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L. M. POTTS

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PRINTING TELEGRAPH APPARATUS

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FIG. 4

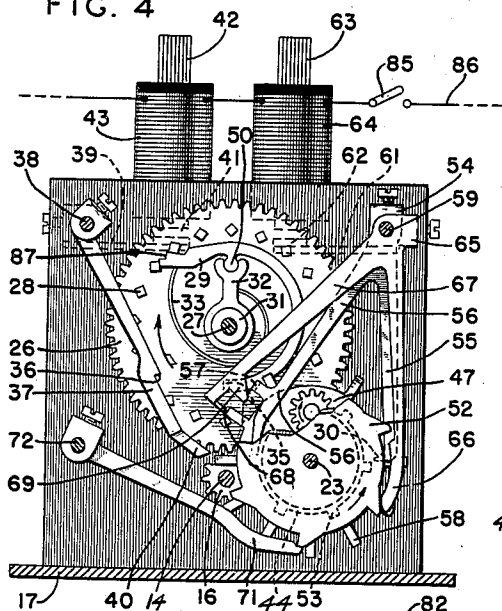


FIG. 3

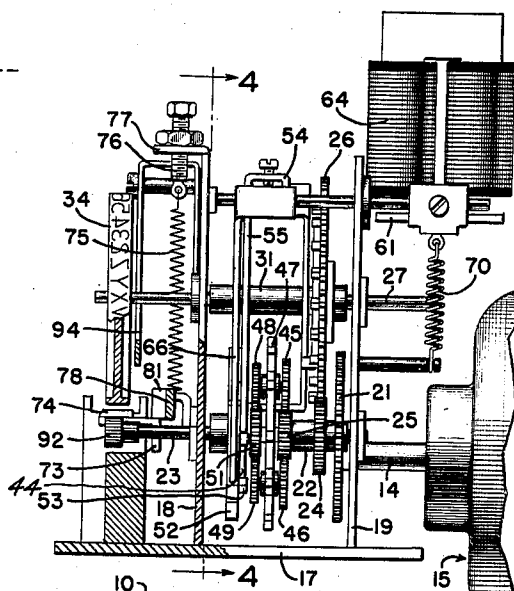


FIG. 5

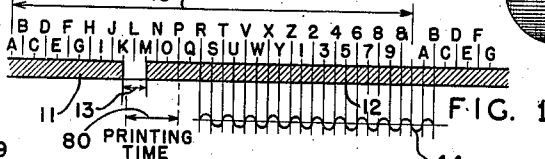
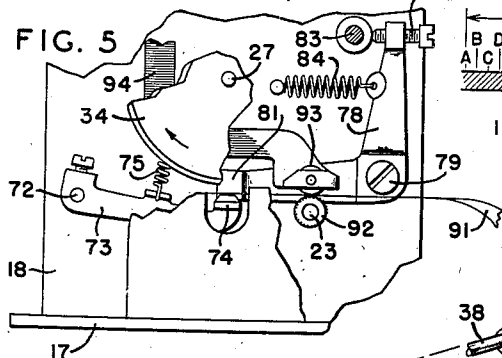


FIG. 2

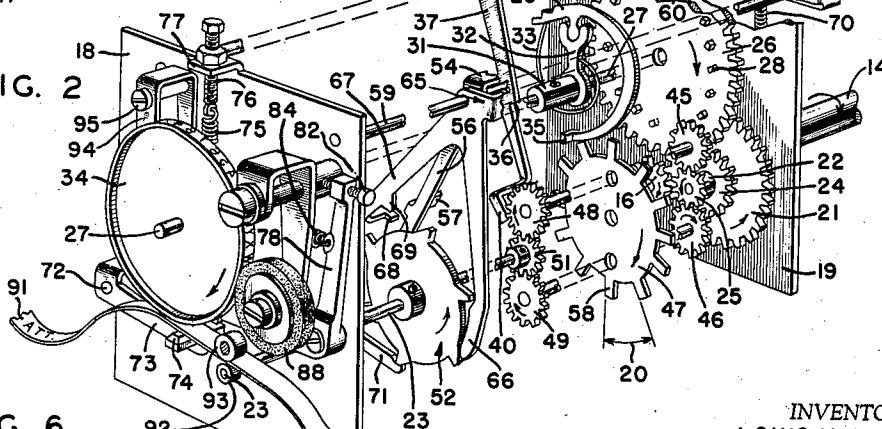
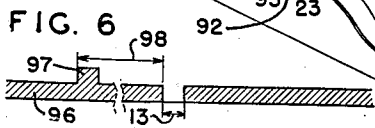


FIG. 6



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PRINTING TELEGRAPH APPARATUS

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33 Claims. (Cl. 178—35)

This invention relates to printing telegraph systems and apparatus and more particularly to synchronous printers with continuously rotating type wheels.

