEM CONTROLLED BY VIBRATIONS OF TUNING FORKS

Filed May 28, 1943 2 Sheets-Sheet 1

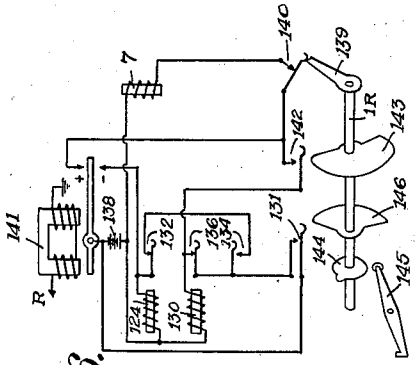

Fig. 6.

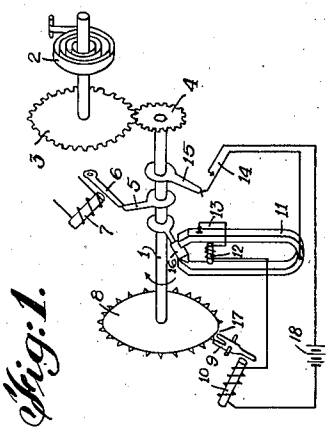

Fig. 1.

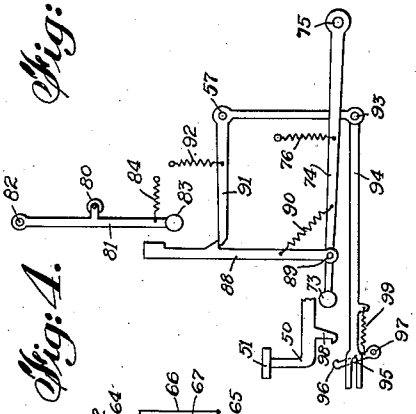

Fig. 4.

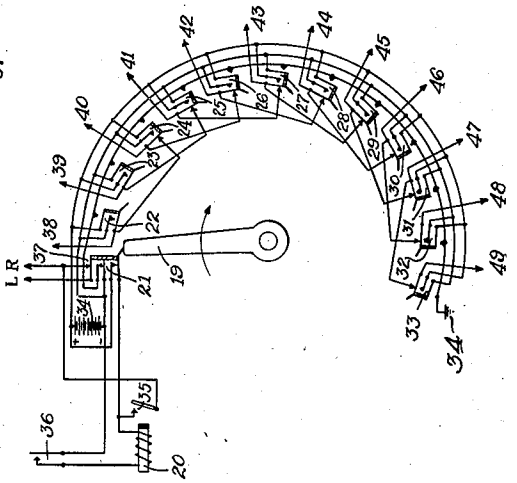

Fig. 2.

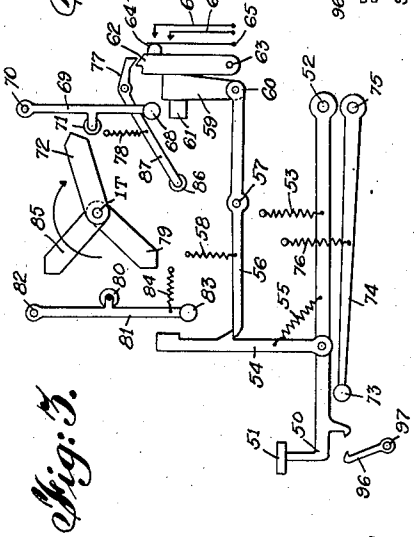

Fig. 3.

