A. N. HOVLAND.

TYPE PRINTING TELEGRAPH APPARATUS FOR LINE AND RADIO TELEGRAPHY.

APPLICATION FILED NOV. 17, 1911.

1,111,695.

Patented Sept. 22, 1914.

2 SHEETS—SHEET 1.

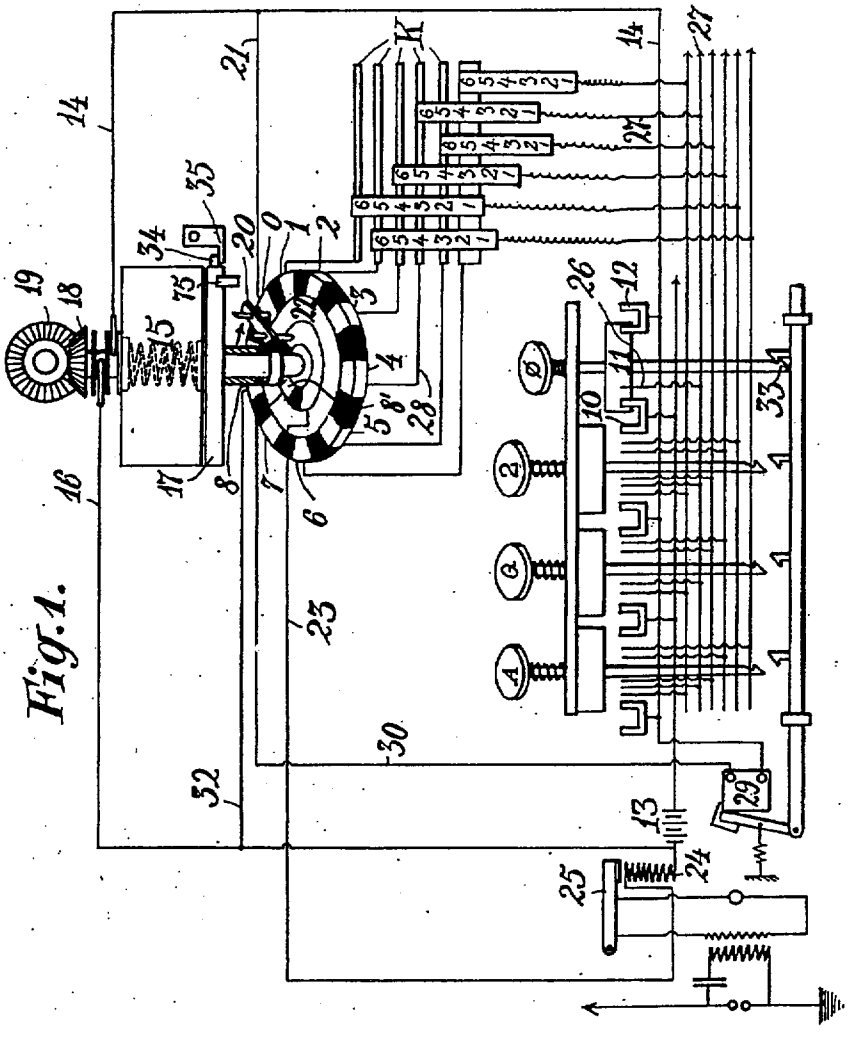


Fig. 1.

Witnesses:
P. W. Sommers
E. Lockert.

Inventor.
Abraham Nilsen Hovland.
By [illegible] Atty

A. N. HOVLAND.

TYPE PRINTING TELEGRAPH APPARATUS FOR LINE AND RADIO TELEGRAPHY.

