C. E. BUELL.

INDIVIDUAL SIGNALING APPARATUS.

No. 248,137. Patented Oct. 11, 1881.

Fig. 1.

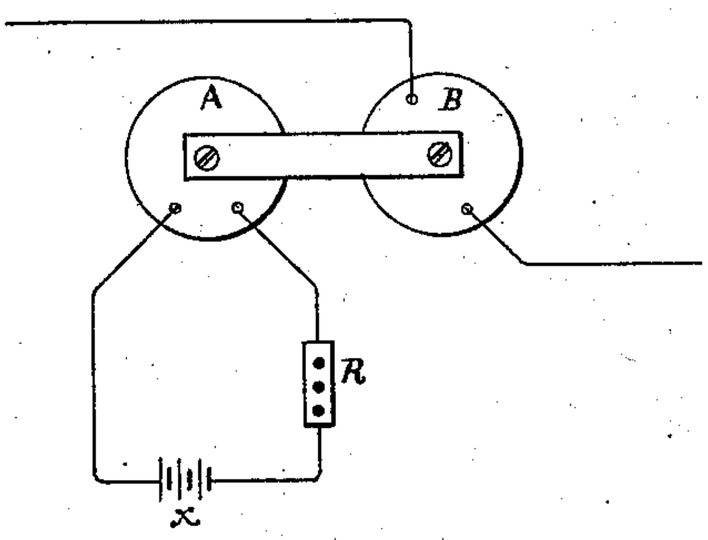


Fig. 2.

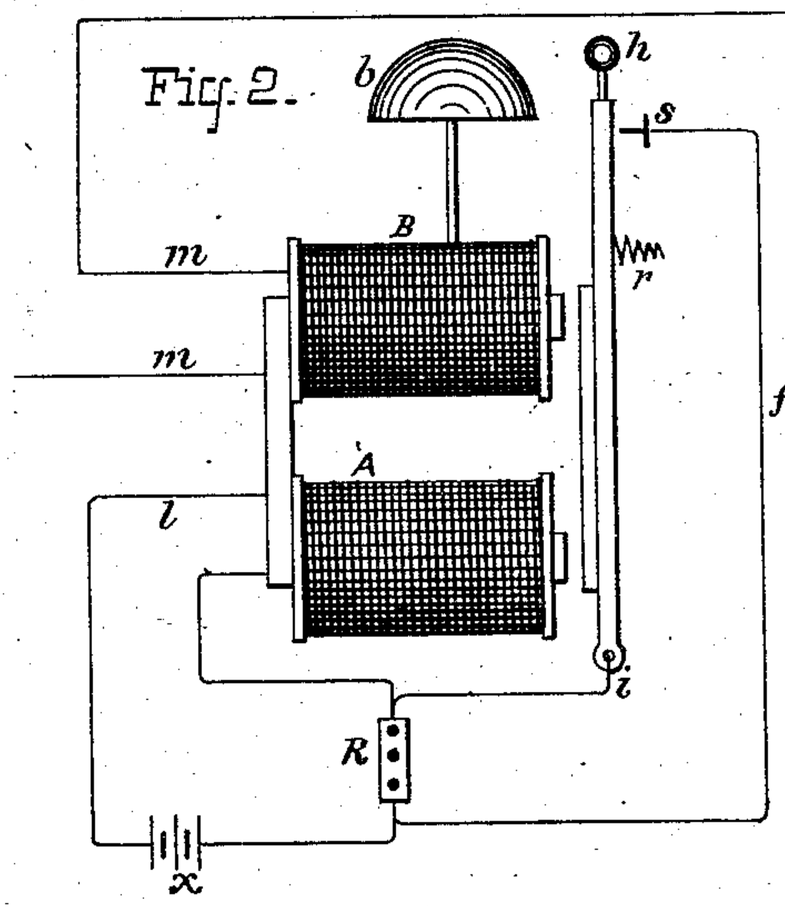


Fig. 3.

