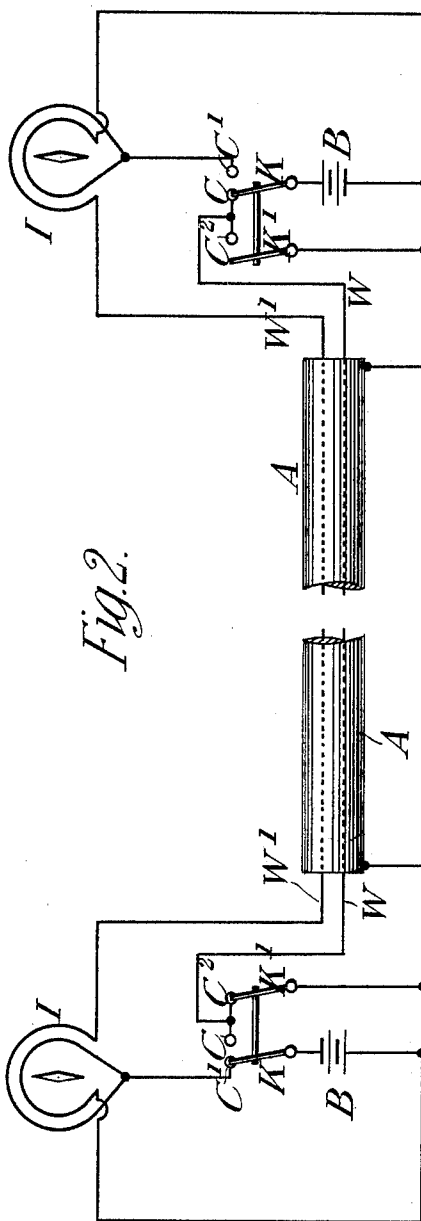
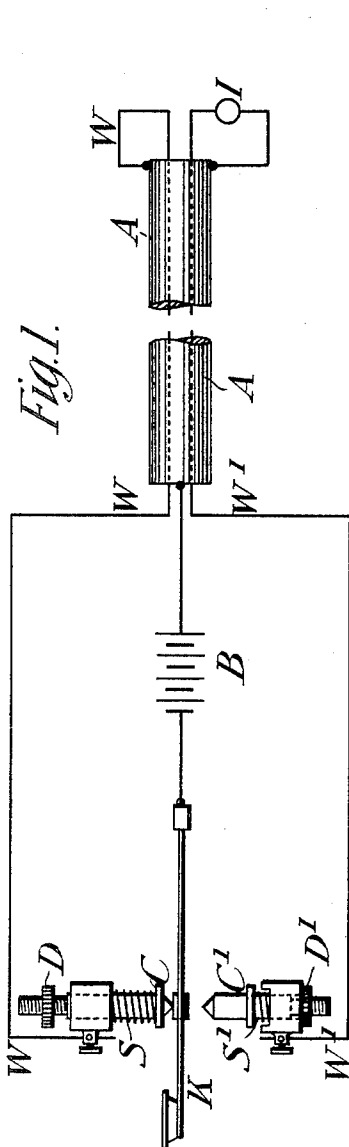


(No Model.)

J. M. BARR.
TELEGRAPH CABLE.

No. 586,755.

Patented July 20, 1897.



Witnesses,

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Herbert Lawson.

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UNITED STATES PATENT OFFICE.

JAMES MARK BARR, OF LONDON, ENGLAND, ASSIGNOR OF ONE-HALF TO
CHARLES EDMUND STANLEY PHILLIPS, OF SAME PLACE.

TELEGRAPH-CABLE.

SPECIFICATION forming part of Letters Patent No. 586,755, dated July 20, 1897.

Application filed December 26, 1896. Serial No. 617,073. (No model.)

To all whom it may concern:

Be it known that I, JAMES MARK BARR, electrical engineer, a citizen of England, residing at Castle House, Shooter's Hill, London, in the county of Kent, England, have invented new and useful Improvements in Telegraph or Telephone Cables and Their Connections, of which the following is a specification.

My invention relates to an arrangement of the conductors in a telegraph or telephone cable and their connections to the metallic sheath or armor of the cable in such a manner that self-induction and capacity are diminished and signaling can be carried on at greatly-increased speed, the signals transmitted being also more clear and definite than with cables arranged and operating in the usual way.

This invention is an improvement in telegraph apparatus, and is especially designed for cable service; and its object is to increase the speed of transmission of messages or signals by lessening the self-inductive capacity of the conductors.

The invention is especially applicable to submarine telegraph cable-lines, and it is summarized in the appended claims, and illustrated diagrammatically in the accompanying drawings, in which—

Figure 1 is a diagram illustrating the construction and arrangement of a telegraphic apparatus embodying my invention for simple telegraphic purposes. Fig. 2 is another like diagram illustrating the invention as adapted for duplex or multiplex telegraphy.

In my invention two main conductors are employed which should be of equal conductivity. Such conductors may each consist of but a single wire or (as in ordinary transatlantic cables) of a number of wires all operating together. In short, the invention is applicable whether the conductors be simple or compound. In the drawings I have illustrated diagrammatically a cable A, having two conductors, (indicated by the lines W W'), each composed either of a single wire or of a group of united conductors, the conductors being indicated by single lines in the diagrams because more clear and more readily understood by those skilled in the art.

