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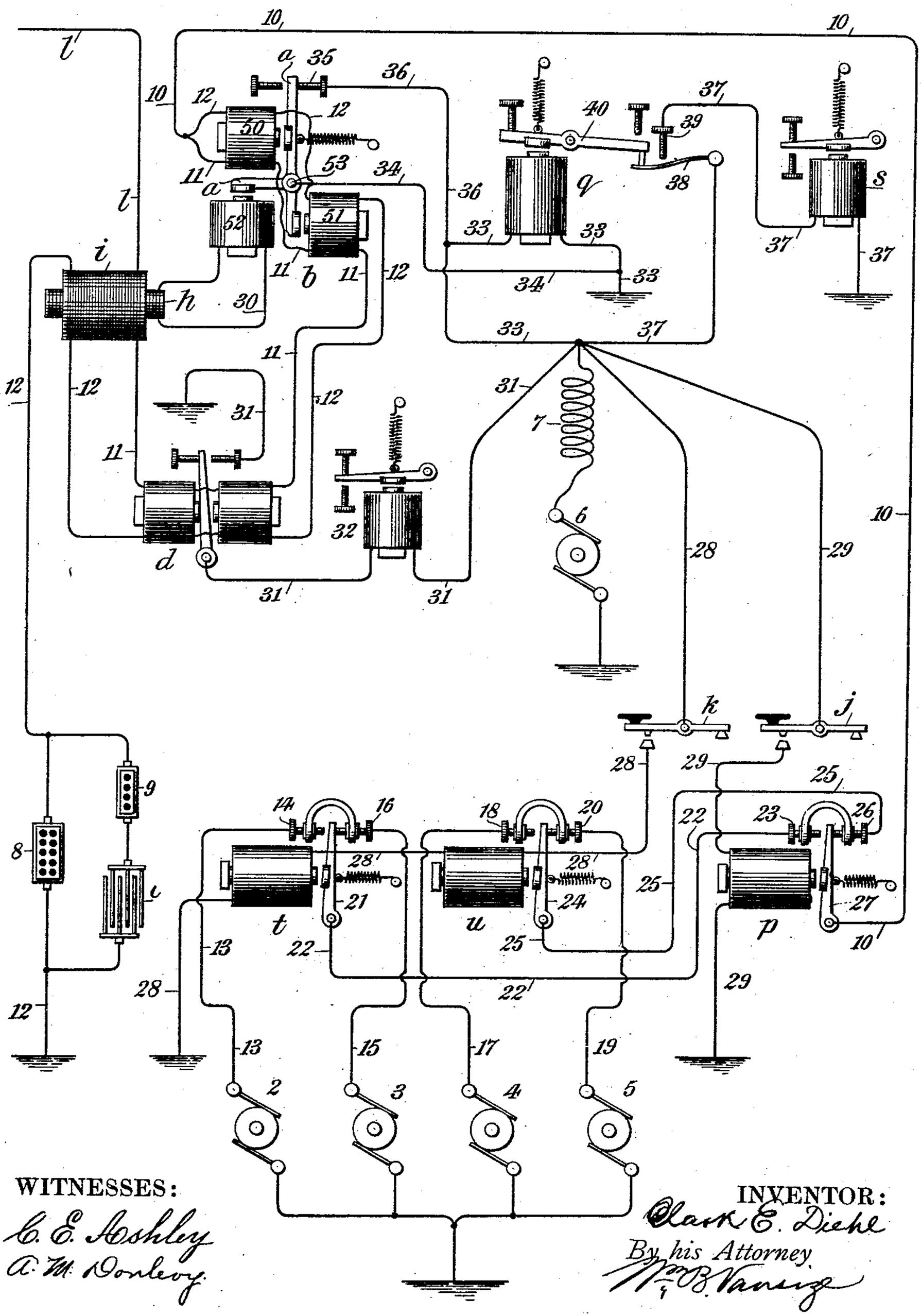
C. E. DIEHL.

QUADRUPLEX TELEGRAPHY.

(Application filed Feb. 25, 1901.)

(No Model.)



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QUADRUPLEX TELEGRAPHY.

