

E. N. DICKERSON, Jr.
MULTIPLE TELEGRAPHY.

4 Sheets—Sheet 1.

No. 429,233.

Patented June 3, 1890.

FIG. 4

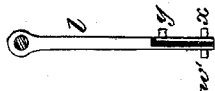


FIG. 1

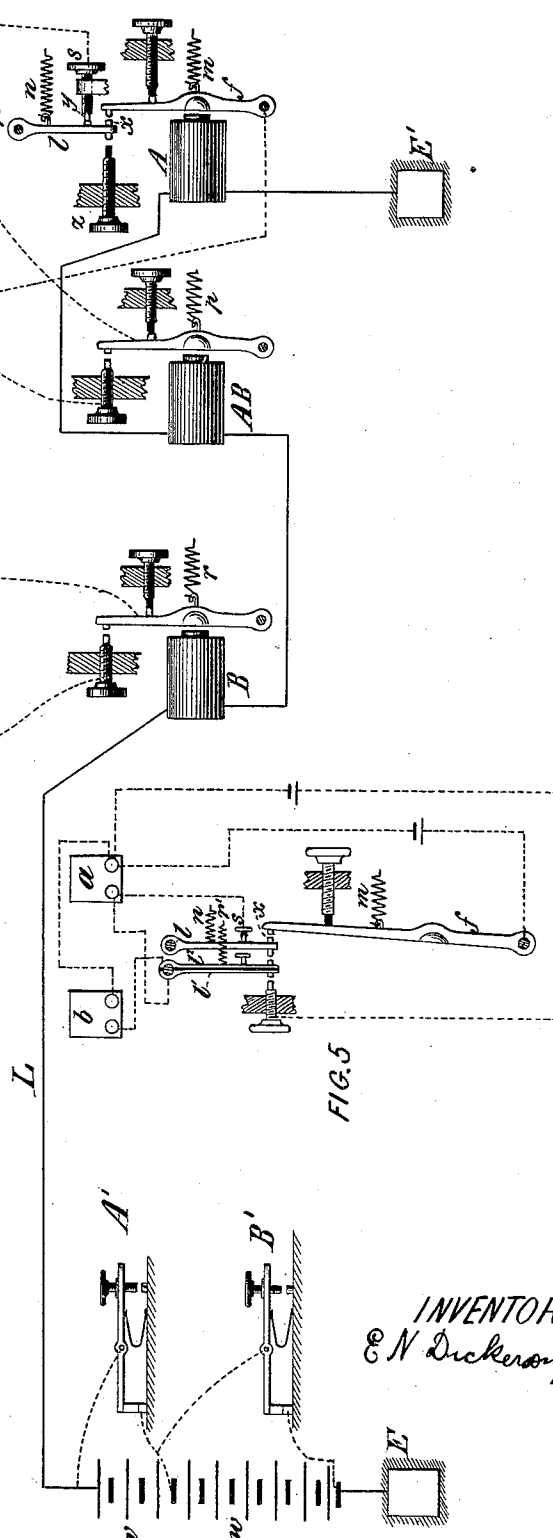


FIG. 5

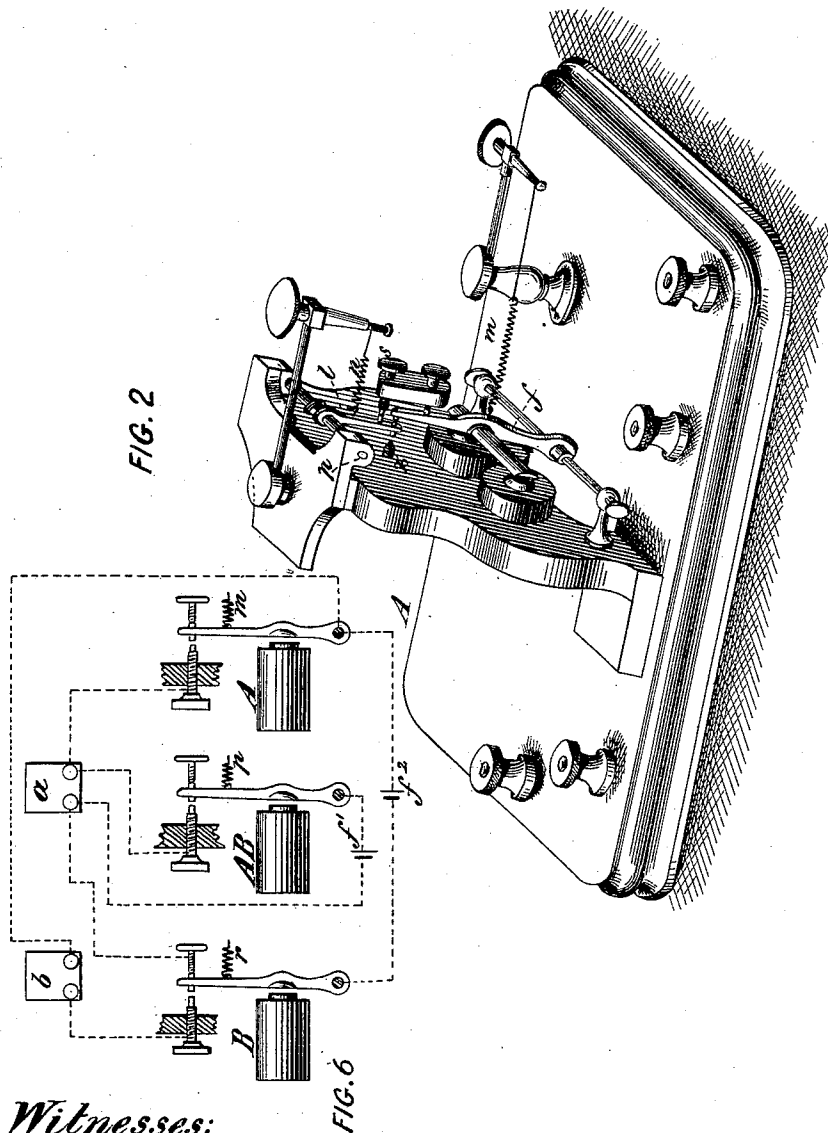
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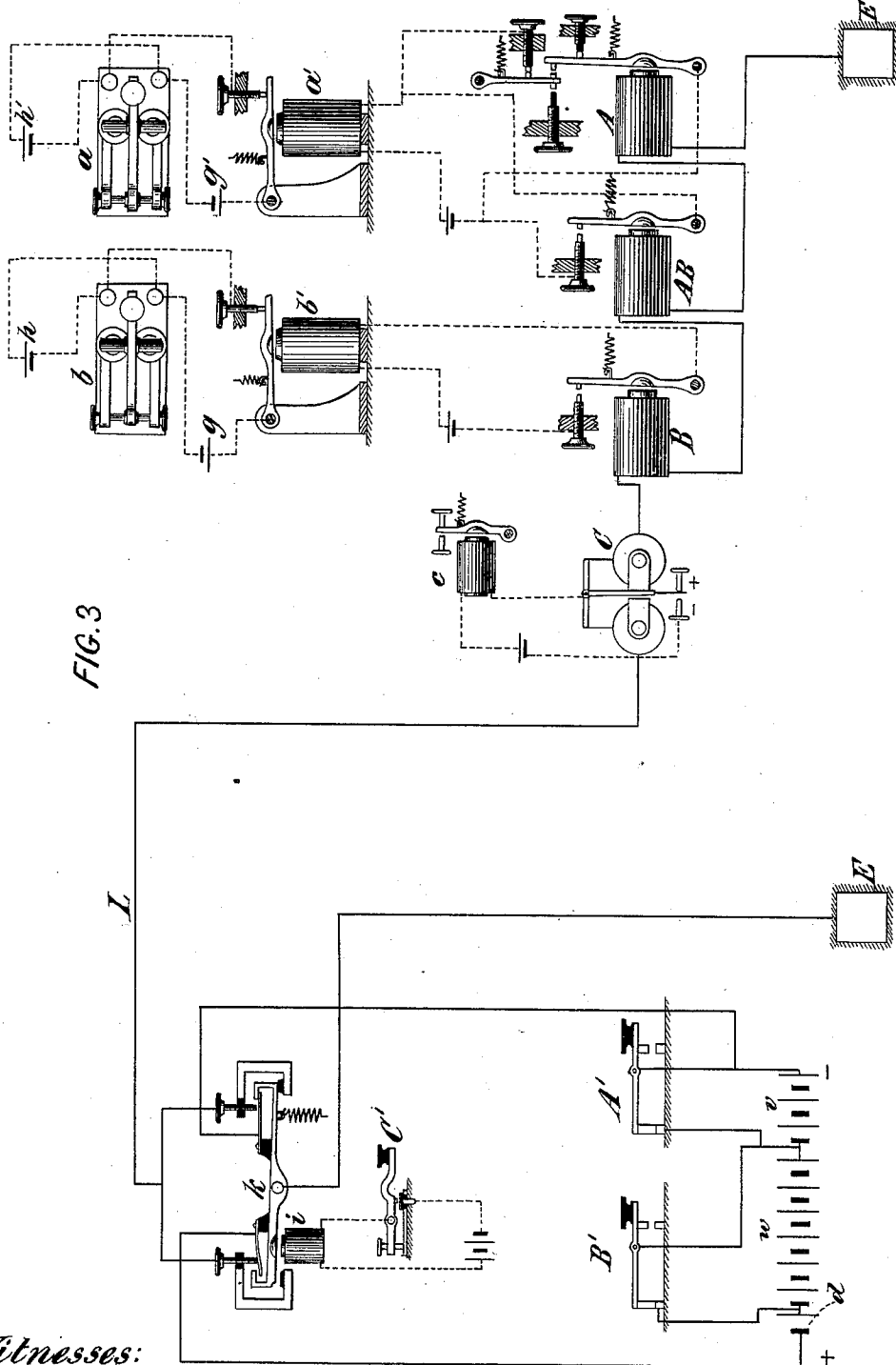


