Oct. 17, 1944. L. M. POTTS 2,360,579

KEYBOARD TELEGRAPHY

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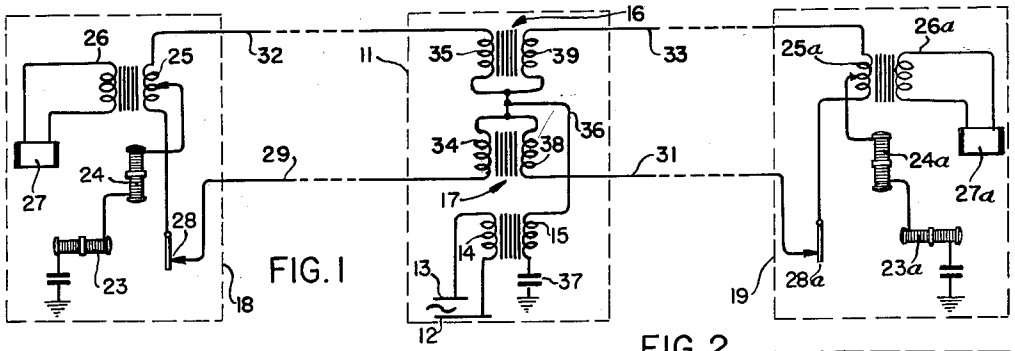
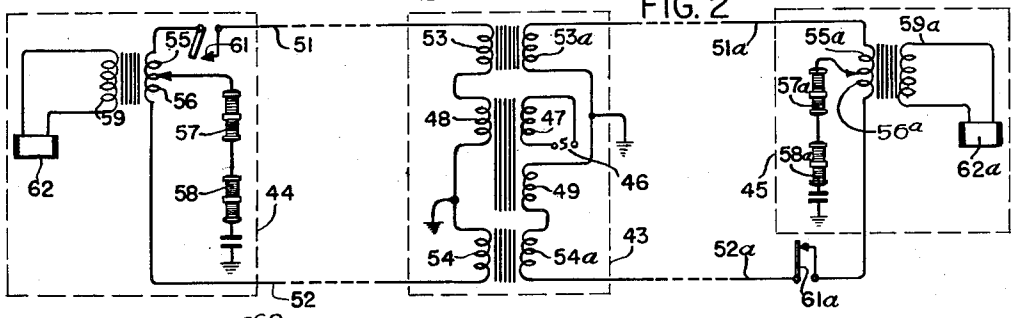


FIG. 1

FIG. 2



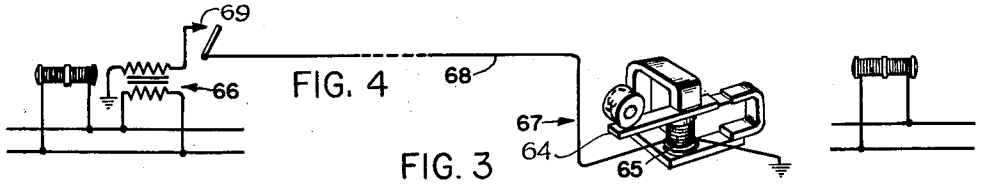
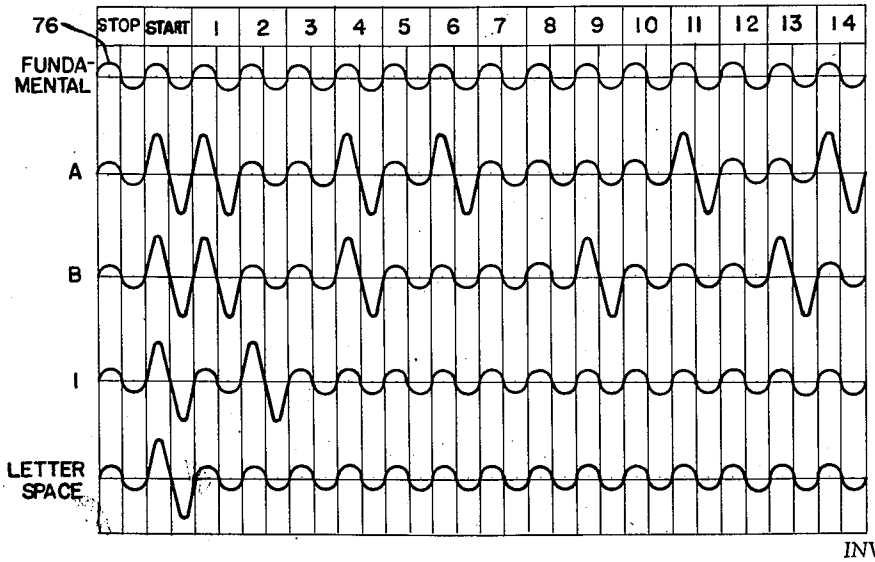


FIG. 4

FIG. 3



INVENTOR.
LOUIS M. POTTS

BY

ATTORNEY.