The primary object of the invention is to provide a remotely controlled printing telegraph machine of simple and compact construction which may be employed economically with standard communication circuits.

Another object is to provide a printer with a tape spacing mechanism requiring a small amount of power by providing an efficient connection to the power source to advance the tape during the entire printing cycle corresponding to a character.

An important object of the invention is to provide a synchronous recorder responsive to a single signal impulse for each character having means effective within certain limits in the variation in the timing of the arrival of the signal corresponding to the same characters to insure uniform timing of the printing operation.

A further object is to provide a type wheel phasing mechanism such that the type wheel may be uncoupled from a constantly rotating shaft by a special signal and recoupled in the correct phase position by a recording signal assigned to that function, which signal corresponds to a character position.

Another object is to provide a printer in which small signaling current are required by operating the signal magnet armature by power independent of the signals.

Specifically, the printer according to the present invention comprises a type wheel continuously rotated by a synchronous motor. A similar synchronous motor operates a transmitting device continuously rotating at the same speed as the type wheel. The transmitting device transmits short impulses at timed intervals corresponding to the characters to be recorded. The print hammer is operated at the proper time to record the selected characters which are impressed while the type wheel rotates, commonly called fly printing. The print hammer is operated by a differential gear comprising one element which constantly rotates with the type wheel and a second element normally at rest which carries the print hammer operating cam and tape spacing drum. The third or intermediate member is normally rotating. A signal controlled escapement is provided which arrests the third member and permits the second member carrying the operating elements to rotate, to operate the print hammer, record the proper character, space the tape and

permit the normal condition to return upon the completion of the recording cycle.

The transmitter, in addition to transmitting the short recording impulses, may also transmit, when required, a special signal of a different character. The printer is provided with a device responsive to the special signal to uncouple the type wheel and arrest it in a predetermined position. The special signal is followed by a standard short impulse approximately corresponding to the arrested position of the type wheel, and responsive to this signal the recording mechanism recouples the type wheel in the proper position and thus synchronizes and phases the type wheel with the transmitter. The short phasing impulse preferably corresponds to a blank position on the type wheel so that no record is made on the tape when the phasing impulse is received. There must be an interval equal to slightly more than the time of one revolution of the type wheel allowed between the special signal and the following short signal. Since the type wheel may require nearly a full revolution after the arresting impulse is received before the type wheel is arrested, the recording signal for phasing is so spaced with respect to the special signal, that the transmitter moves a corresponding angular amount between the strong arresting impulse and the recoupling impulse.

A better understanding of the invention may be had from the following description, taken in conjunction with the accompanying drawing wherein like reference characters designate similar parts throughout the several views, and in which

Fig. 1 is a graphical representation of the type of character selecting signal employed in operating the structural embodiment of the present invention, and illustrates the coincidence of the wave cycles of the alternating current with the character intervals;

Fig. 2 is an exploded perspective view of one embodiment of the present invention;

Fig. 3 is a side elevational view of the printer shown in Fig. 4;

Fig. 4 is a sectional view taken on line 4—4 of Fig. 3;

Fig. 5 is a fragmental elevational view of the printer of the present invention; and

Fig. 6 is a graphical representation of the signals employed in phasing the printer of the present invention.

A graphical representation of a monopulse code signal employed in the practice of the present invention is illustrated in Fig. 1 and rep-

resents, for example, the letter "K." A cycle of rotation of the type wheel shaft may be interpreted as the linear distance 10 between any one of the alphabetical or numerical characters illustrated in Fig. 1, and the point thereafter at which that character first recurs. When no signals are transmitted, a continuous current condition prevails which is symbolized by the shaded section 11 occurring above the median line 12. On the other hand, during a signal interval, the current condition 11 is interrupted and is indicated in Fig. 1 by the interval 13. The frequency of the alternating current supplied to the synchronous motors of the transmitters and receivers is preferably such that one-half cycle corresponds to the time it takes the type wheel to rotate the distance between two consecutive characters. This relation is indicated by the wave diagram indicated at 44 in Fig. 1.

With the type of printer herein disclosed, a plurality of characters may be printed in a single rotation of the type wheel. In other words, the closest characters which may be printed must be separated by a number of characters corresponding to a time interval slightly greater than the time required to record one character, or the printing time 30, which is indicated in Fig. 1 as being coextensive with five characters. If, then, there are forty characters on the type wheel, it would be possible to print eight characters in one revolution for the most favorable sequence of characters. Where consecutive characters more closely situated upon the type wheel periphery are attempted to be printed, it will require an additional rotation of the type wheel.

