E. N. PICKERILL.

BREAKING MEANS FOR RADIOTELEGRAPHY.

APPLICATION FILED SEPT. 20, 1909.

1,073,624. Patented Sept. 23, 1913.

Fig. 1.

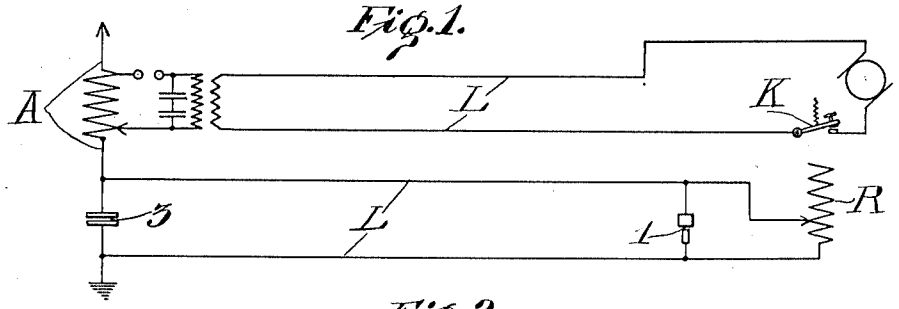


Fig. 2.

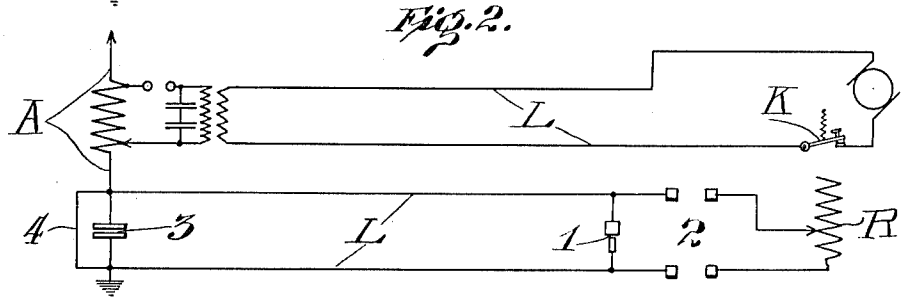


Fig. 3.

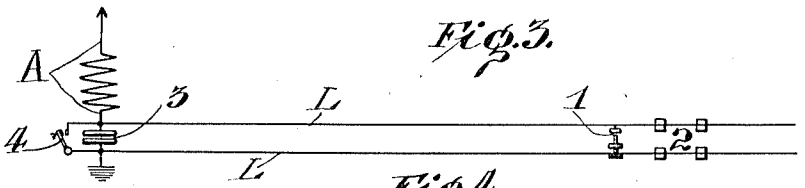


Fig. 4.

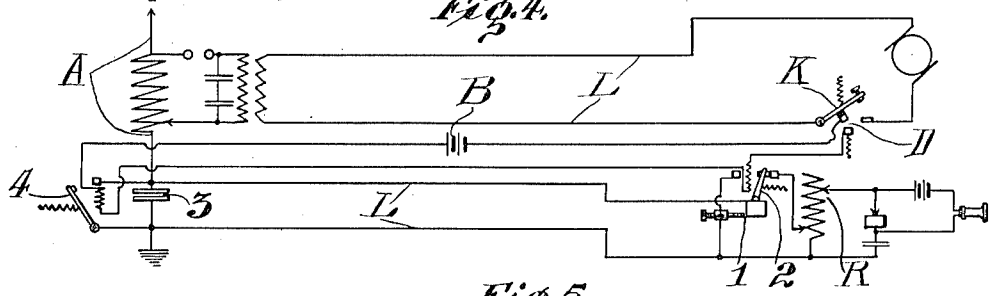
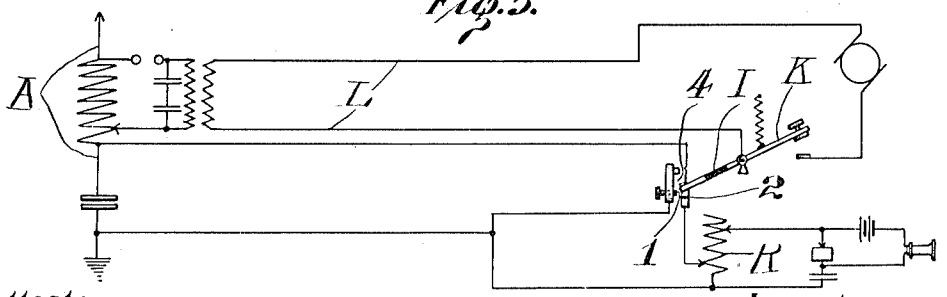