Oct. 17, 1944. L. M. POTTS 2,360,579

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FIG. 6

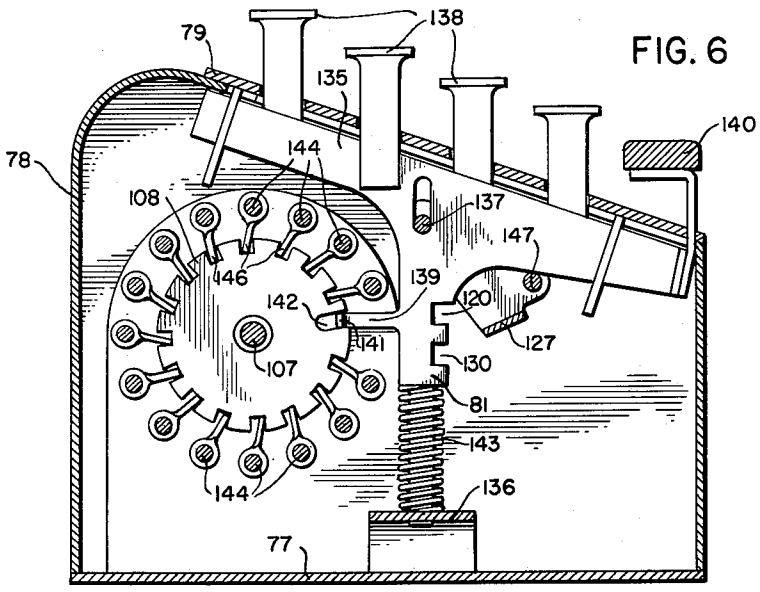


FIG. 11

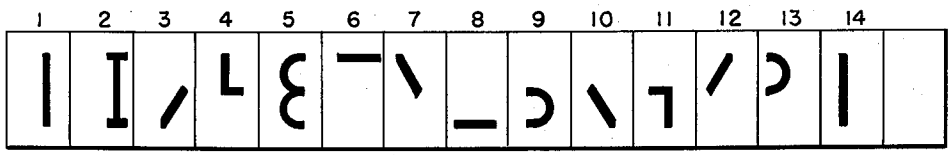
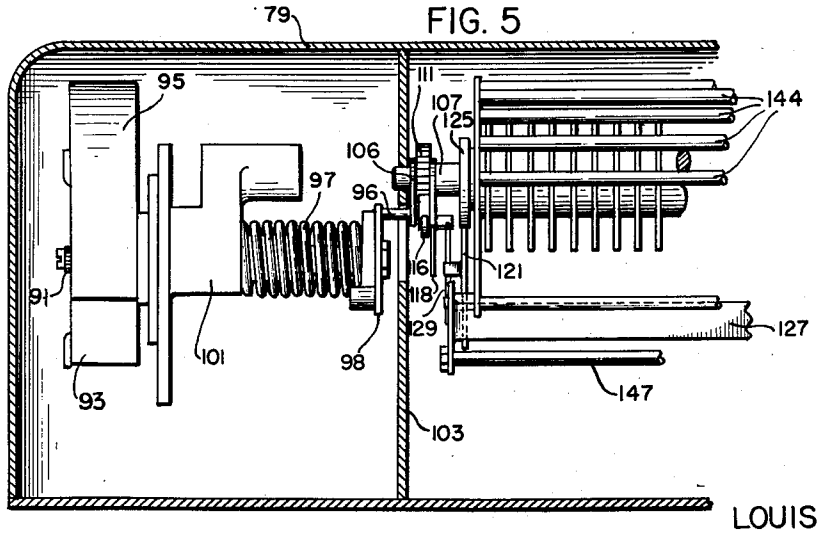


FIG. 5



INVENTOR.
LOUIS M. POTTS

BY

H. B. Whitfield
ATTORNEY.

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FIG. 7

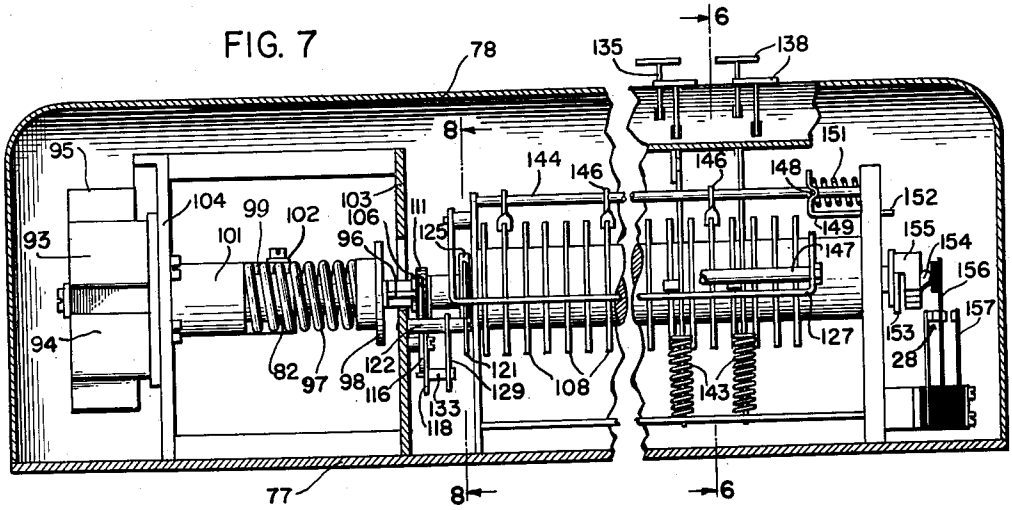


FIG. 8

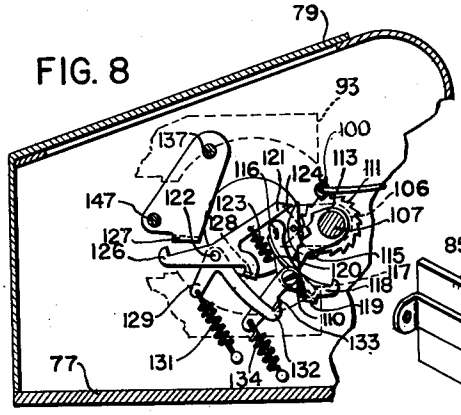


FIG. 10

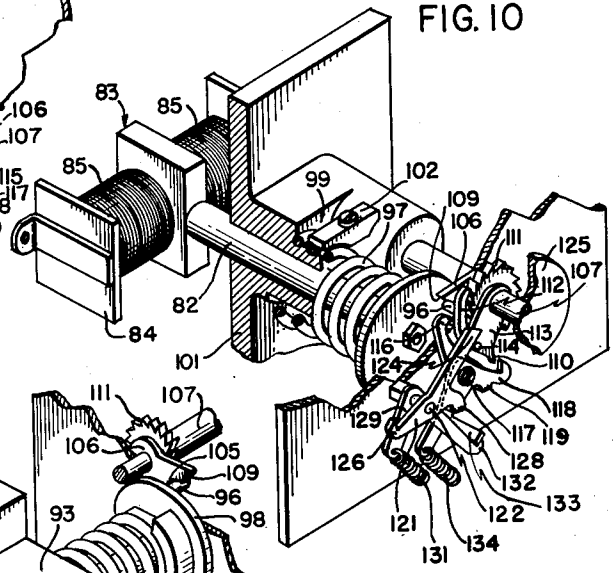
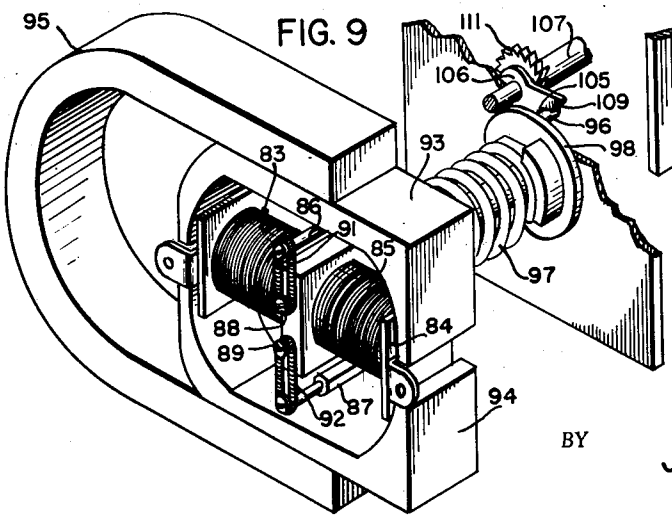


FIG. 9



INVENTOR.
LOUIS M. POTTS

BY

ATTORNEY.

