

Jan. 17, 1939.

M. AMANN

2,144,176

COMMUNICATION SYSTEM

Filed Nov. 9, 1935

4 Sheets-Sheet 1

Fig. 1

R1	R2	R3	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
0																	
1	R	-	+			-											
2	B	2	+			-	+										
3	C	:	+			-	+	-									
4	D	%	+		a	-	+	-	+	b							
5	E	3	+			-	+	-	+	-							
6	F	Ru*	+			-	+	-	+	-	+						
7	G	6	+			-	+	-	+	-	+	-					
8	H	!	+	-													
9	I	8	+	-		+											
10	J	Br*	+	-		+	-										
11	K	(	+	-		a	+	-	+	b							
12	L	)	+	-		+	-	+	-								
13	M	.	+	-		+	-	+	-	+							
14	N	,	+	-		+	-	+	-	+	-						
15	O	9	+	-	+												
16	P	0	+	-	+												
17	Q	1	+	-	+			-	+								
18	R	4	+	-	+	a	-	+	-	b							
19	S	'	+	-	+			-	+	-	+						
20	T	5	+	-	+			-	+	-	+	-					
21	U	7	+	-	+	-											
22	V	=	+	-	+	-		+									
23	W	2	+	-	+	-	a	+	-	b							
24	X	/	+	-	+	-		+	-	+							
25	Y	6	+	-	+	-		+	-	+	-						
26	Z	+	+	-	+	-	+										
27	Bu	*	+	-	+	-	+										
28	Zi	*	+	-	+	-	a	-	+	b							
29	Ft	*	+	-	+	-	+	-	+	-							

Fig. 8

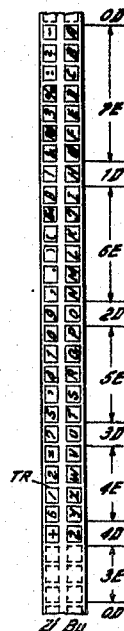
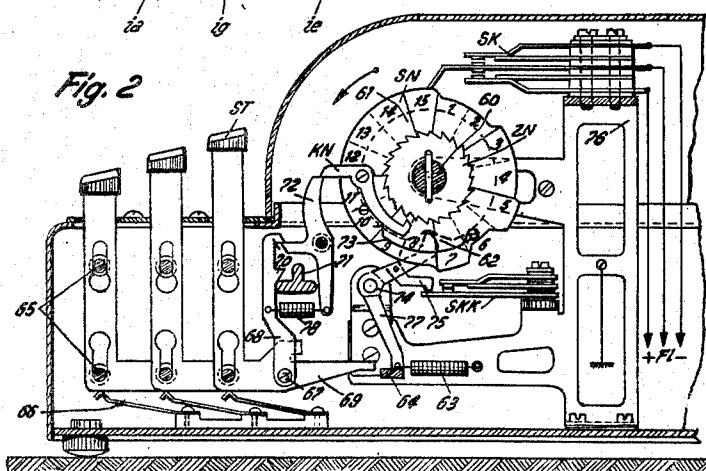


Fig. 2



Inventor.
MAX AMANN
Per. Gill & Jennings
Attorneys.

Jan. 17, 1939.

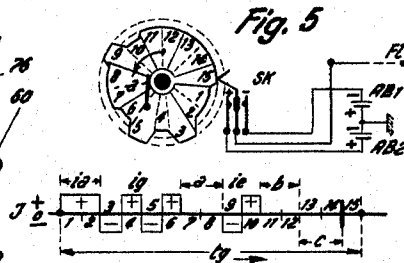
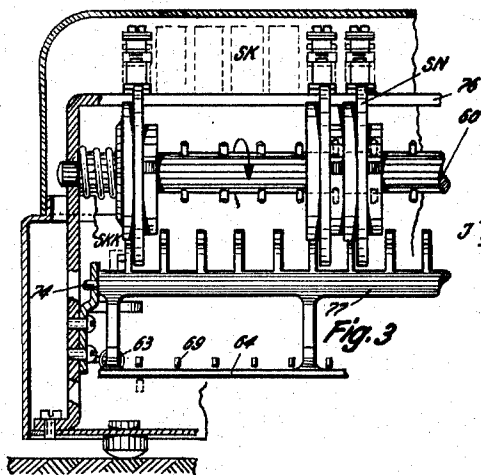
M. AMANN

2,144,176

COMMUNICATION SYSTEM

Filed Nov. 9, 1935

4 Sheets-Sheet 2



Jan. 17, 1939.