Fig. 5.



Attest:

C. Mitchell

C. S. Ashley

Inventor:

Elmo N. Pickerill

by

Philip Farnsworth Atty

UNITED STATES PATENT OFFICE.

ELMO N. PICKERILL, OF NEW YORK, N. Y., ASSIGNOR, BY MESNE ASSIGNMENTS, TO MARCONI WIRELESS TELEGRAPH COMPANY OF AMERICA, A CORPORATION OF NEW JERSEY.

BREAKING MEANS FOR RADIOTELEGRAPHY.

1,073,624. Specification of Letters Patent. Patented Sept. 23, 1913.

Application filed September 20, 1909. Serial No. 518,580.

To all whom it may concern:

Be it known that I, ELMO N. PICKERILL, a citizen of the United States of America, and a resident of the city and State of New York, have invented certain new and useful Improvements in Breaking Means for Radiotelegraphy, the principles of which are set forth in the following specification and accompanying drawing, which disclose the form of the invention which I now consider to be the best of the various forms in which the principles of the invention may be embodied.

This invention relates to radio telegraphy, and, more particularly to means for breaking, *i. e.*, to permit an operator while receiving a message, and in case he misses a part of it, to break in on the distant operator by instantly transmitting to him, and signaling him to repeat the missed portion of the message.

For some time, and since this art has assumed commercial importance, a practicable means of breaking has been greatly desired, because in its lack much valuable time is frequently lost. So far as I know, however, no practicable means has been heretofore devised, notwithstanding that the demand has naturally led to the making of many attempts to produce such a means, all of which, as I understand, have proved useless in practice for one reason or another.

The object of the invention, therefore, is to produce a practicable means of breaking, and the accomplishment of that object is disclosed in various forms in the drawings, of which—

Figures 1 and 2 are diagrammatic illustrations of the conditions of the apparatus during receiving and sending respectively; Fig. 3 is a diagrammatic illustration of the chief features of combination of apparatus; Fig. 4 is a diagrammatic illustration of complete apparatus involving electromagnetic control by the sending key of auxiliary switches; and Fig. 5 is a diagrammatic illustration of complete apparatus involving direct control by the sending key of auxiliary switch contacts.

The drawings are appended chiefly for the purpose of readier explanation, and are not necessarily a precise measure of novelty.

The object of this invention is not merely to provide an operative means for breaking, or to simply insure that the detector shall not be affected by local sending, although these are the fundamental objects, but the object is rather, in addition to these, to provide apparatus which shall insure the safety of the operator, as well as the apparatus, in respect of the high potentials employed in radio telegraphy. Heretofore protection from high potentials has been sought in connection with the matter of breaking, by associating the receiving apparatus with the low potential portions of the transmitting apparatus, but that obvious expedient, by itself, has been proved heretofore to be insufficient to provide the necessary protection. While, of course, it is preferably employed in this invention, the advantages of the invention are largely due to other features.

The preliminary consideration of diagrammatic Figs. 1 and 2 will most clearly present the more important aspects of the invention. It is understood that all details of apparatus not particularly specified are standard Western Union and United Wireless practice.