Patented Oct. 17, 1944 2,360,579

UNITED STATES PATENT OFFICE

2,360,579

KEYBOARD TELEGRAPHY

Louis M. Potts, Evanston, Ill., assignor to Teletype Corporation, Chicago, Ill., a corporation of Delaware

Application April 27, 1942, Serial No. 440,653

19 Claims. (Cl. 178—30)

The present invention relates to signaling telegraph apparatus and more particularly to improvements in printing telegraph systems utilizing alternating current for synchronizing apparatus between outlying and central stations.

The principal object of the present invention is to produce simple telegraph printing devices which can be operated and controlled by a small amount of power such as is transmissible over ordinary telephone subscribers' communication loops.

Another object of the present invention is to provide a system of telegraph apparatus whose maintenance and manufacturing cost are appreciably low and one that may be operated at moderate speeds of signal transmission, and that will require a minimum of local equipment for maintaining signal synchronism between station equipment.

In this basic conception, the present invention proposes the use of an alternating current carrier wave preferably having a fundamental frequency of sixty cycles as is commonly available from commercial sources and having a regulated amplitude sufficient for operating synchronously responsive prime movers such as synchronous wound rotary or tuned vibrating motors. Upon this fundamental wave there is superimposed at variable positions of a signal span full or half wave amplitude modifications which in a receiving apparatus of the system affect specially responsive apparatus in the performance of various functions such as printing, cyclic release, etc. In the utilization of this form of signaling, it is proposed that station equipment be provided with apparatus for automatically arresting the printing and transmitting mechanism in a normal or zero position. From this position, and with the motor elements continuing in vibration or rotation at a measured frequency, a release or start impulse having the form of a modified full or half wave, as preferred, initiates into rotation a receiving shaft which thereupon is adapted to describe a cycle of operation corresponding to a predetermined number of component wave impulses. During this cycle of operation one or more further wave modifications are effected upon the fundamental frequency for the purpose of operating at printer station equipment, a print hammer responsive to the modified wave solely, or to a stronger current, as preferred, causing to be printed, by composition of elements, a character symbolic of or universally indicative of the particular combination of modified impulses thus transmitted.

Within the concept of the present invention, each printing cycle may consist of a number of alternating current component waves or wave intervals commensurate with the number of character signals to be transmitted so that the modulation of a single wave may be made to effect whole character printing. Preferably, however, it is proposed herewith to utilize a character printing type wheel that is made up of character fragments. These fragments or character component elements may be composed in various combinations so as to form pictorially alphabetical or numerical character representations after the manner of popular conventions or ones resembling popular conventions depending upon the number of composition elements utilized, and the degree of artistry, accepted style, or personal preferance employed in the design and formulation of the character elements.

For a more comprehensive understanding of the present invention reference may be had to the accompanying drawings and to the following detailed specification in which like reference characters designate corresponding parts throughout and in which,

Fig. 1 is a diagrammatic circuit illustration of a central station equipment and representations of outlying stations' equipment utilizing the principles of the present invention;

Fig. 2 is a circuit diagram of a modified practice utilizing the principles of the present invention;

Fig. 3 is a fragmentary curve chart illustrating several typical signal codes utilizing a fourteen unit wave cycle with amplified full cycle waves;

Fig. 4 is a rudimentary application of the present invention for use in nonswitching or one way installation;

Fig. 5 is a fragmentary plan sectional view of a keyboard mechanism having embodied therein certain elements utilized in the present invention;

Fig. 6 is a side sectional view of a keyboard mechanism such as that featured in Fig. 5 and taken approximately on line 6—6 of Fig. 7;

Fig. 7 is a transverse sectional view of a keyboard transmitter apparatus such as that shown in Figs. 5 and 6;

Fig. 8 is a transverse sectional detail view featuring the principal drive shaft and operating mechanism of the keyboard apparatus;

Fig. 9 is a fragmentary perspective view featuring a vibrating motor assembly and principal operating shaft such as that utilized in the aforedescribed keyboard mechanism illustrations;

Fig. 10 is a fragmentary perspective view from another angle of the keyboard operating motor and auxiliary drive mechanism; and

Fig. 11 is a development view of the type wheel periphery featuring the alphabetical and numerical character fragments or component elements.

Referring now more particularly to the accompanying illustrations the reference character 11, Fig. 1, denotes a dotted outline of a manual exchange system comprised of a pair of commercial alternating current supply lines 12 and 13, a power transformer comprised of the windings 14 and 15, and a pair of balancing induction control transformers 16 and 17 forming part of a cord circuit in a manual system or part of a link circuit in an automatic system. Characters 18 and 19 designate two illustrative outlying or subscribers' stations represented by dotted rectangles of which there may be any number similarly communicating with the central station equipment.

At each outlying station 18 or 19 there may be provided a keyboard transmitter apparatus as well as a receiving printer, the latter for recording both outgoing and incoming communication. At stations 18 and 19, the keyboard transmitting equipment is represented by the motor armatures 23 and 23*a* which are indicated as being in series circuit connection with the printer motor armatures 24 and 24*a* from a center tap of local primary transformer windings 25 and 25*a* whose secondary windings 26 and 26*a* are in circuit with printer operating magnets 27 and 27*a*.

The keyboard apparatus at each station is adapted to supervise a pair of transmitting contacts 28 and 28*a* which lie in one of the lines 29 or 31 which form part of a pair connecting each outlying station with the central office 11, the other lines of said pairs being designated 32 and 33, respectively.

Outlying station 18 is connected over its line 29 to one terminal of a winding 34 at the central station transformer 17 while its other line 32 is connected with one terminal of a winding 35 of the other central station transformer 16, the opposite terminals of said windings 34 and 35 being connected together and joined by a line 36 from one of the terminals of the power transformer's winding 15 whose opposite terminal extends through a filter condenser 37 to ground. In correspondence therewith outlying station 19 is connected over its lines 31 and 33 with the opposite windings 38 and 39 of the transformers 17 and 16, respectively, and these windings are connected together at their opposite terminals and also over line 36 to the winding 15 of the power transformer as afore-described.

