A. C. CREHORE.

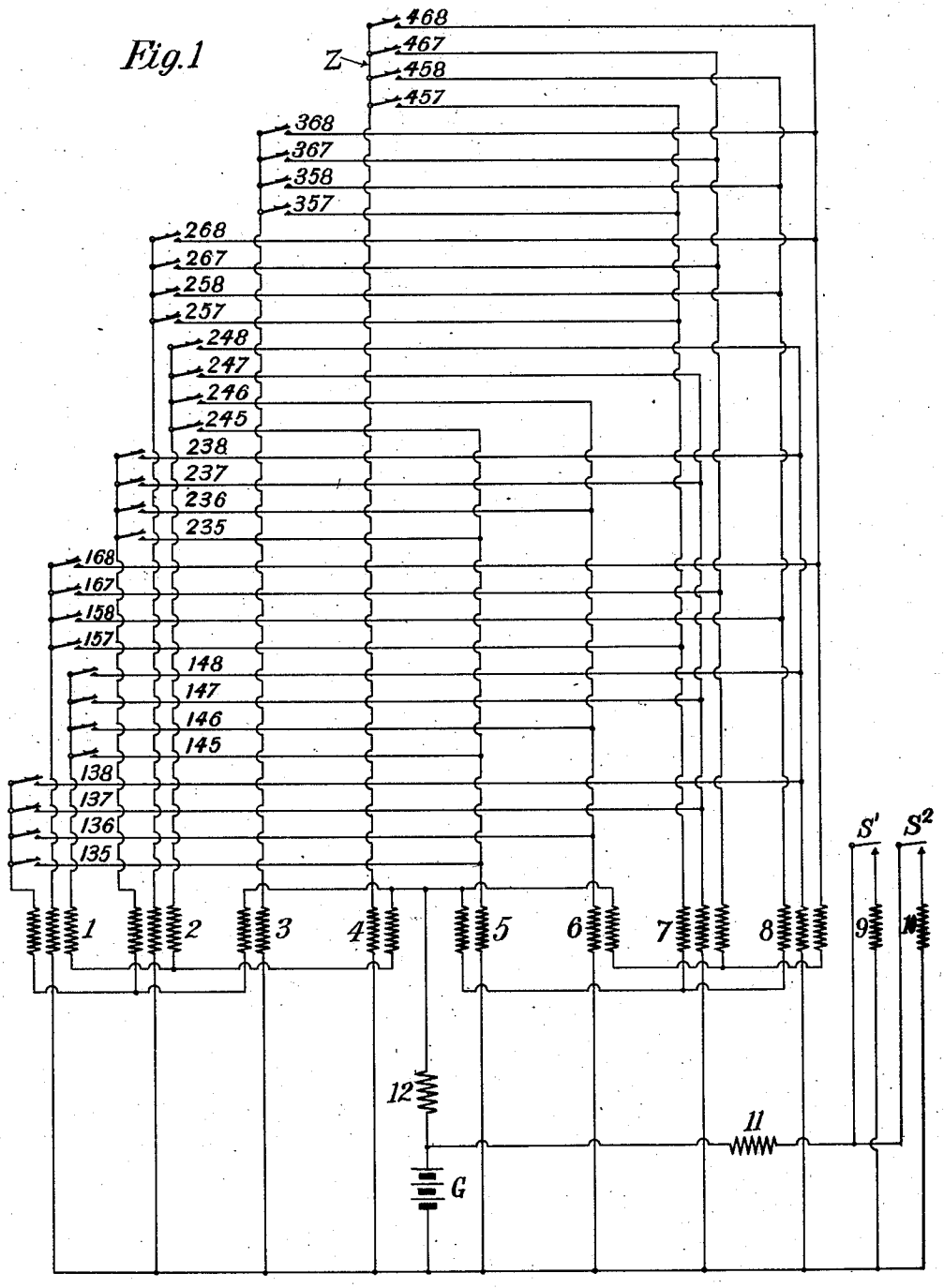
TRANSMITTING APPARATUS FOR TELEGRAPH SYSTEMS.

APPLICATION FILED JULY 23, 1904.

1,010,413. Patented Dec. 5, 1911.