To the reduced end of shaft 14 of a motor 15 is fixed a pinion gear 16 (Figs. 2 and 4). The frame of the printer comprises a base plate 17 and vertical front and back plates 18 and 19. Pinion 16 meshes with a spur gear 21 which is integral with a sleeve 22 loosely carried on a shaft 23 journaled in front and back plates 18 and 19. Also integral with sleeve 22 are gears 24 and 25.

Having reference to Figs. 2 and 3, gear 25 is meshed with a pair of diametrically arranged planetary gears 45 and 46. Gear 45 is fixed to a short shaft journaled in a toothed disc 47 which in turn is loosely carried on shaft 23. Fixed to said short shaft and on the opposite side of disc 47 is a companion planetary gear 48. Likewise, gear 46 is fixed to a short shaft also journaled in disc 47, and to the opposite end of said short shaft is secured a planetary gear 49. Planetary gears 48 and 49 mesh with a pinion gear 51 fixed to the shaft 23.

There is also fixed to shaft 23 and adjacent to gear 51 a multitoothed cam disc 52. Disc 52 is provided integrally on its face, confronting the gear 51, with an annular ridge 44 having spaced square projections 53 (Figs. 3 and 4). Cooperating with projections 53 is an acute angled bell crank lever 54, arm 55 of which terminates in a laterally disposed tooth 39 which is adapted to cooperate with the oncoming projections 53 in a blocking manner. Lever 54 is also provided with an arm 56 which terminates in a curved cam follower portion to cooperate with the projections 53 for the purpose presently set forth. The arms 55 and 56 of lever 54 are in the same plane so that they are both in the path of rotation of projections 53, the arm 55 acting to block the projections 53, and said projections acting in their counterclockwise movement to strike

against the cam shaped extremity of arm 56 to rotate lever 54 clockwise. Arm 55 of lever 54 is also provided with a projection 57 which acts, under certain conditions hereinafter described, to block the radial projections or teeth 53 on the periphery of disc 47. Lever 54 is fixed to a shaft 59 journaled in the plates 18 and 19. Also fixed to shaft 59 to the rear of plate 19 is an armature member 61. Armature member 61 carries a pole piece 62 which cooperates with the pole 63 of an electromagnet 64 (Fig. 4).

Loosely pivoted on shaft 59 is an acute angled bell crank holding lever 65, arm 66 of which engages the multitoothed cam disc 52. Lever 65 is also provided with an arm 67 which terminates in a laterally disposed projection 68 which, under certain conditions hereinafter described, is interposed between the teeth 53 on disc 47. Lever arm 67 has also integral therewith a cam follower portion 69 which cooperates with the cam teeth on the multitoothed cam disc 52. It is thus apparent that arms 66 and 67 of lever 65 are in the same plane, since the extremity of arm 66 and the projection 69 of arm 67 both cooperate with the periphery of the multitoothed cam 52.

Cam disc 52 controls the printing operation and hence actuates a cam follower arm 71 secured pivotally to a shaft 72 journaled in plates 18 and 19. Also fixed to shaft 72 in front of plate 18, as viewed in Fig. 5, is a printing arm 73, which terminates in a hammer portion 74. Adjacent to portion 74 is fastened one end of the printing spring 75, the other end of which is secured to an adjusting screw 76 carried in a bracket 77 integral with plate 18. In this manner the printing spring 75 may have its tension adjusted to produce the desired printing blow. Thus, when cam disc 52 rotates in response to the signal impulse, the arm 71 drops off the cam tooth or projection under power imparted thereto by spring 75, thereby actuating hammer portion 74 to effect printing of the selected character by forcing the tape 91 against an inked type wheel 34 carried on a shaft 27 journaled in front and rear plates 18 and 19.

In order to insure a sharp printing blow, a shock absorbing arrangement has been provided, Fig. 5, which comprises a bell crank lever 78 pivoted at 79 to plate 18. Lever 78 is provided with a horizontal arm which terminates in a laterally disposed portion 81 which overlies the end of printing arm 73 adjacent the portion 74. Lever 78 is also provided with a vertical arm which carries at its upper extremity an adjusting screw 82 which cooperates with a fixed stop 83. Lever 78 is normally urged in a counterclockwise direction against stop 83 by a spring 84. With this construction the effect of the bell crank lever 78 upon the printing arm 73 is controlled by the adjusting screw 82 which serves to regulate the rebound of the print hammer and provides a useful means of obtaining clear impressions. Thus, just before the paper tape 91 touches the type wheel 34, the end of lever arm 73 engages end 81 of lever 78, rotates lever 78 clockwise, and tensions spring 84. Spring 84 is stronger than spring 75, but the momentum attained by lever 73 is sufficient to overcome spring 84 and permit printing, but immediately thereafter spring 84 moves the hammer 74 away from the type wheel. A rapid printing action is desirable in all kinds of recorders but is especially desirable and very necessary with fly printing.