In accordance with this arrangement of elements, alternating current supplied from lines 12 and 13 induces a secondary voltage in winding 15 which is carried over line 36, to the two windings 35 and 39 of transformer 16 whereby each neutralizes the impedance effect of the other. These secondary power current pulsations travel in the same direction over lines 29 and 32 to the midpoint of local transformer primary 25, it being noteworthy that because the halves of coil 25 oppose each other, no current will be induced upon the transformer secondary 26 but instead the secondary pulsations from coil 15 without appreciable impedance loss will traverse in series the windings 24 and 23 of the vibrating printer and transmitter elements to condenser filtered ground.

Since the secondary winding 15 of the power transformer is connected in a similar manner with station 19 through the afore-described circuit connections with coils 38 and 39, no current will be induced upon the secondary winding 26*a* of that station's printer magnet 27*a*. As a result of the neutralizing effects of each half of the windings of local transformer coils 25 and 25*a* upon the other half, no magnetic circuit is established on either side of these transformers; moreover, because winding 35 opposes winding 39 and winding 34 opposes winding 38, there prevails a minimum of impedance in the respective legs of these circuits so long as the described balance is maintained. The opening of one of the circuit legs by reason of the separation of contact pair 28 will, however, cause current to be induced upon one of the secondary windings as will now be described. With the opening of one of the transmitting contact pairs such as 28 there is not only removed one of the balancing halves of the coil 25, permitting the other half to actuate magnet 27, but through effectively removing from the circuit its coil 34 of transformer 17, the winding 38 is permitted to act as an impedance and to reduce the current in circuit 31. The major portion of current from supply line 36 is thereby diverted and flows over the other leg 33 of the parallel paths and through the winding 39. In consequence of this effect, and since the impedance of coil 38 reduces the current flow through leg 31, current is increased through leg 33 causing the upper half of winding 25*a* to induce a voltage upon the secondary winding 26*a* at station 19. The secondary windings 26 and 26*a* are connected to magnets 27 and 27*a*.

It will be understood that the opening of contact pair 28*a* through the operation of the keyboard at station 19 will have a similar effect upon the printer magnet 27 of station 18.

In the detailed description which is to follow hereinafter, the precise manner of operation of the printing and transmitting mechanisms will be described in particular detail. The immediate purpose is to convey an understanding of methods of operation relating to the system generally and to the various stations' apparatus for achieving and maintaining communication through a central office with other similarly equipped stations. Towards this end and with the particular object of illustrating a further modification of the system to which the present invention finds particular application, attention is now directed to Fig. 2 wherein there is illustrated in correspondence with Fig. 1, a central station indicated by the rectangular enclosure 43 and two representative outlying stations 44 and 45. In this system alternating current originates at a source 46 at the central station and is impressed through the primary winding 47 of a power transformer to a pair of secondary windings 48 of station 44 and 49 of station 45.

Each one of the outlying stations 44 or 45 is connected with the central office by means of a pair of lines 51 and 52 or 51*a* and 52*a* as clearly indicated in Fig. 2. As in the case of the preferred embodiment, Fig. 1, lines 51 and 52 form part of a loop circuit having the afore-described power transformer secondary winding 48 in series, together with a pair of additional transformer windings designated 53 and 54. At the outlying station, each loop circuit includes a transformer primary winding consisting of two halves designated 55 and 56 with a midpoint tap connecting through the vibrator motor windings 57 and 58 of the printer and transmitter, re-

spectively. The corresponding several elements at station 45 are designated by similar reference characters having the auxiliary reference suffix *a*.

Windings 55 and 56 oppose each other when the loop circuit 51—52 is closed and under these conditions, no current is induced upon the local station transformer secondary 59. However, when this balanced condition is destroyed, only winding 56 remains effective whereupon a secondary current is induced in winding 59 and as a result flows to print magnet 62. As a consequence of the opening of contact pair 61, current ceases to flow in winding 53 and on this account no current is induced in winding 53*a*. Therefore, at station 45, a corresponding condition obtains when current is cut off in winding 55*a*, winding 56*a* induces a voltage upon secondary 59*a*, and magnet 62*a* is operated. The current for the lower circuit 52 is obtained from primary winding 47 through induction upon secondary winding 49 which is in series with winding 54*a* as obvious from Fig. 2. Current is then increased in secondary 54 by induction from primary 54*a*. Since the circuit which includes winding 48 is at this time open, this current drain in the power transformer is accordingly relieved and the current flow through the secondary winding 49 is correspondingly increased. As a consequence, the current flow through half-winding 56 which is in circuit with secondary winding 54 is also increased causing to be induced a stronger secondary current upon transformer winding 59. The effective circuit is traceable from ground through the winding 54, line 52, winding 56, to the midpoint tap of that transformer's primary, thence through the winding of the vibrating armatures 57 and 58 to ground.

At this time, no current is induced upon winding 53*a* by the primary winding 53 which is in series with the secondary 48 (now open) so that accordingly no current is available in circuit 51*a* of station 45. This destroys the balancing or neutralizing effect of half winding 55*a* against the other half winding 56*a* of the local transformer primary with the result that a secondary voltage is induced upon winding 59*a* causing to be operated the print magnet 62*a*.

From the foregoing, it will be clear that under normal conditions with stations 44 and 45 connected together for communication through automatic switchboard or manual cord and plug arrangement, as well known, alternating current from a common source may be obtained parallelly over circuits 51 and 52, the windings 57 and 58 causing the latter motor elements to attain a vibration frequency which corresponds with that communicated to any other station in the system. When signal transmission is started by the opening of the contact pair 61, then, without interrupting the vibration frequency which is thereafter available over but one-half of the windings 55 and 56, there is caused to be induced a further control, and that, upon the print magnet 62 so as to produce record printing both locally as well as at the remote station.

As has already been stated, the systems of telegraph transmission discussed above though specifically designed for use with vibrating motor type actuators may be adaptable for use with any other class of synchronously driven motor. The principal incentive in the use of a pulsating power supply source is believed to be its adaptability as a phase regulating medium and the facility with which its undulations may be modified for the purpose of signal transmission and function control. One of the functions now to be described is that of print hammer operation, a performance which may occur one or more times during each cycle of rotation of the type carrying wheel. In Fig. 4, a print hammer has been designated 64 and indicated as an integral element of a biased armature of polar magnet 65 at a receiving station 67. At a transmitting station 66, alternating current is obtained from a frequency regulated source which should have exactly the same vibrating frequency as that of an alternating current source at station 67 although it has been found that two independent sources of supply under these conditions of operation need not be accurately phased.