SPECIFICATION forming part of Letters Patent No. 684,415, dated October 15, 1901.

Application filed February 25, 1901. Serial No. 48,652. (No model.)

To all whom it may concern:

Be it known that I, CLARK E. DIEHL, a citizen of the United States, residing in Harrisburg, in the county of Dauphin and State of Pennsylvania, have made certain new and useful Improvements in Quadruplex Telegraphy, of which the following is a specification.

My invention relates to a telegraph in which one set of signals is transmitted by variations in strength of current and another set of signals is transmitted by variations in the polarity of such current. At the receiving-station there is a neutral relay for the first-named signals and a polarized relay for the second set of signals, each relay operating a sounder through an appropriate local circuit.

The object of my invention is to avoid the false signals liable to occur when a current impulse effective to operate the neutral relay has its polarity reversed by the operation of the transmitter to vary the polarity of such impulse.

I include between the contact-points of the neutral relay and the sounder controlled by it an electromagnetic circuit-breaker. A local circuit through the coils of this electromagnet is permanently closed, and the relay on its back contact closes a shunt-circuit around the coils of the magnet. This renders the action of the magnet sluggish. I also prefer to employ for the described break-points a spring normally engaging a fixed contact. The spring is lifted from this contact by the armature-lever of the electromagnet, and I am thus enabled to increase the time interval required for a signal at the relay-contacts to become effective on the sounder. This time interval may thus be made sufficient to eliminate false signals.

The accompanying drawing illustrates my invention.

1 is a main telegraph-line connecting two separated stations. Signals are transmitted by dynamos or generators 2 3, of opposite polarity and one electromotive force, and dynamos 4 5, of opposite polarity and a lower electromotive force than that due to 2 and 3.

t and *u* are electromagnetic circuit-changers and together constitute a transmitter for throwing upon the line a set of signals due to variations in polarity of current. The electromagnets are included in the local circuit 28 with the key *k* and local dynamo 6, 7 being an artificial resistance common to all the local circuits.

p is the current-changing transmitter by which a second set of signals are thrown upon the line, which are entirely independent of the first-named set. The magnet of *p* is in the local circuit 29 with the key *j*. The main-line fragment 10 is connected to the armature-lever 27. The back contact 26 is connected to armature-lever 24 through conductor 25. The front contact 23 is connected to armature-lever 21 through the conductor 22. The dynamo 2 is connected to the front contact 14 of *t* by conductor 13. The dynamo 3 is connected to the back contact 16 of *t* by conductor 15. The dynamo 4 is connected to the front contact 18 of magnet *u* by conductor 17. The dynamo 5 is connected to the back contact 20 of *u* by conductor 19. One pole of the dynamos 2 and 4 is connected to ground. The opposite pole of dynamos 3 and 5 is connected to ground.

The key *k* in the local circuit 28, including magnets *t* and *u*, when closed carries armatures 21 and 24 to their front contacts 14 and 18, respectively. Dynamos 2 and 4, of the same polarity, but different electromotive forces, are thus connected to the contacts 23 and 26 of transmitter *p*. When key *k* is open, dynamos 3 and 5, of the same polarity, but different electromotive forces, are connected to contacts 23 and 26 of transmitter *p*. It is to be noticed that when *k* is closed dynamos of the same polarity and different electromotive forces are connected to points 23 and 26, respectively, and when key *k* is open the same is true; but in the latter case the polarity of the dynamos connected to 23 and 26 is the reverse of what it was when *k* was closed. For instance, when *k* is open 23 and 26 will be connected to dynamos yielding plus three hundred volts and one hundred volts, respectively, and when key *k* is closed points 23 and 26 will be connected to dynamos yielding minus three hundred volts and one hundred volts, respectively. Key *j* is therefore always free to throw upon the line current of one polarity or the other, depending upon the condition of key *k*. The strength of current so thrown upon the line by key *j* depends upon whether it, *j*, is closed or open. When