Movement is imparted to tape 91 by a knurled

spacing roller 92 in cooperation with a pressure roller 93 carried on a lever 94 pivoted at 95 to front plate 18. Lever 94 is biased clockwise by a spring (not shown) to render pressure roller 93 effective to cooperate with roller 92. During the entire printing cycle, feed wheel 92 rotates and moves the tape. It will be noted that the tape is moved by direct gearing from the motor, and the motion is distributed throughout an entire printing cycle so that no heavy load is placed upon the motor. As viewed in Fig. 2, ink is supplied to the type face on the periphery of the type wheel 34 by means of an ink roller 88, suitably carried on the front plate 18.

Gear 24 meshes with a spur gear 26 loosely mounted on the type wheel shaft 27. Gear 26 is provided on its front face with a circularly arranged series of projections 28, which are of square cross section and are disposed at such an angle as to cooperate properly with a clutch lever 29. In the present embodiment there have been provided twenty such projections 28, or equivalent to one-half the total number of characters on the type wheel. However, there are two teeth 87 on the end of lever 29, and either one of these teeth may engage any one of the projections 28 so there are 40 possible coupling positions, one for each character. Although either of the teeth 87 may engage a pin 28, only one is correct for any given condition. Fixed to the type wheel shaft 27 and in juxtaposition to gear 26 is a sleeve 31 to which is fixed an arm 32. To the extremity of arm 32 is pivotally articulated the aforementioned clutch lever 29, the pivotal connection between arm 32 and lever 29 being analogous to a ball and socket joint. Distended between arm 32 and clutch lever 29 is a spiral spring 33, which normally tends to rotate the clutch lever 29 clockwise with disc 50 as a center (as viewed in Fig. 4), so that the stepped or shouldered extremity of lever 29 may cooperate with the square projections 28. The type wheel 34 is secured adjacent the left end of shaft 27 (as viewed in Fig. 3).

Since gear 26, as viewed in Fig. 4, rotates normally in a clockwise direction, shaft 27 (and hence type wheel 34) will rotate in the same direction due to the cooperative relation of clutch members 29, 32, and 33 therebetween. The right-hand arm of clutch lever 29, as viewed in Fig. 4, is of curved or arcuate conformation and terminates in a laterally extending portion 35 (Fig. 2) which abuts, during the phasing operation hereinafter described, with a shoulder 36 of a phasing lever 37 pivotally secured to a shaft 38 journaled in front and rear plates 18 and 19. Also fixed to shaft 38, to the rear of plate 19, is an armature member 39. Armature lever 39 carries a pole piece 41 which cooperates with the core 42 of an electro-magnet 43. When magnet 43 is energized sufficiently, armature 39 is attracted. The step or shoulder 36 on lever 37 is moved into the path of portion 35 of lever 29, and when the type wheel 34 has reached the position where portion 35 engages the shoulder 36, tooth 87 is disengaged from the pin or projection 28 which it is engaging, and the type wheel 34 comes to rest with a predetermined character in printing position, preferably a blank position on the type wheel, while shaft 27 continues to rotate. The manner of recoupling the type wheel at the proper time will appear hereinafter in connection with the complete description of the phasing operation.

General operation

In the operation of the present invention, the switch 85 (Fig. 4) in the line wire 86 is closed, thus introducing magnets 43 and 64 into the line. As previously mentioned, when no signals are transmitted a continuous current condition prevails on the line; that is, the condition of the line is a current condition, as distinguished from a no-current condition. The signal magnet 64 responds to normal line current, and when the printing machine is running idly and current is flowing in magnet 64, armature 61 is held against the pole 63 of magnet 64. Signal magnet 64 is of the holding or assisted armature type; that is, the armature 61 is mechanically assisted or actuated, during each operating cycle, toward the poles 63 by the camming action of lugs or projections 53 on arm 56 of lever 54. In this condition, which is opposite to that shown in Fig. 4, the toed end 30 of arm 55 of lever 54 is blocking a stop projection 53 on the cam disc 52, thus holding cam disc 52 against rotation. Magnet 43 is marginal and responds only to stronger current, as for example, a phasing-initiating impulse. Thus, with normal current on the line 86, armature 61 will be in its seized position, and the armature 39 of magnet 43 will be retracted. The motor 15 is operating continuously; thus, through shaft 14 and pinion 16, sleeve 22 and gear 26 are constantly rotating. Because of the particular clutch engagement between gear 26 and shaft 27, constant or continuous rotation is imparted to type wheel 34. As previously mentioned, power for operating the printer is derived from a synchronous motor, and a similar synchronous motor operates a transmitting device, continuously rotating at the same speed as the type wheel 34.

