2 Sheets--Sheet 1.

J. B. STEARNS.

Telegraph Relays and Sounders.

No. 136,876. Patented March 18, 1873.

Fig 1

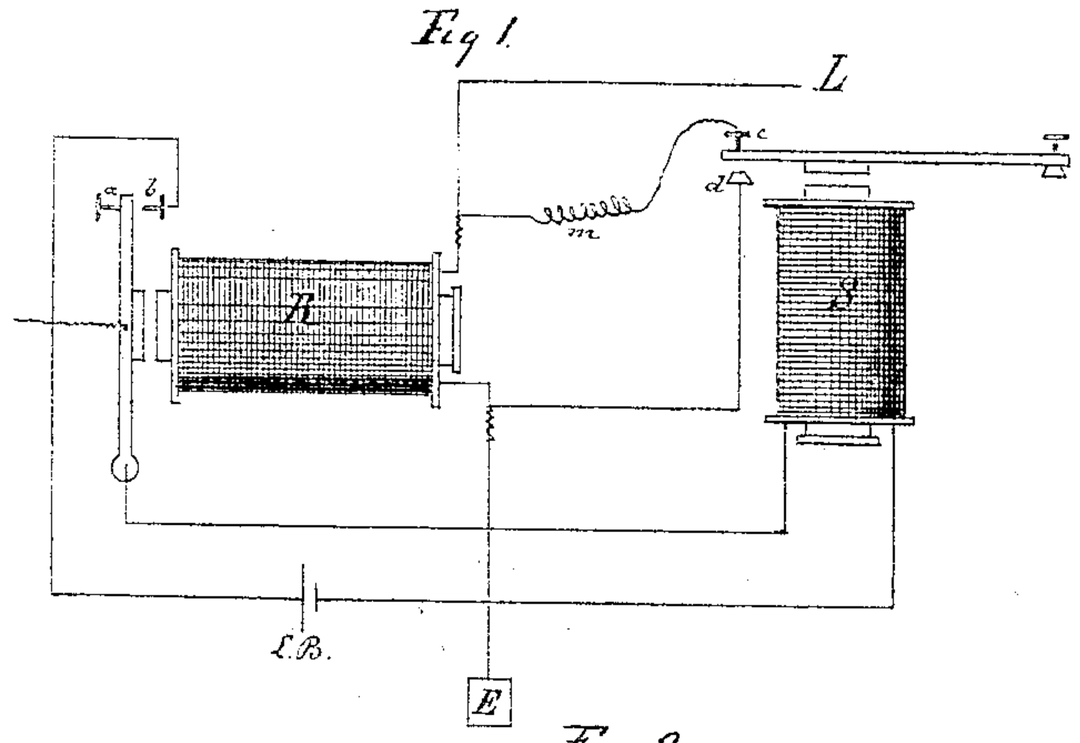


Fig. 2.