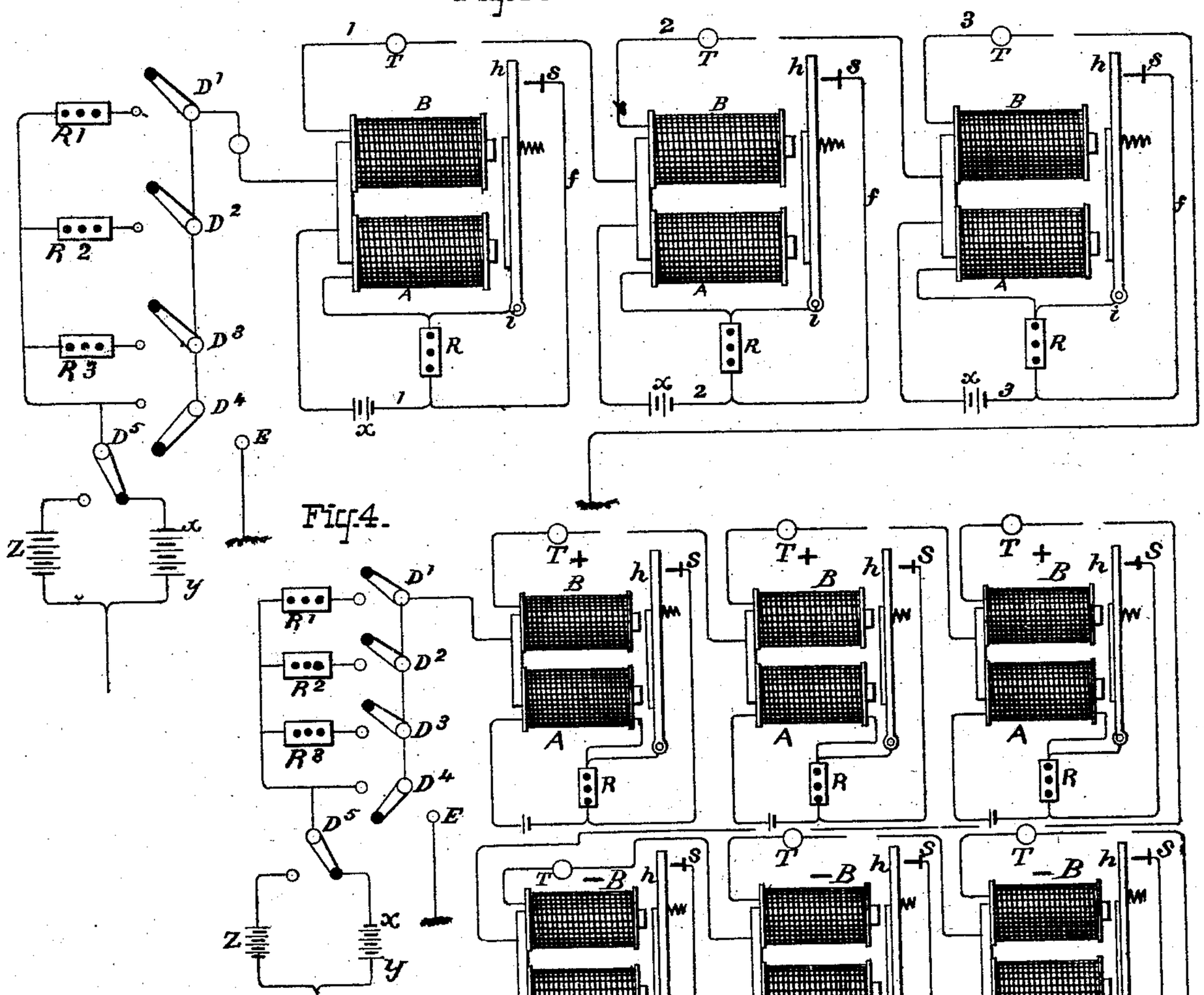