The normal or receiving conditions are shown in Fig. 1, and the sending conditions in Fig. 2, it being understood that these different conditions are controlled, directly or indirectly, by the operation of the sending key K, which, of course, is normally open. The same antenna or aerial, A, is used for both sending and receiving, and it is in respect of this that the prior difficulties have been presented, owing to the alternate presence on the same circuit of extremely high potential transmitting currents and feeble received pulses.

Only low potential radio telegraphy circuits can be safely handled by a telegraph operator engaged in his ordinary duties, which are not those of an electrician. In fact, the high potential apparatus should be located as remote as possible from the operator's table, not only for that reason, but also to avoid or reduce effects of induction from sending to receiving means. Ordinarily this is permissible, and is the practice, as shown in Figs. 1 and 2, where the receiving apparatus R, and the sending key K, each in a low potential circuit, are shown at the right, separated by long leads L from the high potential sending antenna A. But this sufficiently great distance between the high and low potential apparatus is by no

means adequate protection to the operator when the same antenna is used for both sending and receiving. On the contrary, the danger is increased, notwithstanding that the leads to the receiving apparatus are connected to the low potential or ground side of the sending apparatus, because the very length of those leads required to locate the receiving apparatus and the operator at a distance from the high potential oscillation producing circuit, tends to increase the chance of accidental and undesirable or dangerous discharges to ground in shunt to the regular ground connection provided. This danger to operator and receiving apparatus, normally existing, is greatly increased, when, instead of using ordinary protected antenna switches as in ordinary operations heretofore, the circuits are altered by the manipulation of the sending key, as it is, of course, necessary for the receiving operator to do in breaking in on a distant sending operator. Even if the leads from the high to the low potential apparatus are much shorter than is desirable, there is danger of accidental high potential discharges from the leads, and that danger from said cause is not wholly obviated even by the electromagnetic control by the sending key of switching means located at the higher potential end of said leads, even when said switching means is located in the low potential part of the high potential circuits.

In the preferred form of the invention, four simple devices are provided for operation at the proper points, to insure safety at the receiving apparatus. In the first place, as shown in Fig. 1, there is an extremely short air-gap or jump-gap 1 (Fig. 1), as between platinum contacts, located close to the receiving apparatus R, but between the receiving apparatus and the connection of the latter with the ground connection. This gap is made so small, (as of the thickness of a thin sheet of paper) that it adequately short-circuits the receiving apparatus R in respect of high potential currents which may accidentally traverse the long leads L during receiving. It also has a function in relation to the shifting by the key K of connections other than the generator circuit, as will be described. Secondy, although, of course, the receiving apparatus R is connected with the antenna ground while receiving, yet, as shown at 2, Fig. 2, it is positively open-circuited, during sending, in respect of the high potential circuits then employed. The valve of this open-circuiting is that it insures against the passage of a portion of the high potential currents through the receiving apparatus R and to the operator, such as might result from merely short-circuiting in case of a possible tune of the receiving apparatus to the sending impulses. This open-circuiting switch 2 is operated by the key K as will appear in detail. Also, the antenna ground is provided with a short air-gap or jump-gap 3, (Fig. 2), between broad surfaced contacts, which acts to permit the passage of high potential discharges to ground. But since, during sending, a part of the sending impulses might be shunted around the gap 3 through the receiving apparatus R (as even across 2 in case switch 2 had not opened sufficiently wide at the time of too high potential across its contacts), a short-circuit 4 is provided for gap 3, in order to insure that all the sending impulses shall go to ground through such short-circuit. The lack of 4 in Fig. 1 indicates that the sending key opens the short-circuit 4 during receiving, in order that gap 3 may cause the shunting of all the received energy by way of the receiving apparatus R to ground, by preventing its passage directly to ground.