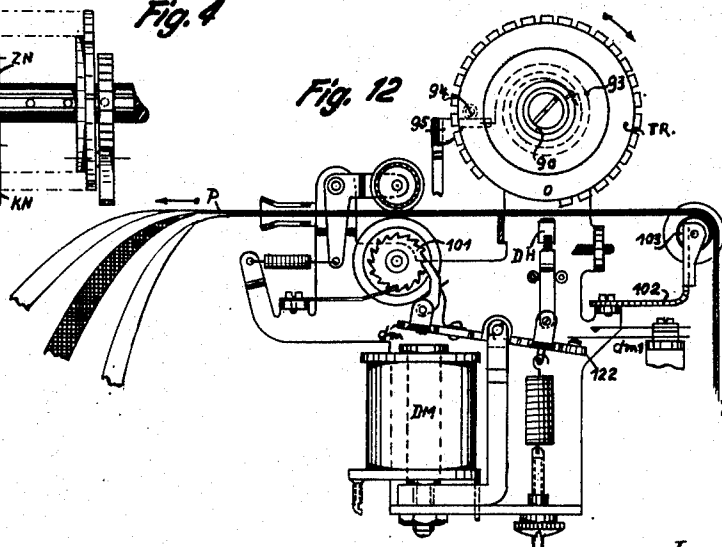
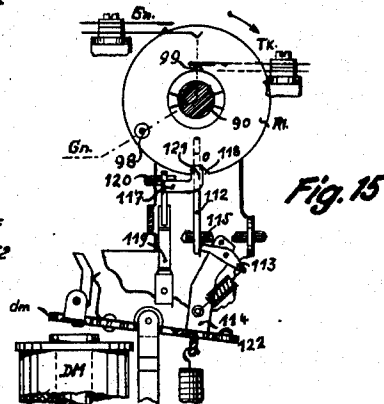
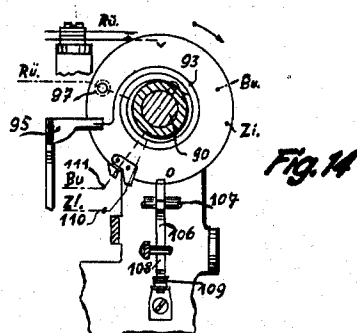
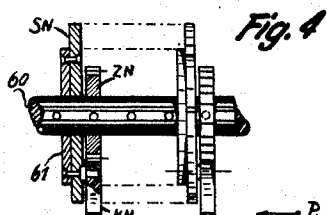
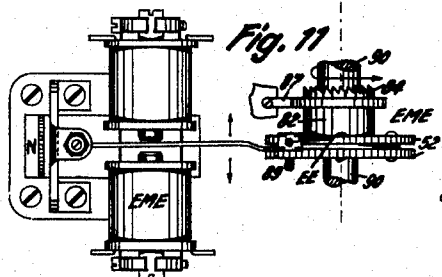
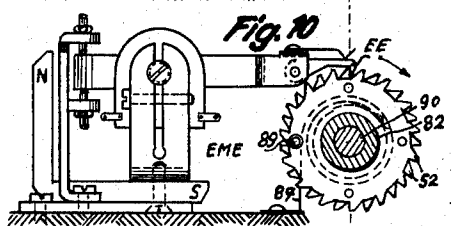
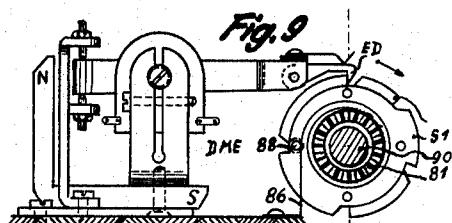
M. AMANN

2,144,176

COMMUNICATION SYSTEM

Filed Nov. 9, 1935

4 Sheets-Sheet 3



Inventor.
MAX AMANN
Per. Full + Jennings
Attorneys.

Jan. 17, 1939.

M. AMANN

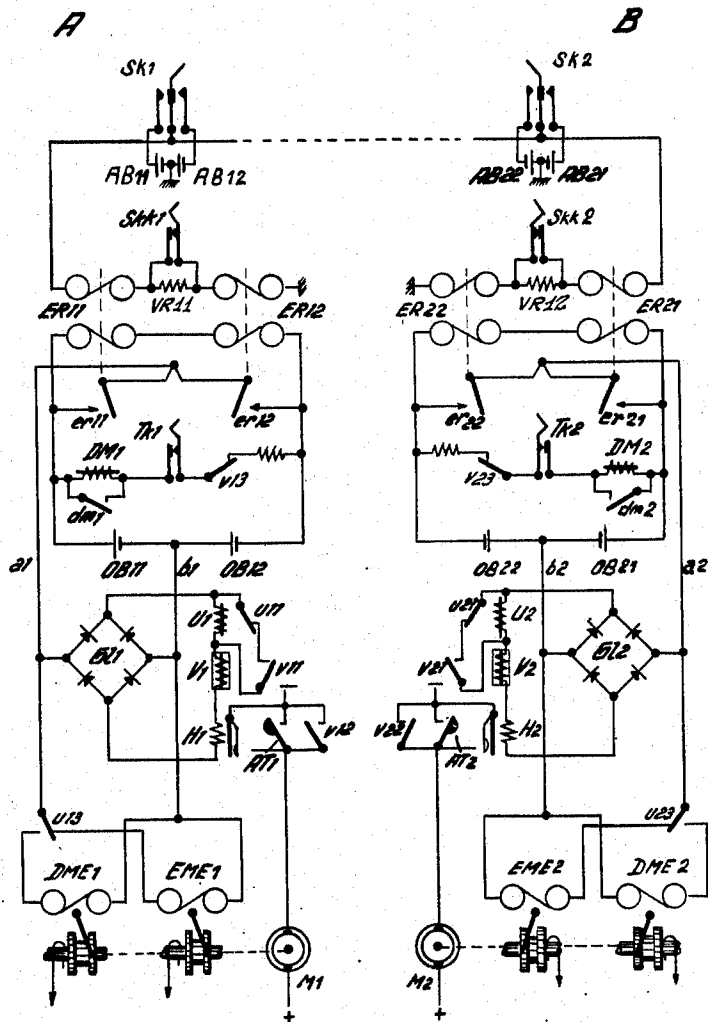
2,144,176

COMMUNICATION SYSTEM

Filed Nov. 9, 1935

4 Sheets-Sheet 4

Fig. 16



Inventor.
MAX AMANN.
Per. *Full & Young*
Attorneys.

UNITED STATES PATENT OFFICE

2,144,176

COMMUNICATION SYSTEM

Max Amann, Frankfort-on-the-Main, Germany

Application November 9, 1935, Serial No. 49,092
In Germany January 1, 1934

23 Claims. (Cl. 178—23)

This invention relates to communication systems in which the transmitted signals are made up of different numbers of impulses. It is usual, in systems of this type, for the order numbers of the various signals to be transmitted to correspond to the number of impulses sent out for their transmission. If there are 25 different types which are to be selectively printed according to the signal that is received, then it is necessary for up to 25 impulses to be transmitted for the selection of a type. A considerable amount of time is necessary for the transmission of such a large number of impulses.