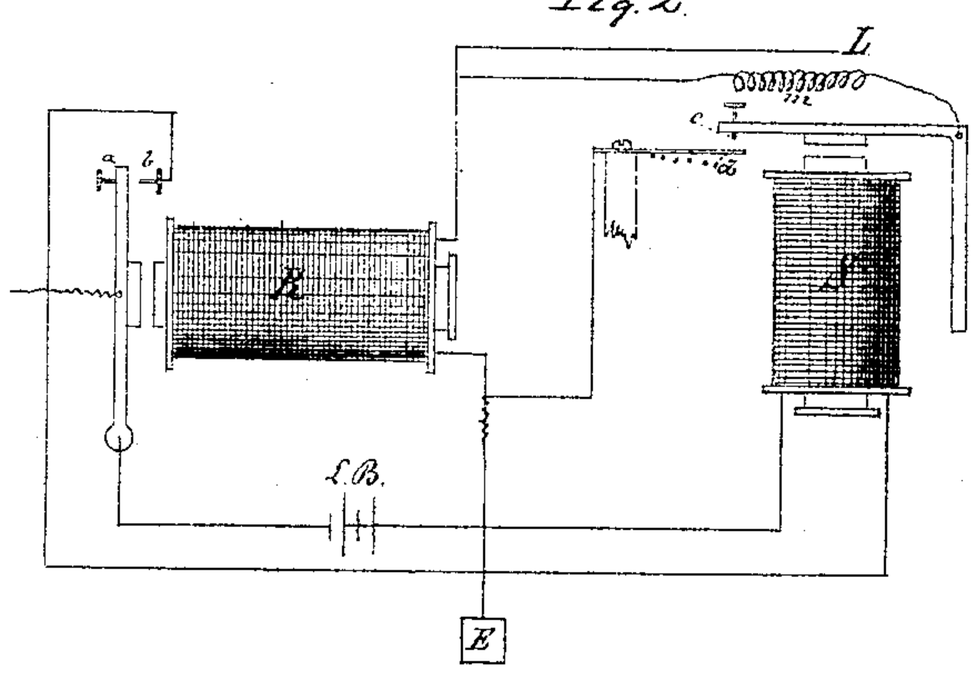


Fig 3

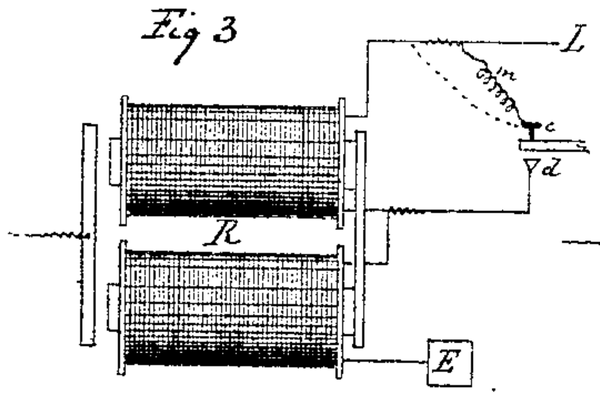


Fig 4

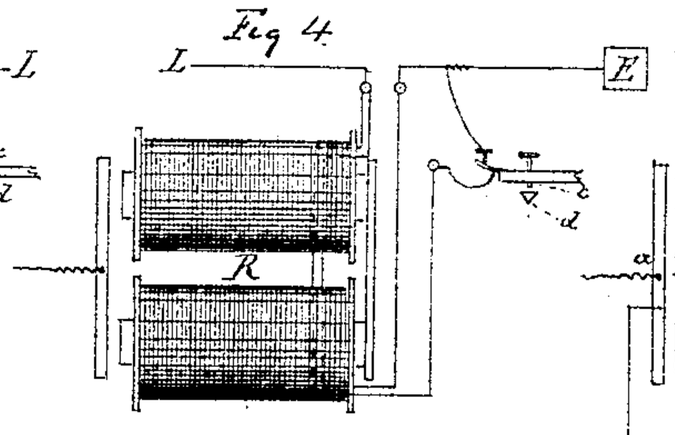


Fig 6

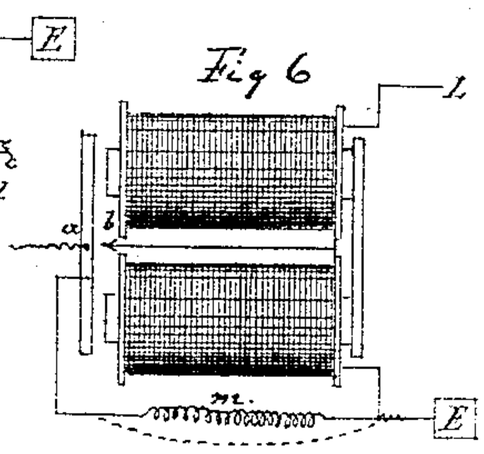
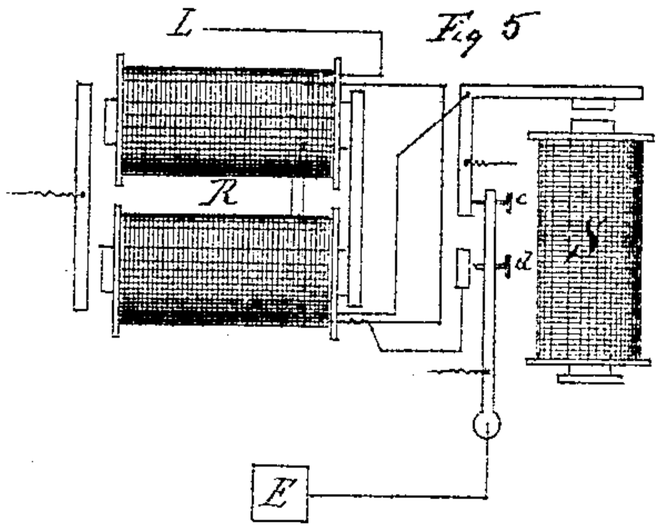


Fig 5