4 SHEETS—SHEET 1.

Fig. 1



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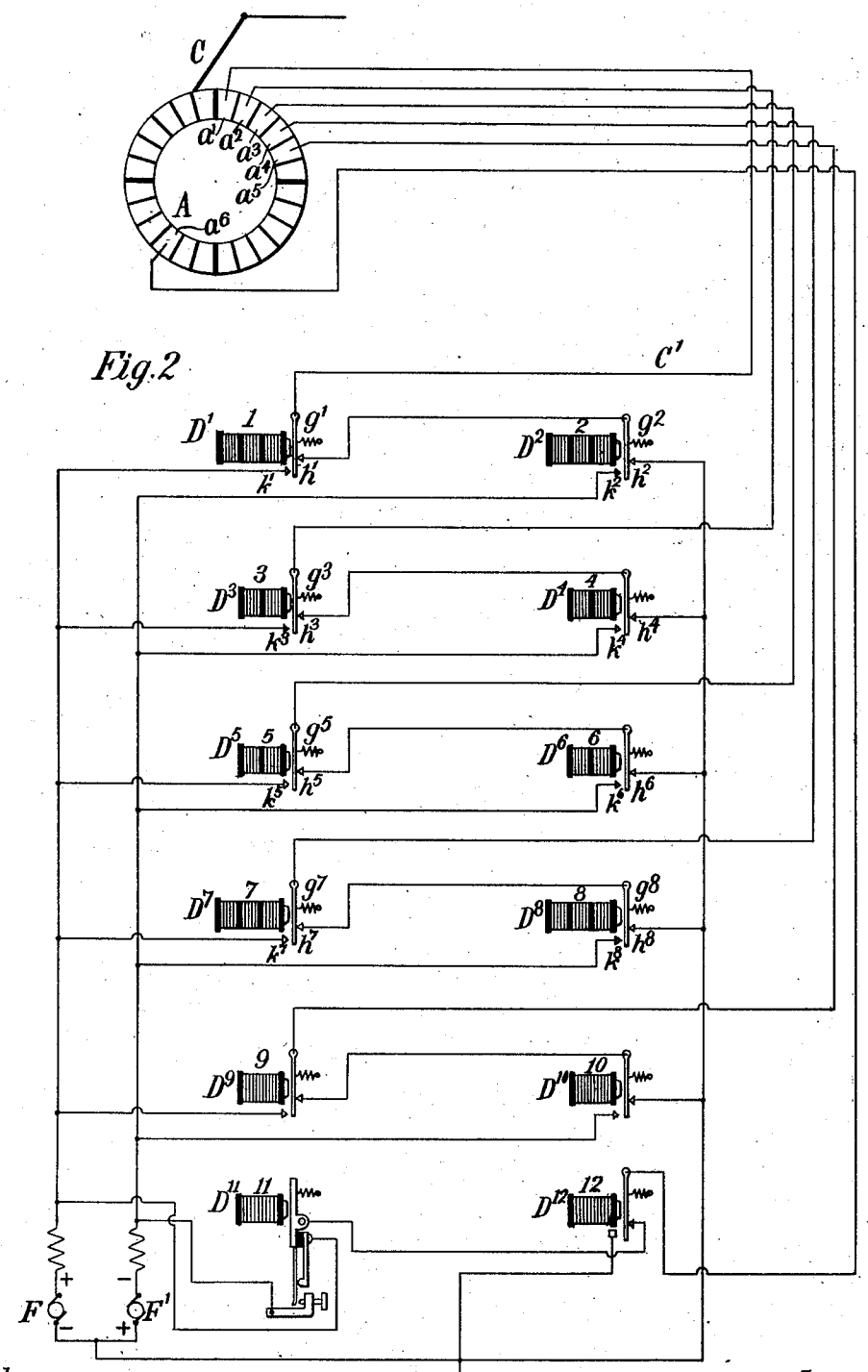
4 SHEETS—SHEET 2.

Fig.2



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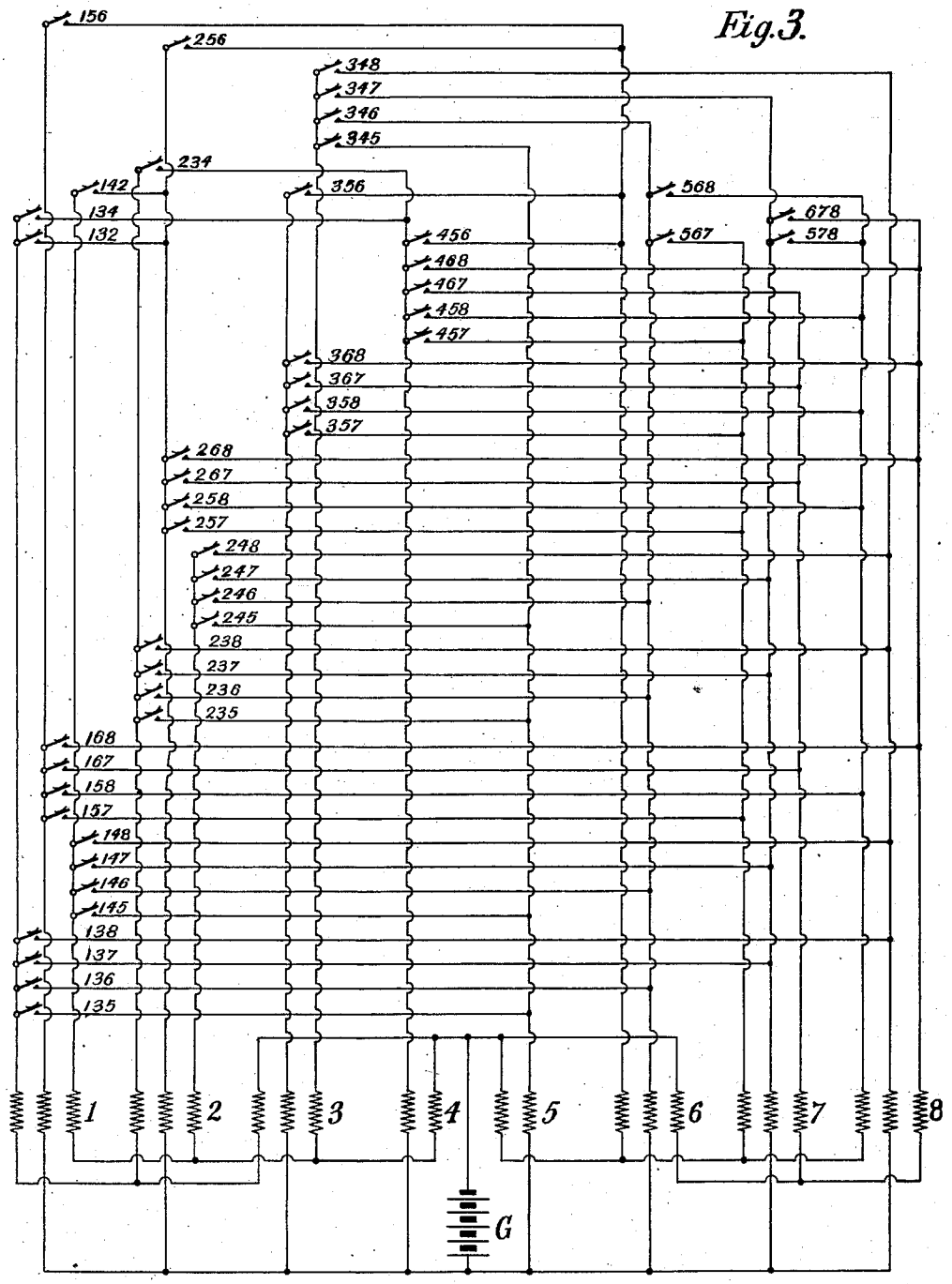
4 SHEETS—SHEET 3.

