(No Model.)

2 Sheets—Sheet 1.

M. W. DEWEY.

OCTUPLEX TELEGRAPH.

No. 396,734. Patented Jan. 29, 1889.

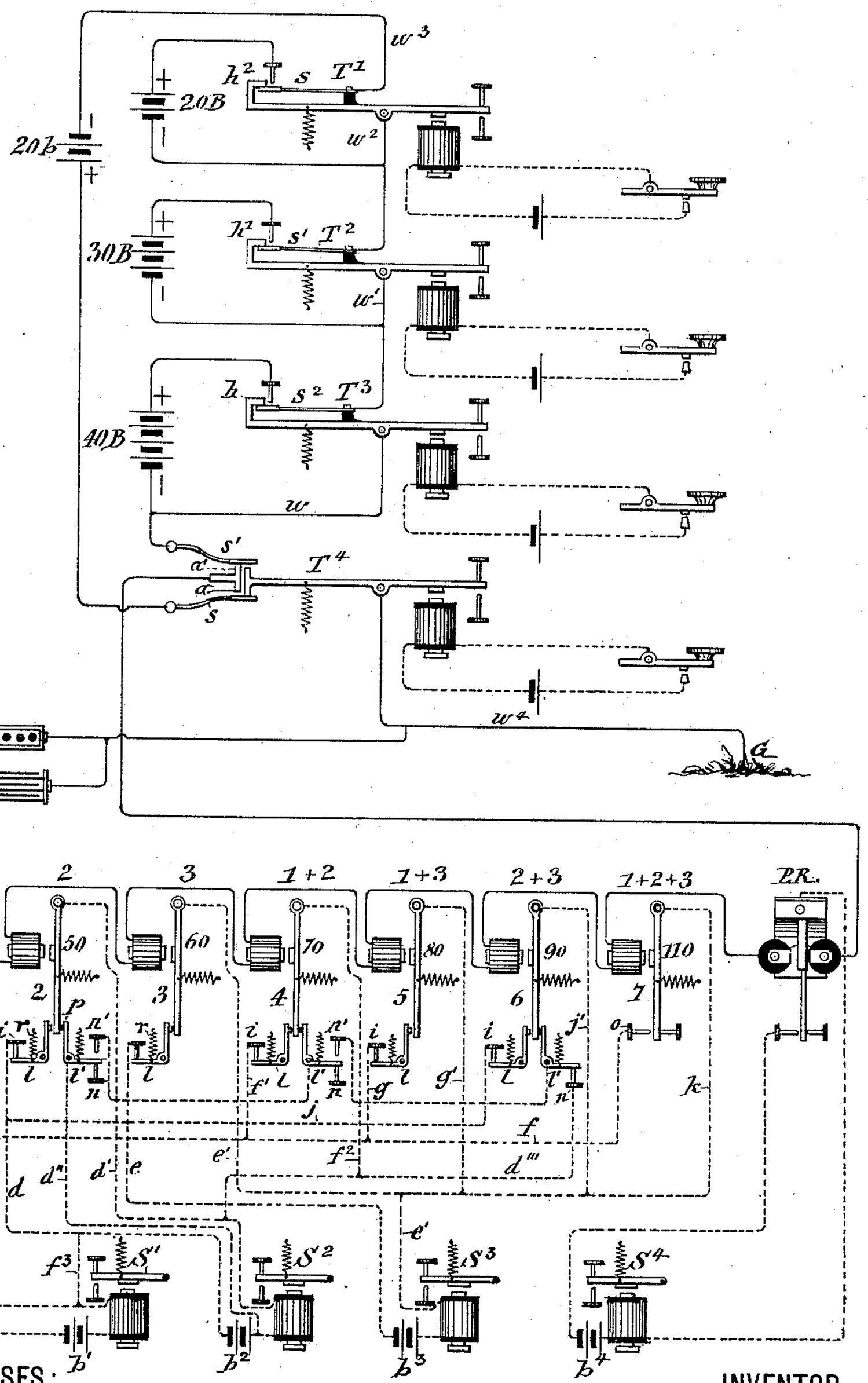

Fig. 1

WITNESSES:

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N. P. Denison.