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PRINTING TELEGRAPH SYSTEM CONTROLLED BY VIBRATIONS OF TUNING FORKS

Filed May 28, 1943 2 Sheets-Sheet 2

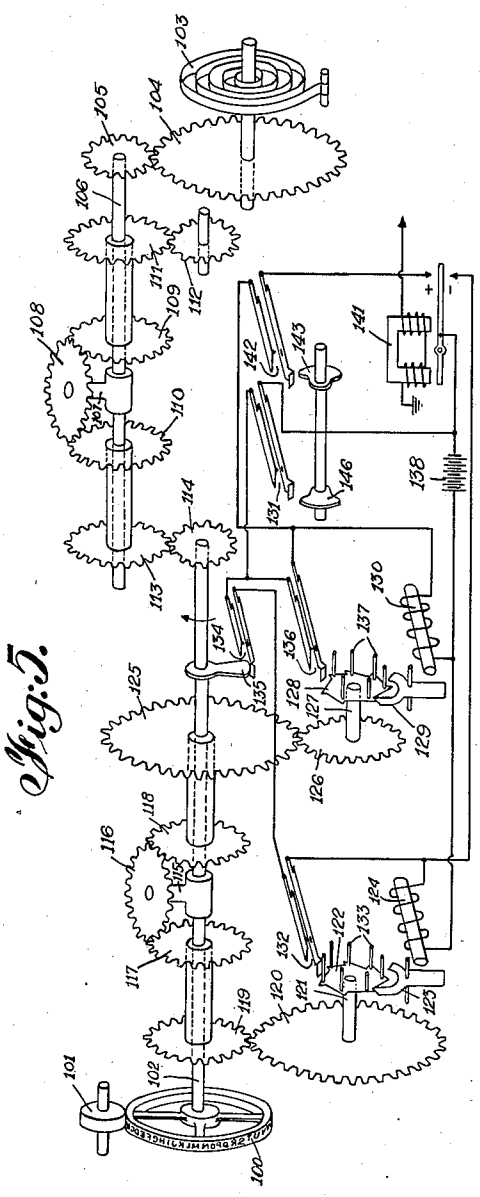
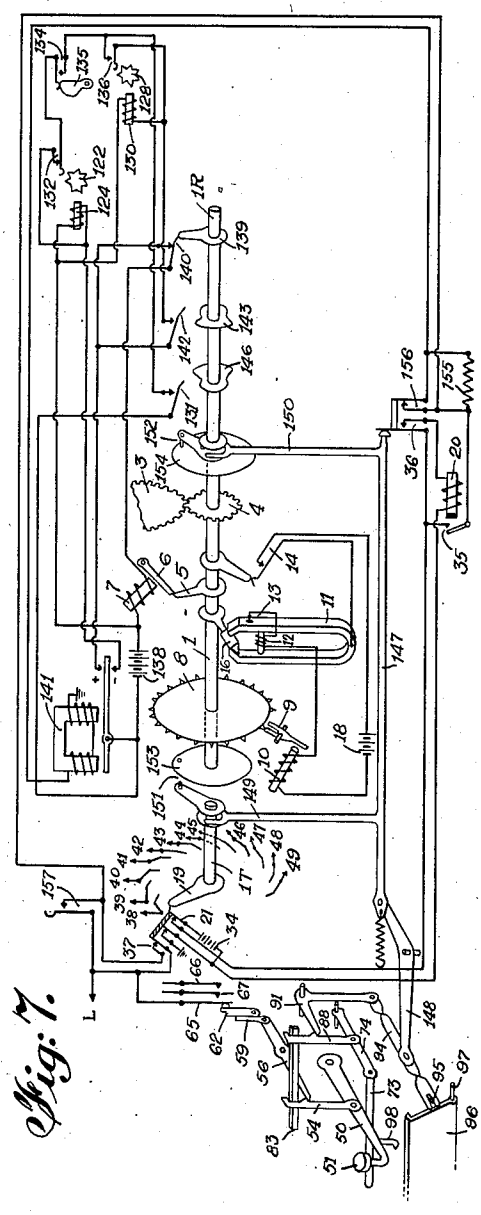


Fig. 7.



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UNITED STATES PATENT OFFICE

2,431,314

PRINTING TELEGRAPH SYSTEM CONTROLLED BY VIBRATIONS OF TUNING FORKS

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In France June 30, 1941

8 Claims. (Cl. 178—35)

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The subject of the invention is a printing telegraph system having a simple mechanism, capable of being used in offices having no electric power source and suitable particularly when the speed of transmission can, without objection, be made relatively low and can be subordinated to ease of operation without need of great time in learning the operation thereof, conditions that arise particularly in small rural offices.

A general description of the invention is as follows. The transmitting device includes a keyboard similar to that of a typewriter. The depression of a key produces first of all the passage of a current, which simultaneously brings into operation two shafts, one located at the transmitter and one located at the distant receiver, these shafts being driven by clockwork. The two shafts make a single turn at substantially the same speed, this latter element being synchronized by means of a tuning fork in each device. During a portion of this rotation the transmitter sends out pulses varying in number, depending upon the key depressed. At the receiver, the rotating shaft uses the received pulses to operate releasing electromagnets, which in turn cause the rotation of a typewheel, this latter rotating through a definite angle, depending upon the number of received pulses. The typewheel having thus been brought into the desired position and the time interval allowed for the pulses having elapsed, the rotating shaft of the receiver causes the printing mechanism to operate in order to produce the printing of the character transmitted. Then it causes the paper tape to advance while the typewheel is being restored to its starting position.

A feature of the present system resides in the combination of the typewheel control-pulses so as to reduce to a minimum the total number of pulses for each character. Alternatingly positive and negative pulses are used, and to each character is assigned a definite number of such positive and negative pulses.

Assuming that the number of different characters to be transmitted is 49, that is, 7 times 7, the following combinations, for example, can be provided for:

Space	0 negative pulses	0 positive pulses
Letter A	0 negative pulses	1 positive pulse
Letter B	0 negative pulses	2 positive pulses
Letter F	0 negative pulses	6 positive pulses
Letter G	1 negative pulse	0 positive pulses
Letter M	1 negative pulse	6 positive pulses
Last mark	6 negative pulses	6 positive pulses

The maximum total number of pulses for obtaining 49 combinations is thus seen to be 12.