Fig. 3.



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4 SHEETS—SHEET 4.

Fig. 4.

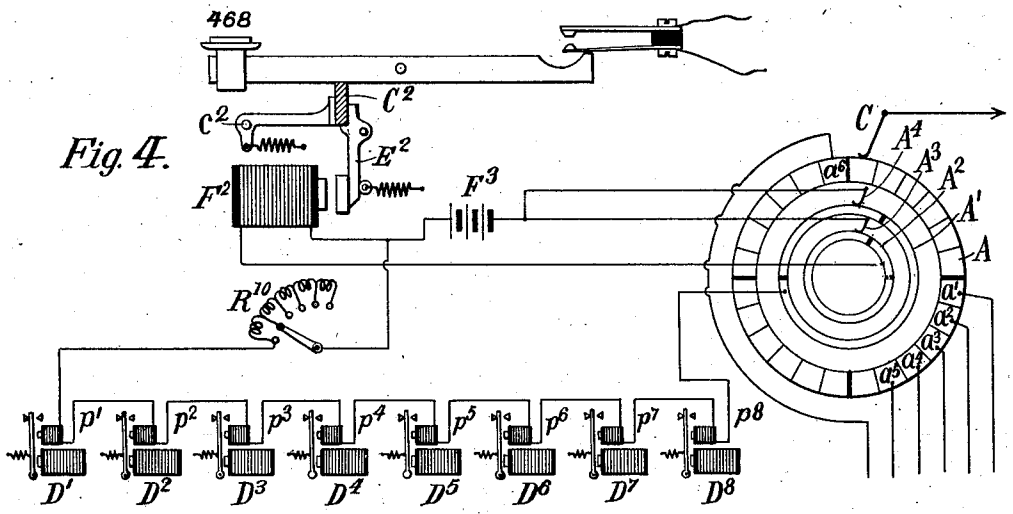
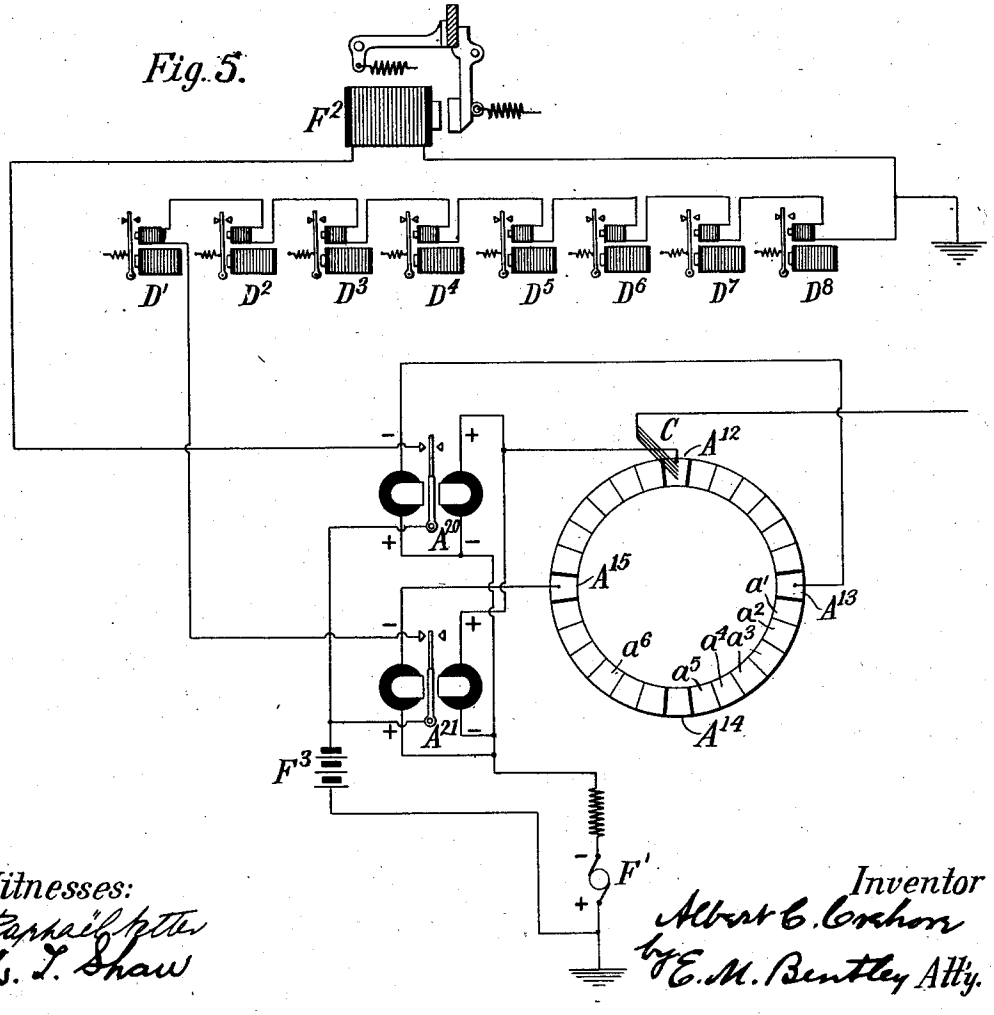


Fig. 5.



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TRANSMITTING APPARATUS FOR TELEGRAPH SYSTEMS.

1,010,413. Specification of Letters Patent. Patented Dec. 5, 1911.

Application filed July 23, 1904. Serial No. 217,756.

