J. GOTT.

WORKING SUBMARINE CABLES.

APPLICATION FILED MAR. 18, 1912.

1,056,533. Patented Mar. 18, 1913.

Fig. 1.

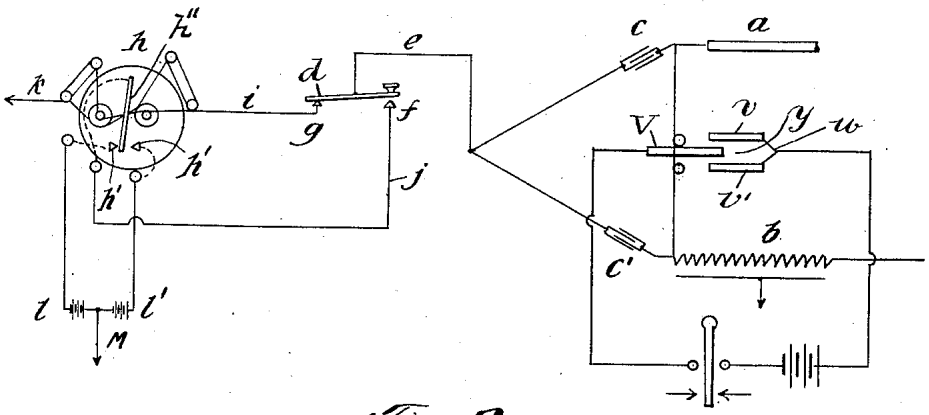


Fig. 2.

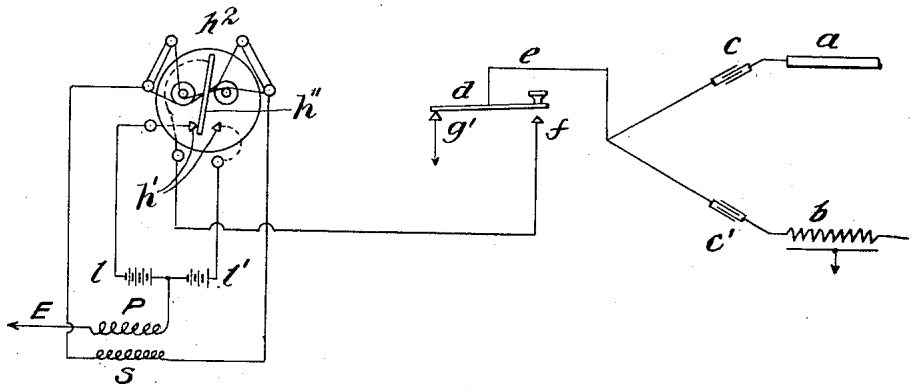


Fig. 3.

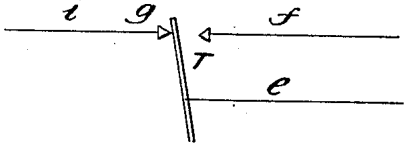
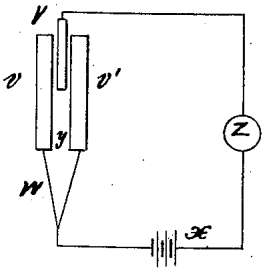


Fig. 4.



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WORKING SUBMARINE CABLES.

1,056,533. Specification of Letters Patent. Patented Mar. 18, 1913.

Application filed March 13, 1912. Serial No. 684,572.

To all whom it may concern:

Be it known that I, JOHN GOTT, a subject of the King of Great Britain, and resident of Hove, Brighton, England, have invented certain new and useful Improvements in Working Submarine Cables, of which the following is a specification.

In the drawings, Figure 1 is a diagrammatic view showing the invention applied to a duplex cable system, and in which the discharge from the cable to earth reverses the polarity of the current to the main line; Fig. 2 a similar view in which the reversals are secured by induced currents in the secondary winding of a transformer; Fig. 3 a detail view of a simple relaying means; and Fig. 4 a detail diagrammatic view of the receiving apparatus.

This invention relates to a system intended to apply the international Morse code to the transmission of messages over long submarine cables, in place of the code now used whereby uniformity of working with land lines and other connections is established.