INVENTOR.

Mark W. Dewey

BY

Hull, Lacey & Hull

ATTORNEYS.

(No Model.)

2 Sheets—Sheet 2.

M. W. DEWEY.

OCTUPLEX TELEGRAPH.

No. 396,734. Patented Jan. 29, 1889.

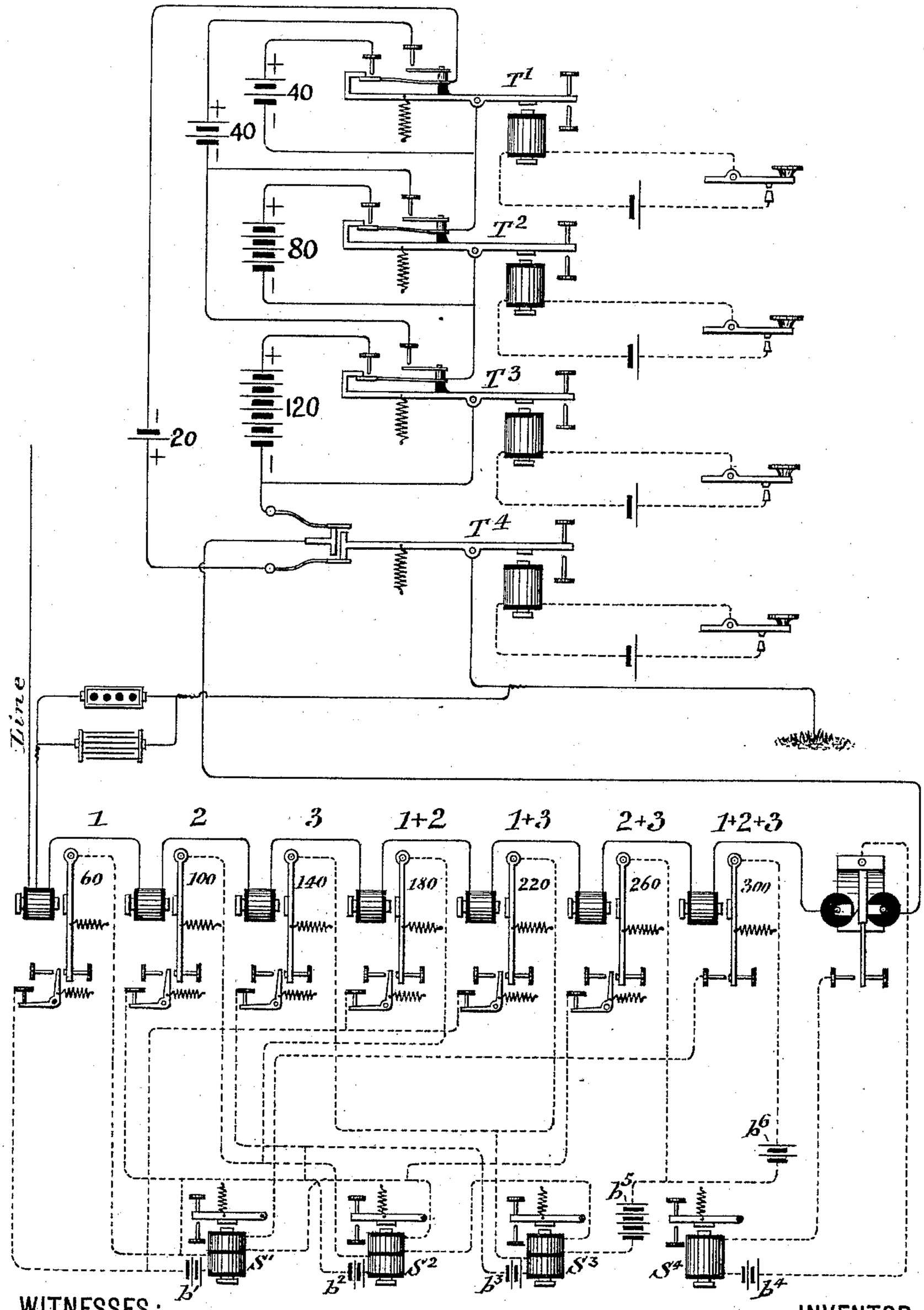

Fig. 2

WITNESSES:

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UNITED STATES PATENT OFFICE.

MARK W. DEWEY, OF SYRACUSE, NEW YORK, ASSIGNOR OF TWO-THIRDS TO EMIL LAASS AND CHARLES H. DUELL, BOTH OF SAME PLACE.

OCTUPLEX TELEGRAPH.

SPECIFICATION forming part of Letters Patent No. 396,734, dated January 29, 1889.

Application filed December 21, 1887. Serial No. 258,548. (No model.)

To all whom it may concern:

Be it known that I, MARK W. DEWEY, of Syracuse, in the county of Onondaga and State of New York, have invented new and useful Improvements in Octuplex Telegraphs, of which the following, taken in connection with the accompanying drawings, is a full, clear, and exact description.

My invention relates to an electric telegraph adapted for the simultaneous transmission of four distinct and separate messages on one line-wire, to produce which currents differing in polarity and intensity are used.

This improvement consists in so combining several sections of battery with three single-current transmitters or keys and one double-current or pole-changing transmitter or key that when a certain key or keys are operated they will send currents to line that will select and operate the corresponding receiving instrument or instruments and no other.

It also consists of the combination of seven neutral relays, described below, whereby three sounders or registers may be properly operated by the three single-current transmitters, and one polarized relay, which operates independently another sounder or register whenever the current is reversed by the double-current transmitter.

That this invention may be more clearly comprehended I have in the annexed drawings endeavored to illustrate the same fully and will describe it, referring to them.

In the drawings, Figures 1 and 2 show two forms of apparatus differing slightly from each other in arrangement but not in principle.

In both figures four transmitters are represented. Three of them, as before stated, are known as single transmitters and the other a double transmitter or pole-changer. When all the transmitters are at rest or in their inoperative position, a comparatively-weak current of a certain polarity from battery 20 *b* continually flows to line, the same as all the single transmitters send to line when operated without the double transmitter. This is sufficient to operate the polarized relay when the double-current transmitter T^4 is used alone, closing its local circuit through sounder S^4 only when current through line is reversed, or, according to drawings, whenever a positive current flows to line. This strength is not sufficient to move the neutral relays on account of their retractile springs; therefore they will only respond when currents of greater strength are sent to line by the single transmitters T' T^2 T^3. Each single transmitter has the independent control of a separate battery. In Fig. 1 of the drawings T' controls a battery of the same strength of that already to line, (indicated by 20 B,) T^2 controls a battery of greater strength, (indicated by 30 B,) and T^3 controls battery 40 B of still greater strength. The difference of the numbers indicates the difference in the strength.

I do not limit myself specifically to the various strengths of the aforesaid batteries indicated in the annexed drawings, it being only necessary that enough difference should exist to give the required margin for the adjustment of the neutral relays at the remote station.

If transmitters T' T^2 T^3 are open, twenty cells of battery 20 *b* are in circuit, subject to the control of pole-changing transmitter T^4. In this case the route from line to ground will be through magnets of relays, then to support of contact-points of T^4, springs s', then to T^3, by wire w to hook h, spring s^2, wire w' to T^2, hook h', spring s', by wire w^2 to T', hook h^2, spring s, wire w^3 to battery 20 *b*, spring s, T^4, by wire w^4 to ground G. When the double transmitter T^4 is open the negative current is to line, if closed the positive current, transposing the route of the battery 20 *b*. When the negative is to line, the armature of the polarized relay P R is held to open the local circuit through sounder S^4, and if the polarity is changed to positive the armature will move to close the local circuit through said sounder.