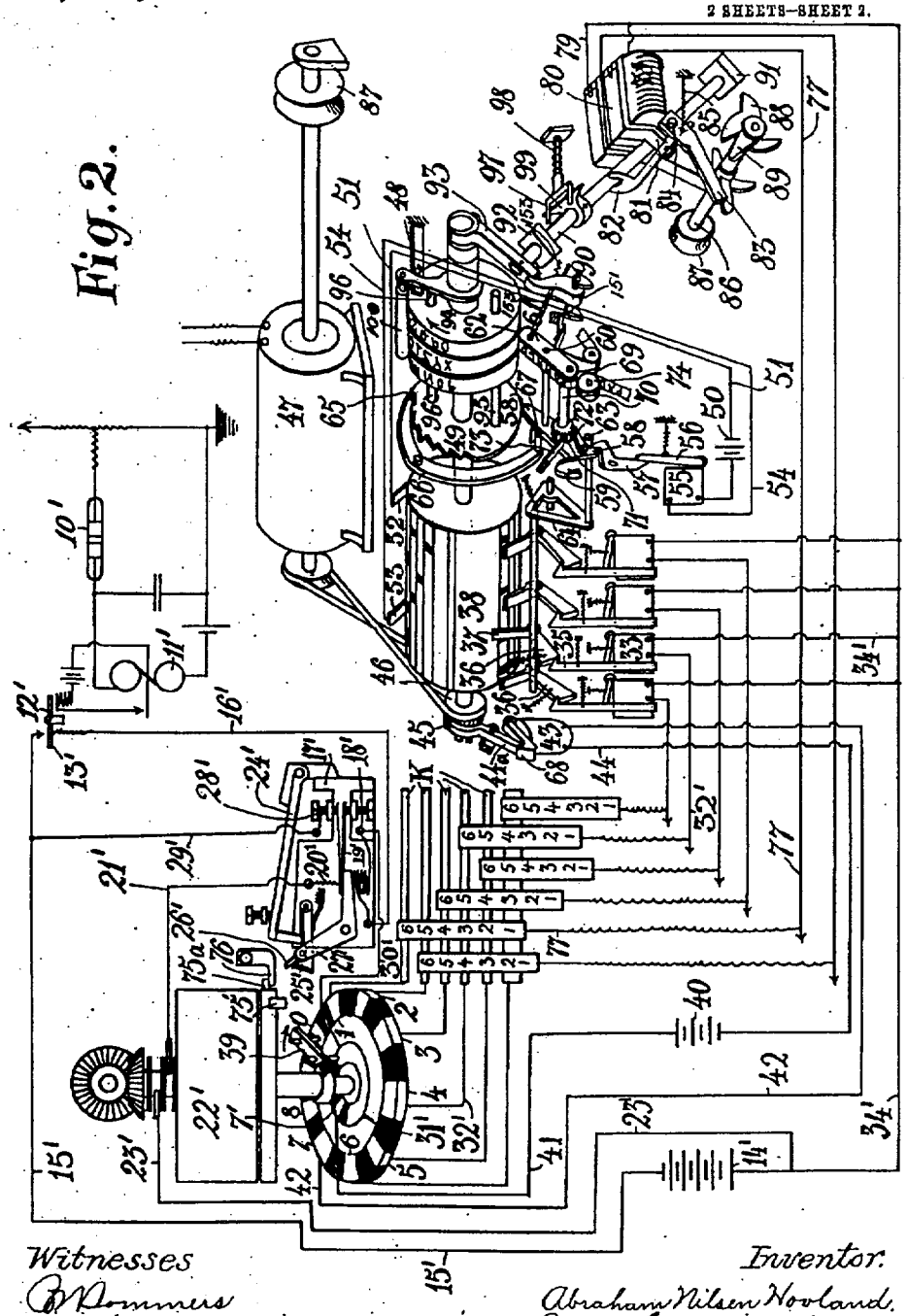
APPLICATION FILED NOV. 17, 1911.

1,111,695.

Patented Sept. 22, 1914.

2 SHEETS—SHEET 2.

Fig. 2.



Witnesses
C. Dommers
E. Leckert.

Inventor.
Abraham Nilsen Hovland.
By Henry Orth & Co. Attys.

UNITED STATES PATENT OFFICE.

ABRAHAM NILSEN HOVLAND, OF CHRISTIANIA, NORWAY, ASSIGNOR TO A/S HOVLANDS RADIOTELEGRAF, OF CHRISTIANIA, NORWAY.

TYPE-PRINTING TELEGRAPH APPARATUS FOR LINE AND RADIO TELEGRAPHY.

1,111,695. Specification of Letters Patent. Patented Sept. 22, 1914.

Application filed November 17, 1911. Serial No. 660,780.

To all whom it may concern:

Be it known that I, ABRAHAM NILSEN HOVLAND, a subject of the King of Norway, residing at Christiania, Norway, (whose postoffice address is Thomas Heftyes gate 48, Christiania, Norway,) have invented certain new and useful Improvements in Type-Printing Telegraph Apparatus for Line and Radio Telegraphy; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same, reference being had to the accompanying drawings, and to letters or figures of reference marked thereon, which form a part of this specification.