j is open, lever 27, connected to line, will rest on stop 26, and a current of one hundred minus, let us assume, will go to line. When j is closed, lever 27 rests on stop 23, and a current of three hundred minus under the same assumption will go to line, the key k being closed. If key k be in its opposite position from that assumed, the change of key j will result in passing from a current of one hundred plus to a current of three hundred plus. If, however, key j is directing a current of three hundred plus to line and key k is operated to reverse the polarity of the current while j maintains its position, there will be a short interval of no current, because it is not practicable to preserve the continuity of contact between the line and the dynamos during the reversal, and the interval of no current is somewhat more extended than is the case where chemical generators are used, because the low internal resistance of the dynamos creates a practically short circuit, including two dynamos of opposite polarity, and this results in burning or melting the contact-points. To obviate this difficulty, there is necessary an interval of no current, and it is this extended interval of no current, due to the use of dynamo-machines for signaling, that the present improvement overcomes. The interval of no current is measured by the time it takes levers 21 and 24 to pass over from contacts 14 and 18 to contacts 16 and 20.

The receiving-relays consist of the polar-relay d, differentially wound, and operating sounder 32 through the local circuit 31, connected to the local dynamo 6. The neutral relay b is composed of a compound lever a, pivoted at 53. There are two main-line coils 50 and 51, differentially wound, upon opposite sides of the lever a and affecting it in the same direction. The third coil 52 is in a local circuit 30 with the primary coil h of an inductorium, the secondary coil of which is differentially wound and is included in the main and artificial line in a well-known manner. The neutral relay b operates the sounder s, upon which the signals are received. Sounder s is in a local circuit 37 with the dynamo 6, the contact-point 39, and the spring-contact 38. The magnet q, operating the lever 40, makes and breaks contact at 38 39. Magnet q is in a constantly-closed circuit 33, including the dynamo 6. There is a shunt formed upon the coils q by the conductor 34, extending from the local circuit 33 at one side of q to the lever a of relay b, and the conductor 36, connected to the local circuit 33 upon the opposite side of magnet q and extending to the back contact 35 of relay b. The main-line fragment 10 connects the transmitting system with the main-line branch 11, which includes one differential coil of 50, 51, d, and i, continuing to the distant station as main line 1. The artificial line 12 includes the second differential coil of 50, 51, d, and i, passing through the adjustable rheostat 8, around which is connected the condenser c and the rheostat 9 in a well-known manner.

The operation is as follows: Let us assume two sets of signals to be transmitted from the distant station and that an impulse of current, effective to close lever a of the neutral relay b upon its front contact, is present in the line and that during this interval the current is reversed in the process of transmitting a second and independent set of signals. Lever a will temporarily leave its front contact; but this is not effective in the circuit of sounder s. To affect sounder s, lever a must rest upon its back contact 35 and shunt the current from the coils of q long enough to demagnetize q and allow it to break contact at 38 39, and I may increase this time interval by so adjusting the contact-stop 39 that the spring 38 will dwell upon it after the armature-lever 40 has struck upon spring 38. The time gained and due to the sluggish action of the magnet q when the shunt 34 36 is formed is sufficient to bridge the time of reversal due to the operation of the pole-changing transmitter t and u.

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

1. In a quadruplex telegraph the combination of four grounded dynamos arranged in two pairs of respectively opposite polarity and different electromotive forces, two transmitters and suitable circuit connections therefor, one of which when operated reverses the polarity of the dynamo connected to line, the other of which changes from a dynamo of one electromotive force to the other, a relay responsive to changes of polarity for one set of signals, a relay responsive to changes in current strength for a second set of signals, a sounder and local circuit for the last-named relay, break-points in said sounder-circuit, an intermediate electromagnet controlling said break-points, a permanently-closed local circuit containing the coils of said intermediate magnet, a shunt or short circuit around the coils of said magnet and break-points controlled by said relay included in said shunt-circuit.

2. In a quadruplex telegraph the combination of four dynamos arranged in two pairs of opposite polarity and different electromotive force, two mechanically-independent transmitters electrically connected together and to line, one of which changes the polarity and the other the electromotive force of the current sent to line, a polarized and a neutral relay responsive to said transmitters, respectively, a local-relay magnet in a permanently-closed local circuit, a shunt-circuit around said magnet-coils including the main-line-relay contact-points, and an electromagnetic sounder in a local circuit including a spring contact-point controlled by said local relay.

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