The time necessary for the transmission can be shortened if the impulses are divided into a number of groups and a shift indication is transmitted in addition to the impulses, which serves to set the receiving device. In this way, the number of necessary impulses is reduced so that the length of time necessary for the transmission of the impulses is shortened.

If the time required for the transmission of a signal is to be made as short as possible, it is necessary not only to reduce the number of impulses but also to make the impulses themselves of short duration. If the number of impulses is reduced but the length of certain impulses is increased, it is clear that the time taken up by the transmission of a signal is still capable of being reduced.

The invention aims at reducing the transmission time to a very considerable extent. In accordance therewith, a transmitter is used which can emit impulses, all of the same length in the form of two groups separated by a shift signal and these impulses are received by a receiving device which has means for endowing the impulses of one group with setting values of equal magnitude and the impulses of at least one other group with setting values of unequal magnitude. The impulses are all of the same length. There are no short and long impulses. The impulses can thus all be short impulses. On the other hand, the number of impulses can be relatively small. If the impulses are sent, for example, in two groups, then a receiving device which may be a type wheel can be stepped by the impulses of one group in steps of different lengths and by the impulses of the other group in steps of the same length, the size of the steps effected by the impulses of the first group being a multiple of the size of those effected by the impulses of the second group. In this way, 35 different settings of the receiving device can be obtained with

impulse trains containing a maximum of seven impulses.

The invention is particularly suitable for use in telegraph printer installations and, in order that the invention may be properly understood and be readily carried into effect, an example of construction of such an installation in accordance with the invention will now be described with reference to the accompanying drawings in which:—

Figure 1 is a table showing the impulse trains corresponding to the various signals to be transmitted.

Figures 2 and 3 show in side and front elevation a device for the impulse transmission.

Figure 4 shows a detail of construction of the transmitter of Figures 2 and 3.

Figure 5 shows diagrammatically a cam disc for determining the emission of a train of impulses.

Figure 6 shows in elevation a device for controlling the type wheel of the printer.

Figure 7 is a section through the type wheel.

Figure 8 shows a development of the type wheel.

Figures 9, 10 and 11 show details of construction of the devices provided for setting the type wheel.

Figure 12 shows the arrangement of the parts of the printer.

Figure 13 shows in side elevation the type wheel and its controlling devices.

Figures 14 and 15 show details of construction of the arrangement illustrated in Figure 13, and

Figure 16 shows a circuit arrangement for the telegraph installation.

In the illustrated printing telegraph arrangement, the types which can be printed are arranged in two rows on the type wheel (Figures 7 and 8). This type wheel can be moved out of its normal position into 29 different positions. 29 different trains of impulses are therefore necessary for setting the type wheel. These impulse trains are shown one below the other in Figure 1. The first column R1 gives the order number of the various impulse trains. The second and third columns R2 and R3 give the type in each of the two rows on the type wheel which is selected on reception of each of the impulse trains. The spaces in these columns which are marked with an asterisk correspond to blank spaces on the type wheel. When the type wheel is set to these spaces, no printing of a type occurs but, instead, a shift which will be explained later is effected.

For setting the type wheel, a maximum of seven impulses are sent out. Each impulse consists of a current of short duration, the current flowing in alternate directions for successive impulses.

This is indicated by the signs + and - in Figure 1. These impulses are grouped in two groups *ig* and *ie* but the impulses of any impulse train do not necessarily include impulses in both groups.

Between transmission of the impulses in the group *ig* and those in the impulse group *ie* a "shift" signal *a* is transmitted and a further "shift" signal *b* is transmitted at the end of the impulse group *ie*. These shift signals are transmitted by depriving the transmission line of current for two different lengths of time. The transmission of the shift signal *a* serves for setting the type wheel and that of the shift signal *b* the printing of a selected type. A further "shift" signal *ia* is transmitted at the beginning of each transmission in the form of a positive current which serves to prepare the receiver.

The signal numbers 1 to 7 given in the table of Figure 1 are transmitted by means of impulse trains containing from 1 to 7 impulses and belonging to the group *ie*. No impulses in the group *ig* are transmitted for these signals. The shift signal *a* is transmitted directly after the shift signal *ia*.

For transmission of signals 8 to 14, one impulse belonging to the group *ig* and from 0 to 6 impulses belonging to the group *ie* are transmitted; for transmission of signals 15 to 20, two impulses belonging to the impulse group *ig* and from 0 to 5 impulses belonging to the group *ie*; and so on.

As will be seen, the number of impulses in the group *ig* increases as the order number of the signal increases, while the greatest number of impulses in the impulse group *ie* diminishes accordingly. The total number of impulses in the two groups never exceeds seven.

As, in the example under consideration, there are only 29 signals, only 29 different impulse trains each consisting of not more than seven impulses are shown in Figure 1. 6 further impulse trains could, however, be formed. In the impulse train numbers 30 to 32, there would be 5 impulses in the group *ig* and 0, 1 or 2 in the group *ie*; in the impulse train numbers 33 and 34, there would be 6 impulses in the group *ig* and 0 or 1 in the group *ie*; and in the impulse train number 35, there would be 7 impulses in the group *ig* and 0 in the group *ie*. If a signal number 0 is included, then, with not more than seven impulses, 36 different signals can be transmitted. The successive impulses of the group *ig* must therefore step the receiving device, that is to say, the type wheel, through amounts of decreasing magnitude, and those of the group *ie* through amounts of equal magnitude. The first impulse of the group *ig* steps the type wheel through eight single steps, the second through seven single steps and so on while those of the group *ie* step it through single steps. The impulses are all of the same length but the impulses of one group (in the described example, the first group) have "setting values" of different magnitudes while those of at least one group (in the described example, the second group) have "setting values" of equal magnitude, the former setting values being multiples of the latter. The sum of the "setting values" of all the impulses of a train gives the "setting value" of the train which determines, in the present case, the angle through which the type wheel is rotated. These setting values need not, however, represent geometrical magnitudes as in the case under consideration but can represent various mechanical or electrical magnitudes according to the desired result.