It will be observed that all line-currents pass *via* T^4, and when said transmitter is open or in its normal position the negative current is to line under any or all conditions that the single transmitters may be placed in; therefore the polarized relay P R will only respond to the movement of the double-current transmitter T^4, and will do so whatever the strength of the battery may be in circuit at the time.

Referring, as before, to Fig. 1 of the drawings, if T' is depressed battery 20 B is in cir-

cuit with that already to line, which equals 40, and is of sufficient strength to move the tongue of neutral relay R′ to contact of lever *l*, but is insufficient to overcome the tension of spring *r*, and therefore closes the local circuit operating sounder S′. The circuit from local battery *b′* in this case is by wire *c* to stop *i*, armature-lever of relay R′, wire *c′*, through sounder S′, returning to battery. The other relays, R, 1, 2, 3, &c., are unable to move because the current is not of sufficient strength to overcome their retractile springs. If T² is depressed alone, battery 30 B will be in circuit with the 20 *b*, equaling 50, and is sufficient to move the tongue of relay 2 to contact of its lever *l*, and relay R′ will move its lever *l* to break the circuit controlled by it, because the strength of current is sufficient to overcome the spring *r* of lever *l* and break contact with stop *i*, but is not sufficient to overcome retractile spring of lever *l* of relay 2; therefore the local circuit is closed through sounder S². The route of current in this local circuit is from battery *b*², wire *d* to stop *i*, lever *l*, armature-lever of relay 2, wire *d′*, through sounder S², and return to the battery.

It will be noticed that when the armature-lever of relay 2 moves, lever *l′* moves with it to break a shunt-wire, commencing from between battery *b*² and sounder S², and extending by wire *d″* through contact-levers *l′* of relays 2, 3, and 6, wire *d‴* to wire *d′*. This serves to shunt sounder S² when necessary, and for the purpose hereinafter explained. The levers *l′* are insulated from the armature-levers of the relays. When T³ is closed alone, battery 40 B is in circuit with the 20 *b*, making 60, which will move armature-lever of R³ to its contact-lever *l*, but not farther, on account of retractile spring *r* closing its local circuit through sounder S³ by wire *e*, stop, contact-lever, and armature-lever of relay 3, wire *e′*, through sounder S³, to battery. In this case both relays 1 and 2 have moved to their extreme condition. Thus their local circuits are open; but the shunt mentioned above is closed through lever *l′* and stop *n′* of relay 2. When T′ and T² are closed simultaneously, batteries 20 B and 30 B with the 20 *b* are in circuit, making a strength of 70. This serves to move the armature-lever of relay 4 to contact-point of its lever *l*, closing the circuit through sounders S′ and S², and opens the shunt by means of its lever *l′*, so that S² will not be shunted. Relays 1, 2, and 3 have moved to their extreme condition, breaking their circuits through their contacts. The current in this case is from battery *b′*, wire *c*, *f*, and *f″* to stop *i*, lever *l*, armature of relay 4, wire *f*² *d‴* *d′* through S², battery *b*², wire *d* to *f*³, sounder S′, and return to battery *b′*. When T′ and T³ are depressed together and T² open, 20 B, 40 B, and 20 *b*=80 is in circuit, and is sufficient to move armature-lever of relay 5 to contact-point of its lever *l*, closing a circuit through sounders S′ and S³. There is no lever *l′* on this relay, and the other relays, 1, 2, 3, and 4, having moved to their extreme position, the shunt is therefore closed, so that sounder S² is cut out and will not respond. The route of this circuit is from battery *b′*, wire *c f g* to stop *i* of relay 5, contact-lever *l*, armature-lever, wire *g′ e′* through sounder S³, battery *b*³, wire *e d‴*, lever *l′* of relay 6, then to stop *n′*, lever *l′* of relay 4, then to *n′ l′* of relay 2, wire *d″* to battery *b*², wire *d f*³, sounder S′ and return to *b′*. When transmitters T² and T³ are both closed and T′ open, 30 B, 40 B, and 20 *b*=90 are in circuit, and cause the tongue of relay 6 to come in contact with its lever *l*, closing the local circuit through sounders S² and S³.