My invention relates to a form of the receiver system for exerting any one of numerous possible distant actions by combining short or long current impulses such as described in my U. S. application No. 474490, in combination with an arrangement for transmitting current impulses for telegraphing purposes for line telegraphy as well as for radiotelegraphy and with the use of a key-board as in a typewriting machine. Such a transmitting arrangement is mentioned in the above mentioned patent application, where it is stated that it is desirable, if not exactly a necessary condition for enabling this kind of characters to be used entirely satisfactorily, that there should be used at the transmitting station a transmitting apparatus transmitting with a constant regularity adapted to correspond to the receiver.

Thus the present invention comprises a combined transmitting and receiving apparatus of which the transmitting arrangement is intended to transmit impulses of current with a constant regularity, and of which the receiving arrangement is based on the principle set forth in my said prior application and according to which the arriving impulses of current are used to set up a corresponding "Morse type" which is thereupon caused to perform a relative movement with respect to some series of break points arranged as Morse signals or specially formed characters until the Morse type formed finds the corresponding characters whereby a circuit of an electromagnet is closed, causing the corresponding letter type to be printed on a slip of paper.

Otherwise the characteristic feature of this apparatus consists in the insertion of a special device for producing a secret type, a cryptograph, relating both to the transmitting and to the receiving apparatus, and which is set simultaneously for both. The cryptograph used in the present instance is of a well-known construction and consists of a series of bars connected with the corresponding contacts 1, 2, 3, 4, 5, 6 and being capable of being brought separately, one by one, as desired, into contact with bars movable transversely of said bars and provided with numerals from 1 to 6, whereby the cryptograph is set on a certain figure, in the present example 213546.

The construction and manner of operation of the telegraph apparatus will appear from the diagrams which will be explained in the following:

The transmitting diagram is shown in Figure 1.

In the key-board of the transmitter are provided 48 keys, each representing its own letter, numeral, or signal. Each key has at its top a button marked with the corresponding letter or signal. From the button extends downwardly a metal rod having beneath the key supporting frame member a transversal metal cylinder for making contact and at the bottom a hook by which it is retained, by another hook after it has been pressed down, until the signal has been transmitted. The hook is then released by an electromagnet after which the button is forced upward by a helical spring. Beneath the contact cylinder of each key are arranged a number of contact springs forming for each key a special group or signal characteristic of the key in question as will appear from the diagram.

In the accompanying drawing which shows a form of the apparatus, Fig. 1 is a diagram of the transmitting arrangement and Fig. 2 a diagram of the receiving arrangement.

If a key is pressed down, for instance that which contains the letter ø, the following operation will take place (Fig. 1): Contact is made from the spring 10 through the metal cylinder 11 and spring 12 whereby a current passes from the battery 13 through the line 14, the coupling electromagnet 15, the line 16 and back to the battery 13. Thereby the armature 17 is attracted by

the magnet and begins to travel around, the magnet 15 being constantly driven around with a given uniform velocity by means of a clockwork and the bevel gears 18, 19. With the armature travels the contact arm 20 with the two contact brushes, and the latter will first glide across the contact 0. At this moment a current is passing from 13 through 10, 11, 12, 14, the line 21 and the contact 0 of the sunflower switch, the ring 22, the line 23, telegraph magnet 24 and back to 13. Thereby the key 25 is attracted and will transmit the first impulse of current through the radio-transmitting-apparatus shown below the key. The contact arm then moves across the contact 1, but without any operation taking place, as there is no line between 1 and 11. The arm moves on across the contacts 2 and 3 without any operation taking place. But as the arm arrives at 4, the current is again closed and this time from 13 through 10, 11, the spring 26, the line 27, the cryptograph K, the line 28, through 4, 22, 23, 24 and to 13, and the radio-transmitting-apparatus again transmit a short train of waves. The contact arm moves farther on across 6 without any operation taking place likewise across 7 and then arrives at 8. The current is then closed through 13, 10, 11, 12, the releasing electromagnet 29, the line 30, through the contact 8^1 the arm 20, contact 8, the lines 32, 16 and to battery 13. Thereby the magnet 29 will release the hook 33, and the key ϕ shoots upward. Thereby the connection is broken between the cylinder 11 and the springs 10, 12 and 26, and the coupling magnet 15 looses its current whereby the armature 17 is pressed back into inoperative position by a spring around the shaft. This takes place a little before the lug 34 of the armature strikes against the stationary stopping lug 35. After the armature has been released, it follows the shaft on account of friction, until the lug 34 strikes against the lug 35 whereby the armature is stopped just in its initial position. Thereby the letter ϕ has been telegraphed, that is to say, 2 impulses have been transmitted, viz. the first and the fifth.