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These pulses being positive or negative, it is advantageous, in order to speed up the operation, to alternate the positive and the negative pulses. In this manner the time interval that must otherwise necessarily space two pulses of the same sign is occupied by the emission of a pulse of opposite sign, if needed, so that the total time of 12 positive and negative pulses cannot exceed the duration of 6 pulses of the same sign spaced by 6 equal intervals. However, in practice, for reasons of mechanical design, a pulse of one sign cannot be followed instantly by a pulse of opposite sign and a small time interval is necessary, which somewhat lengthens the duration of the 6 pulses.

Since the pulses are alternated in polarity, the sending, for example, of the letter Z, corresponding to 3 negative pulses and 5 positive pulses, will be effected as follows:

$$-+-+-+\ +\ +$$

The positioning of the typewheel is effected step by step, but the steps corresponding to the negative pulses are of $\frac{1}{7}$ of a single turn and those corresponding to the positive pulses are of $\frac{1}{49}$ of a single turn. The pulses for the letter Z will therefore cause the wheel to advance as follows:

Pulse $-$: $\frac{1}{7}$ of a turn, i. e., $\frac{7}{49}$
Pulse $+$: $\frac{1}{49}$ of a turn
Pulse $-$: $\frac{1}{7}$ of a turn, i. e., $\frac{7}{49}$
Pulse $+$: $\frac{1}{49}$ of a turn
Pulse $-$: $\frac{1}{7}$ of a turn, i. e., $\frac{7}{49}$
Pulse $+$: $\frac{1}{49}$ of a turn
Pulse $+$: $\frac{1}{49}$ of a turn
Pulse $+$: $\frac{1}{49}$ of a turn

Total $\frac{26}{49}$ of a turn

The typewheel has then acted to place the letter Z in front of the printing bail.

The length needed for each pulse depends upon the precise timing of the devices and it can be short, but it is advantageous, in order to facilitate the construction of the devices and make them sturdy, to use pulses of relatively long duration, for example of the order of 20 milliseconds, which, with the small interval elapsing between the pulses, gives about 0.250 to 0.300 second for the sending of a single character. The printing, the return to starting position of the typewheel and the advance of the paper can all be effected in 0.200 to 0.300 second, so that the speed of transmission can reach 1.5 to 2 characters per second, a speed that it is not practical to exceed, as this system is intended to be used by operators having but little experience in the art.

A low rotational speed of the main shaft of the typewheel is an essential requirement for the driving of the mechanism by means of clockwork actuated by a spring requiring only feasible

winding-up force and not too frequent replacement.

In the detailed description of the system that follows, reference is made to the following drawings, where:

Fig. 1 shows one embodiment of a device according to this invention, for determining adjustment of the rotational speed of a shaft by means of an escapement wheel.

Fig. 2 shows a portion of the pulse distributor of the transmitter sufficient to illustrate the construction and operation thereof.

Fig. 3 shows one form of the mechanism of a keyboard key according to this invention.

Fig. 4 shows one form of the mechanism of the common pedal of one form of keyboard according to this invention.

Fig. 5 shows one form of the mechanism of a typewheel according to this invention.

Fig. 6 shows one form of the distributor of a receiver according to this invention.

Fig. 7 shows one form of the general layout of a complete telegraph station according to this invention.

As has just been explained, the transmitter and the receiver each use a shaft driven by clockwork, these two shafts rotating in synchronism. The arrangement used for obtaining the regular rotation of these shafts will therefore be first described.

In Fig. 1, the shaft whose movement must be regulated is shown at 1. It is arranged to be driven by clockwork including a spring 2 and a certain number of multiplier wheels, of which, in order to simplify the drawing, only two are shown at 3 and 4. The movement of the shaft is arrested by an arm 5 resting against a stop 6 formed by the armature of an electromagnet 7.

Shaft 1 is provided with an escapement wheel 8 the teeth of which can be engaged by an escapement pawl 9 carried by the armature of another electromagnet 10, each forward and return movement of the armature producing an escapement, in two steps, equal to one tooth of wheel 8.

The movement of the armature of electromagnet 10 is controlled by a tuning-fork 11. For this purpose, the circuit of electromagnet 10 is in series with the exciting coil 12 of the tuning-fork, which latter is in series with the contact 13, opened and closed by the movement of the prongs of the tuning-fork. While at rest, when arm 5 is bearing upon stop 6, the circuit of electromagnets 10 and 12 is broken by the opening of a contact formed by springs 14, which latter are operated by an arm 15 mounted on shaft 1.

In order to give the tuning-fork a starting pulse, a prism 16, attached to the end of an arm carried by shaft 1, is placed between the prongs of tuning-fork 11, these prongs being bent so that in passing therethrough, when shaft 1 starts to rotate, prism 16 will draw them apart slightly and then release them suddenly.