To all whom it may concern:

Be it known that I, ALBERT C. CREHORE, a citizen of the United States, residing at Yonkers, county of Westchester, State of New York, have invented certain new and useful Improvements in Transmitting Apparatus for Telegraph Systems, and in pursuance of the statute I have set forth in the accompanying drawing and specification as an illustration of the invention that form thereof which I now regard as the best one of the various forms in which the principle of the invention may be embodied.

In the drawings Figures 1 and 2 show in diagram the arrangements at the transmitting station, Fig. 3 is a modification, Figs. 4 and 5 show a locking device for controlling the time of operation of the keys.

My invention relates to a transmitter for a system of telegraphy in which the principal object is first, to transmit messages by means of a keyboard arranged like the keyboard of an ordinary typewriter—each button operating a circuit closer. In Letters Patent 773,198, granted to me October 25, 1904, I have shown and described such a system and made claim thereto and to its several parts excepting the transmitter which was held by the Patent Office to constitute a separate invention not claimable therein. In the present application I make claim only to the transmitting apparatus thereof. I have also added the locking arrangement shown in Figs. 4 and 5, as a part of said apparatus.

I do not undertake, in my present disclosure, to show the details of the transmitting keyboard, but simply indicate a series of circuit closers which may, in ways well known to the art, be arranged in keyboard form with a button for each of the circuit closers.

By the use of the shift-keys I am able to transmit as many as ninety different characters, using three cases of thirty each, with two shift-keys. This number may be increased if desired by an extension of the principles hereinafter described.

Referring to the drawings, A of Fig. 2 represents the synchronous sunflower at the transmitting station, and one-quarter of said sunflower is assigned to each one of four distinct systems which make use of the main line simultaneously. Each quarter of the sunflower is divided into six segments, these six segments being utilized, in one of the four transmission systems, to provide the combinations necessary to operate my selective arrangement by which any desired key at the transmitting station will control a corresponding magnet at the receiving station. The segments at sunflower A are lettered a^1, a^2, a^3, a^4, a^5 and a^6 respectively.

It will be understood that the segment a^1 will be connected at the proper moment with the trailing brush C to close a special circuit through special apparatus at the transmitting station. In like manner segments a^2 will next be connected to the line and establish a different circuit. The succeeding segments will, in the same way, be connected up in order. This will manifestly provide six transmitting circuits acting successively and producing a comparatively small number of elementary effects which may be combined in different ways to give a much greater number of composite differential effects controllable at the sending station and each operating at the receiving station a specified part of the apparatus. I prefer to assign two of the six to special purposes, to-wit, a^5 to the operation of shift-keys and (placed apart from and opposite to the others) a^6 to the operation of the release magnets hereinafter described. This leaves the four segments a^1, a^2, a^3 and a^4 which may be utilized for transmitting the letters, punctuation marks, etc., and, since I utilize reversed currents with each of the four segments, I in effect multiply the number of elements to be combined by two giving eight elements in all assignable to letters and other characters. I find that if these eight elements are combined in groups of three each there are fifty-six possible combinations which might be made, but for a reason which will be hereinafter mentioned, I utilize, in the particular form I am now describing, but thirty-two of these fifty-six possible combinations. That is to say, I find that, by transmitting, at each rotation of the trailing brushes C, three current impulses over any chosen three of the four segments a^1, a^2, a^3 and a^4 respectively, I may thereby select and operate at the receiving station any chosen one of a series of thirty-two magnets, the magnet chosen corresponding to the particular group of three sunflower segments selected at the transmitting station, and to the transmission there-

through of either a positive or negative impulse, and, since there are thirty-two available combinations of three segments with either a positive or negative impulse over each, I may select and operate any desired one of the thirty-two magnets of a receiver and so cause the magnet to print on the receiving typewriter any desired character assigned to it. In other words, the transmission of three impulses is required to select and operate each of the thirty-two receiving magnets.

Referring to Fig. 2 I will now begin the explanation of the method of selection at the transmitting station. On the sunflower A each of the segments a^1, a^2, a^3, a^4 is connected to two independently controlled transmitters by which either a positive or negative impulse may be delivered to the segment, these transmitters being lettered respectively D^1, D^2 . . . D^8. The transmitters are also capable of producing three conditions on each sunflower segment, to-wit, the transmission of a positive current, the transmission of a negative current and the transmission of no current with line connected to ground. The third condition is the normal one, while either of the other two conditions may be produced according as one or the other, of the two transmitters provided for each segment, is operated. Each transmitter has an operating magnet in a local circuit controlled, as will be explained, by the finger of the operator. Referring to the transmitters D^1 and D^2, both of the contact levers g^1, g^2 are shown in their normal position, held by their springs against their back stops h^1, h^2 which are connected to each other, through the lever g^2, and to ground E. The respective positive and negative terminals of the dynamos F F^1 are connected to the front stops k^1, k^2, &c., the other dynamo terminals being connected to ground E. The lever g^1 is connected to the line c^1 extending to sunflower segment a^1 and thus, in the condition shown, the line c^1 is connected directly to the ground and the circuit of both dynamos is open. If, however, the lever g^1, operated by the magnet 1 of transmitter D^1, is attracted, a positive current from dynamo F will flow through the front stop k^1, the lever g^1 and line c^1 to segment a^1 and thence to the main line, whenever the trailing brush C comes in contact with said segment a^1. In a similar manner, when the lever g^2 operated by magnet 2 of transmitter D^2 is attracted, a negative current will be transmitted from dynamo F^1, through front-stop k^2, lever g^2, opposite back-stop h^1, lever g^1 and thence over the same route, and it is manifest that, if any three of the transmitter levers are simultaneously attracted and maintained attracted while the trailer C is passing over the sunflower segments, there will be three impulses transmitted in succession over the main line. It should be noted, however, that both transmitters pertaining to any one of the four segments, cannot be operated at the same time, because it is impossible to send simultaneously both a positive and a negative impulse on the same line. It is for this reason that the fifty-six possible combinations of eight elements in groups of three are reduced to thirty-two available combinations which may be utilized in this form of my system.