The next diagram Fig. 2 is that of the receiver.

The condition of a proper coöperation with the transmitter is firstly that the two clockworks should be set for the same velocity of rotation, that is to say, that the coupling magnets of both apparatus should have the same velocity of rotation. Secondly both cryptographs must be set on the same numeral. In both diagrams the cryptogram figure is seen to be 213546. Now we assume that ϕ has been telegraphed on the transmitter which letter consists of the 1st and 5th impulse. When the first impulse strikes the aerial of the receiver the coherer 10^1 will react and the relay 11^1 make contact for the type printing relay 12^1. During the experiments it has proved to be the best to have a single slow relay, the type printing relay, between the radio-telegraph apparatus and the type telegraph. The relay 12^1 will then close a circuit of the local battery 14^1 for operating the printing mechanism and a current will pass from the battery 14^1 through line 15^1, the tongue 13^1, conductor 16^1 through the auxiliary magnet 17^1 through the screw 18^1, double spring 19^1 the helical spring 20^1, conductor 21^1, the coupling magnet 22^1 conductor 23^1 and back to the battery 14^1 to drive the sunflower switch. Thereby the two magnets will attract their armatures. The coupling magnet or its shaft carries a helical spring that urges the armature into released position when the magnet is de-energized. The armature 24^1 of the auxiliary magnet will strike against the hook 25^1 so that it will release the pin 26^1 on the two armed lever 27^1, whereupon the spring 20^1 will pull lever 27^1 and the double spring 19^1 mounted on the tail of lever 27^1 will be moved from the screw 18^1 and toward the contact screw 28^1. As the upper leaf of the double spring 19^1 touches the latter, a current will be established through the conductor 29^1 to the coupling magnet, and the latter, from now and during the entire revolution, will receive its current this way. The relay thereby becomes free for use for the impulses of current that are intended to set the type wheel and set up the Morse type. In order that current through the electromagnet 22^1 shall not be interrupted during the movement of the double spring 19^1, the contact screws 18^1 and 28^1 are so adjusted relatively to spring 19^1, that when the lever 27^1 is released, the upper leaf of spring 19^1 first contacts with screw 28^1 so that for a moment both leaves are in contact with their respective screws, and then become flexed sufficiently to raise the lower leaf from its screw 18^1.

The operation of the two magnets takes place during the first impulse of the transmitter. During this operation the contact arm of the receiver passes the contact 0. At the contacts 1, 2 and 3 no impulse is transmitted from the transmitting station nor will consequently any operation take place in the receiver. At the contact 4, however, there will again be an impulse, and the relays will close the circuits whereby a current will pass from the battery 14^1 through 15^1, 13^1, 16^1 through the auxiliary magnet 17^1 the conductor 30^1 the ring 31^1 the contact 4, the conductor 32^1, the cryptograph K the conductor 32^1, the magnet 33, the conductor 34^1, and the battery 14^1. The armature of the magnet 33 will then strike against the hook 35 thereby causing it to