Toothed wheel 8 has a toothless portion 17. In normal position, pawl 9 is facing the beginning of this portion 17, so that, when magnet 7 is energized and arm 5 is released, shaft 1 can turn through a small angle in the direction of the arrow before the first tooth of wheel 8 is engaged by pawl 9. This first movement is used for causing prism 16 to force its way in between the prongs of the tuning-fork and to release them for starting the vibration. The vibration is maintained then, by magnet 12, which latter is supplied by battery 18 feeding electromagnet 10 via contact 14, which latter was closed from the beginning of the rotation.

Each closing and each opening of contact 13 produced by the vibration of the tuning-fork causes a forward and return movement of pawl 9, and wheel 8 turns by the extent of one tooth, each time. The vibration period of the tuning-fork being regulated and constant, the time it takes one tooth of wheel 8 to pass along is quite definite and, hence, the time required for a complete turn is constant. The rotation occurs by jerks, but damping springs may be provided between shaft 1 and wheel 8 in order to make the rotary movement regular to a certain extent and lessen the degree and force of the impact of the teeth of wheel 8 against the prongs of pawl 9.

All the tuning-forks of one and the same set of devices are adjusted to the same frequency, so that the speed of the shafts of two corresponding devices is substantially equal; therefore, if the transmitter shaft is released at the same instant as the receiver shaft, the two shafts will constantly occupy the same angular positions at a given instant. As will be explained later on, a precaution is taken to compensate for any slight maladjustment in the speed of the shafts of two corresponding devices.

The system regulating the speed of the main shaft having been described above, no further reference need be made to it in the description that follows. Whenever shaft 1 is mentioned hereinafter, it will mean a shaft subjected to driving torque from a spring through clockwork and whose rotational speed is regulated by a tuning-fork by substantially instantly bringing the tuning-fork into vibration as soon as the shaft, normally held by a pawl, is released.

Shaft 1 is common to the transmitter and to the receiver of one and the same telegraph station. It is normally engaged with the receiver shaft, which hence is termed 1R, so that this station shall at all times be ready to receive a message. When this station is used to transmit a message, shaft 1 is separated from receiver shaft 1R and is engaged with the transmitter shaft, which is termed 1T. The engaging and disengaging operation is performed automatically through the sending of a character, as will be hereinafter explained.

The transmitter includes a keyboard for sending characters. These keys put in operation a mechanism whose function is first to send a current pulse of definite sign, which will be assumed to be positive, so as to release shaft 1 simultaneously at each of two corresponding stations. Then, during a portion of the turn made by shaft 1, the transmitter sends out the negative and positive pulses corresponding to the code of the character to be transmitted, the negative and positive pulses being alternated. Once the period of time reserved for the sending of the pulses has elapsed, the transmitter shaft completes its rotation, so as to give the receiver shaft time to effect the operations of printing, etc.

A single distributor, shown schematically in Fig. 2, serves to send out the current pulses in the order desired. It is composed of a series of spring contacts operated in sequence by an arm 19 mounted on shaft 1T, a relay 20 cooperating with the distributor for the sending of the first pulse.

In the embodiment here shown, the springs consist of 13 groups numbered from 21 to 33, all connected with battery 34 and with the ground, as shown at 34'. When at rest, the springs of

group 21 are depressed by arm 19. The negative pole of the battery is connected to the ground and the positive pole to the winding and to contact 35 of relay 20, the armature of which latter is connected to the circuit of receiver R and to the contact next to line conductor L.

As soon as a key is depressed, a contact 36 inserted in series in the circuit of relay 20 is closed and this relay, of the slow-acting type, operates after a short time. The positive pole of battery 34 is connected to receiver R and to line L via contact 35. The positive current of the battery travels through the two polarized relays of the corresponding stations, a line-resistance compensating resistor being inserted in the circuit of the relay of the transmitting station. The result thereof is that the relays of the two stations in communicaion operate simultaneously and close the circuit of the magnets releasing shafts 1 of both stations. The two shafts therefore start together and their movement is continued synchronously, as has been explained.

Immediately after the starting operation, line conductor L is transferred from the receiver to the transmitter through the opening of contact 37. The passage of arm 19 under spring groups 22 to 31 produces successively the grounding of the positive and of the negative pole of battery 34, this permutation being repeated six times, the other pole being connected each time to wires 38 to 49. The even wires correspond to the negative pulses and the odd wires to the positive pulses. The keyboard keys serve to connect wires 38 to 49, in suitable fashion, to line L, for the sending thereover of the number of pulses, of each sign, corresponding to the code symbol for the particular character to be transmitted.

A negative pulse can be sent by connecting wire 38 to the line, two pulses with the use of wire 40, three with the use of wire 42, etc., and finally six with the use of wire 48. Likewise, wire 39 sends one negative pulse, wire 41 sends two, etc., and finally wire 49 sends six. The keyboard keys must therefore be arranged so as to close two contacts that will connect the distributor to the line at two suitable points, it being understood that, when the code of the letter comprises a zero, the pulse springs, regardless of whether positive or negative pulses are involved, are not connected at all to the line.