The contact pair 69 is closed periodically in accordance with the operation of the keyboard apparatus and its performance may be identical with that of contact pair 28 described above. Upon the closure of this contact pair a circuit 68 is completed for energizing print magnet 65 which thereupon will actuate its armature 64 causing it to strike against the type wheel at precise cyclic intervals coinciding with the presentation of appropriate character printing fragments of its periphery. The curve representing the signal transmitted over line 68 may resemble the fundamental curve 76 during any of the fourteen character cycles with the intervening period constituted of a straight line representing zero. The instant at which armature 64 is driven into impingement against the type wheel may correspond with the first or second half cycle of each wave. This will depend upon the particular design of magnet 65 with regards to the direction of its winding as effecting the permanent magnet cooperating therewith. For some purposes, it may be preferable to design polar magnet 65 so that the first half wave of a complete alternating current wave will actuate its armature affording the second half wave time interval in which to restore the armature to its unoperated position. In this way, there may be avoided a condition whereby there is first created an additional bias towards the unoperated position which in addition to the normal spring bias must be overcome during the operating half wave if the relay should be designed to be effective at the second half of a full wave. Tests have proved, however, that satisfactory supervision may be had under either conditions of polarity print magnet control.

The present system utilizes a fundamental alternating current frequency wave represented in Fig. 3 at 76 and designated by the legend Fundamental. This recurring undulation may be transmitted indefinitely and its effect upon a synchronous wound motor or upon a vibrating motor is to maintain in motion the station apparatus with the regularity of the current stabilization factor. The manner of signaling in accordance with the herein proposed system, consists in a practice of superimposing an amplitude modification such as designated in the example curves A, B, and I, or by changing the modified waves in any other way, however, in either case a unit cycle of operation is designated by a total of sixteen divisions. These consist of fourteen signaling intervals each interval of which is comprised of a full alternating current wave, that is, two half waves of opposite characteristics, and two additional signal intervals or component wave intervals designated Stop and Start.

As may be noted, each one of the charted

signals consists of a full wave modification during the Start interval. Thereafter the occurrence of wave modifications varies in accordance with the particular signal. This variation in nature may not be termed permutational variation within the sense that this term is used in connection with the conventional five or six unit signaling code, but instead the signal composition consists of a number of wave modulations or modifications during the respective component intervals of which there occur in printing position in a printing mechanism, predeterminately designed in accordance with a plan, certain character composition fragments.

Referring now to the illustration, Fig. 11, there is indicated a typical arrangement of character composition fragments or elements, fourteen in number. Thus, the letter A which consists of an amplitude modulation in the first, fourth, sixth, eleventh, and fourteenth intervals will be composed of the fragments illustrated in the type wheel developments and thereat designated 1, 4, 6, 11, and 14. A composite figure made up of these fragments of printing elements in the designated order will produce a character that may be readily identified as the alphabetical character A and after the same manner alphabetical characters B, C, etc. may be composed, as may also the numerical integers from a representative arrangement of fragments as designated in Fig. 11. Where the artistic composition of a set of communication characteristics following any other pattern is desired, it is necessary but to arrange the fragments in shape and number to suit the particular requirement. For the purpose of obtaining a simplified and yet readily discernible alphabet, fourteen character fragments as shown here proved sufficient for practical comprehension.

Referring now more particularly to Figs. 5 to 10, inclusive, attention is directed to the detailed construction of a keyboard transmitter apparatus designed for the purpose of generating amplitude modulation or modification signals of the type portrayed graphically in Fig. 3. This signal generating unit is preferably housed in an enclosure consisting of a base plate 77 and a rectangular cover housing 78. The top surface of the enclosure housing 78 is preferably sloped at a slight angle as clearly shown in Fig. 6 and thereat provided with a face plate 79. The space within the enclosure housing 78 is occupied by a set of vertically movable character or key bars 81 all of identical profile, and a rotary transmitting apparatus the center of which is a cyclically rotatable drive shaft 107. An oscillatory drive shaft 82 receives its motion from a vibrating armature element generally designated 83, Figs. 9 and 10, which consists of a transverse soft iron core member 84 on which is supported a pair of windings 85 connected in series.

Electrical current is supplied to the windings 85 from suitably located binding posts, in the stationary part of the motor structure, which have electrical communication with the conductor elements 86 and 87. These in turn are bridged with other conductor terminals 88 and 89 by means of the pair of conductor garter springs 91 and 92, Fig. 9. When an alternating current carried parallelly over conductors 86 and 87 is impressed upon the windings 85 of armature 83, its pole faces, becoming alternately and oppositely charged at the current changing frequency, do accordingly become attracted to and repelled from the field magnet pole pieces 93 and 94 of a horseshoe permanent magnet 95.

As a result, an oscillatory movement initiating with the vibrating armature 83 is communicated through shaft 82 to a crank pin 96. Also, to reduce the amount of energy required in the operation or propulsion of shaft 82, and to assist in maintaining regularity of time in the aforedescribed oscillatory movement, a tuned reed having the shape of a coil spring 97 is provided, one end of which is secured to a crank pin disc 98 and the other end of which is disposed in a recess 99 of a journal plate 101. Within the afore-mentioned recess 99, tuned coil spring 97 is anchored by means of a variably positionable anchor lug 102 through the use of which an adjustable number of coils and fractions of coils may be disposed so as to be free to vibrate to correspond accurately with the current oscillations. When alternating current is applied to a device of this sort, the first impulse, being of one polarity, biases the armature and places a small torsion upon the spring in one direction. As the current is reversed this torsion is removed, the force built up in the spring is spent in moving the armature in the opposite direction, and together with the following reverse impulse the armature is moved further in the reverse direction than in the direction it had attained in the first movement and thereby still more energy is stored in the spring. The accumulation of energy and accordingly the increase in amplitude continues until a condition is reached when the energy loss in each swing equals the energy added in each swing when a constant amplitude obtains. While a certain amount of current is consumed in maintaining or in regaining this maximum amplitude of vibration, it is notably of smaller degree than that which would be otherwise required for performing the necessary printer operations if no advantage was taken of the practice of storing energy from idle oscillations.

As best indicated in Fig. 9, the motor structure is supported as a separate unit from the remaining portion of the keyboard apparatus and as shown in Fig. 7, may be mounted upon a pair of sidewalls 103 and 104. The crank pin 96 extends through an opening in wall 103, Fig. 5, and is received within a slot 105 of a pallet arm 106 carried freely upon the principal operating shaft 107 which traverses longitudinally the chamber of the housing containing the keyboard mechanism and a series of peripherally notched operating discs 108.