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2 Sheets--Sheet 2.

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Telegraph Relays and Sounders.

No. 136,876. Patented March 18, 1873.

Fig 9

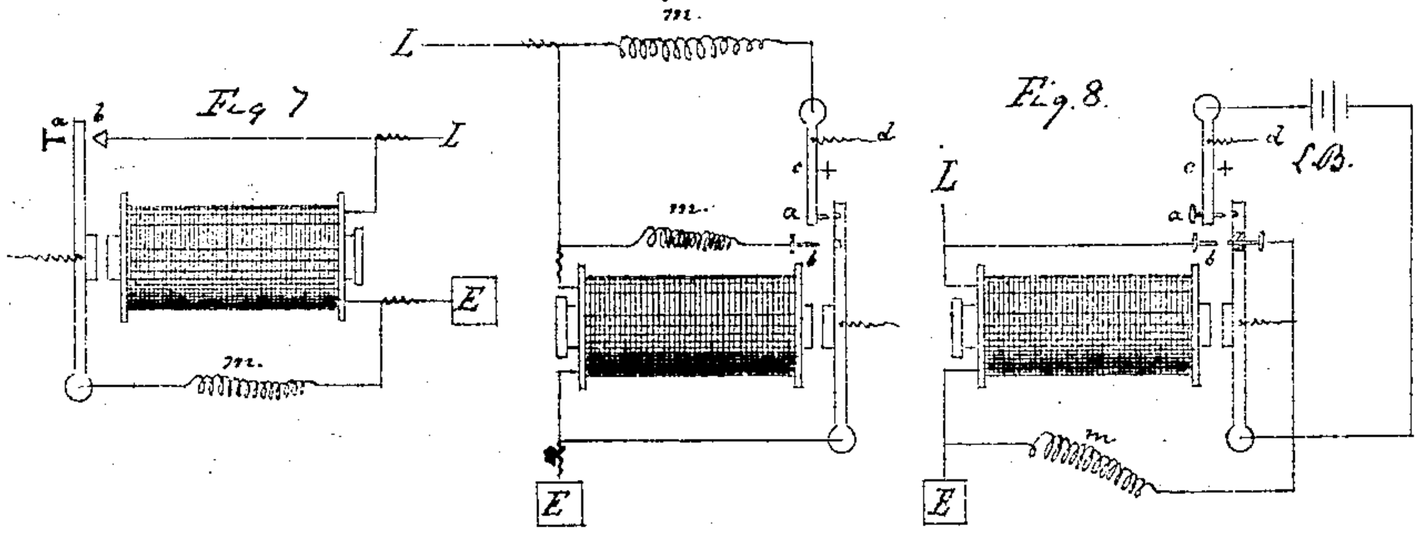


Fig 7

Fig. 8.