The transmitter which effects the emission of these various impulse trains comprises a shaft 60 (Figures 2 to 4) driven by a motor and on which cam discs SN are freely mounted. A special cam disc is provided for each of the 29 impulse trains. A ratchet wheel ZN is fixed to the shaft 60 next to each cam disc SN. Each cam SN can be coupled by means of a pawl KN to the ratchet wheel ZN associated with it, for the duration of one rotation of the shaft 60. The pawls KN are pivotally mounted on the cam discs SN on bearing pins formed as extensions of rivets by means of which control discs 61 are fixed to the cam discs SN. A depression 62 is formed in each control disc 61 and in the normal position, these depressions are aligned beneath the shaft 60 (Figure 2) and are engaged by the free ends of a cranked lever 77 (Figures 2 and 3) under the influence of a spring 63. The lower end of this cranked lever is formed as a bar 64 which is moved to the left (Figure 2) when the cranked lever 77 is moved against the action of its spring.

The number of cam discs SN is equal to the number of transmitting keys ST. These keys ST are guided by two transverse rods 65 and are under the influence of springs 66. Each key has a pawl 68 connected to it which, on depression of a key, is lowered together with the free end 69 of the key. During the first part of its movement, the pawl carries with it an intermediate lever 72 which is thus swung counter-clockwise against the action of its spring 78. The coupling pawl KN associated with this lever and which, in the normal position, rests on the end of the lever is thus released and, under the action of the spring 73 engages in one of the teeth of the ratchet wheel ZN. On further depression of the key, the pawl 68 pivots about the point 67 because the oblique surface of the projection 70 on it shuts against a cross bar 71. The member 72 is thus again released and returns to the illustrated position (Figure 2). At the end of the rotation of the cam disc, the tail of its coupling pawl KN abuts against the intermediate lever 72 so that the position shown in Figure 2 is again reached in which there is no connection between the cam disc SN and the ratchet wheel ZN.

At the beginning of the rotation of the cam disc SN, the cranked lever 77 is pivoted about the axis 74 by the control disc 61 and the cross bar 64 is moved to the left and engages above the tail end 69 of the actuated key ST and below the tail ends 69 of the unactuated keys. The actuated key is thus held in the actuated position and the remaining keys are latched in their normal position. When the cam disc has completed a full rotation, the cranked lever 77 again engages in the depression 62 in the control disc and the keys are unlatched.

The movement of the cranked lever 77 also causes a contact SK to be opened by the projection 75 on it for the duration of the rotation of the cam disc SN.

A make-and-break contact SK is associated with each cam disc SN and is arranged with its centre spring resting on the circumference of that disc. All the make and break contacts SK are mounted side by side on a frame 76 and their contact springs are multiplied. In the normal position (Figure 2), neither the upper nor the lower contact is made. The centre contact spring is connected to the transmission line FL, the low-

er spring to the positive and the upper spring to the negative pole of the battery.

Each cam disc is divided into 15 sections subtending equal angles as, for the transmission of signal numbers 7, 14, 20, 25 and 29 (see Figure 1), a time corresponding to 15 impulses is required. The cam disc illustrated in Figure 2 serves for sending out the impulse train corresponding to signal number 3. While sections 1 and 2 of the cam disc lie beneath the centre spring of the contact SK, the lower contact is made and positive current is therefore sent to the line for the duration of two impulses (start signal *ia*). While the sections 3 and 4 lie beneath the make-and-break contact SK, neither the upper nor the lower contact is made and no current flows to the line (shift signal *a*). The sections 5 to 7 correspond to three impulses belonging to group *ie*. When these sections arrive beneath the centre spring of the contact SK, the upper contact is first of all made so that for the duration of one impulse, the negative pole of the battery is connected to the line; then, for a similar period, the positive pole is so connected and finally the negative pole of the battery is again connected to the line. When the sections 8 to 11 pass beneath the centre spring, the line is again devoid of current (shift signal *b*). The sections 12 to 15 are superfluous for signal number 3 and no current flows through the line while these sections are passing.

The cam disc for signal number 28 is diagrammatically illustrated in Figure 5. The sections 3 to 6 of this disc serve for the emission of the impulses of the group *ig* and the sections 9 and 10 for the emission of the impulses of the group *ie*. The other discs are constructed in accordance with the various impulse trains set out in Figure 1.

The receiver illustrated in Figures 6 to 15 comprises a type wheel TR which can be driven by means of the shaft 90 and a motor M. Two escapement mechanisms actuated by the magnets DME and EME are provided for controlling the rotation of the type wheel. These two escapement mechanisms are selectively brought into operation by displacement of the sleeve 80. One of the escapements comprises a pair of wheels 51 and the other a pair of "wheels" 52. A pawl ED co-operates with the "wheels" 51 (Fig. 9) and a pawl EE (Fig. 10) with the wheels 52. The pawls can be swung transversely from the circumference of one of a pair of escapement wheels to the other according to the state of energization of the polarized driving magnet on the armature of which they are mounted. The escapement wheels 51 and 52 are mounted on clutch sleeves 81 and 82 which are themselves loosely mounted on the type wheel shaft 90 and can thus be clutched to the sleeve 80 having teeth 83 and 84. The sleeve can be displaced axially on the shaft 90 to the extent allowed by the pin 85.

The displacement of the sleeve 80 is effected by the armature of an electromagnet U. The unclutching of the sleeve 82 from the sleeve 80 and the clutching of the latter to the sleeve 81 is effected by the movement of attraction of the armature of the magnet U.