FIG. 3

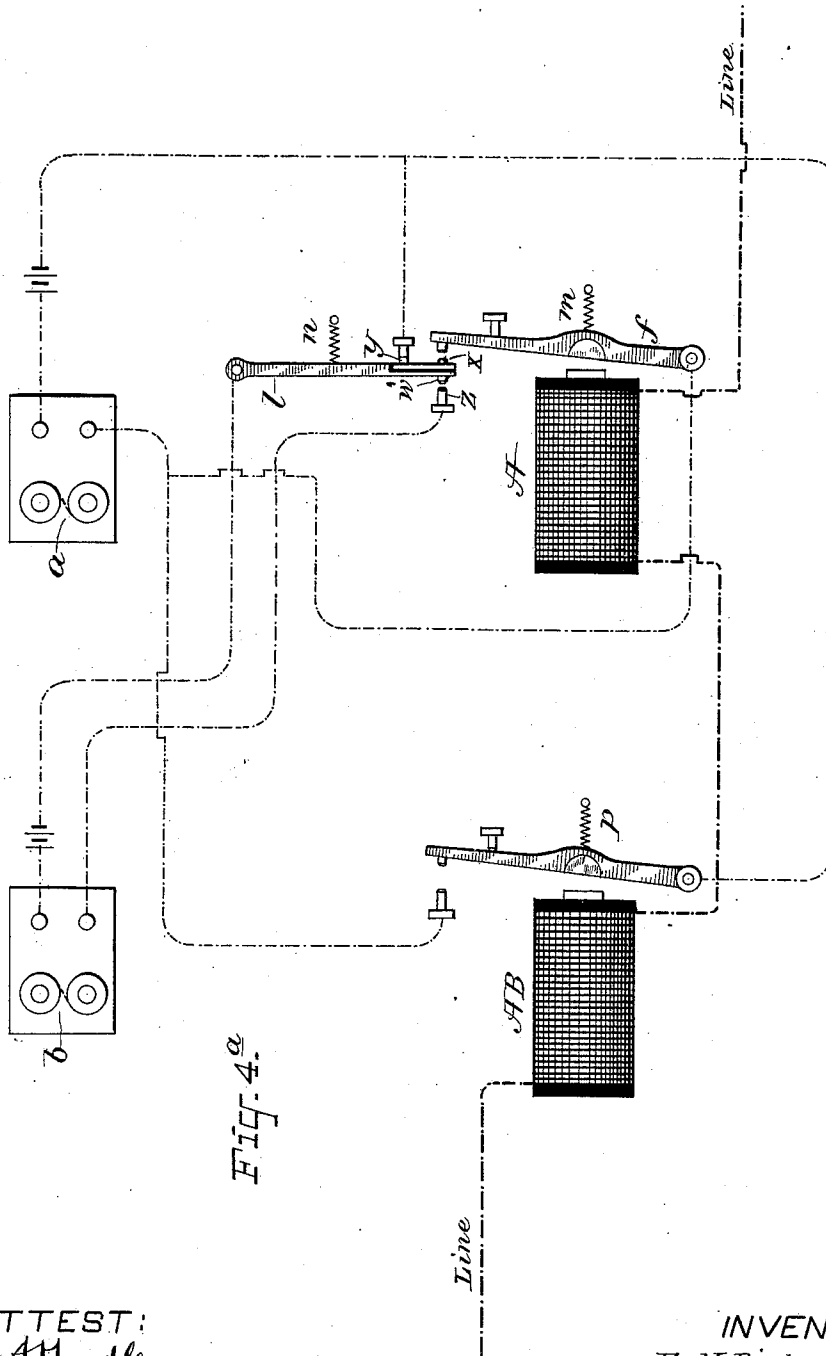
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UNITED STATES PATENT OFFICE.