At the time that the signal impulse is received, indicating the character to be printed, which consists in a breaking of current in the line, as indicated by portion 13 in Fig. 1, signal magnet 64 will become de-energized, thus permitting spring 70 to retract armature 61, and actuate bell crank lever 54, to its counterclockwise position, thereby releasing the toed end or tip 30 of arm 55 of lever 54 from the stop projection 53 on the cam disc 52, thus freeing shaft 23 for rotation. Simultaneously, arm 56 will bring its projection 57 into the path of the oncoming tooth 58 of the disc 47. The shaft 23 and hence cam disc 52, however, will not actually begin to rotate until the oncoming tooth or projection 58 of disc 47 has been arrested by the projection 57 of arm 56 of lever 54. The reason for this is as follows: While the rotation of disc 52 is being arrested by the engagement of toed end 30 of arm 55 of lever 54 (during the energization of magnet 64), disc 47 is rotating because projection 57 is not in the path of teeth 58; and in the planetary gear system shown, when gear 51 is prevented from rotating (for the same reason that disc 52 is prevented from rotating), the planetary gears 48 and 49 will revolve around sun gear 51, thus imparting rotation to disc 47. Then, when magnet 64 is deenergized, with the resultant disengagement of toed end 30 from disc 52, the rotation of planetary gears 48 and 49 about sun gear 51 ceases, and the rotation of sun gear 51 (and hence shaft 23 and disc 52) begins. The time at which the armature 61 is released may vary considerably, and yet projection 57 will fall in the correct opening in disc 47 which, of course, is rotating at this time. Then, when said tooth 58

strikes the projection 57 to hold disc 47 against rotation, planetary gears 45, 46, 48 and 49 will also be prevented from revolving around the pinions 25 and 51. Under these conditions, rotation will be imparted to pinion 51, and hence shaft 23, to rotate the cam disc 52 in a counterclockwise direction. The ratio between gears 24, 25, 26, 45, 46, 48, 49, and 51 is so chosen as to cause disc 47 to rotate through the angular distance 20 (Fig. 2) between two adjacent teeth 58 on disc 47, while the type wheel 34 rotates through the angular distance of one character space. Observing that when a no-current impulse (signal impulse) is received, and the cam disc 52 is initiated into rotation, the cam lobe on the periphery thereof which has been cooperating with cam follower 69 of lever 65, moves away from the follower, and a diametrically disposed cam lobe on disc 52 acts upon arm 66 to rotate lever 65 counterclockwise. Thus, the lever 65 is rocked counterclockwise to bring projection 68 into the path of teeth 58, and it is apparent that absolute coincidence between signal reception and the interception of a tooth 58 by projection 68 is not necessary. With the arrangement according to the present invention, certain limits of variation in the timing of signals is permitted so that, despite this fact, the timing of the operation of the print hammer is uniform, and consequently accurate recording of the selected character is nevertheless insured.

Immediately after the initiation of rotation of cam disc 52, arm 71 will become disengaged from the cam tooth or lobe thereon with which it has been engaged, to permit the performance of the printing operation. Printing arm 73 will thereupon respond to the action of printing spring 75, and print hammer 74 will be thrown against the periphery of the type wheel to effect printing of the selected character. After the printing operation has been performed, cam disc 52 will, through arm 71, return the print hammer 74 to its clockwise or lower position, thus tensioning spring 75, thereby storing energy therein to effect the succeeding operation.

As previously described, immediately upon rotation of cam disc 52, cam follower 69 rides off of the cam tooth with which it has been engaged, and lever arm 66 is operated by the oncoming cam tooth. As cam follower 69 rides off of said cam tooth, projection 68 on arm 67 of the lever 65 is brought into the path of the oncoming radial tooth on disc 47, thus providing a secondary stop for disc 47. As disc 52 continues to rotate, the projections 53 thereon act on arm 56 of bell crank 54 to rock lever 54 in a clockwise direction, thus acting to assist armature 61 into contact with the pole 63 of the selector magnet 64 where it is held by the current which has been re-established before the tip of lever 56 disengages the projection 53. It is recalled that the duration or interval of the signal impulse (no-current) is very short (Fig. 1), therefore, the magnet 64 is energized again before the armature 61 is returned to its attracted or seized position.

When shaft 59 is returned as described, projection 57 is disengaged from one of the teeth on disc 47, but just prior to this, projection 68 had been moved into the path of another similar projection and is held there until the end of the cycle, thus assuring the completion of rotation of the cam disc 52. But, when projection 57 is disengaged, disc 47 moves a very short distance and engages projection 68 so that shaft 23

continues its rotation. After printing has been effected, one of the projections 53 on the disc 52 also operates on arm 56 to restore lever 65 to its clockwise position, whereby at the end of the cycle, projection 68 is disengaged from tooth 58, and shaft 23 is again arrested by a projection 53 engaging the tip 30 of lever arm 55 which has been previously returned, and disc 47 resumes its rotation in step with the type wheel. At the end of the cycle, bell crank 65 is returned to its clockwise position, as viewed in Fig. 4, and is maintained there due to the fact that cam follower 69 rests again on one of the cam teeth or lobes on cam disc 52.