Fig. 10

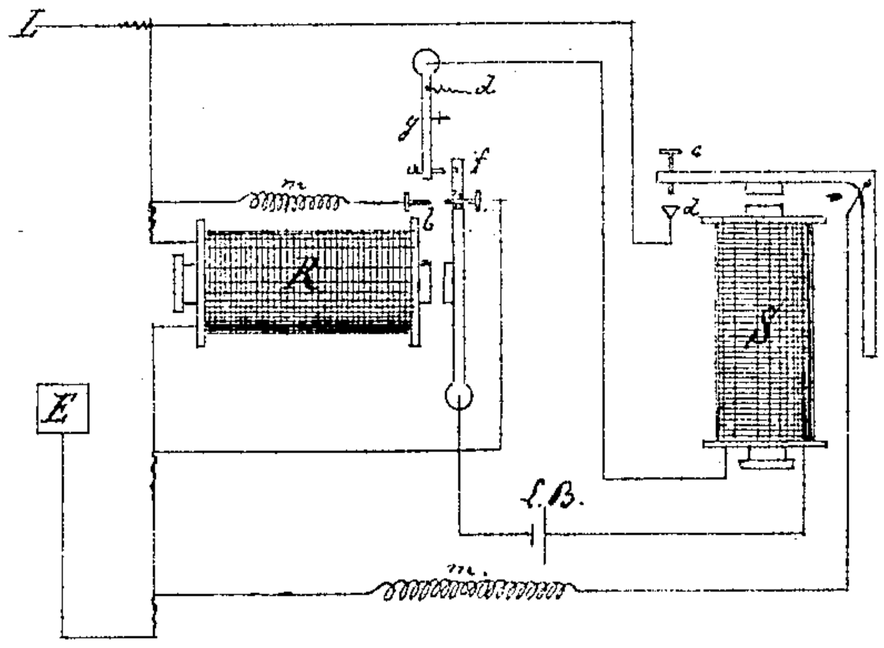


Fig. 11.

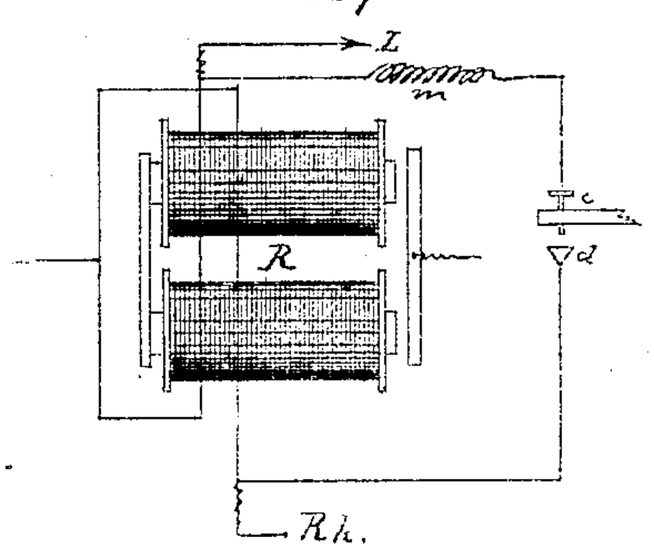
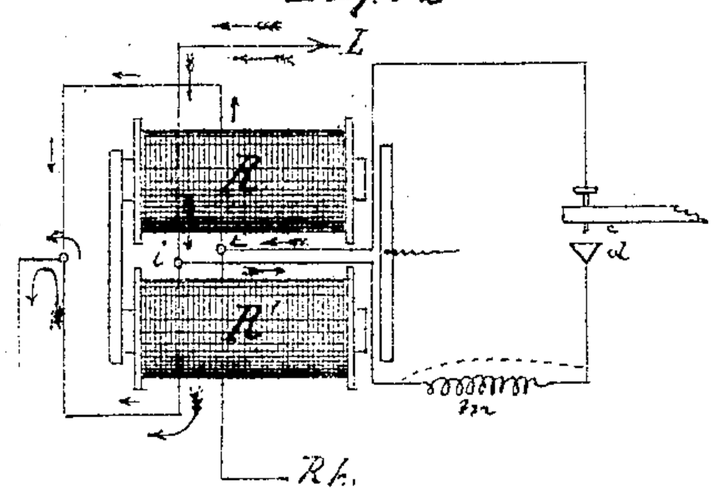


Fig. 12



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UNITED STATES PATENT OFFICE.