It will be understood, of course, that all the relays adjusted to respond to weaker currents have moved to their extreme position, thereby breaking the circuits through their contact-stops *i* and levers *l*, but closing the shunt between stops *n′* and levers *l′*; but as it is necessary to have the shunt broken in this case in order to have S² in circuit, relay 6 breaks it between stop *n* and lever *l′*. The current through local circuit flows from battery *b*², wire *d j*, stop *i*, lever *l*, and armature-lever or relay R⁶, wire *j′* to *e′*, magnet of S³, battery *b*³, wire *e d‴ d′*, sounder S² to battery *b*². When the armatures of the relays pass over from one extreme position to the other, it will be observed that the local circuit is closed for an instant, but not long enough to produce any effect whatever upon the levers of sounders. When transmitters T′, T², and T³ are closed, all the batteries are in circuit, equaling 110. This is sufficient to move the seventh and last neutral relay to its extreme position with the others, closing circuit through all the sounders of neutral relays S′, S², and S³. The local current flows from battery *b′*, wire *c f*, stop *o*, armature-lever of relay 7, wire *k e′* S³, battery *b*³, wire *e d‴ d′* S², battery *b*², wire *d f*³ *c′* S′, and return to battery *b′*. The shunt being broken between stop *n* and lever *l′* of relay 6 allows sounder S² to respond.

It will be understood that if transmitter T⁴ be operated a reversal of the different strengths will always actuate the polarized relay and sounder S⁴.

By the above it will be also noticed that there are sixteen electrical conditions of the line corresponding with the sixteen possible positions of keys at transmitting-station.

It is obvious from the arrangement of the apparatus, as shown in the annexed drawings, that four separate messages may be simultaneously transmitted over a single wire in the same direction, and in order that eight messages may simultaneously pass over a single wire it is only necessary to have a set of transmitting and receiving instruments at each end of the line properly constructed in any well-known manner for simultaneous transmission in opposite directions, or the entire number of transmitters at a station may be used simultaneously to transmit to another station a single message in accordance with the plan described in a former application for Letters

Patent in an improvement in telegraphy, Serial No. 255,695, filed November 21, 1887. On this plan two messages may be transmitted at the same time—one in each direction—and two operators are enabled to perform the work of eight in the same length of time.

Fig. 2 of the drawings shows a modification of the hereinbefore-described arrangement, whereby a greater difference in strength sent to line is derived, giving more margin for the adjustment of relays at receiving-station, and the relays are simplified, having but one contact-lever *l*, which allows the armature to move more freely. In this case there should be two magnets to each sounder governed by the neutral relays, or the magnets have double helices, as shown in drawings. This is done in order to properly select the sounders or registers, as the case may be, for there is no shunt-wire in this plan to cut out sounder S^2, as will be observed, and the local circuits are somewhat different from those shown in Fig. 1 of the drawings. The principal difference in the transmitting apparatus is that there is what might be called a "fragment" of the line-wire which contains a battery, and is included in the circuit only whenever the first and second transmitters, first and third, or first, second, and third transmitters are closed together. This fragment of line-wire is connected by means of a second contact-spring on each single transmitter and contact-point, as shown.

In the transmitting apparatus the strength of each section of main battery is marked in the drawings—to wit, one of twenty, two of forty, one eighty, and another one hundred and twenty. The different strengths sent to line are also marked near the relays which they govern and the number of the transmitter or transmitters that send it, and the sounders are numbered to correspond with the transmitters and respond only when their corresponding transmitter is depressed at the distant station.