In accordance with the design of driving arm 106, any variation in the amplitude or angle of rotation of motor shaft 82 is not transmitted thereto because of the fact that crank pin 96 after imparting a predetermined degree of rotation to arm 106 by reason of its engagement with the adjacent surfaces of slot 105 will, due to overtravel, leave the slot in either direction as permitted by the flared or undercut surfaces 109 which have sufficient width to accommodate all of the possible overtravel that said pin 96 may have within the known limits of operation. Upon its return movement ,after having achieved any degree of overtravel, pin 96 follows back into the slot 105 and reverses the direction of rotation of arm 106 from its previous direction repeating this phenomenon indefinitely regardless, as has been said, of the angle of vibration or oscillation.

While arm 106 is freely rotatable on shaft 107

as is also its adjacent ratchet wheel 111, driving connection is established between said elements 106 and 111 (which are integral with each other) and the shaft 107 by means of an engagement pawl 112 pivotally carried at 114 between an arm 113 integral with shaft 107 and pallet arm 106 which is spring urged in a counterclockwise direction about its pivot 114 so as to seek engagement between its shoulder tooth 115, Fig. 8, and the teeth of ratchet wheel 111 successively, as the latter member is oscillated through its integral association with pallet arm 106.

Thus shaft 107 is able to rotate by intermittent single step movements as ratchet wheel 111 is oscillated to and fro since the shouldered extremity 115 engages successive teeth and releases previously engaged teeth as detent 100 holds wheel 111 against following backwardly, in accordance with the conventional operation of spring urged ratchet pawls. A zero position is achieved by shaft 107 when the tail end of pawl 112 comes into engagement with the uppermost extremity 116 of an auxiliary lever pivoted at 117 alongside of its associated control lever 118, also pivoted at 117, see especially Fig. 8. Moreover, lever 116 is spring urged in a clockwise direction, Fig. 10, about pivot 117 until its lowermost extremity (not visible in Fig. 10 but dotted in Fig. 8) engages a horizontally extending shelf 119 of its control lever 118. It is to be understood that a torsion spring 120 carried on shaft 117 which thus urges lever 116 clockwise, Fig. 8, until its tail engages shelf 119 of lever 118 is slightly stronger than the spring (not shown) which serves pawl 112 so as to overcome the latter member upon the afore-described encounter and to coerce the pawl into a withdrawn condition and to so retain it thereafter that its shoulder 115 is unable to further engage the teeth of ratchet wheel 111. Resumption of engagement between pawl 112 and ratchet wheel 111 is effected by withdrawing the obstructing auxiliary lever 116 and this is done by rocking its control lever 118 in a counterclockwise direction about pivot 117 as will now be described.

A three armed lever 121 is pivoted at 122, Fig. 8, and urged in a clockwise direction by its associated spring 123. An extremity 124 of one of its arms follows the periphery of a cam 125 which is integrally associated with shaft 107.

Another one of the arms of lever 121 is provided with a hooked extremity 126 for engaging a latchable bail 127 for a purpose later to be described. The third arm of lever 121 terminates with a sidewardly extending lug or shelf 128 which is disposed in the path of one arm 129 of a latch lever also pivoted at 122 and urged by a spring 131 in a counterclockwise direction so that its latching tooth 132 may engage and hold a sidewardly extending projection 133 which is integrally formed upon one arm of the afore-described control lever 118 which is influenced by a spring 134 in a counterclockwise direction about pivot 117.

When thus latched through its lug 119, control lever 118 permits auxiliary lever 116 to be disposed sufficiently clockwise so that its sidewardly protruding lobe may engage the rearmost end of pawl 112 first camming and then retaining the latter member's tooth 115 out of engagement with ratchet wheel 111. As a result of this condition ratchet wheel 111 when reciprocated by its integrally associated arm 106 will not cause the step-by-step advancement of shaft 107, but instead will oscillate idly. The placing of control lever 118 into the position where it may be latched by the extremity 132 is a function under the control of the toothed extremity 110, Fig. 10, of arm 113 which lies in the same vertical plane as does the toothed projection of control lever 118.

From the foregoing it will be evident that while the principal object of motor 83 is to impart rotation to shaft 107 in accordance with cyclic control, this movement is restrained by the pawl and ratchet control mechanism just described by reason of the fact that control lever 118 when latched in the condition shown in Fig. 8 does not permit pawl 112 to extend its engagement nose 115 into the path of ratchet wheel 111. Thereafter, reciprocating crank pin 96 moves idly, its force terminating with the to and fro movement of the integral assembly 106—111 until said control lever 118 releases pawl 112. The supervision of control lever 118 is dependent upon latch lever 129 which in turn is actuated by the three armed lever 121. Movement of lever 121 in a counterclockwise (latch 129 freeing) direction is contingent upon a reciprocation of the key bar latch bail 127 which will now be described.

Having particular reference to Figs. 6 and 7, it will be noted that each key bar 135 is supported for vertical parallel movement within a slotted longitudinal guide bar 136, and a common transverse alignment rod 137. The several bars 135 are preferably of similar contour though the location of the individual key top sections 138 and the space key 140 is different. In this way the standard practice and arrangement of a conventional keyboard is made possible. Each key bar 135 is provided with a sidewardly extending arm 139 which, in turn, is bent sidewardly as at 141 and is thereat engageable within a slot 142 of an individually associated disc 108.

Accordingly, there is provided one notched disc 108 for each key bar 135 and also a return spring 143 for seeking to maintain each key bar in its uppermost position and at the same time maintaining its associated disc 108 in its counterclockwise extreme position. When one of the key tops 138 is depressed, its associated key bar 135 is driven downwardly compressing spring 143 and rotating disc 108 in a clockwise direction (Fig. 6) through a limited angle of rotation. As a particular key bar 135 is depressed, it engages universal rod 147 which rocks latch bail 127 into an extreme clockwise position, Fig. 6, entering a notch 120 of the particular bar 135 then operated, and the notches 130 of the remaining unoperated key bars 135 with whose level the operated key bar notches 120 then come into horizontal registration. In this way, the operated key is held down while the other keys are prevented from being actuated until restoration of the former is effected.