The invention primarily involves a method of transmission of the Morse code which enables it to be applied in the most economical manner as regards time. It is well known that reversed currents sent rapidly through a long submarine cable are the most effective in definition as received at the distant end of the cable—each following current having the effect of neutralizing the preceding one. In this invention every unit of each letter is formed by a reversed current so that in no case during transmission does a current of the same polarity follow. At the receiving end of the cable these reversed units of letters are transformed in a simple manner so that the alphabet comes out in Morse characters as if received through a short land line and are therefore easy to read and transcribe.

To obtain the reversal of polarity for each unit of a letter with absolute uniformity and certainty I make use of the discharge of current from the cable itself, which, having considerable energy, is able to act upon a polarized relay and cause the desired change of direction for the following signal. The direction of the discharge, as is well known, is a factor of the polarity of the charge, and changes in accordance therewith, so that the reversals produced by this action on the polarized relay follow in sequence with infallible regularity. Another method of effecting the reversal of the polarized relay when, from any cause, the first method is not preferred, will also be described. It consists of a transformer provided with primary and secondary coils, the primary being placed in the earth circuit of the split, or double battery. Currents are induced in the secondary which is connected to and actuates the polarized relay. The induced currents in the secondary coil are reversed according to the polarity of the last current sent into the cable and these reversals take place in regular sequence assuring that no two successive currents are sent of the same polarity. One advantage of this last method is that on making contact with the key to charge the cable the battery contact in the relay is reinforced at the moment the key is depressed thus assuring perfect transmission. This is brought about by the action of the secondary coil. The sending of messages through the cable is effected by the working of a single Morse key of the usual type so that the operator's mode of manipulation is exactly the same as if he were sending into any ordinary line.

Where it is desired to send messages automatically the message is prepared on a perforated slip and the Wheatstone transmitter takes the place of the key, the reversing polarized relay being connected in circuit as for hand keying with the ordinary and well-known Wheatstone transmitter. The two upper contacts of the vibrating contact arm are used to take the place of the key. So also where the system is applied for translation from a land line or short connecting cable, the usual receiving relay is connected to the reversing polarized relay in the manner described for the hand key and the received Morse signals are translated into the cable in the form of my "reversed current alphabet" or alternating current alphabet. Also the relay referred to may work a sounder relay in a local circuit which, being connected in place of the single Morse key translates the signals from the short connecting lines or cables into the main cable.

Having described the method of transmis-

sion it remains to point out how the Morse code which is sent through the cable in the form of reversals for each unit of a letter, is retransformed into the common Morse code. In all systems of relay repeaters on long cables hitherto used, the contact arm when at rest occupies a neutral position (known as no man's land) between two contact plates which are connected to the local battery intended to actuate local instruments for repeating the signals either into another cable or to record the received signals. If we connect the two contact plates together it follows that the movable contact-making tongue will record signals made on either side, and these signals will appear on the local apparatus as if made continuously on one contact. For example, two reversals will appear as four dots, (the letter "h" in Morse) and we shall have all the reversed signals received through the cable transformed into the well known Morse characters. These may be read by sound or printed on a Morse slip and similarly they may be repeated automatically to another distant station in the Morse characters. It follows from these observations that the cable relay, with its contact tongue and neutral center, will faithfully transmit the reversed Morse code into another cable in the form received, and that the final transformation takes place at the terminal station of the main cables where the message is either transcribed for delivery, or repeated inland.

In order that this invention may be clearly understood and properly carried into effect it will now be described with reference to the accompanying drawings.

The invention consists mainly of a new disposition of parts to permit of the use of a code of signals consisting of reversed or alternating currents for the successive units of a letter.

In the diagram Fig. 1, *a* designates a cable; *b* the artificial cables used for duplex working; *c*, *c'* the sending condensers; *e* the wire connecting the key *d* to the apex of the bridge arms; *f* the front contact of the key; and *g* the back contact thereof. The front contact *f* is connected to the tongue or vibrating arm *h''* of a polarized relay *h* by wire *j*; and the back contact is connected to the coils of the relay *h* by wire *i*. When the key is depressed the battery is connected to the cable, and when the key is open and in engagement with the back contact the cable discharges through the relay coils and to earth at *k*. To the two stops *h' h'* of the relay *h* are connected the opposite poles of a split battery *l l'*, the center part of said battery being grounded at M. The tongue or vibrating arm *h''* of the polarized relay is adapted, as is usual, to make contact with either of the stops *h' h'*.