It has been above stated that relay 20 was slow acting. This time lag constitutes a precaution against the effect of a slight default in synchronism between the corresponding stations. It is, in fact, necessary that at the beginning of each signal the shafts of both stations be exactly at their null positions. If, owing to a slight maladjustment, the receiver should be lagging with respect to the transmitter, it could not catch up with it in case of signals being transmitted, without stopping, and the synchronism would thereby be destroyed. The time lag provided by relay 20 offsets such possible defect, by causing the transmitter to make a stop for a short period, thus giving the receiver shaft time to complete its rotation, regardless of the direction of the transmission.

The pulse distributor having been described, the mechanism of the transmitter keys will now be explained, one of these keys being shown in Fig. 3.

This key includes a lever 50, provided with a button 51 bearing the designation of the character to be transmitted thereby. The lever pivots on a rod 52 and is pulled upwards by a spring 53.

Lever 50 carries a pivoting hook 54, which a spring 55 keeps engaged with the end of a lever 56. This latter pivots on a rod 57 and a spring 58 keeps it in its normal position. Lever 56 carries a tongue 59, which pivots on a pin 60 and which, when at rest, is maintained between a stationary bar 61 and a member 62 oscillating around a stationary rod 63. An interponent 64 attached to member 62 serves to operate a spring 65 to cause it to close the contacts of springs 66 and 67.

When a key 51 is depressed, hook 54 causes lever 56 to rock and tongue 59 is introduced between an oscillating bar 68 and member 62. Bar 68 is carried by arms 69 pivoting around rod 70, one of which arms carries a roller 71 that can be driven by the end of an arm 72 mounted on transmitter shaft 1T.

The depressing of a key further entails the depressing of common pedal 73, carried by arms 74 pivoting on rod 75. A spring 76 tends to maintain this pedal in its raised position. It is pedal 73 that closes the contact 36 (Fig. 2) causing the operation of relay 20 and the sending of the first starting pulse. In addition, by means of driving-gear not shown in the drawing, pedal 73 serves to disengage receiver shaft 1R, normally engaged with the clockwork shaft 1 (Fig. 1), and to engage this latter shaft with the transmitter shaft 1T. Consequently, as soon as pedal 73 is depressed through the operation of any key, the starting pulse is sent out, and shaft 1T starts to turn in the direction of the arrow.

Arm 72 drives roller 71 and bar 68 drives tongue 59, which latter, in moving, drives member 62. Interponent 64 then closes the contacts between spring 65 and the two springs 66 and 67. Member 62 is locked immediately in position by catch 77, which, under the urging of spring 78, engages the notch of member 62.

Contact spring 65 is connected to the line wire. Contact spring 66 is connected to one of the even numbered contact springs 38 to 48 of the distributor so as to send out the desired number of negative pulses. Likewise, contact spring 67 is connected to one of the odd numbered contact springs 39 to 49 so as to send out the negative pulses.

As soon as catch 77 engages the notch of member 62, an arm 79 drives a roller 80 carried by one of arms 81, pivoting on a rod 82 and carrying a bar 83; this latter drives an enlarged extension of hook 54, disengaging the end of lever 56, which, under the urging of spring 58, returns to its normal position by disengaging tongue 59. Bar 83 normally is drawn out of the path of lever 56 by spring 84, but member 62 remains locked for the duration of the transmission of pulses, caused by the rotation of shaft 1T which drives the distributor cam (Fig. 2).

Immediately after the transmission of the pulses, a third arm 85 acts upon roller 86, carried by lever 87, which forms part of catch 77. This latter releases member 62, which returns to its normal position, thus opening the contacts of springs 66 and 67, the function of which is now completed.

Fig. 4 serves to explain the operation of pedal 73. One of the arms 74 of this pedal carries a hook 88, similar to hook 54, pivoting on a rod 89 and provided with a spring 90 that tends to keep it engaged with the end of a bell-crank 91, pivoting on the same rod 57 as lever 56. Lever 91 is pulled by a spring 92 and it is provided with a pin 93 lodged in a hole at the end of a connecting-rod 94, which latter is forked at its other

end. The fork is engaged by a stud 95 attached to a catch member 96 pivoting on trunnions 97. Bar 96, common to all the keys, serves to engage hooks 98 carried by key levers 50. A spring 99 draws stud 95 to the bottom of the fork.

Bell-crank 91 serves to close the operation controlling contact 36 inserted in series with the circuit of relay 20 (Fig. 2) and in addition it controls, via a connection not shown in the drawing, the disengaging of the receiver shaft and the engaging of the transmitter shaft.