Summing up all operations, diagrammatically, Fig. 3 indicates normal receiving conditions, switch 2 being normally closed to the receiving apparatus, switch 4 being normally open in short-circuit of gap 3, and gap 3 causing the shunting of received impulses through switch 2. Now, assume the receiving operator breaks, by depressing his sending key, K. First, switches 2 and 4 are thereby operated, 2 being opened, and 4 closed. The opening of switch 2 open-circuits the receiving apparatus, and if that is adequately done, it is impossible for the receiving apparatus or the operator to be injured by subsequent sending discharges. But suppose that, before switch 2 has sufficiently opened, a high potential discharge occurs, as by the premature closing of the main key-contact in the generator circuit. Such an accidental occurrence might be highly dangerous, both to operator and receiving apparatus. It is liable to occur, because it is not practicable to allow much play to the telegraph key K; and it is not likely that switch 4 would not close prior to the full opening of switch 2. Of course, within the invention, switches 2 and 4 may be adjusted so that 4 may adequately close before 2 adequately opens, to prevent the accident referred to; and to the same end, 2 and 4 might be operated by the key successively, and independently of each other. But in any such case the operation would not be invariably certain. Right here is the important feature of gap 1, which is located within easy access of the operator and is adjusted by him to a very minute size, such that it is so much smaller than the probable distance of opening of switch 2 at a time when main key-contact might close, that the small gap in effect short-circuits switch 2 and carries off any dangerous currents directly to the antenna ground. Meanwhile gap 3 coöperates with gap 1 in providing ample path to ground, and finally, the clos-

ing of switch 4 provides a direct path to ground for the high potential circuits, in shunt to both gaps 3 and 1. Under normal conditions of operation of the apparatus, the main key-contact will not close, to produce high potential sending currents in the antenna, until after switch 4 has closed, and also, not until switch 2 has adequately opened. But it is highly important, nevertheless, to provide the gap 1, in order, by the operations described, to adequately provide for the abnormal conditions liable to occur at any time.

In Fig. 4 illustrating receiving conditions, is shown a case of electromagnetic or indirect control of switches 2 and 4 by key K; B being the source of electromotive force for a circuit including magnet coils in series for the respective switches, and D being the contacts for that circuit, which are controlled by the key K. By engaging with its left-hand contact, switch 2 may short-circuit gap 1. In Fig. 5, also illustrating the conditions at receiving, is shown a direct control of switches 2 and 4 by key K. To this end the key consists of two parts separated by insulator I. This arrangement is less advantageous than Fig. 4 in some respects other than the lack of electromagnets, including the location of switch 4 remote from the antenna ground, (or in the lack of 4 in its location in Fig. 3), which is more liable to result in discharges at the left end of the key. If desired, in Fig. 5, the switch 4 may be located as in Fig. 4 and electromagnetically controlled by the key. When controlled thus differently from directly-controlled switch 2, switch 4 may be closed even earlier than the opening of switch 2.

In Figs. 4 and 5, switch 2, in practice, preferably opens both sides L of the circuit to the receiving apparatus, as indicated in Figs. 1, 2 and 3; the arrangement in Figs. 4 and 5 being shown for greater simplicity of the drawing. The adequate opening of the circuit of the receiving means by any modification of the invention, renders unnecessary the opening of the detector circuit itself. It will be understood that in all cases, switches 2 and 4 are to be operated by the key at an instant prior to the closing of the main key-contact in the generator circuit.

While the combination of all these features disclosed has been shown in practice to be preferable as well as completely satisfactory, one or more may be omitted within the invention; and in general, many modifications of the invention may be devised as an obvious matter in pursuance of the disclosure.

In the claims, the expression "sending means" denotes the sending or oscillation-producing means which is connected with the antenna; the expression "receiving means" denotes all the receiving apparatus which is associated with the antenna, and preferably connected with the low potential portion of the antenna and sending means; and "antenna" refers to the grounded aerial irrespective of parts of the sending and receiving means which may be connected in or to the antenna. The leads from the antenna to the receiving apparatus denote conductors of any length which may tend to produce conditions liable to result in undesirable discharges, and particularly such lengths of leads as are ordinarily employed at commercial installations to reduce inductive effects on the receiving apparatus.