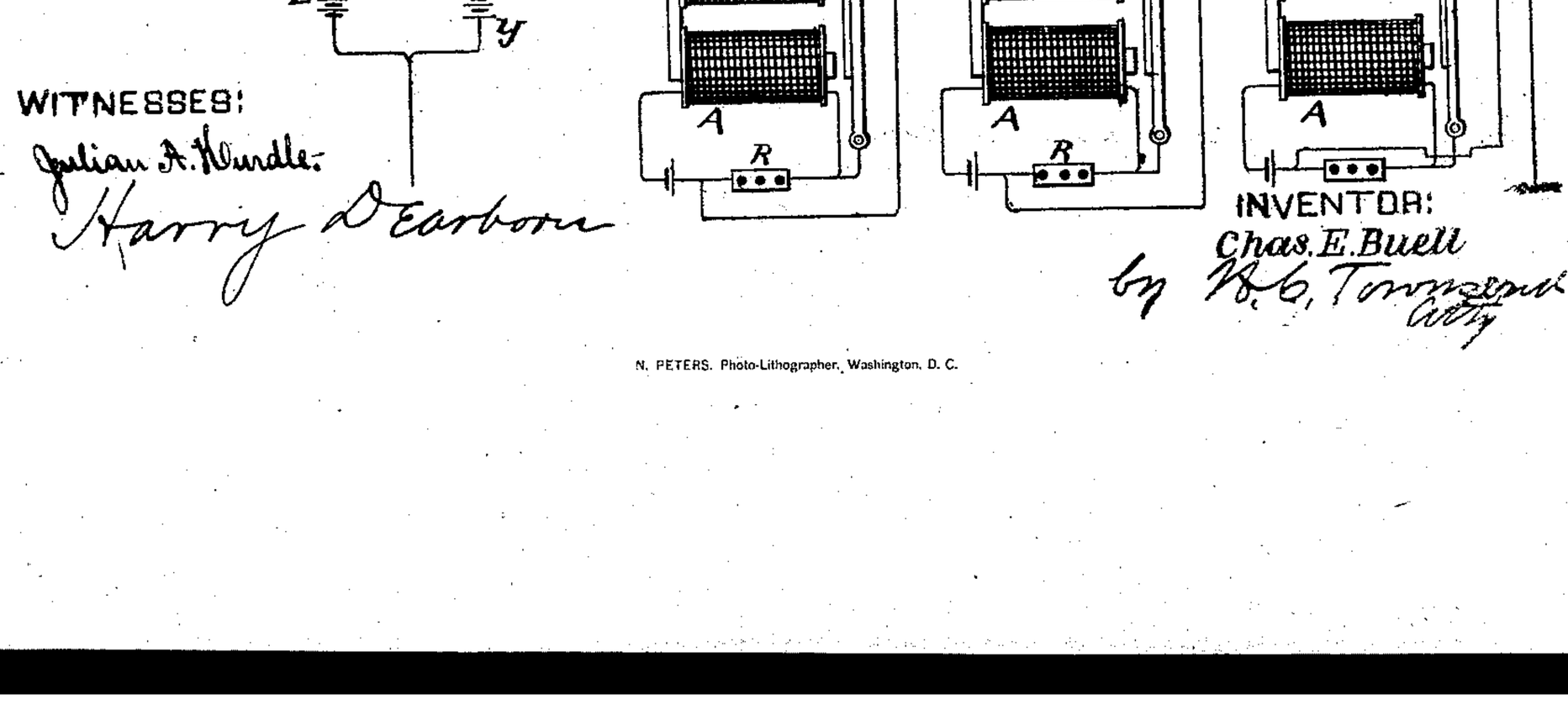