The foregoing arrangement of transmitters may be utilized in other systems than the one particularly described herein. It is suitable for any situation wherein there is a line wire that comes to the transmitter either through a sunflower, or more directly, and on which it is desired to produce the three named conditions of either a positive or negative current or no current. It is particularly suited to such a situation when it is also desired to produce, as in the present case, the aforesaid three conditions on a multiplicity of different line wires without employing more than two generators and without short-circuiting either generator under any normal working condition. In general this arrangement comprises the two contact levers each having front and back contacts, one lever being connected to the line and the second lever being connected to one of the contacts of the first one. Of the three remaining contacts one is connected to ground and the other two to the respective generator terminals. Thus in the normal, or no-current, condition, the line is connected to ground through circuit-breaking devices which are operated and the ground connection broken every time that the line is connected to either generator terminal, while such connection to one generator terminal breaks the circuit leading to the other generator terminal to prevent a short-circuit. It also provides for the grounding, and consequent discharge after the transmission thereon of a current impulse of either polarity.

It is evident that there are eight magnets provided for operating the eight transmitters and if the circuit of each of the eight magnets were provided with a circuit-closer or key, a skilled operator could manually use these eight keys in transmitting, depressing three of them at a time for each letter, and learning by practice which three to depress for each respective letter. I have devised a combination of circuits by which the closing of a single contact key, corresponding to a definite letter, or character, will energize the three transmitter magnets which correspond to that letter or character. The leading feature of this arrangement is the provision of two or more energizing coils on each of the transmitter magnets, each coil being capable

of energizing the magnet and causing the operation of its contact lever, while the several coils are contained in separate circuits from the battery, and the circuits so arranged that the single operator's key assigned to a particular character may control the three magnets which have to be energized for such character. Thus it appears from Fig. 2 that transmitter magnet 1 has three energizing coils and magnets 2, 7 and 8 have likewise three coils each, while magnets 3, 4, 5 and 6 have two coils each.

Turning to Fig. 1, which shows the local circuits through which the transmitters are controlled, G is a battery from which the transmitter magnets 1–8 are energized under the control of thirty-two keys numbered respectively according to the three magnets which they control. The magnet 12 (see Fig. 2) is included in series with battery G, in that part of the battery circuit which is common to all of the group of magnets 1–8 so as to be operated every time that any one of the thirty-two keys is operated, the function of this magnet being described hereinafter. It may also be mentioned for future reference that the same battery G also serves for the operation of similar transmitter magnets 9 and 10 (see also Fig. 2) which operate the transmitters D^9 and D^{10} and are controlled respectively by the operator's keys S^1 and S^2, while it may be further noted that the circuits of these magnets 9 and 10 are connected directly to the battery G through the magnet 11 of a transmitter D^{11} but without including the aforesaid magnet 12. As already mentioned this group of transmitters D^9, D^{10}, D^{11}, D^{12} controls the transmission over the remaining sunflower segments a^5 and a^6, which are assigned to the operation of the shift-keys of the receiver, and to the releasing magnets of the receiver.

It is not necessary to follow out in detail each one of the circuits from the battery G through the several coils of the group of transmitter magnets 1–8, but, for example, we may assume the operator's key 135, representing—say the letter S, to be depressed and, by tracing the circuits from that key, it will be found that it serves to energize coils in the corresponding transmitter magnets 1, 3 and 5 in series, all of the other coils being open-circuited at the time. In like manner key 267, representing some other character, may be depressed. By following the circuits it will appear that coils will be energized in transmitter magnets 2, 6 and 7 while all the other coils remain on open circuit. By this arrangement I require but one contact for each key, although by means of that one contact I energize three different magnets, each key automatically selecting the group of three magnets which corresponds to the character which the key is to transmit, while the magnets in turn connect either a positive or a negative dynamo terminal to the corresponding three of the four segments a^1, a^2, a^3, a^4 of the sunflower. The synchronous rotation of the sunflower is sufficiently rapid for the trailer C to pass over the three energized segments while the key is depressed, and will transmit three impulses in succession over the main line and at the receiving station deliver them to suitable apparatus which need not be here described.

It remains to explain the operation of the shift-keys for printing capitals and figures respectively, as in ordinary typewriter operation. It is manifest that, I might assign two of the thirty-two magnets which I have provided for printing letters and punctuation marks, to this duty, but at the sacrifice of those two magnets for their described function, or I might enlarge the number of combinations by working with groups of four instead of three, but I prefer to employ a separate segment on the transmitting and receiving sunflowers for shifting, since, as will be explained, I thereby require but two key-movements to print a capital or figure just as in the present type-writers, a single retained depression of the shift-key serving to set and maintain the apparatus in condition for capital or figure printing—so long as the corresponding shift-key is held down. Referring to Fig. 1, S^1 and S^2 are the shift keys for capitals and figures respectively, both acting like the letter keys to close a circuit from battery G, the former through transmitter magnet 9, coördinate with transmitter magnets 1 to 8, and the latter through a similar magnet 10. Both 9 and 10 are in series with a release transmitter magnet 11, corresponding to magnet 12.

Magnets 9 and 10 act on transmitters D^9 and D^{10}, similar to D^1, D^2, &c., by which either a positive or negative generator terminal is connected to sunflower segment a^5 according to whether 9 or 10 is energized.