let go its hold of the arm 36 on the contact brush 37 which will then be pressed up against the contact drum 38 by a helical spring. The hook 35 and the brush 37 will remain in the position illustrated in the drawing. The armature of the magnet 33, on the other hand, as soon as the impulse is over, will be pulled upward into its inoperative position by a small helical spring. The contact arm 39 now moves on across the contact 5 and 6 without any operation taking place, as no more impulses will arrive from the transmitter. On the contact arm arriving at the contact 7, a circuit will be closed from the battery 40 through 41, contact 7^1 contact arm 39, contact 7 wire 42 and the magnet 43, conductor 44, and to the battery 40. The magnet 43 will attract its armature and release the arm 44^a which is mounted on the same shaft as the contact drum and the type wheel, and which locks these latter in their initial position. At the moment the arm 44^a becomes free, a pawl on the same will be forced into engagement with the cog wheel 45 rigidly connected with the rope pulley 46 which is kept in uniform rotation by means of the motor 47. Thereby the contact drum the type wheel 48, and the cog wheel 49 will suddenly be caused to rotate in the direction of the arrow. During this operation the Morse type set up, that is to say, in this instance the brush 37, will glide across the characters formed by silver plates on the contact drum, until it arrives at the character only containing the third break point from the right a circuit being then momentarily closed from the battery 50, through conductor 51, brush 52, the character in question and brush 37, brush 53, line 54, magnet 55, and to the battery 50. The armature 56 of the magnet strikes against the hook 57 so that the latter will release the strong, pawl-shaped steel member 58 which by the powerful plate-spring 59 will be thrown upward against the cog wheel 49 and engage the tooth corresponding to the Morse signal in question on the drum. Thereby the steel member 58 is rotated about its shaft 60 carrying along with it the frame 61 rigidly connected to said steel member and having attached to it the paper strip and the printing roller 62, so that the latter will press the paper strip up against the letter type corresponding to the character on the drum, in this instance ø, printing it on the strip. As the lower arm of the steel member 58 is thrown forward, it strikes against the arm 63 on the frame 64 for effacing the Morse type, whereby the latter will force the arm 36 downward and thus bring the brush 37 outward from the contact drum. In other words as soon as the Morse type has performed its duty, it will be effaced. As the arm 36 gets underneath the hook 35, it will be retained by the same in its initial position. During the revolution of the cog wheel 49, its pin 65 in the last part of the revolution gets underneath the two-armed lever 66 and presses the same upward. Thereby the lower end of the lever will press with its pin 67 against the upper projection of the steel member 58 and push the same back to its initial position, until its lower end gets behind the hook 57 and is retained by the same. During this motion the pin of the cog wheel gets clear of the lever 66, and this occurs at the same time as the arm 44^a at the other side of the contact drum strikes against the hook 68 on the magnet armature and is retained by the same. Thereby the pawl is released from the cog wheel 45, and the contact drum, the toothed wheel 49 and the type wheel will remain in their initial position.

The feeding of the paper is performed automatically during the return motion of the printing roller and the steel member 58, in the following manner: The paper feed roller 69 the object of which is to feed the paper strip forwardly a suitable distance (about ¼ of an inch) after each letter printing, is mounted on the same sleeve 70 as the ratchet wheel 71 against which two pawls 72 and 73 are pressing. The lower pawl 72 is attached to a pin on the steel member 58 and follows the latter during its motion; the other pawl 73 turns about a pin at the front side of the apparatus. Against the paper strip and the paper feed roller 69 presses a small roller 74. As now the steel member 58 turns about its shaft during the printing operation, the lower pawl 72 will press against the ratchet wheel 71 and turn the latter, counter clock-wise one tooth, while at the same time the upper pawl will slip across one tooth. During this operation also the paper feed roller will be turned and pull the paper so much downwardly as to hold it tight across a printing roller without, however, now pulling it over the same. As the steel member is returned by the lever 66, the ratchet wheel 71 is stopped by the upper pawl 73 so that it cannot partake of the rotation about the shaft. Thereby the paper is held firmly clamped between the two rollers 69 and 74 and it must therefore be pulled over the printing roller a distance, as the latter moves downward. Thereby the paper is displaced on the printing roller a distance corresponding to the width of a letter-interstice.

To furnish all the lettertypes with ink is generally used an inking roller 100 with a coat of felt, which roller follows the lateral movement of the type wheel, when the latter is shifted to its position.

The operations lastly described, *i. e.* the letter printing, the effacing of the Morse type and the further feeding of the paper,