The escapement wheels 51 and 52 are provided respectively with stop pins 88 and 89 which determine the normal positions which they assume under the action of the springs 86 and 87 and into which they return when they are unclutched from the sleeve 80.

The type wheel shaft 90 is driven by the motor M through gearing worm Z and a friction gear 91. Normally, the type wheel cannot be rotated

because of the engagement of the pawl EE with a wheel 52.

The type wheel is provided with a return spring 93 (Figures 6 and 14) and normally lies with its stop pin 94 on the stop 95 (Figures 6 and 7). The discs Zi, Bu and Rl (Figures 6 and 13) are fixed to the type wheel. The disc Rl is axially movable on the shaft 90 against the action of a compression spring 96. The discs have cam pins 97 or 98 (Figures 14 and 15) which, at particular angular displacements, actuate contacts Ru and Gu. A further cam 99 is provided on the disc Rl for actuation of a contact Tk.

The type wheel TR has two rows of types on its circumference. One row contains the letters of the alphabet and the other figures and signs. The paper strip P runs beneath the type wheel transversely to its axis. It is of the same width as the type wheel TR and is marked with a double line, figures and signs being printed in an upper row and letters in a lower row (see Figure 6). In order to avoid the necessity of providing a colour ribbon or a colour roller, the printing strip is formed in three parts. The intermediate strip consists of a double sided coloured carbon paper and the cover strip is transparent. The printed text can be read through the transparent cover sheet. The base strip which can be gummed in the usual manner is pressed on to the upper side against the cover strip, the rear side of which is printed. The strip feed mechanism (Figure 12) is, as usual, controlled by a printing magnet DM. After actuation of the printing hammer DH, the strip is stepped on by means of the ratchet 101. A tension roller 103 is mounted on the leaf spring 102 which always supplies sufficient tension and elastic resilience to the strip when it is displaced rearwardly.

The printing hammer DH (Figure 13) is mounted on a link 104 and bears on a part 105. Its position beneath the rows of type on the type wheel TR is determined by the weighted lever 106 which is pivotally mounted at the point 107. Its free end 108 is held by means of a resilient stop 109 in one or the other of the positions in which it can be set by the cams 110 and 111 on the discs Zi and Bu (Figure 14) one of which is in engagement with the lever 106 according to the angular displacement of the type wheel. The printing hammer DH is thus displaced so that subsequently received signals are printed in the other line on the strip.

When the printing magnet is actuated, the projection 114 on the armature *dm* is lifted so that the pawl 113 slips over the tail of the lever 112 (Figures 13 and 15). On release of the armature, the projection 114 is drawn downwards and the pawl 113 causes the lever 112 to turn counter-clockwise about its pivot 115 (Figure 13) and to press against the disc Rl. This disc is thus moved against the action of the spring 96 so that the clutch 92 is opened. The type wheel Tr is now rotated back together with the discs Zi, Bu and Rl into the normal position by its restoring spring 93 and the pawl 113 slips off the tail of the lever 112.

For ensuring that the type wheel will return to the normal position although the lever 112 may be actuated only for a short time, a pawl 117 is pivotally mounted on the pin 120. One end 121 of this pawl is normally held in the notch 118 in the disc Rl by the spring 119. When the type wheel is displaced, this end 121 is lifted out of the notch 118 and bears idly under the pressure of the spring 119 on the circumference of the

disc. When the lever 112 is pivoted and the disc R1 is thus displaced towards the left out of the range of the pawl 121, the latter under the action of the spring 119 snaps back into the illustrated normal position. The disc R1 is thus held against lateral movement after the return of the actuating lever 112 into the normal position for the duration of the return movement of the type wheel TR. The disc R1 can only be displaced towards the right under the action of the spring 96 when the type wheel has reached its normal position because only then can the pawl 117 engage in the notch 118 in the disc R1.

When the printing magnet DM1 is actuated, a contact dm1 is actuated by means of the extension of the armature 122.

Preferably, both a transmitter and a receiver are arranged in each station of a telegraph installation. The transmitter and the receiver can be built as a unit and be driven by the same motor. The circuits between two stations A and B which are connected together by means of the line F1 are illustrated in Figure 16. Other stations such as these can be connected to the line F1. The stations A and B are similarly constructed.

Of the 29 transmitting contacts sk at the station A, only one, sk1, is illustrated. The marking contacts of all the transmitting contacts sk are connected to the poles of the transmitting batteries AB11 and AB12 and their centre contacts are earthed. The line F1 is connected to earth through the upper windings of two polarized line relays ER11 and ER12 so that normally no current flows through the line. The senses in which these two relays are wound and their polarizations are opposite so that when the current is positive only the relay ER12 is energized and when the current is negative only the relay ER11.

Each of the line relays also comprises a lower additional winding which are connected in series in the circuit of the local batteries OB11 and OB12. These additional windings are differential to the main windings and exert a magnetizing force such that as long as no current flows through the main windings, the influence of the additional windings preponderates so as to bring the contacts er11 and er12 into the normal position.

A direct current relay U1, a slow-to-release relay VI and a hot wire relay H1 connected in series are connected to the contacts er11 and er12 from a point midway between the local batteries OB11 and OB12 by a full wave rectifier G11. Also, the polarized magnets DME1 and EME1 controlling the type wheel escapements are selectively connected to the similar lines a1, b1, through the contact u13. These magnets are polarized in the same direction and respond only to alternate impulses which are transmitted through the lines a1, b1 in opposite directions. The relays U1, VI and H1 also respond to these impulses; they remain, however, permanently energized in opposition to the control magnets owing to the rectification effected in the rectifier G11.

The batteries OB11, OB12 also serve for supplying the printing magnets DM1 as well as for energization of the direct current shunt-wound driving motor M1. These circuits can be closed through the key AT1, through the contact v12 of the relay V1 and by the contact of the hot wire relay H1.