Referring to Fig. 3, the arrangement at the transmitting keyboard will be found to be essentially similar to that already described, but instead of utilizing only thirty-two of the possible combinations of eight coils arranged in groups of three, I find that it is possible, without employing more than three coils upon any one of the transmitter-magnets, to utilize forty-eight of the fifty-six possible combinations, while, by extending the same arrangement, so as to provide four coils on some of the magnets, the entire fifty-six combinations may be utilized. I have, however, shown herein only forty-eight, which will ordinarily be adequate for this form of the invention. It will be unnecessary to describe Fig. 3 in detail, since it is like Fig. 1, with the exception that a third coil has been added to magnets 3 and

6 which in Fig. 1 contain but two coils each. By combining these additional coils with the others, according to the principles already explained, I am enabled to add sixteen keys to the thirty-two found in Fig. 1 and I have arranged these keys in a separate group at the top of the figure. By this means I have forty-eight keys, or if desired fifty-six keys, on my transmitting keyboard, each having but a single contact and yet each serving to operate three of the transmitter magnets, the three operated by one key being different from any other group of three operated by any of the other keys. I have designated the additional keys in Fig. 3 by the three numbers corresponding to the three transmitters controlled by the keys respectively.

In all of the foregoing arrangements it is required that, after the depression of the key by the operator to select the three impulses corresponding to the character transmitted, there shall be no depression of a second key until the trailer shall have passed over the selected segments (to receive therefrom the three impulses which they have been made ready to transmit) and shall also have passed over the unlocking segment, which resets the apparatus for the transmission of another character. This requirement detracts from the highest possible speed of transmission, since it practically involves two rounds of the trailer for each character. I have, therefore, provided an arrangement whereby the depression of a key can occur only at one definite point in the rotation of the trailer, this point being sufficiently in advance of the transmitting segments to permit the selection and operation of the transmitter magnets by the key, and the consequent connection of the three selected segments to the battery, before the arrival of the trailer at the segments thus energized. I moreover provide that the depression of the key need be but momentary, the operator being free from the necessity of holding the key down until the trailer shall have reached the transmitting segments. This arrangement is illustrated in Figs. 4 and 5. In the first place, I lock all the keys mechanically and maintain them locked except when the trailer is at the specified position.

Referring to Fig. 4, A represents the sunflower heretofore described, while A^1 and A^2 represent two contact rings operated synchronously with the sunflower and corresponding to the set of segments $a^1 \ldots a^6$ which are supposed to be operating. Each of the three remaining sets of segments corresponding to other transmission systems will each be similarly provided with two contact rings. Ring A^1 has a brush A^4 bearing thereon and a similar brush A^3 bears upon ring A^2. The latter ring is insulated from all electrical connection except for a short section shown as occupying nearly a quarter of its circumference and connected to one terminal of a battery F^3 through a magnet F^2. The other terminal of the battery is connected to the brush A^3. In like manner the ring A^1 has an active segment which occupies however about three-quarters of the circumference of the ring and is likewise connected to one terminal of the battery F^3 through a series of small magnets P^1 P^2 . . . P^8 which respectively supplement the transmitter magnets $D^1, D^2 \ldots D^8$ and act upon the same armatures. The magnet F^2 when energized attracts its armature E^2 upon which is a latch normally resting under a cross bar C^2 which extends beneath the entire series of keys and locks them all against depression. For example, the key shown is that numbered 468 and is of the kind ordinarily found in typewriters. The cross bar C^2 is pivoted on lever arms centered at c^2 in a manner well known in typewriter construction. It is manifest that all of the keys will be locked against depression except during the time that the magnet F^2 is energized and therefore holding the latch withdrawn from the locking cross-bar C^2. This energizing of the magnet F^2 occurs while the short energized section of the ring A^2 is passing under the brush A^3 and this will take place at a point in the rotation of the sunflower and contact rings somewhat in advance of the time of arrival of the trailer C at the said operating segments $a^1 \ldots a^6$. At this unlocked period the operator is free to depress his key and so select the three desired segments before those segments are reached by the trailer C. Experience proves that the operator readily accommodates himself to this arrangement, merely pressing upon the key until he feels that it is released and free to make its stroke. In order, however, that he may not have to continue his pressure on the key until the apparatus at the receiving station has completed its functions, I provide in the second place the eight supplementary magnets aforesaid P^1, P^2 . . . P^8 which are energized simultaneously with the energizing of magnet F^2 by the arrival of the brush A^4 at the active portion of the ring A^1. They remain energized, however, for a longer time than F^2, in fact, during a considerable portion of the rotation of the trailer—at least until the trailer has passed the operating and releasing segments.

The supplementary magnets are carefully adjusted in strength by means of the rheostat R^{10} to a point where they are unable to attract their armatures away from the back stops but are strong enough to hold their armatures after they have been attracted by the more powerful magnets $D^1 \ldots D^8$. It is manifest that the three transmitter magnets which have been originally energized by the

depression of key 468 will have their armatures retained by the supplementary magnets so long as the brush A^4 is on the active part of the ring A^1 or until the trailer has passed over the operating segments. All of the other transmitting magnets will, however, remain un-energized with their armatures on the back stops and will not have their armatures attracted by the weak supplementary magnets. It is therefore only necessary for the operator to momentarily depress his key at the time of its release, this action being just like that of an ordinary typewriter. The effect of such depression, to-wit, the selection and energizing of three transmitting segments, is automatically prolonged or continued by the supplementary magnets for the necessary period and it is no longer needful for the operator himself to cause such a continuation of the effect by holding down his key.

It is not necessary that the contacts which control the locking and retaining devices just described should be on a separate part of the sunflower. It is quite possible to employ for this purpose certain of the ordinary segments and I have shown in Fig. 5 how this can be done, using the line trailer C and the line current to operate polar relays which control the circuit of battery F^3 that extends through the supplementary magnets and the locking magnet F^2. The sunflower A is provided with four special segments A^{12}, A^{13}, A^{14}, A^{15}. One of these precedes and another follows each of the four transmission systems served by the sunflower. For example A^{12} serves to excite both the locking and the supplementary magnets, while A^{13} serves to deënergize the former (thereby relocking the keys) and A^{15} to deënergize the latter after the trailer C has passed the segment a^6.