When a key is depressed, pedal 73 is operated and, under the action of latch 88, bell-crank 91 is rocked, driving connecting-rod 94. Catch bar 96, drawn by spring 99, engages latch 98, which latter action prevents the depressed key from again rising. But as soon as shaft 1T has commenced its movement and member 62 is locked by catch 77 (Fig. 3), bar 83 pushes the enlarged portion of latch 88 and releases lever 91, which then returns to normal. Contact 36 (Fig. 1), which is no longer in use, is opened, catch bar 96 is pushed back, and the depressed key can then rise. The release of lever 91 does not entail the disengagement of shaft 1T, because the clutch mechanism is of the type of those used in printing telegraph apparatus and remains engaged until the shaft has made a complete turn. Thus the movement of the transmitter shaft continues, regardless of the position of pedal 73.

If the operator keeps the key down, the transmitter will stop after having made one complete turn, for the reason that, lever 91 being at rest, the disengagement of the transmitter shaft occurs after the completion of such turn.

Normally, the operator should allow the key to rise. He then can without waiting for the shaft to make the turn corresponding to the sending of a first transmitted character, prepare the sending of the next character by depressing a second key. The rising or restoration of the first key, and of the pedal, relocks levers 56 and 91, and the depressing either of the same key or of another key produces the closing of contact 36 and the latching of the depressed key. Shaft 1T is not disengaged at the end of the first turn. An interval for the stoppage is provided by the time lag of relay 20. Then shaft 1 starts again, and the key is released, as has been explained with respect to the first key.

A locking device of any known type prevents a key from being depressed when some other key is already locked.

The transmitter pulse-sending device having been described above, there remains to be explained the use of the pulses by the receiver for the positioning of the typewheel and the operating functions of the receiver itself.

The main part of the receiver is the typewheel, with its control mechanism. The typewheel is a light weight wheel with raised characters around its periphery. It is inked by a small felt pad impregnated with preferably greasy ink, which pad bears lightly at one point. Since the typewheel makes one complete turn for each character transmitted, all the characters pass constantly under the pad.

The movement of the wheel is controlled by epicycloidal gearing so that the negative pulses cause it to rotate by sevenths of a turn and the positive pulses by sevenths of a seventh, i. e., by forty-ninths of a turn. Therefore, when the letter P, the code of which is 23, is received, the first negative pulse causes the wheel to rotate by one seventh of a turn; then the next positive

pulse causes it to rotate by one forty-ninth; the second negative pulse causes it to rotate by a second seventh and the next two positive pulses cause it to rotate by two forty-ninths of a turn. The wheel therefore rotates through a total angle of $\frac{2}{7}+\frac{3}{49}$, i. e., $\frac{17}{49}$ of a turn, and places the letter P in front of the printing bail.

After the printing, the wheel continues its movement, so as to return to its initial position, by means of pulses produced locally in the receiver.

The typewheel control mechanism is shown, by way of example, in Fig. 5. The typewheel 100, upon which bears inking-roller 101, is mounted on shaft 1R, which is subjected to the action of main spring 103 through a differential associated with one of the clockwork wheels. For example, spring 103 drives wheel 104, which meshes with pinion 105, mounted on shaft 106. This shaft carries arm 107, on which pivots a satellite pinion 108 that transmits the torque of spring 103 to two wheels, 109 and 110. Wheel 109 is integral with a wheel 111, this latter meshing with pinion 112, which forms part of the clockwork driving main shaft 1. The other wheel (110) is integrally connected to a wheel 113, this latter wheel meshing with a pinion 114 mounted on shaft 1R, which thus receives the torque of the driving spring.

Shaft 102 carries an arm 115 constituting the supporting bearing of a satellite pinion 116, this latter meshing with two toothed wheels, 117 and 118. Wheel 117 is associated with a wheel 119 meshing with a wheel 120 mounted on the same shaft 121 as a seven-tooth escapement wheel 122 which is engaged by a pawl 123, mounted on the armature of an electromagnet 124. The torque of shaft 1R is therefore transmitted to wheel 122, and each forward and return movement of the armature of electromagnet 124 allows one tooth of the wheel to escape. Wheel 119 has 30 teeth and wheel 120 has 60, so that the escapement of each tooth of wheel 122 causes wheel 120 to rotate by one seventh of a turn, wheel 119 rotates by two sevenths and, through gearing 117—116, shaft 1R rotates by one seventh of a turn, driving the typewheel. Similarly wheel 118 is associated with wheel 125, which meshes with a wheel 126 mounted on the same shaft 127 as a seven-tooth escapement wheel 128. Wheel 128 engages with a pawl 129 carried by the armature of an electromagnet 130.

Wheel 126 has 20 teeth and wheel 125 has 70 teeth, so that each tooth of wheel 128 causes wheel 125 to rotate by two sevenths of a seventh of a turn, i. e., two forty-ninths of a turn, and shaft 1R rotates by one forty-ninth of a turn.

The typewheel is therefore positioned by the movement of the armatures of electromagnets 124 and 130, electromagnet 124 making it advance by steps of one seventh of a turn and electromagnet 130 by steps of one forty-ninth of a turn.