JOSEPH B. STEARNS, OF BOSTON, MASSACHUSETTS.

IMPROVEMENT IN TELEGRAPH RELAYS AND SOUNDERS.

Specification forming part of Letters Patent No. **136,876**, dated March 18, 1873.

CASE A.

To all whom it may concern:

Be it known that I, JOSEPH B. STEARNS, of Boston, in the county of Suffolk, State of Massachusetts, have invented an Improvement in Telegraph Apparatus, of which the following is a specification:

The nature of this invention consists in a method of preventing the effect of "retardation" due to "static induction" on the transmission of signals on submarine, subterranean, or long land lines of telegraph, and of obviating the necessity of a fine adjustment in the relay or receiving instrument, by automatically weakening it during the transmission of the signal, and at the completion of the stroke of the armature.

The accompanying drawing, making part of this specification, represents the various forms in which my invention may be applied to telegraphic purposes.

In telegraphing through submarine, subterranean, or long land lines of telegraph, the phenomena technically known as retardation, which is caused by the static induction of the line, prevents the current, when a signal is transmitted, from arriving at once at its full intensity, or nearly so, as in short lines, but causes it to come feebly at first, gradually increasing until a certain maximum strength is reached, and then it gradually subsides. Thus, the character of the transmitted signals is changed during transmission, the long and short signals forming dots and dashes are not accurately defined, the proper spacing is not preserved, and the signals coalesce and are received in one continuous but not uniform signal. This renders telegraphing on submarine and long land lines slow, and necessitates a constant and very careful adjustment in the receiving-relay, in order to get intelligible signals. Heretofore, the ordinary method of obviating this difficulty, so as to permit the reception of readable signals, has been the use, upon the relay, of a retracting-spring of sufficient power to resist the current until it has reached a certain strength, which results in shortening the signals, causing what is technically called "light writing," and necessitates a constant and very delicate adjustment in the relay; for if the spring of the relay is so strengthened that it is overcome when the strength of the current has reached, say, one-half the maximum at the beginning of the signal, it will, in turn, overcome the current when its strength has diminished to one-half the maximum at its termination, thus making the received signal much shorter than the transmitted signal; and in case a dot or short signal is made so quickly as not to allow the strength of the current to reach this half maximum, the instrument at the receiving end will not be affected, and no signal will be received; while, on the other hand, if the spring be so weakened as to lengthen the signal, it will not have sufficient power to overcome the effect on the relay of the prolonged partial current due to retardation, and the armature will not be withdrawn during the interval between two successive signals. If, however, the attractive force of the relay can be weakened after it has done its work of moving the armature and closing the sounder-circuit, which is the same in effect as strengthening the spring, a weak spring can be used, so as to permit the reception of a long signal, and thus avoid light writing, and at the same time this weak spring, owing to the weakening of the magnet, will have power to retract the armature at the close of the signal, and "sticking" will be prevented. I accomplish this automatically by connecting the relay with a "shunt," or by short-circuiting one of the coils, or in any other analogous manner weakening the relay by the movement of its armature, in the manner which I will now proceed to describe, and which is shown in the drawing accompanying and forming part of this specification.