An artificial line VR11 which is suited to the resistance of the line F1 is connected in the circuit of the upper windings of the line relays ER11

and ER12. This artificial line is normally short circuited by the contact Skk1 (Figure 2) which is actuated during the transmission. When the station A is transmitting, the line relays ER11 and ER12 of this station are traversed by currents of approximately the same strength as the line relays of the station B at the other end of the line.

The circuit of the printing magnet DM1 is dependent upon the contacts v13 and Tk1. The contact Tk1 is closed when the type wheel reaches its normal position (Figure 15). When the armature of the magnet DM1 is attracted, the energizing coil of the magnet is short circuited by the contact dm1, short circuiting of the batteries OB11, OB12 being prevented by a resistance.

If signals are to be sent out from the station A to the station B, then the starting key AT1 is first of all depressed. In addition to closing its contact, this key, like all the keys ST of the transmitter, clutches a cam disc SN to the transmitting shaft for the transmission of a train of impulses and, indeed, the train 29 (Figure 1). When the contact of the key AT1 is closed, the motor at the station A is started and it immediately begins the transmission of the train of impulses number 29. This current transmission begins as do all others with two positive marking current impulses which traverse the line and are received by the line relays ER21, ER22 of station B. The relay ER22 is actuated so that it overcomes the oppositely acting magnetizing force of its counter winding and throws its armature er22. In this way, a positive current is transmitted over the lines a2 and b2. This influences the polarized escapement control magnet EME2 through the contact u23, which is still in the normal position, in such a way that this magnet throws its armature and, with it, the escapement pawl EE which it controls, into a particular position, for example, into the illustrated left hand position out of which position the escapement can be displaced by the further impulses which, later on, are sent out in alternate directions. When the contact u23 has been operated, the control magnet DME2 also receives the starting impulses so that its armature is brought into the illustrated starting position should it not already happen to be there.

This latter impulse actuates the relays U2, V2 and H2 through the rectifier G12. The relay U2 effects the above described switching step through its contact u23 during the transmission of the above mentioned impulse. The hot wire relay H2 is very slow in responding and, at the start, has no effect at all.

When the relay V2 responds, the contact v22 is closed and the motor M2 is thus started. The same switching steps occur as in the station A because the marking current impulse ia2 is received from the line relays ER11 and ER12. In what follows, only the switching steps occurring in station B will be described.

On response of the relay U2, in addition to the contacts being actuated, the sleeve 80 (Figure 6) is displaced. The clutch 84 is thus opened and the clutch 83 closed. The sleeve 82 and the escapement wheels 52 are thus released and rotate under the influence of the spring 87 into the normal position determined by the stop 89.

Four impulses in alternate directions and belonging to the impulse group ig follow the marking current impulses ia, starting with a negative impulse. The first impulse is trans-

mitted from relay ER21 to the control magnet DME2 while the relay ER22 sets its armature back into the normal position. The armature and the pawl ED of this magnet are released with the result that, the motor, acting through the clutch 83, the sleeve 80, the pin 85, the shaft 90 and the clutch 92, displaces the type wheel TR through the first "large step" under the influence of the motor. The term "large step" is used to differentiate the stepping of the type wheel by the impulses of the group *ig* from the stepping in "single steps" effected by the impulses of the group *ie*. This first large step corresponds to eight single steps (Figure 9) and is determined by the teeth or notches formed on the wheels 51.

In the same way, the subsequent impulses of the impulse group *ig* displace the type wheel through three further large steps which correspond to 7, 6 and 5 single steps respectively and are determined, again, by the teeth or notches formed on the wheels 51. During the reception of these impulses in alternate directions, the relays U2 and V2 remain energized as does the hot wire relay H2. The electrical connection of the control magnet DME2 and also the mechanical displacement of the sleeve 80 are thus both maintained. The contact v23 maintains open the circuit for the printing magnet DM2 which has been prepared in the meantime by the cam contact Tk2.

The shift signal *a* which consists of two no current impulses follows the impulses of the group *ig*. During these impulses, the relay U2 drops and reverses its contacts and displaces the sleeve 80 into the normal position. The clutch 83 is thus disengaged and the clutch 84 engaged so that the sleeve 81 and the escapement wheels 51 are released and return into their normal position under the influence of the return spring 86.

The delay in the release of the relay V2 and that of the hot wire relay H2 are so large that the two relays are maintained operated during these no current impulses *a*. The impulses in alternate directions of the impulse group *ie* now follow and act on the control magnet EME2 so that the type wheel is displaced in single steps which are determined by the teeth or notches formed on the wheels 52.

The relay U2 is not influenced by these impulses because its winding is short circuited by the contacts v21 and u21. It is only the relay V2 and the hot wire relay H2 which are maintained energized by further energizing current impulses through the rectifier G12.

The shift signal *b* which consists of at least four no current impulses follows the impulses of the group *ie*. After about the middle of the third no current impulse, the relay V2 drops and through the contact v23 closes the circuit for the printing magnet DM2. On attraction of its armature, this magnet actuates the printing hammer DH (Figures 12 and 13) and, at the end of its attraction, closes the contact dm2 which short circuits its energizing winding. When the armature has dropped, as is described above, the resetting of the type wheel TR is initiated by the lever devices 112 and 117. In the normal position of the type wheel, the contact Tk2 is again opened. The contact dm2 is preferably so formed that its opening is delayed in order to prevent a further actuation of the printing magnet DM2 during the running back of the type wheel.

The impulse train of the transmitted signal number 29 was also received in the transmitting station A.