The movement of the electromagnets is obtained by connecting them to the respective negative and positive contacts of a polarized relay receiving the line current, as will be hereinafter explained.

After the printing has been accomplished, the typewheel is restored to its starting position by completing its rotation, this movement being controlled electrically.

The distributor, which will hereinafter be referred to in detail, closes the local circuit of electromagnets 124 and 130 via a contact 131 in series with contacts operated by the escapement wheels.

The circuit of electromagnet 124 includes a pair of springs 132, the contact of which is closed at each passage of a tooth of wheel 122 by means of pins 133 carried by this wheel, and, in series with springs 132, a second pair of springs 134, the contact of which is closed as soon as typewheel 100, and hence shaft 1R, has rotated by one seventh of a turn. This latter contact is opened by insulating cam 135, when wheel 100 has to make but $^{6}/_{49}$ of a turn, or less, before reaching its normal or null position.

The circuit of electromagnet 130 includes only one pair of springs 136, the contacts of which can be closed by six pins 137, carried by six of the teeth of wheel 128. The seventh tooth, which carries no pin, arrives in front of springs 136 when wheel 100 is in normal position, or when its position does not differ from the normal position but by an exact number of sevenths of a turn.

When contact 131 is closed by the distributor, after the printing, the current from battery 138 travels through one or the other of electromagnets 124 and 130, or both, depending upon the position of wheel 100. Immediately the electromagnets attract their respective armatures, which causes wheels 122 and 128 to turn by half a tooth, thus opening the contacts of springs 132 or 136, respectively. The armatures fall back, the wheel advancing again by half a tooth, and closing the contacts. This operation is repeated for electromagnet 124 until the contacts of springs 134 are opened, which indicates that wheel 100 has less than one seventh of a turn to make before reaching its normal position. For electromagnet 130, its operation stops when the pinless tooth of wheel 128 arrives in front of springs 136, which means that wheel 100 has rotated by an exact number of sevenths of a turn. The typewheel therefore returns to its normal starting position.

The receiver distributor is shown in Fig. 6. Its function is to establish the circuits intended for the reception of the starting signal, the control of the advance of the typewheel according to the received pulses, and the return of this wheel to its normal position.

Receiver shaft 1R, normally engaged with main clock-work-driven shaft 1, carries an arm 139 acting as a cam. At the beginning, when the receiver is idling and awaiting the receipt of a message, arm 139 closes the contact 140, thus connecting the positive contact of polarized line relay 141 to starting electromagnet 7 (Fig. 1). When a positive pulse is received, electromagnet 7 is energized and shaft 1 and, hence, shaft 1R are both brought into operation.

Immediately afterwards, the positive contact of line relay 141 is removed from starting electromagnet 7 and is connected by springs 142, actuated by cam 143, to electromagnet 130 (Fig. 5), which series of steps serves to advance the typewheel by forty-ninths of a turn. The width of cam 143 is such that the duration of the closing of the contact of springs 142 corresponds with the transmission time of the pulses determined by the transmitter operation. Since, on the other hand, the negative contact of relay 141 is connected permanently to the electromagnet 124, causing the advance by sevenths of a turn, the result is that at the end of the pulses causing the movement of the armature of relay 141, typewheel 100 has arrived at the desired position.

At this moment, a cam 144, carried by shaft 1R, mechanically actuates the printing bail (not shown) carried by lever 145. Immediately afterwards, another cam 146 closes the contact of the springs 131 inserted in the local circuit of electromagnets 124 and 130, for causing the return to normal of the typewheel (Fig. 5). Contact 131 remains closed until the end of a single rotation of shaft 1R, so as to give the typewheel the total time required for it to make a complete turn.

During the passage of cam 14 under springs 131, another cam causes the paper tape to advance.

At the end of one complete turn of shaft 1R, the positive contact of relay 140 is connected again to starting magnet 7, so as to await the next signal.

Fig. 7, showing an example of a general layout of a complete station, serves to show the connections between the various elements that have been above described, separately, the same reference numbers having been affixed to the various members. In order to avoid complicating the drawing to the point of making it illegible, the springs of the transmitter distributor have not been shown in detail, and the cams and other members the function of which is merely mechanical are not shown. The mechanism used to disengage receiver shaft 1R and to engage transmitter shaft 1T when a key is depressed is represented wholly schematically by slider 147, operated by a bell-crank 148, which letter is itself controlled by connecting-rod 94. The slider carries two forks 149 and 150, respectively acting so as to cause members 151 and 152 to slide on shafts 1R and 1T and so as to cause them to engage in the respective holes of discs 153 and 154 or disengage them therefrom.

Line wire L normally is connected to polarized relay 141 via contact 37, and consequently the station is always ready for reception.

When the device is used for transmission, the depressing of a key engages shaft 1T, disengages shaft 1R and, by closing contact 36, causes the operation of slow-acting relay 29, which latter sends out the starting pulse by connecting the positive pole of battery 34 both to line wire L and to relay 141. Resistor 155 is inserted in series with relay 141 by the opening of contact 156, to compensate for the line resistance and to cause the two relays 141 of the transmitter and of the receiver to operate substantially simultaneously.