take place from the moment the contact arm touched the contact 7 and until a distance before it reached its inoperative position. This movement is effected by the means for rotating the magnet 22^1 and its attracted armature, as described with reference to the like magnet 15 and armature 17, Fig. 1. The contact arm glides across the contact 8 without any action, as said contact is for the transmitter. When the arm has arrived at this point, a pin 75^1 on the armature begins to press against the long pin 26^1 and force the same in a lateral direction, until it gets underneath the hook 25^1 and is retained by the same. Thereby the connection between the double spring 19^1 and the screw 28^1 and thereby the current of the coupling magnet 22^1 is again broken, whereupon the armature of this magnet will move away and be stopped as the lug 75^a strikes against the stopping lug 76. Thereby everything has been returned to the initial position, and the apparatus is ready to receive a new letter. If now this letter is one of those that are situated on the left or the right type ring, the type wheel, as already mentioned, will have to be set beforehand. This is done in the following manner: If for instance the key marked 2 is pressed down, impulses will be transmitted from the transmitting apparatus as its contact arm glides across contacts 0 1 3 4, 5 and 6. Of these the impulse through contact 1 is used to set the type wheel in position, the four latter impulses being used for setting up the Morse type. We shall then see in the transmitter diagram what is taking place in the receiver. On arrival of the first impulse the coupling magnet 22^1 and auxiliary magnet 17^1 are operated as explained for the letter ø. As the arm passes across the contact 1 a new impulse arrives. A current will then pass from the battery 14^1 through 15^1, 13^1, 16^1, through the magnet 17^1, through 30^1, 31^1 contact 1, cryptograph K conductor 77, through magnet 78, conductor 79, 34^1 and back to the battery 14^1. The magnet 78 will then attract its armature 80 which with its lip 81 will strike against a cross shaped latch 82 supporting the arm 83. Thereby this somewhat curved arm will fall down turning on a screw 84 and being pulled downward by the spring 85. Vertically underneath the arm 83 and transversely of the same is a shaft 86 which is kept speedily rotating by means of the rope pulleys 87 and the motor 47. On the shaft is mounted underneath each arm 83, a wheel 88 having three teeth and also a crank 89. The three-toothed wheel is so adjusted relatively to the arm 83 that its teeth will engage the inner side of the arm as this falls down, whereby the same, which is bent inwardly, will be pushed laterally outward. The crank 89 is constantly moved by pulley 87. When armature 80 is attracted the arm 83 will fall into the path of the three-toothed wheel 88, any one of the teeth of which will move said arm toward arm 89. As soon as arm 89 engages arm 83 it moves said arm back to initial position. The type wheels are shifted in opposite directions by a magnet adjacent the magnet 79. Thereby the arm, which is rigidly mounted on the inclined shaft 90, will turn the latter in its journals 91 and 92, whereby a cross arm 93 at the upper end of the shaft will carry the type wheel in this instance inwardly toward the toothed wheel, for the cross arm 93 has at its upper end a bifurcation with which it grips over a sleeve 94 on the type wheel. The type wheel is guided in four pins 95, 96 (two are not shown in the figure). As the type wheel reaches its innermost position, it is locked by a single small latch, and it will remain there until the printing is done. This latch 151 is lifted by a bar 152 on the printing frame against the action of its holding spring 153. The latch 151 is drawn down by spring 153 beside the lower part of arm 93 and locks said arm in one of its extreme positions. After having rotated the shaft 90, the arm 83 will at once be turned upward into its initial position by the crank 89 so that it will again be ready for use.

The Morse type is set up as explained with respect to the letter ø. Also the printing takes place in the same manner, everything remaining in its place except the type wheel which is placed in its innermost position. As now the steel member shoots upward, it releases the small latch that locked the type wheel in its innermost position the wheel thereupon returning to its middle position. This is effected by means of a buffer arrangement at the middle of the inclined shaft. The buffer 97, which is pressed forward by the helical spring 98, presses against a cross bar 99 on the inclined shaft. On the latter being turned in one direction or the other, the cross bar 99 will push the buffer back the helical spring being thereby further tensioned. When now the type wheel is released after the printing operation, the helical spring pushes the cross bar into its place thereby turning the inclined shaft and the type wheel back into their middle position. Otherwise the remaining operations take place as explained with respect to the letter ø.

With these apparatus it will be possible to use 720 different alphabets. This figure is determined by the formula:

$$X=1.2.3.4.5.6=720.$$

If it is desired to enable the alphabets to be varied still more, the apparatus may be constructed for one impulse more whereby

the cryptograph will get 2×7 bars. It will then be possible to vary between

$$X=1.2.3.4.5.6.7=5040.$$

different alphabets.

