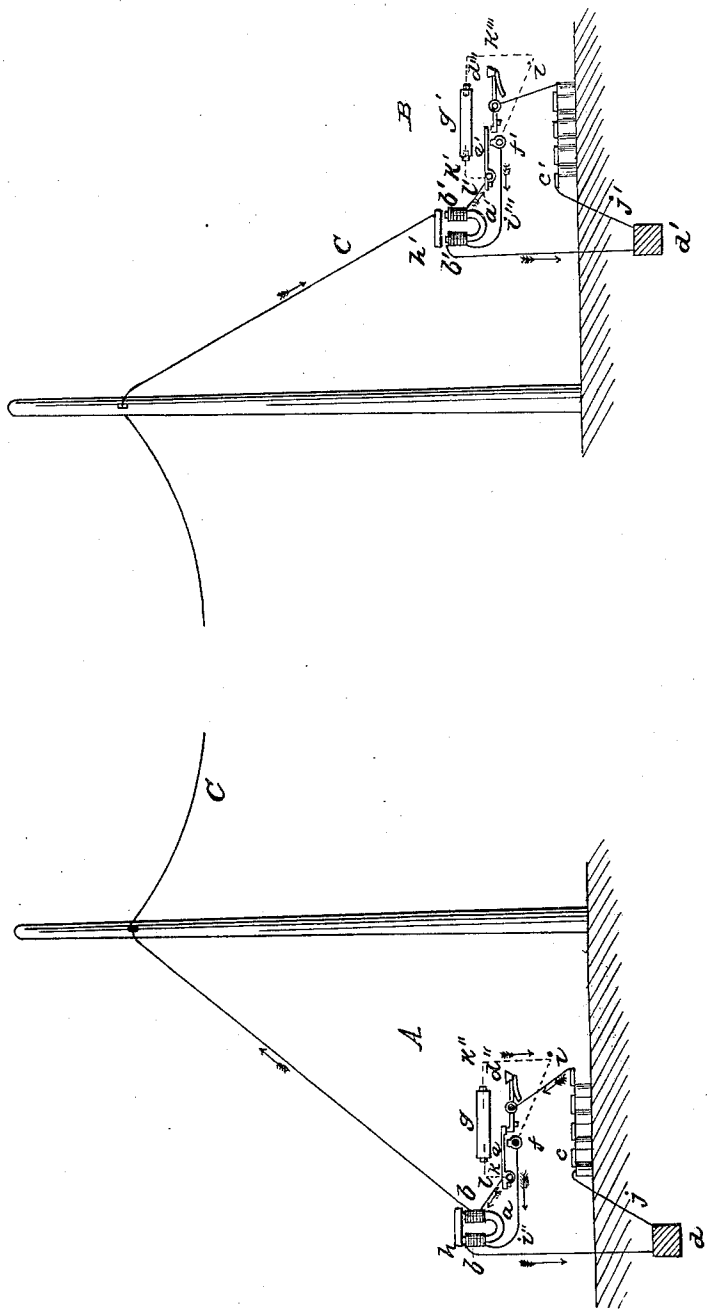
D. E. HUGHES.

Duplex Telegraph.

No. 22,531. Patented Jan. 4, 1859.



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UNITED STATES PATENT OFFICE.

DAVID E. HUGHES, OF NEW YORK, N. Y., ASSIGNOR TO THE AMERICAN TELEGRAPH COMPANY.

IMPROVEMENT IN ELECTRO-MAGNETIC TELEGRAPHS.

Specification forming part of Letters Patent No. **22,531**, dated January 4, 1859.

To all whom it may concern:

Be it known that I, DAVID E. HUGHES, of New York, county of New York, and State of New York, have invented certain new and useful Improvements in Telegraphing; and I do hereby declare that the following is a full, clear, and exact description of the same, reference being made to the annexed drawing, making a part of this specification, which is fully referred to by letters—that is to say—

My invention consists in certain improvements in that class of electric-telegraph apparatus whereby messages may be transmitted from both ends of a line over a single wire at the same time without interference. In the present plan of operation I employ the system of natural magnets and electro-magnets as patented to me on the 20th of May, 1856, although I do not wish to be limited to the mode or mechanism therein set forth, as my invention is also applicable to other systems. I shall use said patent and description in illustrating this invention so far as the same may be applicable thereto. The principle consists, chiefly, in retarding the current of electricity, whenever the circuit is closed by the operating-key, from arriving at the ground-plate nearest to the operator any sooner than the current which passes over the line-wire arrives at the distant ground-plate at the opposite end of the line. Since by using only a single line-wire every current of electricity sent over the same must necessarily pass through both telegraphic instruments, it will be seen that an operator would, unless provision were made to prevent it, write or print both upon his own telegraph-machine and at the distant one. By my invention and by the means above set forth the machine near the operator is not affected by the passage of the electric current through its electro-magnet, but the distant one is only operated upon.

The letters A and B represent two stations, being at each end of a single line-wire, suspended, as usual, upon poles, and as seen at C.

At *a* and *a'* are the soft-iron bars, inclosed within the coils *b* and *b'*, as described in my aforementioned patent.

At *c* and *c'* are the batteries, of usual construction; *d* and *d'*, the respective ground-plates.

At *d''* and *d'''* are operating-keys to close the circuit in connection with a signal-cylinder, as set forth in the said patent, and represented by the spring-finger *e* and *e'* as equivalents for the purposes of this description.

f and *f'* are the insulated supports upon which the spring-fingers rest, and which form the connecting-pieces for the circuit-current to pass to the opposite pole of the battery at the distant station when *e* and *f* or *e'* and *f'* are in contact.