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MULTIPLE TELEGRAPHY.

SPECIFICATION forming part of Letters Patent No. 429,233, dated June 3, 1890.

Application filed May 22, 1877. (Model.)

To all whom it may concern:

Be it known that I, EDWARD N. DICKERSON, Jr., of the city, county, and State of New York, have invented a certain new and useful Improvement in Telegraphic Transmission, of which the following specification is a full, clear, and exact description, reference being had to the drawings.

My invention relates to an improvement in double or multiple transmission and to the apparatus connected therewith.

Heretofore apparatus has been contrived whereby two messages can be sent upon the same wire in opposite directions, which apparatus is usually known as a "counterplex telegraph." Other apparatus has also been contrived whereby two messages can be sent from the same sending to the same receiving station, which arrangement has been designated by the name "diplex."

The first part of the invention herein contained consists of an apparatus which may be either diplex or counterplex at the will of the operator.

The second part of the invention consists in the arrangement of apparatus and circuits whereby three messages can be sent in the same direction at the same time, which telegraph I shall designate "triplex."

The principle of my invention consists in so combining together sending and receiving apparatus that each sending apparatus shall only affect its corresponding receiving apparatus, and in my diplex apparatus this result is obtained without any reversal of the current, in which respect it differs from the diplex apparatus now in use. The manner in which this result is accomplished is by the use of two batteries of different strength, one being about double that of the other, though this exact proportion need not be observed; and my apparatus is so arranged that whenever the weaker battery is on the line its corresponding receiving-instrument will be affected, while whenever the stronger battery is on the line it will affect its corresponding receiving-instrument.

I will now describe my drawings.

Figure 1 represents a general view of my diplex apparatus, showing a plan of the instruments used, of the batteries, and of the

circuits. Fig. 2 is a perspective view of the relay A shown in Fig. 1. Fig. 3 is a view of my triplex apparatus. Fig. 4 shows a form of auxiliary lever whose use enables one of the main-line relays B shown in Fig. 1 to be omitted. Fig. 4^a represents the auxiliary lever *l* of Fig. 4 applied to the arrangement shown in Fig. 1 with relay B omitted. Fig. 5 represents a single relay and auxiliary levers for controlling two independent sounders. Fig. 6 represents a further modification of main-line relays and local circuits by which three relays without the use of an auxiliary lever are adapted to operate two sounders.

Similar letters of reference refer to similar parts in all the figures.

I will first describe Figs. 1 and 2.