In the foregoing description of operation, it has been assumed that the operating shafts are rotating in synchronism and in phase. Moreover, the printing operation has been described first since the phasing operation involves a printing cycle. When it is necessary to phase the apparatus, an impulse of strong current is transmitted to the receiver, and upon receipt thereof magnet 43 becomes energized. Having reference to Fig. 6, which is a graphical representation of the current condition of the line during the phasing period, the shaded portion 96 represents the normal current condition of the line. The phasing-initiating impulse is indicated by the higher shaded portion 97, and the stronger current comprising this impulse persists for the same length of time as a printing impulse period; namely, about two character spaces. It is recognized, of course, that when the magnet 43 has become energized by the impulse 97 of strong current, and the armature 39 has been attracted, the armature 39 will remain seized even after the stronger current has been diminished in strength to the normal line current 96. For a reason which will presently appear, the armature 39 is permitted to remain seized for a predetermined period, indicated as 98 in Fig. 6, which is equivalent at least to one complete rotation of the type wheel 34. In this connection, the mechanism for transmitting the signals for performing the phasing operation is disclosed in copending application Serial No. 182,422 filed December 30, 1937 by L. M. Potts. The arrangement specifically shown in Fig. 10 of said application is particularly adaptable to the present apparatus.

Upon receipt of the phasing-initiating signal 97, magnet 43 will be energized and armature 39 will be attracted, thus actuating lever 37 counterclockwise to bring shoulder 36 into the path of lateral portion 35 of clutch lever 29. Lever 37 terminates in an offset portion 40 (Fig. 2) which portion, upon the energization of phasing magnet 43, is brought against the periphery of cam disc 52, the purpose of which, as will presently appear, is to disengage end 35 of lever 29 from shoulder 36.

As previously described, gear 26 is normally rotating constantly, and as lever 37 is actuated to its counterclockwise position, shoulder 36 thereon is brought into the path of the oncoming portion 35. Thus, when portion 35 strikes against shoulder 36, further rotation of gear 26 will cause clutch lever 29 to rotate slightly in a counterclockwise direction about its ball and socket pivot connection 50 against the tension of spiral spring 33. The shouldered or stepped extremity 87 of lever 29 will become disengaged from the square projections 28, thereby permitting gear 26 to continue its rotation idly on shaft 27. The arrestment of lever 29 by shoulder 36 will, through arm 32, cause shaft 27 to cease

its rotation, hence causing the stoppage of type wheel 34 with a predetermined character position thereon in printing position. When type wheel 34 is thus stopped, the blank position (for example) on its periphery will be presented to the printing point opposite hammer portion 74. As previously mentioned, when the current in magnet 43 is restored to normal, the armature 39 will still remain in attracted position.

As previously alluded to, the transmitter is arranged to transmit after a time interval 98 (Fig. 6) corresponding to slightly more than a revolution of the type wheel 34, a recording signal 13 corresponding to the blank position on the type wheel, where it is arrested, or rather substantially in this position since certain timing considerations will likely make it necessary to have the stopping position slightly different from the actual printing position. As soon as the special recording signal 13 is received, magnets 43 and 64 will become de-energized. The apparatus is so designed that the pressure of projection 35 on shoulder 36 of lever 37 is sufficient to hold the armature 39 in attracted position even when magnet 43 is completely de-energized. However, as soon as the recording signal 13 is received, armature 61 is released, whereupon a printing cycle takes place, as previously described, and during the cycle, projection 40 is engaged by one of the cam lobes on printing cam 52, and lever 37 is cammed away and caused to rotate slightly in a clockwise direction to effect the release of lever 29 therefrom, and then one of the teeth 87 engages a pin 28 so that the type wheel is in the correct phase position and ready to receive regular recording signals 13. Either of the teeth 87 may engage a pin 28, but only one is correct for any given condition.

Although a particular embodiment of the invention has been described herein, it will be understood that the apparatus is capable of many modifications, and it is contemplated that all forms which come within the range and scope of equivalency are intended to be embraced within the purview of the appended claims.

What is claimed is:

1. In a recorder, a constantly rotating type wheel, signal controlled means to determine the character to be recorded according to the position of the type wheel when the signal is received, and all-mechanical means local to the recorder to time the operation of the recorder within certain limits of variation in the time of arrival of the signal to insure accurate recording of the character.

2. In a recorder, a shaft, a constantly rotating type wheel, a signal controlled means to determine the character to be recorded according to the position of the type wheel when the signal is received, a phasing means comprising an engaging means associated with the type wheel and shaft, normally effective to operatively engage said type wheel and shaft, and a further signal controlled means to disengage said phasing means to enable the arrestment of the type wheel in a predetermined position for phasing.