The periphery of each disc 108 is provided with a plurality of evenly spaced notches according to the number of component intervals of a complete printing cycle, in the instant embodiment sixteen. Since it is desired that the depression of each key top 138 results in the transmission of certain ones only of the fourteen possible amplitude modulation signals, means are provided whereby in accordance with the rotation of each key bar certain preconditioning operations individual to that key bar are established.

This is obtained by associating each one of the discs 108 with certain ones only of a periph-

eral distribution of a set of longitudinal rods 144, fourteen in number. The control over the start impulse is invariable and hence for the generation of this impulse, an inert projection is provided taking the position of one of the projections 152 when shifted or extended. The connection between each disc 108 and the rods 144 and 145 is effected through the medium of small paddle arms 146 secured at various points to the rods 144 and disposed within the peripheral notches of certain discs 108 in accordance with the relationship of that particular signal component to the discs 108. That is to say, where for example, the letter A is to effect an amplitude modulation of the start impulse wave and the numbers 1, 4, 6, 11, and the 14 impulse waves, paddles 146 are provided for connecting the character A disc 108 with the rods 144 and 145 relating to the afore-recited particular impulse waves.

A further result of the depression of any one of the key bars 135 is effected through its engagement with the universal rod 147 which is integrally associated with and parallel to the universal latch bail 127 mentioned above. Latch bail 127 is pivoted at its extremities upon the alignment rod 137 and, upon the engagement of any one of the bars 135 with its longitudinal universal rod 147, this member is rocked in a clockwise direction, Fig. 6 (counterclockwise, Fig. 8), about its pivot 137 until the longitudinal bar portion 127 engages behind the shouldered extremity 126 of the three armed lever 121. Upon this encounter, spring 123 is overcome and three armed lever 121 is rotated slightly in a counterclockwise direction until the latch projection 126 is securely seated behind bar 127. This holds bar 127 and consequently the universal rod 147 in the latched position until towards the end of a transmitting cycle release is effected when the cam 125 engages with its cam projection the extremity 124 of three armed lever 121.

Cam 125 being carried by shaft 107 rotates in a step-by-step manner in a clockwise direction as viewed in Figs. 8 and 10 until its cam projection engages extremity 124 causing lever 121 to be moved in a counterclockwise direction about its pivot 122 and against the influence of its return spring 123 until the key latching bail 127 is released and permitted under the influence of a particular key bar spring 143, then under compression, to resume its normal position as designated in Fig. 6.

Each rod 144 may have any number of paddle arms 146 connecting it with ones of the discs 108 depending upon the number of times that a particular character fragment, Fig. 11, characteristically associated with said rod 144 occurs in the alphabet. In other words, while certain ones of the character fragments or elements, Fig. 11, may enter into combination with other ones to make complete character symbols less frequently, certain others of said character elements may enter into combinations more frequently. Accordingly, the number of paddle wheels 146 relating to some of the rods 144 may be correspondingly greater in number than those of other rods 144.

When any one of the discs 108 is rotated under the impetus of a key bar 138, it displaces its associated paddle arms 146 and causes its related rods 144 and 145 to be rocked in a counterclockwise direction, Fig. 6, and when this occurs, a pin 148, one of which passes through each of the rods 144 and lies in a recess of a shiftable member 149, effects the camming of said member rightwardly, Fig. 7, against the compression of its associated spring 151. As a result, the remote extremity 152 of said member 149 is displaced from a normal extent of protrusion to a somewhat greater extent which is sufficient to come into the path of a rotatable extremity 153 of a contact closing lever whose other portion lies at 154 in the axial center of shaft 107 and the assembly of code discs 108.

Contact closing lever 153—154 is pivotally carried upon an endmost supporting member or collar 155 so that when extremity 153 engages one or more of the displaced extremities 152 of the members 149, the lobe 154 of the contact closing lever will force contactor 156 into engagement with one of its associated contact springs 157 depending upon whether open or closed line is the normal line condition, and cause to be generated correspondingly signal impulse modulations as afore-described, at characteristic intervals in the cycle of rotation of shaft 107 which modulations relate at a remote station with associated character elements, Fig. 11, of a type wheel such as that explained and described in copending application Serial No. 465,333, filed Nov. 12, 1942.

Contact elements 157 and 156 correspond to the contact pair 28 in the foregoing description in connection with Figs. 1 and 2, and the opening of the circuit controlled by this contact pair results in the transmission of a corresponding number of line breaks. Conceivably in accordance with other circuit arrangements, the normal condition of contact pair 28 may be open with the balance arrangements of circuit control such that upon the closure of contact pair 28, a supervisory impulse may be transmitted to effect printing control at local as well as outlying stations. Accordingly, in the illustration, Fig. 7, contactor 156 is designated as operable between a pair of associated contact points, opening at one and closing with the other in response to the encounter of the seeker lever 153—154 with any one of the protruding projections 152.

There has been accordingly explained and described a system of keyboard control for generating signal impulses that may be utilized in the supervision and operation of printing telegraph apparatus in which commercially available and regulated alternating current is ultilized for maintaining synchronism, supplying the operating voltage to the motor actuating elements, as well as for supporting the signal impulse components whereby intelligence is transmitted.

While the present invention has been explained and described in contemplation of certain specific embodiments, it is to be understood, nevertheless, that certain modifications and variations may be incorporated without departing from the essential spirit or scope thereof. Accordingly, it is not intended to be limited by the specific language of the foregoing detailed specification nor by the particulars of the accompanying illustrations except as indicated in the hereunto appended claims.

What is claimed is:

1. In a system of telegraphic signaling, a source of continuous alternating current, an oscillating motor element tuned to the frequency of said current, a signal generating mechanism, means to couple said mechanism to said motor element to initiate a signal, means to modulate the first cycle of a series of alternating current cycles coincident with said mechanism and motor element coupling, means to modulate varying

ones of ensuing cycles of a series following said coupling according to each signal transmitted, and means to uncouple said mechanism from said motor element after the lapse of a predetermined number of said cycles following said first cycle.

2. In a telegraphic signaling system, a motor element continuously responsive to an alternating current of constant frequency, telegraph apparatus operated by said motor including means to generate an initiating modulation in said current and means to generate subsequent modulations therein within a signal span, and mechanism to disconnect said motor element from said apparatus after the transition of a predetermined number of alternating current cycles.

3. In a signaling system, apparatus for generating an alternating current of fundamental amplitude, a keyboard apparatus, means responsive to each keyboard operation for modifying any one of the consecutive cycles of alternating current indicative of a start interval thereby establishing the beginning of a predetermined span of waves, and means for modifying any one or more of succeeding cycles within said span in accordance with fractional sign elements to be integrated into a legible character.