When the key *d* is depressed the battery *l* or *l'* is connected to the cable through the wires *j* and *e*. When the key is opened the cable discharges through the polarized relay to earth and in doing so causes the tongue of the relay to be thrown to either contact *h' h'* according to the polarity of the discharge. As this polarity is always opposite to the polarity of the preceding discharge it is manifest that the tongue or arm *h''* will be thrown from one contact *h'* to the other at the end of each key operation so that the battery to the line will be reversed each time the key is opened and the cable discharged. The result of this is that the current impulse sent to the line at each key operation will be opposite in polarity to the previously sent current impulse. It is, therefore, manifest that in operating the key for sending Morse code signals each signal unit impulse will be opposite in polarity to the preceding signal unit impulse and no two succeeding signal unit impulses will be of the same polarity.

Owing to the considerable energy of the discharge from the cable and condensers (not heretofore utilized) the resistance of the coils of the polarized relay may be negligible and still afford ample opportunity for the discharge to be effective for good signaling.

Referring to the construction diagrammatically illustrated in Fig. 2, the back contact *g'* of the sending key *d* is connected to earth and the discharge from the cable and condensers is directed to earth through said contact when the key is open. The reversal of the polarized relay h^2 is brought about by the split battery making earth at E through the primary coil P of a transformer, the secondary coil S being connected to the relay coils. The opposite poles of the two portions of the split battery are connected to the contacts *h' h'* of the polarized relay in the same manner as shown in Fig. 1, and the front contact of the key is electrically connected to the movable tongue or vibrating arm *h''* of the polarized relay. It is manifest that when the key is depressed a current will be induced in the secondary coil of the transformer which current will firmly hold the tongue of the polarized relay against one of its stops. It is also manifest that when the key is opened a reversal of current in the secondary coil will take place and the vibrating tongue or arm will then be thrown against the other stop of the polarized relay thereby reversing the polarity of the current to the front stop *f*, and consequently to the line, when the key is again depressed or closed. It is also manifest that the same cycle of operations follows each depression and raising of the sending key.

Fig. 3 simply illustrates how the tongue T of a relay connected to a land line or short cable takes the place of the key either in

Fig. 1 or Fig. 2. It also illustrates how the rocking contact bar of a Wheatstone transmitter is connected in place of the key to send automatically into the cable, the upper two contacts of the transmitter only being used.

Fig. 4 represents the apparatus used at the receiving or terminal end of the cable. The two metal plates v and v' are separated by an insulator y. The contact making tongue V is actuated by an attachment to the signal coil of a recorder which coil is in circuit with the cable. Arriving signals move this tongue from zero to v or v' according to the polarity of the arriving current. For the purpose of this invention the two metal plates are connected together by the wires at W and are in circuit with the local battery x, etc. The instrument at Z may be a Morse recording instrument, a sounder or relay or other instrument. It will be clearly seen that rapid reversals will be indicated by the sounder, for example, as dots or dashes, as if made on one contact only, as in ordinary Morse working.

As hereinbefore stated the transmitting key is manipulated as in transmitting ordinary Morse characters, that is to say, to transmit a dash impulse or signal the key is held down or closed longer than when transmitting a dot impulse or signal. It is, therefore, manifest that I throw upon the line or cable impulses of successively opposite polarity and of varying time relationship and distinguish such impulses as signals or units of signals by their time relationship and irrespective of their polarity; and that I provide a receiving apparatus constructed to respond to impulses on the line irrespective of their polarity. It also will be noted that the line current will be reversed for each successive signal whether the signals consist of a number of Morse dots in succession or a number of Morse dashes in succession, or a combination of dots and dashes as occur in the various Morse codes of telegraphic signals.

The subject-matter of invention shown and described herein but not claimed, forms the subject-matter of a divisional application.

What I claim is:

1. The method of electric signaling consisting in transmitting impulses of current of opposite polarity in a constantly alternating series, each impulse constituting a single unit of the signal and discharging the line between each impulse, whereby no two following signal units will be transmitted by impulses of current of the same polarity.

2. The method of working cables consisting in transmitting a constantly alternating series of impulses of current of opposite polarity, each impulse of current forming a single unit of a signal, whereby each succeeding signal unit will be formed by a current impulse of changed polarity and no two successive signal units will be formed by impulses of current of the same polarity, discharging the cable after each signal impulse and securing the reversals in polarity of the current to the line through the discharge of the cable.