3. In a recorder, a constantly rotating type wheel, signal controlled means to determine the character to be recorded according to the position of the type wheel when the signal is received, differential means, and means controlled by said differential means to time the operation of the recorder within certain limits of variation in the time of arrival of the signal to insure accurate recording of the character.

4. In a recorder, a constantly rotating type wheel, signal controlled means to determine the character to be recorded according to the position of the type wheel when a signal is received, differential gearing, and timing means associated with said gearing to time the operation of the recorder within certain limits of variation in the time of arrival of the signal to insure accurate recording of the character.

5. In a recorder, a constantly rotating type wheel, signal controlled means to determine the character to be recorded according to the position of the type wheel when the signal is received, printing mechanism, planetary gears, and a multitoothed disc for carrying said gears to control the operation of said printing mechanism within certain limits of variation in the time of arrival of the signal to insure accurate recording of the character.

6. In a recorder, a constantly rotating type wheel, signal responsive means, a printing control disc, planetary gears carried on said disc, said gears normally ineffective, but effective when said disc is arrested under the control of said signal responsive means, and cam means acting in response to said arrestment to control the printing mechanism to effect the recordation of a character corresponding to the received signal.

7. In a telegraph recorder, a type wheel clutch means for driving said type wheel comprising a driving means and a driven means, said driven means comprising an arm fixedly related to said type wheel and pivotally carrying thereon a lever, one end of which is adapted to cooperate with a circular series of lugs on said driving means, an electromagnet, and a lever controlled by said electromagnet in response to a signaling condition to cooperate with the other end of said lever to disengage said lever from said lugs to stop said type wheel in a predetermined phasing position irrespective of the rotation of said driving means.

8. In a telegraph recorder, a normally constantly rotating type wheel, signal controlled means to determine the character to be recorded according to the position of the type wheel when the signal is received, printing mechanism, planetary gears, a multitoothed disc for carrying said gears to control the operation of said printing mechanism within certain limits of variation in the time of arrival of the signal to insure accurate recording of the character, clutch means for driving said type wheel comprising a driving means and a driven means, said driven means comprising an arm fixedly related to said type wheel and pivotally carrying thereon a lever, one end of which is adapted to cooperate with a circular series of lugs on said driving means, a signal responsive means in the same circuit with said signal controlled means, a lever controlled by said signal responsive means in response to a signaling condition to cooperate with the other end of said lever to prevent said lever from cooperating with said lugs to stop said type wheel in a predetermined phasing position irrespective of the rotation of said driving means, and means associated with said last recited lever to estop the response of said printing mechanism to said signal controlled means.

9. In a telegraph receiver, a type wheel, means to rotate the type wheel continuously, a normally energized magnet adapted to be de-energized at varying times according to the character to be recorded, means controlled by the de-energiza-

tion of said magnet to record the selected character, and mechanical means effective after the recording operation has been initiated to return the armature of said magnet to contact with the pole pieces of said magnet.

10. In a telegraph receiver, a type wheel, means to rotate the type wheel continuously, a normally energized magnet adapted to be de-energized at varying times according to the character to be recorded, means controlled by the de-energization of said magnet to record the selected character, and cam actuated means effective after the recording operation has been initiated to return the armature of said magnet into contact with the pole pieces of said magnet.

11. In a recording machine, a set of gears including three elements, means to rotate one element continuously, means effective under certain operating conditions to arrest either of the other elements and cause the remaining element to rotate, a cam carried by one of the arrestable elements, and recording mechanism operated by the cam.

12. In a recording machine, a set of gears including three elements, means to rotate one element continuously, means effective under certain operating conditions to arrest either of the other elements and cause the remaining element to rotate, a cam carried by one of the arrestable elements, recording mechanism operated by said cam, and a signal receiving magnet adapted to control said arresting means.

13. In a recording machine, a set of gears comprising three elements, means to rotate one element continuously, means to arrest either of the other elements and cause the remaining element to rotate, a cam carried by one of the arrestable elements, recording mechanism operated by said cam, a signal receiving magnet adapted to control said arresting means, and means carried by the one of said elements which carries the printing cam to move the record receiving materials to produce character spaces.

14. In a recording machine, a set of gears comprising three elements, means to rotate one element continuously, means to arrest either of the other elements and cause the remaining element to rotate, a cam carried by one of the arrestable elements, recording mechanism operated by said cam, a signal receiving magnet adapted to control said arresting means, and means carried by the one of said elements which carries the printing cam to move the armature of the signal receiving magnet in one direction.