Two keys A' and B' are placed at the sending-station. The key A' is so arranged that when open it shunts or short-circuits the battery *v*, whereby that battery is practically thrown off the line. The key B' has the same office with reference to the battery *w*. I represent this manner of increasing and diminishing the battery force for simplicity; but it is not the best way of accomplishing this result, the better way being to use some of the well-known continuity-preserving keys, for the reason, among others, that the short-circuiting of powerful batteries greatly increases the consumption of material in them and reduces their electro-motive force. It must therefore be understood in all my drawings that I prefer to use other arrangements for throwing my batteries in and out of circuit, but show these short-circuiting keys for simplicity. It is obvious, therefore, that if the key A' be closed the battery *v*, composed of three cells, will be thrown upon the line; but if the key B' be closed while the key A' is open a battery *w* of six cells will be thrown upon the line, while if both keys be closed simultaneously a battery of nine cells will flow along the line, and these battery-currents will always flow in the same direction, and it is obvious that these currents can be introduced at any point of the line.

I employ two receiving-instruments *a* and *b*, which may be either sounders, registers, or chemical instruments. There are three

relays used to operate these two receiving-instruments. The relay B operates the receiving-instrument *b*. The relays A and A B operate the receiving-instrument *a*. The relay A is so adjusted by means of its retractile spring *m* and by varying the distance between the magnet and the armature, which is ordinarily done by means of a withdrawing-screw, that the armature *f* will be attracted by a current of three cells, and will make a contact at the point *x* with the lever *l*. This contact with lever *l* is so arranged that it closes the circuit made by the advance of *f* through the receiving-instrument *a* and through the points *y* and *x*. This lever, pivoted at *p'*, is held up against its set-screw or back-stop at the point *y* by means of a spring *n*, which spring is so adjusted that it will hold the lever *l* against its back-stop *s* until it has been forced away from it by the attraction of the magnet A upon the armature *f*, and the spring *n* is so adjusted that the contact between *l* and *s* will not be broken until a current greater than that emanating from three cells is passing through the magnet A; but if a current greater than that emanating from three cells pass through the magnet A then the spring *n* will yield to the attractive force of the magnet A and armature *f*, and the contact at the point *y* will be broken. If, therefore, a current from three cells pass at the closure of key A', then the armature *f* will be attracted, and will close the circuit of the receiving-instrument *a* through the points *x* and *y* and the back-stop *s*; but if a current from six cells produced by the closure of key B' be sent over the line then the spring *n* will yield to the attraction of the magnet A, and the circuit which was before made through the points *x* and *y* will now be broken at the point *y*. It is obvious that there is an instant of short-circuiting of the local battery through the instrument *a*; but this is found to be too short to affect such instrument. Therefore if a current of six cells pass over the line it is obvious that the sounder *a* will not be affected by it. The receiving-instrument B, which is an ordinary relay having a short coil, (as indeed all the relay-coils used in this apparatus should be,) closes in the ordinary way by means of a local battery the receiving-instrument *b*. This relay B is so adjusted by means of the spring *r* and the position of the magnets that its armature will not be attracted until a current of six cells or more passes over the line. Therefore it will remain unaffected when the key A' is closed, while the relay B will respond whenever the key B' is closed. It is also obvious that the relay B will be closed whenever a current of nine cells is sent onto the line. Therefore the receiving-instrument *b* will respond to the closure of the key B', but not to the closure of the key A'. The relay A B is so adjusted by means of its retractile spring *p* and the position of the magnets that it will close the circuit of the same battery

through the receiving-instrument *a*, which was previously closed by the relay A whenever a current from nine cells of battery passes over the line.

The operation of the instrument can now be understood. So long as the key A' is closed alone it is obvious that the instrument *a* will respond. As long as the key B' alone is closed it is obvious that the receiving-instrument *b* will respond, while the receiving-instrument *a* will not respond, owing to the continuity of the circuit being broken at the point *y*; but while the key B' is closed, if key A' is also closed, a current from nine cells is thereby sent over the line which is strong enough to affect relay A B, and thus operate receiving-instrument *a*. It is now plain that if the key A' is closed the instrument *a* alone will respond, and if the key B' is closed the instrument *b* alone will respond, while if both keys be closed both instruments will respond, and that this is accomplished without any reversal of the direction of the currents. Now, supposing that a current from nine cells be passing over the line, whereby the receiving-instrument *b* is closed by the relay B, and the receiving-instrument *a* is closed through the relay A B, and that at that instant the key B' is opened, leaving only a current of three cells upon the line, then it is obvious that the armature of A B will begin to fall back at the same time that the armature of A begins to fall back, and that there will be an instant of time when there will be no circuit through the receiving-instrument *a*. It is found, however, in practice that with close adjustment this interval either in opening or closing is too short to affect the receiving-instrument *a*; but this trouble can be avoided by the use of any of the well-known slowing devices, one of which is shown at *a'* in Fig. 3.