In Figure 1, R represents the relay or receiving magnet of a submarine, subterranean, or long land line; L, the line; S, the sounder-magnet; *a b*, the contact-stops of the relay; *c d*, the contact-stops of the sounder; and *m*, the shunt, which, as shown in the figure, is connected with the relay when contact is made by the sounder-points. In this apparatus, as soon as the current reaches sufficient strength to overcome the spring, the sounder-circuit is closed, and the contact-points *c* and *d* complete a circuit through the shunt, and thereby weaken the current in the relay; but as the current has by this

time increased to its full strength, it still has power to overcome the spring until the current has commenced to subside, when the sounder-circuit opens and the shunt is taken off. The relay is now at its full strength, and the residual current of the ending signal has sufficient power to attract the armature and make a second signal or short dot, which is, however, easily prevented by making contact with the shunt through a spring on the sounder-lever, as shown in Fig. 2, which gives on the stroke of the armature-lever and follows it on its upstroke, keeps the shunt on while the sounder-lever is making the greater part of its movement, and allows the terminating-current to become so weak and the relay-armature to get so far from the poles of the magnet that when the shunt is cut off the relay has not power enough to repeat the signal.

Fig. 3 represents a modification of the apparatus in which the relay is weakened by cutting off or short-circuiting one helix of the magnet. A shunt may be introduced into the branch circuit, if desired.

Fig. 4 represents a modification in which the relay is composed of two wires, one of which is broken when the sounder-circuit is closed, and the relay is thereby weakened. Instead of winding the helices with two wires, as represented, they may be made one, or each in two or more sections, and be disconnected by closing the sounder-circuit, as before; or the helices may be composed of concentric shells, and one or more shells be disconnected in like manner. These forms are more particularly applicable to quantity magnets and short circuits.

Fig. 5 shows a modification in which the relay is wound with two wires, as in Fig. 4; but the two are connected for intensity instead of for quantity. When the sounder is open the current from the line goes through both wires, one after the other; but when it is closed it goes through only one of the wires, and to earth. Instead of making the relay of two wires it may be made of two or more sections or shells, as before mentioned, and one or more of the shells disconnected.

Figs. 6 and 7 represent the manner of applying this invention to a relay or receiving magnet when no local battery or sounder is used. In this form the closing of the relay-points shunts one or both of the coils, as may be found most convenient; or short-circuits one of the coils by omitting the shunt and connecting, as shown.

Fig. 8 shows an arrangement intended to prevent the effect of varying currents. In this plan the shunt is not brought into action while the current is weak, the armature being arrested by the point *a* in the arm *c*, which closes the local circuit at *a*; but if the current increases for a longer or shorter period the greater pressure at *a* overcomes the spring *d* and the shunt-points are closed at *b*, weakening the relay to its ordinary standard.

Fig. 9 represents a modification of the arrangement shown in Fig. 8, in which two shunts are introduced successively. When the current reaches a certain strength the shunt *m* is thrown on by the point *a*, and on the further increase in the strength of the current the shunt *m'* is thrown on at *b*.

Fig. 10 is another modification in which the first shunt is thrown on by the sounder, as in Fig. 1, and the second shunt is thrown on at *b* by the force of the increased current overcoming the spring *d*.

Fig. 11 shows one method of applying this invention to the duplex instrument. In this plan the shunt is thrown across the relay from the line screw-cup to the rheostat screw-cup.

Fig. 12 shows another method of applying the invention to the duplex instrument. In this arrangement the course of the current is different from that in the other plans. The arriving current traverses the line-wire of both coils with full force, as shown by the large arrows in the drawing, giving the magnet a certain strength; but when the shunt is put on by closing the sounder contact-points the course of the current changes, as shown by the small arrows. The arriving current then enters and traverses the line-wire of the coil R until it arrives at the point *i*, where it divides, one portion passing with diminished force through the line-wire of coil R', and the other passing through the sounder-points back to point *i*, and then through the rheostat-wire of coil R in a reverse direction. Both coils are, therefore, weakened, though in a different manner.

What I claim as my invention, and desire to secure by Letters Patent, is—

In telegraphic apparatus, the combination, with the relay or receiving magnet, of a shunt-circuit, which is established automatically on the completion of the stroke of the relay-armature, as and for the purpose set forth.

JOSEPH B. STEARNS.

Witnesses:

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