As transatlantic cables are ordinarily formed of a number of wires bound together, in applying my invention thereto I separate

from each other the metal wires or strands of the cable by covering them with material of comparatively low conductivity and low specific inductive capacity, such as paper, and I divide the wires or strands into two equal groups, preferably selecting for each group wires or strands intermediate to those of the other group. Assuming, for instance, that there are eight wires or strands insulated from each other by paper wrapping and arranged around a core of hemp, paper, or the like, then one of the groups, which I may term the "odd" group, would consist of the wires or strands 1, 3, 5, and 7, the other or even group consisting of the intermediate wires or strands 2, 4, 6, and 8. Both groups being surrounded by a thick layer of impervious material of high specific resistance, such as gutta-percha protected by armor in the usual way, at each end of the cable I connect each of the two groups to the armor through a battery and key, the key being so arranged that when it is employed for signaling the one group is brought into circuit with the armor and the other group is cut out of circuit. The wires in each group are employed collectively to send one signal. The separate wires in the groups are not used to send separate signals, but the groups are employed as units in sending signals. By this arrangement the armor is always in circuit with the one or the other of the two groups; but in the act of signaling the energy in the one group as it is cut out of circuit falls, while the energy in the other group as it is brought into circuit rises, the rise of the one compensating for the fall in the other, so that there is little or no self-induction, and consequently there is no appreciable retardation except that which is due to the insulating material which separates the wires. This, however, being of lower specific inductive capacity causes very little retardation to the signaling-waves. Owing to the absence of self-induction resulting from the grouping of the wires, as described, and to the low capacity of the insulating material signaling can be carried on much more rapidly than with cables as they are usually constructed and operated, and the signals—such, for instance, as those formed by the siphon-recorder—are much more sharp and well defined.

The cable having its conductors arranged

in two groups, as described, can be used for telegraphing by connecting the two groups of wires and the armor, as shown diagrammatically in Fig. 1.

5 A, the armor of the cable, is connected directly to the one terminal of a battery B, the other terminal of which is connected to a spring-key K, which normally makes contact with C for the one group W of the cable-
10 wires, or can be pressed so as to break contact with C and to make contact with C' for the other group W'. The contact-slides C C' are urged by springs S S' as far as permitted by adjustable collars D D'. At the distant
15 end of the cable the wire group W is connected to the armor A, the other group being connected to the armor A through any suitable receiving instrument I. On depressing the key K for the purpose of sending a signal
20 the circuit from B, through C, W, and A, back to B, remains closed until just after the key has come in contact with C', at which moment the circuit from B, through C', W', I, and A, back to B, is also closed, but on
25 further depressing the key the circuit through W is opened, that through W' being alone closed. During the instant of change of circuits the wave of energy in W is falling, while that in W' is rising, so that there is no self-
30 induction in the cable and consequently no loss of time due to self-induction.

The movements of the diaphragm of a telephone-transmitter may be used to operate somewhat like the key K, increasing energy
35 in the one group of wires while it diminishes that in the other group.

For duplex telegraphy the instruments and connections may be arranged as shown diagrammatically in Fig. 2.

40 At each terminal station there is a receiving instrument or relay I oppositely coiled, the one coil connecting the contact C' with the one-wire group W' and the other coil connecting the contact C with the armor A.
45 The contact C connects to the wire group W. The two contacts C and C' are arranged as described with reference to Fig. 1, having between them a spring-key K, which opens the one circuit while it is closing the other.
50 The key K is rigidly connected to another key K', which moves with K, either making or breaking contact with C', which, like C, connects to the wire group W. The key K is connected through the battery B to the armor A and K' is also connected to the armor A. The circuits are all provided with suitable resistances or rheostats for purposes of adjustment. From this arrangement it will
55 be seen that signals can be transmitted to and received by both terminal stations at the same time, each signaling movement of either key K increasing energy in the W' group of wires and lessening energy in the W group. The armor also is always in circuit with the
60 one or the other group of wires, the current flowing through it being practically constant.
Although I have described the groups of

conducting wires or strands as being connected at the ends of the cable to the armor, obviously the operation and results would be
70 the same if instead of the armor a special wire were employed or earth-return as equivalent to the armor.

Having thus described the nature of my invention and the best means I know for carrying the same into practical effect, I claim—

1. In a telegraph apparatus the combination of a pair of parallel adjacent conductors connected at one end to a common return, a source of current having one pole connected
80 to the common return, contacts connected to the conductors at the transmitting end, and a key connected to the other pole of the source between said contacts, all substantially as and for the purpose described.

2. In a cable telegraphic apparatus, the combination of two equal parallel groups of insulated conductors, each group being connected at one end of the line to a return-conductor, and each respectively connected at the other
90 end of the line to a contact; a key interposed between the contacts, and an electrical supply connected at one pole to the key and at the other to the return-conductor, said key being adapted to throw either group of conductors into circuit and simultaneously throw the other group of conductors out of circuit, whereby, in the act of signaling, the energy in the one group as it is cut out of circuit falls, while the energy in the other group as
100 it is brought into circuit rises, the rise of the electromotive force in one group corresponding to and compensating for the fall in the other, so that there is little or no self-induction and consequently no appreciable retardation; substantially as set forth.

3. In a cable telegraphic apparatus, the combination of two equal groups of insulated wires of the cable, each group being connected at one end of the cable to the armor thereof
110 as return-conductor, and each provided at the other end of the cable with a contact; a key adapted to engage either contact and simultaneously disengage the other; and an electrical supply connected by one pole to the key and the other pole to the armor, whereby, in signaling, the rise of electromotive force in the group brought into circuit by the key is accompanied by a fall of electromotive force in the other group cut out of circuit by the
120 key, the rise and fall in the respective groups so compensating each other that there is no self-induction in the cable, and consequently no retardation from that cause, all substantially as described.

In testimony whereof I have signed my name to this specification, in the presence of two subscribing witnesses, this 8th day of December, A. D. 1896.

JAMES MARK BARR.

Witnesses:

OLIVER IMRAY,
JNO. P. M. MILLARD.