In my drawings the main-line circuit has been shown in a continuous line, while the local circuits have been shown by dotted lines.

E and E' represent the earth-plates. The instrument *b* could also be closed by means of the instrument *a* by closing its local battery through the back-stop *z* and lever *l* in a manner easily understood by electricians; but I have preferred to represent a separate relay *b* for simplicity, and the same relay A might be used for closing both receiving-instruments *a* and *b* without altering the principle of my invention, which consists in so combining two receiving-instruments and two batteries of unequal strength that each receiving-instrument is affected by the current from its own battery independent of the current from the other battery. It will now be seen that this arrangement can be used either as a duplex or as a counterplex, and that the receiving-instruments can be put at any part of the line, which is also the case with the sending-instruments, and this is a great advantage, which I believe has not hitherto been practically obtained by using direct currents. It is obvious, likewise, that the bat-

tery force could be increased or diminished by the introduction of resistances, as well as by the throwing in of extra battery power in a manner well known to electricians.

Fig. 4 represents a peculiar kind of lever to be substituted in place of the lever *l* on the relay A. When the said relay is to be used for the purpose of closing both the sounders *a* and *b*, the battery-current to close the sounder *b* passes down the lever *l* through the point *w'* and the point *z*, which is not then insulated, while the connections through the points *x* and *y* are made in the same way as in Fig. 1. By this contrivance the relays A and B are combined in one.

Fig. 5 represents a contrivance by which one relay is used in place of the three relays A, A B, and B. The circuits through the sounders are clearly shown. Two levers *l* and *l'* are used. *l* is held back against the screw *s* by the spring *u*, while the screw *l'* is held back by the spring *v'* against its back screw. The lever *l* will yield to a current greater than three cells; the lever *l'* to a current greater than six cells. *l'* is divided longitudinally by an insulator into two parts *l'* and *l''*.

Fig. 6 represents another method of accomplishing the same result by three ordinary Morse relays. The relay B has both a back and front contact. The other relays close on the front points in the ordinary way, the relay A being adjusted for a current of three cells, the relay B for a current of six cells, and the relay A B for a current of nine cells.

It is obvious that in working any of these contrivances over long lines the necessity will arise for overcoming the difficulties of the static discharge by means of condensers or similar contrivances.

Fig. 3 represents a diagram of my apparatus for sending three messages in the same direction at the same time. The apparatus is the same as that previously described, with the addition thereto of apparatus for giving signals by the reversing of the battery-current. The keys A' and B', respectively affect, as before, the receiving-instruments *a* and *b*; but the circuits of these instruments are not closed directly by means of the relays A and B and A B; but they are closed by means of the intermediate back-closure magnets *a'* and *b'*. Through the instrument *a* and *b* there pass in opposite directions two batteries of equal strength, and thereby the effect of either battery is neutralized and the instruments remain unaffected; but if the circuit from either battery is broken then it is obvious that the other battery will close the receiving-instrument. When, therefore, the receiving-instrument *a'* is closed by the closure either of A or A B, the local-circuit battery *g'* is broken, and thereby the battery *h'* is allowed to close the receiving-instrument *a*. This is likewise true of the receiving-instrument *b*. These or well-known equivalent contrivances are here used for the purpose of preventing the falling back of the

sounders upon the reversal of the battery-currents, as will be presently explained.