I claim:

1. The combination with a radio telegraph installation comprising sending means having leads to the sending key, receiving means, a common antenna for sending and receiving means and having leads to the receiving means, of breaking means comprising two jump-gaps and two key-operated switches, one of each in the antenna and the other of each in said receiving means leads the said gap and switch in the receiving means being relatively close to each other and to the receiving means.

2. The combination with a radio telegraph installation comprising sending means having leads to the sending key, receiving means, a common antenna for sending and receiving means and having leads to the receiving means, of breaking means comprising a switch operated by said sending key and open-circuiting said receiving means leads relatively close to the receiving means, and a jump-gap shunted across said receiving means leads near said switch.

3. The combination with a radio telegraph installation comprising sending means having leads to the sending key, receiving means, a common antenna for sending and receiving means and having leads to the receiving means, of breaking means comprising a switch operated by said sending key and open-circuiting said receiving means leads relatively close to the receiving means, and a jump-gap shunting said switch.

4. The combination with a radio telegraph installation comprising sending means having leads to the sending key, receiving means, a common antenna for sending and receiving means and having leads to the receiving means, of breaking means comprising a jump-gap shunted across said receiving means leads relatively close to the receiving means, and a key-operated switch open-circuiting the antenna between the two leads to the receiving means.

5. The combination with a radio telegraph installation comprising sending means having leads to the sending key, receiving means, and a common antenna for sending and receiving means and having leads to the

receiving means, of breaking means comprising two jump-gaps, one in the antenna, and one across said receiving means leads relatively close to the receiving means.

6. The combination with a radio telegraph installation comprising sending means having leads to the sending key, receiving means, and a common antenna for sending and receiving means and having leads to the receiving means, of breaking means comprising a jump-gap in the antenna, a key-operated switch open-circuiting said receiving means leads relatively close to the receiving means, and a second jump-gap across said receiving means leads near said switch.

7. The combination with a radio telegraph installation comprising sending means having leads to the sending key, receiving means, and a common antenna for sending and receiving means and having leads to the receiving means, of breaking means comprising a key-operated switch open-circuiting the antenna between the two leads to the receiving means, a second key-operated switch open-circuiting said leads near the receiving means, and a jump-gap across said leads relatively close to the second switch.

8. The combination with a radio telegraph installation comprising sending means having leads to the sending key, receiving means, and a common antenna for sending and receiving means and having leads to the receiving means, of breaking means comprising a key-operated switch open-circuiting the antenna between the two leads to the receiving means, a jump-gap in the antenna and shunting said switch, and a second jump-gap across said receiving means leads and relatively close to the receiving means.

9. The combination with a radio telegraph installation comprising sending means having leads to the sending key, receiving means, and a common antenna for sending and receiving means and having leads to the receiving means, of breaking means comprising a jump-gap across said receiving means leads and relatively close to the receiving means.

10. The combination with a radio telegraph installation comprising sending and receiving means and a common antenna therefor, and a sending-key, of breaking means comprising a jump-gap across the leads to the receiving means and relatively close to the receiving means, and a switch controlled by the sending key and short-circuiting said gap.

11. The combination with a radio telegraph installation comprising sending and receiving means and a common antenna therefor, and a sending-key, of breaking means comprising a jump-gap across the leads to the receiving means and relatively close to the receiving means and a switch controlled by the sending key, short-circuiting said gap and open-circuiting said receiving means leads.

12. The combination with a radio telegraph installation comprising sending and receiving means and a common antenna therefor, and a sending-key, the receiving means being connected by long leads to a low potential part of the antenna, of breaking means comprising a jump-gap across the connections and relatively close to the receiving means, and a switch controlled by the sending key, short-circuiting said gap and open-circuiting said receiving means connection.

ELMO N. PICKERILL.

Witnesses:
ALMA LAWSON,
PHILIP FARNSWORTH.