The routes of local currents in this plan are when sixty cells are in circuit through main-line relay 1 responds as in the other plan, the armature-lever moving to its contact-lever *l*, but no farther on account of the retractile spring of lever *l*. The current flows from local battery *b'*, lever *l*, armature-lever of relay, to lower section of helices of sounder S' to battery. The relays respond in the same manner as those in the other receiving apparatus, with the exception that in Fig. 2 of the drawings there is no shunt and the contact-levers *l'* are omitted, and whenever any of the first five neutral relays respond without the two others, 6 and 7, the local currents flow through the lower sections of helices of sounder, and when either of the last relays, 7 and 8, respond the current flows through the upper section of helices of sounders from either or both batteries b^5 and b^6. When 6 moves to close its circuit, battery b^5 only is in circuit, and when relay 7 closes its circuit both b^5 and b^6 are in circuit.

The description of the operation of the polarized relay in the first-described plan applies also to the modified arrangement.

What I claim as my invention is—

1. The combination at one station of the telegraph-line with its weak battery in constant circuit of four transmitters, four batteries of different strengths, each of the latter being controlled separately by one of said transmitters, and eight relays at another station controlling four registers or sounders, substantially as specified.

2. The combination at one station of three single-current transmitters, several batteries of different strengths, each of the latter being controlled separately by one of said transmitters, and seven relays at another station controlling three sounders or registers, as set forth.

3. The combination at a receiving-station of seven relays adapted to be operated by currents of different strengths sent from another station through a single line-wire, the levers *l*, and contact-stops *i*, controlling three sounders, and a polarized relay controlling a separate sounder, substantially as specified.

4. In a system of multiplex telegraphy having a single line-wire, the combination at the receiving-station of seven relays differently adjusted and actuated by currents of different strengths, their contact-levers *l*, stops *i*, contact-levers *l'*, stops *n* and *n'*, and their respective local circuits, batteries, and sounders, substantially as specified.

5. In a system of multiplex telegraphy having a single line-wire, the combination at the receiving end of seven relays differently adjusted and actuated by currents of different strengths sent from a distant station, their contact-levers *l*, stops *i*, contact-levers *l'*, stops *n* and *n'*, their respective batteries and sounders, and the polarized relay controlling a separate sounder or register by a separate local circuit, substantially as specified.

6. The combination of three single transmitters at one station, a portion of main line containing on its circuit a section of a battery that forms part of the main line only when two or more of said transmitters are closed simultaneously, the batteries of different strengths, and the neutral relays controlling the sounders at the receiving-station, substantially as set forth.

7. In a multiplex telegraph, a single main line in combination with a series of batteries of different strengths at the transmitting end of the line, a series of transmitting-keys corresponding to said batteries and each of which is adapted to couple its battery in the line-circuit, a series of sounders or registers at the receiving end of the line corresponding to said transmitters, a series of relays in circuit with the main line and corresponding in number to the possible combinations of the transmitting-keys, springs to hold the armatures of the relays back and corresponding in strength to the strength of the possi-

ble combinations of the batteries, local batteries for the sounders or registers, and local circuits for said sounders or registers controlled by said relays, whereby the proper sounders or registers will respond for given keys.

8. In a multiplex telegraph, the combination of a main line, a line-battery of low tension always in line, a series of batteries of different strengths at the transmitting end of the line, a series of continuity-preserving single-current transmitters or keys corresponding to the said last-mentioned batteries and adapted to put one or more of said batteries to line, according as to the number of said transmitters or keys put into action at one time, a continuity-preserving double transmitter or key, also at said transmitting end of the line and adapted to reverse the current in the line, a series of sounders or registers at the receiving end of the line and corresponding in numbers to the transmitters or keys, a series of relays arranged in the main-line circuit and corresponding in numbers to the possible combinations of the continuity-preserving single-current transmitters and adapted to respond to currents of different strengths but greater strength than the current which always traverses the main line from the low-tension battery, a polarized relay in series with the relays above mentioned and adapted to respond to the reversals of the low-tension current which normally traverses the main line and which is controlled by the continuity-preserving double transmitter, and a series of local circuits between said sounders or registers and all of the relays and controlled by said relays, whereby the sounder or register corresponding to each transmitter or key shall sound or register upon the operation of said transmitter and irrespective of the operations of the other transmitters.