As is clear from Figures 1 and 8, there is no signal which can be printed when the type wheel is set to the position corresponding to the impulse train number 29. When the key AT is depressed, nothing therefore happens apart from the setting into operation. When 15 current impulses have been sent out, the key which until then has been held latched in the depressed position is released from the cranked lever 77 (Figure 2). Another key ST can now be depressed for the transmission of letters or figures and signs. If the impulse train number 10 is sent out by depression of the key Gn, the contact Gn (Figure 15) in the receiver will be closed by the pin 98 of the disc R1 and an alarm bell be operated. If the impulse train number 6 is sent out, the contact Ru (Figure 14) is closed by the pin 97 of the discs Bu and Zi so that a signal identifying the station B can be automatically sent out by that station. This signal indicates to the station A that it is connected to the station B.

If a telegram starts with letters, the key Bu must first of all be actuated. In this way, by transmission of the impulse train number 27, the type wheel, and with it the disc Bu, is set so that the cam 111 abuts against the lever 106 (Figure 13) and swings the latter about the axis 107 into its alternative position. In this way, the printing hammer is brought beneath the outer row of types on the type wheel which contains the letters of the alphabet. As the train number 27 is not associated with any type, no impression is effected on the paper strip P.

When the telegram has been sent off and an abnormal pause occurs in the impulse transmission, the hot wire relays H1 and H2 can cool sufficiently to open their contacts. In this way, the motor circuits in the transmitter and in the receiver are opened and the devices in the stations A and B are brought to rest. Only the additional windings of the line relays are traversed by marking current from the local batteries and hold their armatures in the illustrated normal position. Instead of two line relays ER11 and ER12 connected in series and having oppositely arranged counter windings, a single polarized relay can be used, the armature of which is under the action of a spring and which assumes an intermediate position in the absence of current in which none of the contacts is actuated. In practice, such relays work less satisfactorily than the illustrated arrangement.

I claim:—

1. A system for transmitting signals comprising a transmitting device for the emission of signal combinations made up of two groups of substantially equal impulses emitted in alternate directions, a receiving device and a transmission path connecting said devices, said receiving device comprising two polarized relays connected in series, each of said relays being provided with two windings, one of which is connected in a local circuit, a type wheel, means for stepping said type wheel in steps of different sizes and in steps of equal size and a printing device.

2. A system for transmitting signals comprising two stations, a line between said two stations, a transmitting contact at each of said stations, devices for controlling said transmitting contacts for sending out signal combinations made up of two groups of substantially equal impulses emitted in alternate directions, an earthed source of current at each station, each of said contacts being adapted to connect alternately the two poles of one of said sources of current

to said line, polarized relays at each of said stations, said relays being connected between said line and earth and being adapted to be influenced by the impulses in alternate directions, artificial line for damping the flow of current through said relays and means actuated by said devices for controlling said transmitting contacts for connecting said damping artificial line.

3. A system for transmitting signals comprising a transmitting device, and a receiving device and a line connecting said devices, said transmitting device comprising a transmitting battery earthed at the middle, a transmitting contact adapted to connect said line alternately to the poles of said battery without interrupting the connection between said transmitting and receiving devices and devices for controlling said transmitting contact for sending out impulses in alternate directions, and said receiving device comprising a type wheel and means for stepping said type wheel in steps of different sizes and in steps of like size.

4. A system for the transmission of signals comprising a transmitting device and a receiving device, said transmitting device being adapted to emit signal combinations made up of a plurality of groups of impulses of equal length and to emit a shift signal between successive groups and said receiving device comprising means for endowing the impulses of one of said groups with setting values of unequal magnitude and the impulses of at least one other of said groups with setting values of equal magnitude.

5. A system for the transmission of signals comprising a transmitting device and a receiving device, said transmitting device being adapted to emit signal combinations made up of a plurality of groups of impulses of equal length and to emit a shift signal between successive groups, said receiving device comprising means for endowing the impulses of the second of said groups with setting values of equal magnitude and means for endowing the impulses of the first of said groups with setting values of different magnitudes divisible by said setting values of equal magnitude.

6. A system for the transmission of signals comprising a transmitting device, a receiving device and a transmission path connecting said devices, said transmitting device being adapted to emit signal combinations made up of a plurality of groups of impulses of equal length and to emit a shift signal between successive groups, said receiving device comprising a type wheel and means for setting said type wheel in steps of different sizes and in steps of equal size.

7. A system for transmitting signals as claimed in claim 6, wherein said means are adapted to step said type wheel through steps which differ in magnitude from each other by equal amounts from impulse to impulse.

8. A system for the transmission of signals comprising a transmitting device, a receiving device and a transmission path connecting said devices, said transmitting device being adapted to emit signal combinations made up of a maximum of seven impulses of equal length subdivided into two groups and to emit a shift signal between successive groups, said receiving device comprising a type wheel having 29 different working positions and means for displacing said type wheel in steps of different sizes and in steps of like size.

9. A system for the transmission of signals comprising a transmitting device, a receiving

device and a transmission path connecting said devices, said transmitting device being adapted to emit signal combinations made up of a plurality of groups of impulses of equal length and at least two shift signals, said receiving device comprising a type wheel, means for displacing said type wheel in steps of different sizes and in steps of like size and a magnet having a delayed release and adapted to be caused to release by one of said shift signals.

10. A system for the transmission of signals comprising a transmitting device, a receiving device and a printing device, said transmitting device being adapted to emit signal combinations made up of two groups of impulses of equal length, each followed by a shift signal, said receiving device comprising a type wheel, means controlled by the impulses of said groups for displacing said type wheel in steps of different sizes and in steps of like size, a printing device, a magnet having a delayed release and adapted to be influenced by the shift signal transmitted at the end of the first of said impulse groups and to influence said type wheel setting means, and a magnet adapted to be influenced by the shift signal transmitted at the end of the second of said impulse groups and thus to control said printing device.

11. A system for transmitting signals as claimed in claim 4, wherein said transmitting device is adapted to emit impulses in alternate directions.