A^{20} and A^{21} are polarized relays controlling respectively the locking and the supplementary magnets. When trailer C is on A^{12} the line current from one of the generators—say F^1—passes through one of the coils of each relay and carries them both to close their respective local circuits. When the trailer is on A^{13} the line current passes through the opposite coil of relay A^{20} and causes it to open its local circuit and when it is on A^{15} the current passes through the opposite coil of A^{21} and causes it to open its local circuit. Hence the keys are unlocked while the trailer moves from A^{12} to A^{13} and the supplementary magnets are energized while it moves from A^{12} to A^{15}. This is the arrangement for only one of the four sets of working segments, to-wit: those lettered a^1, a^2, a^3, a^4, a^5. The similar relays for the other sets will be correspondingly circuited.

It will be manifest that with the automatic locking of the keys and automatic retention or prolongation of the effect of their depression, the magnet 12, Figs. 1 and 2, need no longer be employed in series with the relay magnets. I prefer, however, to retain it with certain keys which will be operated as first described; that is, they will be held depressed so long as action is desired. For example, I assign two keys—for instance 467 and 468—to the operation of the carriage of the typewriter at the end of the line or at other times when it is desired to work the carriage back and forth and I then insert the magnet 12, Fig. 1 at the point Z where it will be in series with those two keys only and with no others. In this situation the action can be continued long enough to permit the travel of the carriage from side to side of the machine and the apparatus finally released and arrested after the key is allowed to rise.

What I claim as new and desire to secure by Letters Patent is:

1. In a multiple telegraph transmitter, the combination with a line wire, of a series of electrical contacts, part transmitting positive and part transmitting negative impulses to said line wire, a series of operating magnets for said contacts respectively, each magnet having a plurality of coils, a series of operating circuits for said magnets each containing two or more of said coils, and a key-board composed of keys controlling the said operating circuits respectively.

2. In a multiple-telegraph transmitter, the combination with a line wire, of a transmitting apparatus therefor comprising synchronous means for connecting the line wire with a series of local transmitting lines in succession, a normally connected ground for each of said local lines, a corresponding series of contacts controlling the said local lines respectively, a series of operating magnets, one for each said contacts, and a key-board composed of a series of transmitting keys each controlling simultaneously two or more of said magnets.

3. In a transmitting apparatus for multiple telegraphs, the combination with a series of normally grounded electric conductors at the transmitting station, of generator terminals of opposite polarity to be connected to said conductors at said station, a circuit-breaker for each ground connection, two circuit-closers for each conductor for connecting it with either generator terminal, a series of operating magnets one for each of said circuit closers operating also the said circuit breakers, and keys controlling said magnets.

4. In a multiple telegraph transmitter, the combination with a line conductor and two generator terminals of opposite polarity to be connected one at a time to said conductor at a transmitting station, of a circuit-closer between each of the two generator terminals and the said conductor, one

of said circuit-closers being in series with a circuit-breaker in a ground connection controlled by the other closer.

5. In a transmitting apparatus for multiple telegraphs, the combination with a transmitting conductor normally grounded, of two generator terminals of opposite polarity to be connected one at a time to said conductor at a transmitting station, and two circuit-closing switches one having its opposite contacts connected to the said conductor and to one of the said terminals respectively, and the other having its opposite contacts connected respectively to the other generator terminal and to a circuit-breaker for the ground connection controlled by the other switch and connected to the said conductor.

6. The combination with an electrical conductor, of two generator terminals of opposite polarity to be connected one at a time with said conductor at a transmitting station, two circuit-closers each intervening between one of said terminals and the said conductor, operating magnets for the said circuit-closers respectively, and a grounded circuit-breaker in series with one circuit-closer and controlled by the other.

7. In a transmitting apparatus for multiple telegraphs, the combination with an electric conductor normally grounded, of two generator terminals of opposite polarity to be connected one at a time to said conductor, two circuit closers for said terminals respectively, a magnet for each circuit closer having a plurality of coils in separate circuits, key-board composed of keys controlling the said circuits and means for breaking the ground connection.

8. The combination in a system of electrical communication of two independently controlled contact-levers each having front and back contacts of which one is connected to ground, a line wire connected to one lever, a connection from the second lever to one of the contacts of the first lever and two sources of electromotive force of opposite polarity connected on the one hand to the two remaining contacts respectively and on the other hand to the ground.

9. Means for producing in a closed circuit electric current in either direction or no current, which comprises in combination two contact levers, a line connection therefor, a normally-closed ground-connection containing a circuit-breaker, two sources of electromotive force of opposite polarity, a ground connection and means for independently operating said levers to connect either source of electromotive force to the line wire.

10. The combination with two sources of electromotive force of opposite polarity, of a ground connection on one side thereof, a plurality of branch circuits from each of the opposite terminals of said sources, two contact levers for each branch, a line connection for each branch normally grounded outside of the said sources of electromotive force but containing a circuit breaker, and means for independently operating either of said contact levers simultaneously with said circuit-breaker, whereby any one of said line connections may be disconnected from its normal ground and grounded through either one of said sources of electromotive force.

11. The combination with a series of transmitting contacts, of a corresponding series of magnets one for each contact, each magnet having a plurality of coil sections, a series of circuits each containing two or more of said coil sections located respectively on different magnets, and a key-board composed of keys controlling the said circuits respectively.

12. The combination with a series of transmitting contacts, of a corresponding series of operating magnets therefor, each containing two or more coil sections, a series of circuits each containing in series two or more of said coil sections located respectively on different magnets, and a key-board composed of keys controlling the said circuits respectively.

13. In a transmitter for multiple telegraphs the combination with an electric line conductor normally grounded at the transmitting station, of generator terminals of opposite polarity to be connected one at a time at said station to said conductor, a circuit closer between each generator terminal and the said conductor, an operating magnet for each circuit closer, and means for breaking the normal ground connection simultaneously with the operation of each circuit closer.