9. In a multiplex telegraph, the main line, over which a current is normally flowing and which current is varied in strength and polarity, in combination with suitable receiving-instruments at the receiving end and the following transmitting-instruments at the transmitting end, to wit: three continuity-preserving single-current transmitters, three batteries of different strengths, each of which is adapted to be put into the line-circuit by its corresponding transmitter, a continuity-preserving double transmitter for reversing the current passing to line, and a line-battery of less strength than the other batteries always in circuit with the line and controlled as to its polarity by the double transmitter.

10. In a multiplex telegraph, the main line, over which a current is normally flowing and which current is varied in strength and polarity, in combination with suitable receiving-instruments at the receiving end and the following transmitting-instruments at the transmitting end, to wit: three continuity-preserving single-current transmitters, three batteries of different strengths, each of which is adapted to be put into the line-circuit by its corresponding transmitter, a continuity-preserving double transmitter for reversing the current passing to line, and a line-battery of less strength than the other batteries always in circuit with the line and controlled as to its polarity by the double transmitter, and a fifth battery equal to, or substantially equal to, the strength of the weakest battery controlled by the single transmitters and adapted to be put into line-circuit only when the single transmitters controlling the weakest and one or more of the stronger batteries are simultaneously closed to cause the variations in strength of the current flowing in the line to vary uniformly.

11. In a multiplex telegraph, the main line, over which a current is normally flowing, and transmitting-instruments at the transmitting end of the line, consisting of three single-current transmitters and three batteries of differing strength, each battery adapted to be put into line-circuit by its corresponding transmitter for varying the strength of the current in the line in a predetermined manner, in combination with a series of sounders or registers at the receiving end of the line, a series of relays, also at said end of the line in the line-circuit and equal in number to the possible combinations of the sounders or registers and adapted to respond to currents of different strengths, local batteries, and connecting local circuits including said sounders or registers and batteries and controlled by the relays.

12. In a multiplex telegraph, the main line, over which a current is normally flowing, and transmitting-instruments at the transmitting end of the line, consisting of three single-current transmitters and three batteries of differing strength, each battery adapted to be put into line-circuit by its corresponding transmitter for varying the strength of the current in the line in a predetermined manner, and a double-current transmitter for reversing the current in the line when desired, in combination with a series of sounders or registers at the receiving end of the line, a series of relays, also at said end of the line in the line-circuit and equal in number to the possible combinations of the sounders or registers and adapted to respond to currents of different strengths, local batteries, and connecting local circuits including said sounders or registers and batteries and controlled by the relays, a polarized relay in circuit with the above-mentioned relays and line, a sounder or register for said polarized relay, a local battery, and a local circuit including said sounder or register and battery and controlled by said polarized relay.

13. The combination at the receiving-station of the line-circuit conveying currents of different strengths with seven relays adapted to be operated by currents of different strengths sent from another station through the line, three sounders or registers having

double windings, local batteries, seven local circuits including said batteries and sounders or registers and respectively controlled by said seven relays, levers *l* of said relays adapted to offer different resistances to movement, and stops *i*, connecting, respectively, with one end of the local circuits, the other ends of which circuits connecting with the relay-armature, whereby said seven relays control the three sounders or registers for seven variations in the line-current.

In testimony whereof I have hereunto signed my name, in the presence of two witnesses, at Syracuse, in the county of Onondaga, in the State of New York, this 19th day of December, 1887.

MARK W. DEWEY. [L. S.]

Witnesses:
HOWARD P. DENISON,
C. L. BENDIXON.