Fig. 4.



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UNITED STATES PATENT OFFICE.

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INDIVIDUAL SIGNALING APPARATUS.

SPECIFICATION forming part of Letters Patent No. 248,137, dated October 11, 1881.

Application filed April 21, 1879.

To all whom it may concern:

Be it known that I, CHARLES E. BUELL, of the city and county of New Haven, State of Connecticut, have invented certain new and useful Improvements in Individual Signaling Apparatus, of which the following is a specification.

The object of my invention is to call or signal any one of several stations in the same electric circuit without the call or signal being produced at any station other than the one for which it is intended.

My invention is applicable to those modes of individual signaling which depend upon step-by-step mechanism actuated or controlled by electro-magnets, to those calls which depend for their action upon isochronous or vibratory motion due to magnetic changes, and to those calls which are made operative by definite and different variations of the circuit's tension for each, admitting of multiplying the number of stations in a circuit without a corresponding multiplying of the complicated parts of those systems.

The object of my invention may be accomplished by employing electro-magnets of ordinary construction with their armatures of different polarization, or differential electro-magnets with either neutral or polarized armatures, which may be made operative by a make and break of the circuit, or by varying the circuit's tension.

To describe my invention I have chosen the employment of electro-magnets with neutral armatures and made differential by the combined action of a local and main circuit, and made operative separately by varying the tension of the circuits to a different and definite degree for each, the tension of the local circuits being prearranged to correspond with the desired variations of the main circuit, so that but one electro-magnet can be made to respond to the manipulation of the main circuit at the same time.

In the drawings, Figure 1 is an end view of an electro-magnet and local circuit arranged as hereinafter described. Fig. 2 is a side view of a differential electro-magnet with a bell and vibrating bell-hammer carried by the armature. Fig. 3 is a diagram of a circuit having three stations whose bells are worked by currents of the same polarity, and provided with apparatus for varying the strength of the current to the required amount, and for changing the polarity, when necessary, in order to work the bells at other stations provided with oppositely-polarized apparatus. Fig. 4 shows a line provided with six stations, half worked by currents of one and half by currents of the other polarity.

In the accompanying drawings the same letters refer to corresponding parts in each.

Fig. 1 is an end view of an ordinary horse-shoe electro-magnet, one of whose arms, B, has a coil in a main-line circuit. The other arm is provided with a similar coil in a local circuit, with a battery, X, but so wound or with the poles of the battery so placed that the current flowing through it will exert an opposite magnetizing effect upon the magnet from that exerted by helix A. If, now, equal currents circulate through both coils, their magnetizing effects will be neutralized and the armature of the magnet would be retracted. If, however, the current strength in helix B be greater or less than in helix A, the armature will be retained in the one case by the preponderating effect of A. If two such magnets be arranged in the same circuit, the local coil of one exercising a magnetizing effect of, say, 2, and the local coil of the other an effect of 3, then the armature of the first will cease to be attracted when a current of sufficient strength to exercise a magnetizing effect of 2 is thrown upon the line, while the armature of the second will continue to be attracted, because of the preponderating effect of its local coil. Conversely, a line-current of a strength 3 will allow the armature of the second to fall back, while the armature of the first will be held up, because of the preponderating effect, in this instance, of the line-coil.

The armatures of both may obviously be held normally in contact with these front stops by allowing a current of a strength either of 1 or of 4 to circulate in the line-coils. This principle of action may theoretically be extended indefinitely. Six electro-magnets ar-

ranged on the same circuit would have their locals graduated to produce a definite magnetizing effect upon each relay, the amount being different for each. The armatures would be normally held against their front contacts by means of a line-current, producing an effect smaller or greater than that of any of the local coils. By placing to a line a battery-current of such strength that its effects will be equal, or approximately equal, to the local effect in any given relay, the armature of that relay would fall upon its back stop, while the armatures of all the other relays would be retained, because in some the main-line coils would have a greater and in others a less power than the locals, and in none of them would there be a balance of the magnetic forces, so as to allow the retracting-springs of the armature to act.

In Fig. 2 is shown an arrangement of circuits whereby the counterbalancing local battery may be used for producing a vibrating signal. A B is the electro-magnet, having independent coils.

X is a local battery, whose circuit is through the local coil.

R is a resistance for adjusting the current strength in the local coil to a definite and determinate amount.

b is a bell, and *h* a bell-hammer attached to an armature pivoted at *i*, and provided with the ordinary retracting-spring *r*. Shunt-wires from the local battery pass to the back stop, S, of the armature, and to the armature at *i*. The local coil is so wound, or the poles of the battery so placed in the circuit, that it will tend to neutralize the effects of the main-line coil upon the core of the electro-magnet. When the main-line current is at its normal, or when it is varied to the degree necessary to call other stations, the armature is held away from its back stop by the overbalancing effect of either the main or the local current. When the main-line current is of such a strength that it balances the local the core ceases to exert an attractive effect, and the armature is drawn against its back stop, thereby shunting the battery from the local coil, whereupon the main-line current acts without opposition, the armature is drawn up, breaking the shunt, and the operation is repeated, thus producing a vibrating movement of the bell-hammer.

In Fig. 3 I have shown three independent electro-magnets, and batteries, keys, and resistances for varying the main-line currents, so that the armature of either one may be operated without affecting the others.

A B are horseshoe electro-magnets, whose coils A are in a single circuit, as shown. The coils B are in local circuits, with batteries and resistances arranged as in Fig. 2. The local resistances are so adjusted that the local and counterbalancing current in 2 will be greater than in 1, and in 3 greater than in 2.