4. In a keyboard transmitting apparatus, an alternating current power source, a transmitter shaft, a clutch for imparting cycles of rotation from said source to said shaft, a series of code discs carried on said shaft, each disc representing a complete character, a plurality of longitudinal rods peripherally arranged about said code discs, each rod allotted to a fractional sign element of a complete character, a set of keys each representing a complete character, means responsive to the operation of said keys and effective through said code discs for causing to be displaced ones of said rods for composing its complete character, and a rotary element carried by said shaft for generating impulses in accordance with the displacement of said longitudinal rods and the fractional sign elements allotted thereto.

5. In a telegraph signaling system, a transmitting station, means for supplying a constant frequency carrier current, apparatus at said station including keyboard transmitting and record printing mechanisms having elements tuned to the frequency of said carrier current, means associated with said transmitting mechanism for impressing an amplitude modulation upon any one of the consecutive cycles of said frequency carrier current thereby establishing the beginning of a predetermined signal span of waves, and means for modulating any one or more succeeding cycles within said span in accordance with fractional sign elements to be integrated into a legible character.

6. A telegraph transmitter comprising, a set of transmitting contacts, a step-by-step motor, a rotary member advanced by said motor in cycles of rotation having means for actuating said contacts, a series of settable devices corresponding in number to the steps of said member during each cycle for causing said means to actuate said contacts a number of times and at intervals corresponding to ones of said devices, and keyboard controlled apparatus for characteristically setting said devices so as to thereby establish signal characteristics of an intelligence character.

7. In a telegraph transmitting apparatus, a set of transmitting contacts, a cyclically operative signal composing member comprising means for operating said contacts a variable number of times during each cycle, a series of settable devices for determining the number of times and the positions in a cycle that said member is to operate said contacts to generate a composing signal, vibratory means responsive to an alternating current supply for actuating said rotary member, and keyboard controlled apparatus for characteristically setting said devices.

8. In a system of signaling in which intelligence symbols are analyzed into component fragments and each fragment is allotted an individual interval in a signal cycle, a set of control keys each related to an intelligence symbol, a series of contact controllers, a motor whose rate of speed is controlled by a constant frequency alternating current, and means responsive to the operation of any key of said set of control keys for causing to be impressed a characteristic modulation upon a variable number of alternating current undulations in correspondence to said allotted symbol component fragments.

9. In a system of signaling in which each signal is comprised of a number of component elements and each element is allotted an individual interval in a signal cycle, a set of control keys each related to a signal, a series of contact controllers, a motor responsive to normal alternating current undulations, and means responsive to the operation of any key of said set of keys for causing to be imposed a characteristic modulation upon a variable number of alternating current undulations.

10. In a signal transmission system, a plurality of character keys, a set of transmitter contacts, a signal generating apparatus comprising a rotary mechanism for supervising the operation of said set of contacts according to control by said character keys to open and close a variable number of times during each cycle of rotation of said rotary mechanism, means responsive to an alternating current supply for imparting constant speed rotation to said mechanism, and means responsive to the operation of said keyboard apparatus and said rotary mechanism supervised contacts for producing modulations of amplitude upon said alternating current supply in accordance with the operation of one of said character keys.

11. In a telegraph transmitting apparatus, a cyclically operative member comprising vibratory means for operating a set of transmitting contacts a variable number of times during each cycle, a series of settable devices for determining the number of times during a cycle that said member operates said contacts, means responsive to an alternating current supply for actuating said cyclically operative member in synchronism with a corresponding member at a remote station, and keyboard controlled apparatus for characteristically setting said devices.

12. In a signal transmission system, a keyboard apparatus including a plurality of character keys, cyclically operative apparatus for supervising the operation of a set of contacts whereby to open and close said contacts characteristically a number of times during each cycle of rotation of said apparatus, means responsive to an alternating current for imparting regular rotation to said cyclic apparatus, and means responsive to the operation of said keyboard apparatus for producing selective and characteristic modulations upon said alternating current.

13. A method of telegraphic signaling which includes the procedure of transmitting a continuous alternating current over a line defining

signal intervals by modifying at random an alternating current cycle, and thereafter modifying one or more additional cycles of said alternating current within a signal interval constituting a character.

14. The method of signaling which includes the steps of transmitting continuously over a line an alternating current of fundamental amplitude, modifying any one of the consecutive cycles of alternating current waves by changing its amplitude and thereby establishing the beginning of a signal span of waves, modifying any one or more of succeeding cycles within said span in accordance with a signal pattern, and terminating the signal after the lapse of a predetermined number of current waves with a final cycle of either fundamental or modified amplitude.

15. In combination with a telegraph signaling apparatus, a shaft having cyclic rotation, an oscillator for imparting rotation to said shaft comprising a vibrator element having a predetermined tuned frequency, a magnetic coil, and means including said oscillator responsive to an alternating current of a frequency identical with that of said vibrator element when induced upon said magnetic coil for intermittently advancing said shaft through its cycle of rotation.

16. In a telegraph system, a character signal shaft having cyclic rotation, a pawl-and-ratchet mechanism for advancing said shaft one tooth-step distance at a time, a driver shaft including a crank pin for engaging during a limited angle of oscillation a slot in said pawl-and-ratchet mechanism to impel said pawl and for escaping and overrunning said slot during movements of oscillation exceeding said limited angle of oscillation, a regulated period vibrator for imparting a fundamental frequency to said driver shaft, and a magnetic coil responsive to alternating current fluctuations of the frequency of said vibrator for supplementing amplitude losses of said vibrator.

17. In a signaling telegraph apparatus, means for issuing over a signal channel a regulated frequency alternating current wave, a shaft having signal cyclic rotation, a pendulum for impelling said shaft by intermittent movements coincident with each alternating current cycle, and electromagnetic means responding to said alternating current wave for maintaining said pendulum at a minimum amplitude of vibration.

18. In a printing telegraph transmitter, transmitting means, means for actuating said transmitting means including a vibrating element having a natural oscillating frequency corresponding to that of a predetermined source of alternating current, manual control means for causing said transmitting means to superimpose signal defining wave modulations upon said alternating current, and means for superimposing signal characteristic modulations upon said alternating current in positions intervening said signal defining wave modulations.

19. In a signaling apparatus, a keyboard, means responsive to each operation of said keyboard and phased with an alternating current supply for superimposing characteristic amplitude modulations upon said alternating current corresponding to the particular keyboard operation, and means for superimposing signal boundary modulation upon said current.

LOUIS M. POTTS.