The key *k* is a battery-reversing continuity-preserving key of any of the well-known patterns, and its effect is to constantly maintain a contact with the earth and line in reversing the battery, which reversing is done by the closure of the key C'. This pulls down the reversing-key *k*, and, as will be readily understood, the battery-current, whether from the batteries *v*, *w*, or *d*, is thereby reversed. In the main-line circuit is placed a polarized relay C, operating a receiving-instrument *c*. This polarized relay will be affected by a current of very slight intensity, much less than is necessary to affect any of the other neutral relays A, A B, and B, which are all in the same circuit with C. I therefore use a very weak battery *d* for this purpose, which battery is kept constantly in circuit. If, now, the key C' is closed, it is obvious that this battery *d* will be reversed and the receiving-instrument *c* will be closed by the closure of the polarized relay C, which polarized relay will close whether a strong or a weak current be passing over the line. The closure of the keys A' and B' will, as before explained, close the instrument *a* and *b* and the closure of the key C' will close the instrument *c*. The batteries *w* and *v* are much larger than the battery *d*, and the battery *w* should be about double the battery *v*. It is obvious that batteries of sufficient strength to suit the exigencies of the line should be used. It is obvious that both my duplex and triplex can be doubled by duplexing them either on the differential or the bridge system, and that thereby a quadruplex and a triduplex are obtained.

I claim—

1. The combination, with the main-line circuit, of three continuity-preserving keys situated at the same station, two of which send currents of different intensities in the same direction and the other of which reverses the entire current, substantially as described.

2. The combination, with the main-line circuit, of two transmitting-instruments transmitting currents of different intensities, and a reversing-instrument reversing the current of whatever intensity situated at the same station, and of a polarized relay responding to the reversing-instrument, and of a series of neutral relays responding to the transmitting-instruments when the said receiving-relays are combined with receiving-instruments, which receiving-instruments will not be affected by the reversal of the battery-current, but will be affected by an increase or decrease in its strength, whereby three transmitting-instruments, situated at the same point on the line, respectively affect three receiving-instruments situated at the other points on the line, each receiving-instrument operating in response to its own transmitting-instrument independently of the action of the other transmitting-instruments, substantially as described.

3. The combination, with the main-line circuit, of three sending and three receiving instruments, one of said sending-instruments being used to reverse the battery-current of whatever strength it may be, the second instrument being used for throwing in a battery of a weaker strength, and the third sending-instrument being used to throw in a battery of a greater strength, one of the receiving-instruments being affected by a reversal of the battery-current of whatever strength, the second of the receiving-instruments being affected by a battery-current of weaker strength, and the third receiving-instrument being affected by a battery of greater strength, substantially as described.
4. The combination, substantially as described, of two keys for adding battery and one reversing-key at one station, by which more or less battery-power is put to line or the polarity reversed, and three receiving-instruments at the distant station, two of which respond to different strengths of battery and the third to the reversal of the current, substantially as set forth.
5. In a telegraph system for transmitting two messages in the same direction, two receiving-instruments *a* and *b*, a relay for bringing *b* into action both by an intermediate and a maximum current, and a second relay and two multiple arc branches, one being controlled by an armature-lever and an auxiliary arm *l* and the other by an armature-lever, by which receiving-instrument *a* is actuated both by a minimum and by a maximum but not by an intermediate current.

6. The combination, with a main line, of a receiving-instrument *a*, which is controlled by relays A and A B, lever *l*, and two local circuits or branches, one of which is first closed at contact *x* and next broken at *y* by A, while the other local or branch is closed by A B, and a receiving-instrument *b*, which is independently operated by relay B.

7. The combination, with a main line, of a receiving-instrument *a*, two local circuits for operating said receiving-instruments, one of which locals is closed by relay A and next broken by relay B, the second local being closed by A B, and a receiving-instrument *b*, which is actuated by B alone.

8. A compound relay A, in combination with an armature *f*, closing upon an obstructing-lever *l*, having three contact-points *x y w'*, two of the said contact-points being insulated from the other contact-point, substantially as described.

9. A compound relay A, the armature of which closes upon two movable levers *l* and *l'* before it brings up against its back-stop, substantially as described.

10. The combination of a relay-armature *f* with two obstructing-levers *l* and *l'*, when one of the obstructing-levers has its two opposite contact-points insulated, substantially as described.

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Witnesses:

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