As soon as the transmitter shaft has commenced to rotate, contact 37 is opened and the negative and positive pulses constituting the code of the signal to be transmitted are sent by the distributor via the contact springs 65, 66 and 67 of the key which has been depressed.

It is possible to receive locally the transmitted message by eliminating the action of fork 150, so that the receiver remains engaged during the transmission, and by also keeping the line wire connected to relay 141 by means of key 156.

In case it is deemed desirable to use only pulses of the same sign, instead of alternating positive and negative pulses, the following modification affords the possibility of so doing. The transmitter distributor sends out two separate series of pulses of the same sign. The first series corresponds to the negative pulses from 0 to 6 and the second series to the positive pulses, also from 0 to 6. At the receiver, polarized relay 141 is replaced by a simple relay and the receiver distributor first connects the contact of this relay to electromagnet 124 during the time reserved for the pulses of the first series, then to electromagnet 130 during the time reserved for the

pulses of the second series. The operation remains the same, but, in order to make the total duration of pulses of the same sign equal to that obtained by changing the sign, it is necessary to reduce the length of each one of them, which entails a much more precise and fine construction of the apparatus.

The system that has just been described is intended for wired circuits, but it can evidently be adapted to radio links by replacing the positive and negative pulses by the modulation of the carrier wave with two frequencies and by separating these latter frequencies at the receiving end, by means of filters or resonant circuits.

While certain embodiments of this invention have been shown and described, these are purely illustrative and the invention is limited only by the scope of the hereunto appended claims.

What is claimed is:

1. In a printing telegraph system, a receiving type-wheel, an intermittently operated driving escapement wheel, a tuning fork controlling the rotation of said escapement wheel and means for setting said tuning fork into vibration when said escapement wheel starts to rotate, said last means including a prism mounted so as to rotate in synchronism with said escapement wheel and positioned so as, upon rotation, to pass through the arms of said tuning fork and engage said arms so as to set said fork into vibration.

2. A system according to claim 1, also including at the transmitter an intermittently rotating impulse sending arm and means for producing and transmitting a starting current pulse to both transmitter and receiver rotating drives, whereby said rotating arm and said escapement wheel are synchronously set into motion.

3. A system according to claim 1, also including at the transmitter an intermittently rotating impulse sending arm and means for producing and transmitting a starting current pulse to both transmitter and receiver rotating drives, whereby said rotating arm and said escapement wheel are synchronously set into motion, and also including at said transmitter a slow-acting relay determining the start of rotation of said arm, and means for sending said starting pulse through said relay to compensate for any difference in time of operation between said transmitter and said receiver.

4. System according to claim 1, also including at the receiver a distributor actuated synchronously with the rotation of said escapement wheel and acting to cause the starting, the positioning of the typewheel and the return thereof to the starting point.

5. System according to claim 1, also including at the receiver a distributor actuated synchronously with the rotation of said escapement wheel and acting to cause the starting, the positioning of the typewheel and the return thereof to the starting point, also including means for controlling the rotation of the typewheel including the advance thereof through large and small angles, said means including two escapement wheels, electromagnets controlling said escapement wheels, epicycloidal gearing and a differential connecting said escapement wheels and said typewheel, the operation of said electromagnets corresponding with negative and positive pulses, respectively, received from the transmitter and acting to predetermine the selection of the degree of angular advance.

6. System according to claim 1, including also a single driving source and differential means connected between said source, said escapement wheel and the typewheel, so as to drive both said wheels from said single source.

7. A system according to claim 1, also including at the transmitter an intermittently rotating arm and means for producing and transmitting a starting current pulse to both transmitter and receiver elements, whereby said rotating arm and said escapement wheel are synchronously set into motion and likewise including at both stations of said system means for controlling the transmitter and receiver rotating shafts, the transmitter shaft normally being engaged and means whereby the depressing of a key of the keyboard produces at the receiver, simultaneously, the disengagement of said transmitter shaft and the engagement of said receiver shaft.

8. A system according to claim 1, also including at the receiver a shaft mounting said escapement wheel, at the transmitter an intermittently rotating impulse sending arm, a second shaft mounting said arm, and means for producing and transmitting a starting current pulse to both transmitter and receiver rotating drives, whereby said rotating arm and said escapement wheel are synchronously set into motion and likewise including at both stations of said system means for controlling the coupling of said transmitter and receiver rotating shafts, means normally engaging the transmitter shaft with the receiver shaft and means whereby the depressing of a key of the keyboard produces at the receiver, simultaneously, the disengagement of said transmitter shaft and the retention of the engagement of said receiver shaft, also including additional means at the transmitter to prevent the operation of the means for normally disengaging said receiver shaft at the transmitter, whereby the transmitted message can be received locally.

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