Many substances may be employed to effect the desired retarding of the electric current, but the method which I have found most convenient is to employ the known property of fluids for that purpose, and my invention will therefore be described with reference to the use of water.

At *g* and *g'* is seen the retarding apparatus, and, as represented, it consists of a cylinder of glass stopped at both ends, and is to be filled with water, as being the most convenient fluid to be employed. Conducting-wires pierce the corks and terminate a little within said cylinders. These wires are to be capable of being pushed in or out, so that the distance at which their ends are from each other may be regulated, because the proper retarding of the electric current depends upon the distance these ends are apart, as compared with the length of line-wire intervening between the two stations A and B. The operation of this part, then, is to proportion the effect of water as a retarding medium with that of the line-wire, and it may, for the purpose of illustration, be stated to be a space of one inch between the ends of the wire in the retarded for every hundred miles of line-wire. Thus it will be seen that if the stations A and B were one hundred miles apart, in order that the current from the battery *c*, which flows through the retarder *g*, should reach the ground-plate *d* at the same moment that the current which passes over the line-wire C should reach the ground-plate *d'*, the ends of the conducting-wire within the retarder must be one inch apart. The time, therefore, of the passage of the current through the intervening column of water is retarded to the same that it took the current to pass over the wire C to *d'*. The application of this principle to telegraphing will now be explained.

The two permanent magnets or armatures *h*

and h' are held to the electro-magnets by the attractive force of the same, and are so retained as long as said force continues. When, however, the circuit is closed with the galvanic battery, the poles of the electro-magnet and those of the permanent magnets are made the same. The permanent magnet will then be no longer held, and consequently flies up by the force of the spring-power attached to it, as set forth in the said aforementioned patent. The clock-work is thus set in motion and a letter is printed, as therein described. These permanent magnets are seen at the letters h and h'. A current of electricity is now to be sent from A to B, the order of the conducting-wire being as follows: From one pole of each of the batteries c and c' there is a conductor, i i', leading to the signal-keys d'' and d'''. From the other pole are also two, j and j', leading to the ground-plates, as shown. From each spring-finger e and e' there are two conductors, one set, k and k', (shown in red lines,) leading to one end of the retarder, and the other set, l and l', leading to and connecting with one helix of the electro-magnet b and b', and from said helix to the line-wire C, as shown. From f and f' there are also two sets of conductors. The first, k'' and k''', lead into the retarders, and the second, i'' and i''', to the second of the helices b and b', and thence to the ground-plate, as shown.

The operation will now be as follows: First, the distance apart of the ends of the wire in the retarder must be adjusted, and for this the operator presses down the key d'' and thereby closes the circuit. If the permanent magnet h flies up, it shows that the current reaches the ground-plate d too soon, and the distance between the ends of k and k'' must be increased. This is done by pulling them apart until the magnet h is no longer acted upon. Press down d'', which raises the spring-finger e from the support f. The circuit will be thus established, and one of the currents of electricity immediately flows along i in the direction of the arrow to d'' and e. From e it divides into two branches, one along k through the retarder g, thence by the wire shown in red back to f, thence through one helix, as shown, and thence to the ground-plate d. The other portion flows through l and one helix, and so on the line-wire to the helix of the machine at the station B, thence through l' e' f' to the second helix and the ground-plate d'. As a' thus becomes an electro-magnet, the poles of which correspond with those of the permanent magnet h', the latter is released and is immediately raised by the force of its spring, all which takes place before the other portion of the current can flow through the retarder g to the ground-plate d and establish a like polarity for the electro-magnet b, consequently the permanent magnet still holds itself to the soft iron a. It will thus be seen that an operator can send an electric current through his own instrument, over the line-wire, to the distant instrument without setting his own instrument in motion. In case both operators happen to establish a current at the same moment, of course both permanent magnets would immediately fly up, and setting both machines in motion would print a letter, which letter will in all cases be of the same name at both stations, because the circuit on both machines can only be simultaneously closed when the cylinders of both machines and the type-wheels of each are to print the same letter—that is to say, if it happens that the operators at each end of the line were about to transmit the letter Z and thus should press the keys for that letter of their respective machines at the same instant, of course both would print said letter, for as the cylinder at station A runs in unison with the type-wheel at station B, and vice versa, (that of B in unison with the type-wheel at A,) both machines print a letter of the same name. If, however, the operators strike at the same instant the keys of different letters, it will be seen that they cannot interfere; for if the operator at A desires to print X on the B machine and the operator at B at the same instant desires to print Z on the A machine, it is obvious that two circuits will not at the same instant be established, for the current for the letter X will be sent first, and that letter printed on B's machine, while the circuit will not be established for B until his cylinder comes round, so that the Z-pin will strike his Z-key, when that letter will be printed upon the A machine, according to the principles described in my aforementioned patent.

I claim—

Introducing into that portion of the electric current which passes to the opposite pole of the machine at the station where the operator is working a retarder, such substantially as herein described, whereby said portion shall not reach the near ground-plate until after the other portion of the same current shall have passed over the line-wire and reached the distant ground-plate, whereby said current is enabled to flow through the machine situated at the place of the operator, as aforesaid, without setting said machine in motion, substantially as described.

In testimony whereof I have hereunto subscribed my name.

DAVID E. HUGHES.

Witnesses:
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