14. In a transmitter for multiple telegraphs, the combination with a synchronous sunflower at a transmitting station, of a line wire, a series of local lines extending from said sunflower and connected to the trailer thereof in succession, a normally connected ground for each of said local lines, transmitters in the said local lines respectively, operating magnets one for each of said transmitters, and a key-board composed of a series of keys, each controlling a definite portion of said magnets.

15. In a transmitter for multiple telegraphs, the combination with a synchronous sunflower at the transmitting station, of a line wire, a series of lines extending from said sunflower, a normally connected ground for each of said local lines, transmitters in said local lines respectively, means for simultaneously operating a group of said transmitters and for successively connecting the lines containing the operated transmitters to the line wire, and locking devices for said means limiting the time of opera-

tion thereof with respect to the rotation of the sunflower.

16. The combination with a synchronous sunflower and a line wire, of a series of local lines connected to respective segments of the sunflower, a normally connected ground for each of said local lines, transmitters in the respective local lines, magnets for operating said transmitters, controlling keys for said magnets and a locking device for the keys timed with respect to the rotation of the sunflower so as to permit their operation at a specified point in said rotation.

17. The combination with a synchronous sunflower and a line wire, of a group of two or more local lines connected to respective sunflower segments, a normally connected ground for each of said local lines, transmitters in said local lines, means for operating said transmitters and a locking device for said means set to unlock at a point of time in advance of the time at which the said line wire is connected to the said segments of the sunflower.

18. The combination with a synchronous sunflower and a line wire connected to the trailer of the sunflower, of two or more local lines connected respectively to a group of sunflower segments, a normally connected ground for each of said local lines, transmitters in said local lines, operating devices for said transmitters and means for limiting the action of said devices to a period of time covering the period when the controller of the sunflower is in contact with the said sunflower segments.

19. In a transmitter for multiple telegraphs, the combination with a synchronous sunflower at the transmitting station and a line wire connected to the trailer thereof, of a series of local lines at the said station connected to a group of sunflower segments respectively, a normally connected ground for each of said local lines, transmitters in each of said local lines, and means for limiting the time of action of said transmitters to a period of time covering the period in which the said trailer is in contact with said group of segments.

20. In a transmitter for multiple telegraphs, the combination with a synchronous sunflower at a transmitting station and a line wire, of a series of local lines at said station connected respectively to one of a series of groups of sunflower segments, a normally connected ground for each of said local lines, transmitters in said local lines, and means for limiting the time of action of said transmitters, said means being controlled by the sunflower.

21. In a transmitter for multiple telegraphs, the combination with a synchronous sunflower at a transmitting station and a line wire, of a series of local lines at said station connected respectively to one of a series of groups of sunflower segments, a normally connected ground for each of said local lines, transmitters in said local lines, means for limiting the time of action of said transmitters with respect to the rotation of said sunflower, and a segment of the sunflower controlling the said means.

22. In a transmitter for multiple telegraphs, the combination with a synchronous sunflower at a transmitting station and a line wire, of a series of local lines connected respectively to one of a series of groups of sunflower segments, a normally connected ground for each of said local lines, transmitters in said local lines, an electromagnet controlling the time of action of said transmitters with respect to the rotation of the sunflower, and a segment on the sunflower controlling the said magnet.

23. The combination with a synchronous sunflower of a line wire, of a series of local lines connected respectively to a group of sunflower segments, a normally connected ground for each of said local lines, transmitters in said local lines, locking devices controlling the time of action of said transmitters with respect to the rotation of the sunflower, and means for releasing the said locking devices to permit the operation of said transmitters at a point of time in advance of the time at which the said line wire comes into communication with the said sunflower segments.

24. In a transmitter for multiple telegraphs, the combination with a synchronous sunflower at a transmitting station and a line wire, of a series of local lines connected respectively to one of a series of groups of sunflower segments, a normally connected ground for each of said local lines, transmitters in said local lines, means for operating said transmitters, a lock for said means, an electromagnet operating said lock, and a segment on the sunflower controlling the circuit of said magnet.

25. The combination with a synchronous sunflower and a line wire, of a series of local lines connected to the respective segments of the sunflower, a normally connected ground for each of said local lines, transmitters in the respective local lines, means for operating said transmitters in groups, a key controlling a specified group of transmitters and means for automatically prolonging the controlling effect of said key for a predetermined period of time.

26. The combination with a synchronous sunflower and a line wire, of a series of local lines connected to the respective segments of the sunflower, transmitters in the respective local lines, a series of keys each controlling the operation of a group of transmitters, supplementary magnets for retaining the selected group of transmitters in their operating position, and a contact on the sun-

flower controlling the supplementary magnets.

27. The combination with a synchronous sunflower and a line wire, of a series of local lines connected to the respective segments of the sunflower, transmitters in the respective local lines, a magnet for each transmitter, a series of keys each controlling a group of the said magnets, and means for prolonging the action of the magnets after the momentary operation of the keys.

28. The combination with a synchronous sunflower and line wire, of a series of local lines connected to the respective segments of the sunflower, transmitters in the respective local lines, a series of keys each controlling a group of said transmitters, locking devices for permitting the selection and operation of the transmitters at a predetermined point in the period of rotation of the sunflower ahead of the point at which the sunflower connects the selected segments to line, and means for prolonging the operative condition of the selected transmitters until the controller of the sunflower has engaged the segments corresponding to the said transmitters.

29. The combination with a synchronous sunflower and line wire, of a series of local lines connected to the respective sunflower segments, transmitters in the respective local lines, a series of keys each controlling a predetermined group of transmitters, and two contacts on the sunflower, one controlling the time of permitted action of the keys and the other controlling the time during which the transmitters remain in the operative condition.

In witness whereof I have hereunto set my hand, before two subscribing witnesses, this 21st day of July 1904.

ALBERT C. CREHORE.

Witnesses:
G. W. HOPKINS,
L. T. SHAW.