12. A system for the transmission of signals comprising a transmitting device, a receiving device and a transmission path connecting said devices, and a printing device, said transmitting device being adapted to emit signal combinations made up of a plurality of groups of impulses of equal length emitted in alternate directions, said receiving device comprising a type wheel, an escapement mechanism for controlling the stepping of said type wheel in steps of different sizes and in steps of like size, a polarized magnet for controlling said escapement mechanism and a printing device.

13. A system for transmitting signals comprising a transmitting device adapted to emit signal combinations made up of two groups of impulses of equal length emitted in alternate directions and a plurality of shift signals, a receiving device comprising a type wheel, an escapement mechanism for stepping said type wheel in steps of different sizes and in steps of like size, a polarized magnet for controlling said escapement mechanism under the influence of said impulses, a rectifier, a plurality of magnets having a delayed release and adapted to be controlled by the impulses through said rectifier and a printing device controlled by one of said magnets.

14. A system for transmitting signals comprising a transmitting device, a receiving device and a transmission path connecting said devices, said transmitting device being adapted to emit signal combinations made up of two groups of substantially equal impulses and of a shift signal between said two groups, said receiving device comprising a type wheel, two escapement mechanisms for controlling said type wheel and a switching device for selectively coupling said type wheel with one of said escapements.

15. A system for the transmission of signals comprising a transmitting device, a receiving device and a transmission path connecting said devices, said transmitting device being adapted to emit signal combinations made up of a plurality of groups of impulses of equal length and

a shift signal between successive groups, said receiving device comprising a type wheel, a shaft for said type wheel, two escapement mechanisms arranged on said type wheel shaft for stepping said type wheel in steps of different sizes and in steps of like size, and an electromagnetic controlling device for selectively coupling one of said escapements to said type wheel.

16. A system for the transmission of signals comprising a transmitting device, a receiving device and a transmission path connecting said devices, said transmitting device being adapted to emit signal combinations made up of a plurality of groups of impulses of equal length and a shift signal between successive groups, said receiving device comprising a type wheel, a spring for resetting said type wheel into its normal position, a shaft for said type wheel, two escapement mechanisms arranged on the same shaft for setting said type wheel in steps of different sizes and in steps of like size and an electromagnetically actuated controlling device for selectively coupling said type wheel with one of said escapement mechanisms.

17. A system for the transmission of signals comprising a transmitting device, a receiving device and a transmission path connecting said devices, said transmitting device being adapted to emit signal combinations made up of a plurality of groups of impulses of equal length and a shift signal between successive groups, said receiving device comprising a type wheel, a spring for resetting said type wheel in its normal position, a shaft for said type wheel, two escapement mechanisms arranged on said shaft for setting said type wheel in steps of different sizes and in steps of like size, springs for returning said escapement mechanisms to their normal position and a controlling device for selectively coupling said type wheel to one of said escapement mechanisms.

18. A system for transmitting signals comprising a transmitting device adapted to emit signal combinations made up of two groups of impulses of equal length, a receiving device and a transmission path connecting said devices, said receiving device comprising a type wheel, a spring for resetting said type wheel, means for displacing said type wheel in steps of different sizes and in steps of like size, means for ensuring the return of the said type wheel into its normal position, a printing device and means adapted to be influenced by said printing device for controlling said type wheel displacing means.

19. A system for the transmission of signals comprising a transmitting device, a receiving device and a transmission path connecting said devices, said transmitting device being adapted to emit signal combinations made up of a plurality of groups of impulses of equal length and a shift signal between successive groups, said receiving device comprising a type wheel, means for actuating contacts, means for displacing said type wheel and said contact actuating means in steps of different sizes and in steps of like size.

20. A system for transmitting signals comprising a transmitting device and a receiving device, said transmitting device being adapted to emit signal combinations made up of two groups of impulses of equal length and a shift signal before the emission of each group, said receiving device being adapted to endow said impulses of the second of said impulse groups with setting values of like size and the impulses of the first of said impulse groups with setting values of different size divisible by the said setting values of like size.

21. A system for transmitting signals comprising a transmitting device adapted to emit signal combinations made up of a long current impulse in a particular direction, a group of impulses all of equal length in alternate directions, a short impulse pause, a further group of impulses all of the same length and of the same length as the impulses in the previously mentioned group in alternate directions and a longer pause, a receiving device comprising a type wheel, means controlled by the impulses of the first of said impulse groups for stepping said type wheel in steps of different sizes, means controlled by the impulses of the second of said impulse groups for stepping said type wheel through steps of equal size, means controlled by the impulse pause before the impulses of the second of said impulse groups for selectively connecting said type wheel to one of said means for stepping said type wheel and a printing device controlled by the impulse pause at the end of the second of said impulse groups.

22. A system for transmitting signals comprising a transmitting device, a receiving device, a transmission path connecting said devices and a printing device, said transmitting device comprising keys, transmitting contacts, a rotary shaft, cam discs provided each with a coupling device actuatable by one of said keys for coupling it to said rotary shaft, and adapted to control said transmitting contacts for the purpose of signal combinations made up of a plurality of groups of impulses of equal length and said receiving device comprising a type wheel and means for stepping said type wheel in steps of different sizes and in steps of like size.

23. A system for transmitting signals comprising a transmitting device, a receiving device and a transmission path connecting said devices, said transmitting device comprising keys, cam discs, transmitting contacts controlled by said cam discs, a rotary shaft, each of said cam discs being provided with coupling devices adapted to couple said cam discs to said rotary shaft for the duration of one rotation, each of said cam discs also being provided with controlling devices, a member for latching said keys in any position they may assume, said member being influenced by said control devices of said cam discs, and said receiving device comprising a type wheel, means for stepping said type wheel in steps of different sizes and in steps of like size on reception from said transmitting device of impulses of equal length and a printing device.

MAX AMANN.