15. In a telegraphic recorder, a constantly rotating wheel carrying a plurality of recording elements, a signal controlled means to make varying records according to the angular position of the wheel when a signal is received, a further signal controlled means to disengage the wheel from its driving member, and means co-operating with the first mentioned signal controlled means to re-engage the wheel and driving member so that each recording member is in a predetermined position when the corresponding signal is received.

16. In a telegraphic recorder, a constantly rotating wheel carrying a plurality of different recording elements, means for driving said wheel, signal controlled means to disengage said wheel from said driving means, and cam means associated with said driving means to re-engage said wheel in a selected phase position.

17. In a telegraphic recorder, a signal receiv-

ing magnet, an armature for the magnet, a printing cam started into operation when the armature moves to its released position, means associated with the printing cam to return the armature of the magnet to the pole pieces of the magnet, and means to insure the completion of the rotation of the printing cam after the armature has returned to the pole piece of the magnet.

18. In a telegraph receiver, an escapement device operated once for each single impulse character signal, a recording mechanism operated in response to each operation of the escapement device, and means to maintain the operation of the recording mechanism after the signal has ceased.

19. In a recording device, a shaft, means for rotating said shaft through a fixed angle for each recording operation, recording mechanism operated by members mounted on said shaft, and a record material feeding wheel rigidly mounted on said shaft.

20. In a telegraph recorder, a constantly rotating shaft, a type wheel fast to the shaft to rotate therewith, signal controlled means to uncouple the type wheel from the shaft, and power operated means, effective after the signal has ceased, to control the recoupling of the type wheel to the shaft.

21. In a signal receiving device, a magnet, a movable armature associated with said magnet, a spring restraining the armature from movement toward the magnet when normal signaling current is received and yieldable when a stronger current is received, and power operated means to positively restore the armature to the position appropriate for normal current.

22. In a signal controlled receiver, a type wheel rotating continuously during the reception of recording signals, means for driving said type wheel, means responsive to a certain signal to arrest the type wheel in a predetermined position, and cam means associated with said driving means and controlled in response to a different signal to start the type wheel into rotation.

23. In a signal controlled recorder, a constantly rotating shaft, a type wheel normally engaged to the shaft during periods of recording, means to disengage the type wheel from the shaft, and means operated by the recording means in response to the recording signal to re-engage the type wheel to the shaft.

24. In a recorder, a rotatable type wheel, a synchronous motor, and gearing between the type wheel and motor such that the type wheel moves from one character to the next in an interval equivalent to one-half wave of the alternating current supplied to the motor.

25. In a recorder, a constantly rotating type wheel, signal controlled means to determine the character to be recorded according to the position of the type wheel when a signal is received, sun and planetary gearing associated with said means, and timed means co-operable with said gearing to time the operation of the recorder within certain limits of variation in the time of arrival of the signal to insure accurate recording of the character.

26. In a printing telegraph apparatus, a type wheel, a synchronous motor operated by alternating current, and means to couple the type wheel to the motor in a plurality of positions, each position having a relation to a selected phase condition of the alternating current such that the type wheel moves from one character to the

next in an interval equivalent to one-half wave of the alternating current supplied to the motor.

27. In a printing telegraph apparatus, a type wheel, means to start the type wheel into rotation from a predetermined position at the beginning of a cycle, and means to make a plurality of impressions on record material during a single rotation of the type wheel.

28. In a recorder, a recording element carrier, means to start the carrier into rotation from a predetermined position at the beginning of a cycle, and means to make a plurality of impressions on record material during a single rotation of the carrier.

29. In a printing telegraph apparatus, a constantly rotating shaft, a type wheel, a magnet, means responsive to a certain condition of said magnet to couple the type wheel to the shaft, and means responsive subsequently to a similar condition of said magnet to effect the printing operation.

30. In a printing telegraph apparatus, a constantly rotating shaft, a type wheel detachably engageable to said shaft, a print hammer, and means responsive to a single initial impulse to control the engagement of the type wheel to the shaft, said means also responsive to a subsequent impulse to control the operation of the print hammer.

31. In a printing telegraph apparatus, a type wheel provided with alphabetical and numeral characters, means to start the type wheel into rotation from a predetermined position at the beginning of a cycle, and means to make a plurality of complete character impressions on record material during a single rotation of the type wheel.

32. In a telegraph printing apparatus, a print hammer, spring actuating means for said hammer, mechanical means for loading said print hammer after each printing operation, signal controlled magnet having a reciprocable armature, and means for mechanically returning said armature to its held position operative concurrently with said mechanical means and during a cyclic interval when said print hammer is loaded for a succeeding print operation.

33. In a telegraph printing apparatus, a rotatable shaft, a print hammer, means carried by said shaft to load and release said hammer for print operation, a signal controlled magnet including an armature, and means to periodically restore and release said armature for operation in unison with said print hammer loading and releasing means.

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