3. The system of transmitting electric signals comprising a means for transmitting electric impulses over a line, means for discharging the line after the transmission of each signal impulse and means controlled by the transmitting means to reverse the polarity of the line current at each operation of the transmitting means, whereby each succeeding impulse will be of opposite polarity and each signal unit will be formed by a current impulse of opposite polarity.

4. A system of electric signaling comprising means for transmitting single signal unit impulses of current, means for discharging the line after the transmission of each signal impulse and means controlled by said transmitting means for reversing the polarity of each alternate signal unit impulse.

5. A system of electric signaling comprising means for transmitting single signal unit impulses of current, and means automatically controlled by said transmitting means for reversing the polarity of each alternate signal unit impulse.

6. A system of electric signaling comprising a line, a sending key, and means controlled by said key to automatically change the polarity of the line current after each operation of the key.

7. A system of electric signaling comprising a line, a sending key, and means controlled by the opening of said key to automatically change the polarity for the next succeeding operation of the key.

8. A system of cable working comprising a cable, a sending key, a polarized relay, and means whereby the discharges from the cable will operate the polarized relay to change the polarity of the current to the line.

9. A system of cable working comprising a cable, a sending key, a polarized relay, and means whereby the discharge from the cable when the sending key is opened will operate the polarized relay to change the polarity of the current to the line.

10. A system of electric signaling comprising means for transmitting single signal impulses of current, means controlled by said transmitting means for reversing the polarity of each alternate signal impulse, means for discharging the line after the transmission of each signal impulse and means at the receiving or terminal end of the line for receiving said signal impulses

of opposite polarity and reproducing them in impulses of like polarity in a local circuit.

11. The method of electric signaling consisting in transmitting impulses of current of opposite polarity in a constantly alternating series, each impulse constituting a signal unit, whereby no two following signal units will be transmitted by impulses of current of the same polarity, means for discharging the line after the transmission of each signal impulse and receiving said signal impulses of opposite polarity and reproducing them in a local circuit as current impulses of like polarity.

12. A system of electric signaling comprising means for transmitting over a line single signal impulses of current, means for discharging the line after the transmission of each signal impulse, means controlled by said transmitting means for reversing the polarity of each alternate signal impulse and means at the receiving or terminal end of the line for receiving said signal impulses of opposite polarity and reproducing them in a local circuit.

13. The art of telegraphing on a submarine line which consists in throwing upon the line impulses of successively opposite polarity and of varying time relationship and distinguishing such impulses as signals or units of signals by their time relationship and irrespective of their polarity and discharging the line after each impulse, substantially as and for the purposes set forth.

14. The art of telegraphing on a submarine line which consists in throwing upon the line impulses of successively opposite polarity and of varying time relationship, discharging the line after each impulse, and receiving such impulses upon an apparatus which responds to them irrespective of their polarity, substantially as described.

15. The combination with a submarine line and its condenser, of a key and a circuit reverser constructed to reverse the circuit for each closure of the key, substantially as described.

16. The combination with a submarine line and its condenser, of a key and a circuit reverser constructed to reverse the circuit for each closure of the key, and a receiving apparatus constructed to respond to impulses on the line irrespective of their polarity, substantially as described.

17. In the art of submarine telegraphy characterized by successive signal impulses on the line of opposite polarity and varying time relationship, discharging the line after each impulse, receiving such impulses upon an apparatus which responds to them irrespective of their polarity, substantially as and for the purposes set forth.

18. In a system of submarine telegraphy characterized by successive impulses on the line of opposite polarity and varying time relationship, the combination with the line at its terminal or receiving end of an apparatus constructed to respond to the impulses on the line irrespective of their polarity and discharging the line after the transmission of each signal impulse, substantially as described.

19. A system of cable working comprising a cable, a sending apparatus for transmitting signal impulses, a polarized relay, means for discharging the cable after the transmission of each signal impulse through the said relay to change the polarity of the current to the line for the next succeeding signal impulse.

In testimony whereof I hereunto affix my signature in the presence of two witnesses.

JOHN GOTT.

Witnesses:
WILLIAM MORREY KENT,
JOSEPH DELDERFIELD.