The means operating the coupling magnet may be of any kind, if it only works steady and regularly and allows of being adjusted for different speeds. The disks may be divided for letters or words or revolutions per minute or the like so as to enable the apparatus to be adjusted for the speed to be operated with. This form of apparatus may again be somewhat simplified, *inter alia* by leaving out a number of characters, numerals, etc., so that only the letters of the alphabet most commonly used, will be left. All of these letters being placed around a single type ring thereby doing away with the shifting mechanism of the type wheel and its contacts and conductors. Such a simplified apparatus is supposed to be particularly advantageous in fishing vessels, etc., where the telegrapher cannot be expected to be very skilled in the art. Further the electromotor driving the contact drum and performing the automatic winding up, may be replaced by a clockwork or the like in order to be independent of electric power for driving the motor. The clockwork, if desired, may again be combined with the clockwork rotating the coupling magnet. The coupling magnet may conveniently be combined with the contact drum and both be mounted on the same shaft thereby enabling the mechanism to be simplified. On the whole the present form of apparatus may be simplified in several ways without departing from the main principle.

Claims:

1. In a telegraph system, means for initiating signals whose impulses are of given intervals, receiving mechanism set in operation by the reception of said impulses, means at the sending station for changing the intervals of said impulses, means at the receiving station to correspondingly change the intervals of reception, said intervals and impulses for each signal being completed in a single rotation of the receiving means, and mechanism controlled from the interval changing mechanism to reëstablish the normal interval relation between the impulses of a signal.

2. In a telegraph system, means at a sending station for initiating signals whose impulses are of given intervals, adjustable means for changing both the order of sequence and the time intervals between the impulses, receiving means at a receiving station set in operation by said impulses, means connected thereto for changing the time interval of received impulses arranged to be set in correspondence with the like means at the sending station, and printing mechanism set in operation by said signal impulses and printing the signal after the impulses have been received.

3. In a telegraph system, a sending station having key-actuated signaling means including a sunflower switch, and a cryptograph mechanism between the keys of said means and said switch; a receiving station having a like sunflower switch set in operation by the impulses received and like cryptograph mechanism, a contact drum driven independently of said switch and controlled from said switch, and contact devices coöperating with the drum and actuated by current impulses through said switch and cryptograph mechanism.

4. In a telegraph system, a sending station having key-actuated signaling means including a sunflower switch which in one rotation sends all the current impulses for a given signal, a cryptograph mechanism between the keys of said device and said switch; a receiving station having a like sunflower switch for receiving all the current impulses for a signal during a single rotation, a like cryptograph mechanism connected to said switch, a contact drum, contact levers coöperating with the drum and controlled by current impulses through said switch and mechanism, and printing mechanism controlled from said drum.

5. In combination, a manual key-board, a synchronized transmitter receiving impulses therefrom and associated cryptograph mechanism, a synchronized receiver and associated cryptograph mechanism, a driven type-wheel, and electro-magnetic mechanism controlled by the latter cryptograph mechanism for arresting the type-wheel, and mechanism for moving a record strip against the arrested type-wheel.

6. In combination, a manual key-board, a synchronized transmitter receiving signal impulses therefrom, a cryptograph mechanism associated with the transmitter for controlling the order or time interval or both of said impulses, a synchronized receiver and associated cryptograph mechanism for reproducing the impressed signals, a record strip holding and feeding mechanism, a plurality of driven type wheels, and electro-magnetic mechanism controlled by said cryptographs to position any one of the type wheels in operative relation to the record strip.

7. In combination, a continuously rotating magnet, a local battery circuit, means operated by current impulses to connect said magnet in said circuit to energize same, a contact arm carried by the armature, stationary contacts swept by said arm, and electro-magnetic mechanism controlled by

the rotation of said armature to break the circuit of said magnet when said armature has made substantially one rotation.

8. A sunflower switch, cryptograph mechanism electrically connected thereto to change the sequence of the impulses, a continuously rotating magnet, an armature magnetically carried by said magnet when energized to rotate the switch, means for energizing the magnet by current impulses, Morse type-setting means, and contacts therefor controlled by current impulses through said switch and cryptograph mechanism, printing mechanism controlled from said type-setting means and printing wheel shifting mechanism controlled from said switch.

In testimony that I claim the foregoing as my invention, I have signed my name in presence of two subscribing witnesses.

ABRAHAM NILSEN HOVLAND.

Witnesses:

HENRY HASPER,

WOLDEMAR HAUPT.