Y and Z are two main-line batteries with opposite poles to line, and D^5 is a switch for throwing either battery into circuit with coils A. If the local coils at the stations are all arranged to produce magnetism of the same sign, but one of these main-line batteries is used. D^4 is a switch or key for connecting the main line to battery or to earth.

D', D^2, and D^3 are keys or switches, and R', R^2, and R^3 are adjustable resistances so arranged that either one can be thrown into the circuit with the battery, and each adjusted to interpose a definite resistance differing for each switch D' D^2 D^3. With battery Y in circuit through D^4 and coils A the counterbalancing local currents do not prevent coils A from exerting sufficient magnetic effect to hold all the armatures drawn forward. If, however, battery Y be closed through D' R', (which in the present case is adjusted to a higher resistance than R^2 or R^3,) the current will be so weakened that the local in 1 will sufficiently counterbalance it to allow the armature to be retracted. The local currents in 2 and in 3 will, however, be sufficient to overbalance the main-line current and to hold the armatures up. If the battery be closed through D^2 R^2, which interposes less resistance than R', the line-current will in 1 overbalance the local sufficiently to hold the armature up, in 2 it will balance the local so that the armature will be retracted and the bell sounded, while in 3 it will not sufficiently oppose the effects of the local to prevent it from still holding its armature against the front stop.

Relay 3 may be operated by closing the main-line battery through D^3, which interposes still less resistance than D^2 and D', and the current strength is then sufficient to counterbalance the local of 3 and allow the armature to be retracted, while in 1 and 2 the armatures will be held up by the overbalancing effects of line-current in coils A.

The number of stations capable of being signaled by variations of current within the same degree may be doubled by simply arranging a second set of electro-magnets whose local coils are arranged to produce magnetism of the opposite sign from those of the first set in the electro-magnets. An arrangement of this kind is shown in Fig. 4. In such a case it becomes necessary to use a second line-battery of opposite polarity, or a pole-changing key with the single battery. With this arrangement the armatures of the second set will be held against their front stops by the same battery which is used in signaling to the first set, the locals in all of the second set tending to re-enforce the effects of the line-battery. In sending signals to the second set, however, the polarity of the line-battery is changed, and the operations of signaling are then the same as before described. During such operations the armatures of the first set are all held against their front contacts, because in all of them the line-battery and the locals re-enforce one another.

Instead of closing shunts to the local opposing batteries, the armatures of the electro-magnets may close locals arranged to operate an

ordinary vibrating bell in the well-known manner. Instead of resistances adjusted to different degrees in the local circuits of the differential magnets, I may use batteries of different strength, or the local coils may be of a different number of convolutions, or of different-sized wire. So, also, I may vary the current in the main line by varying the strength of battery. Any form of differential magnet may be used in which the coils are so arranged as to tend to produce magnetism of opposite name in the same core or cores.

My invention is applicable to other purposes besides signaling upon telegraph-lines, and may be used wherever it is desirable to control or move mechanisms of any nature at different points upon the same circuit independently of one another.

What I claim in my invention is—

1. The method of sending independent signals over a single circuit, consisting in varying the strength of current in the circuit to different and determinate amounts, and opposing the magnetic effects of such currents by different and corresponding amounts at the points at which the signals are to be received.

2. In a single circuit, a series of differential electro-magnets, one of the coils on each of which is arranged to exert an effect different in degree from the corresponding coils in the other electro-magnets, substantially as described.

3. A series of electro-magnets whose coils are arranged in main and local circuits, substantially as described, each local coil exerting a magnetic effect differing in degree from that of the corresponding coils in the other electro-magnets.

4. A series of differential electro-magnets provided with coils in the same main-line circuit, means for exerting a magnetic effect upon the cores of the electro-magnets opposed to that exerted by the main-circuit current, and differing in degree for each electro-magnet, in combination with devices for varying the current strength in the main circuit to different and determinate corresponding degrees.

5. A series of differential electro-magnets having coils in the main and local circuits, substantially as described, batteries and resistances in the local circuit, whereby the opposing effects of said local coils may be adjusted as described, in combination with batteries and resistances in the main circuit for correspondingly varying the current strength in said main circuit.

6. A differential electro-magnet, one of whose coils is in circuit with a local battery, in combination with an armature and shunting connections from the local battery to the armature, whereby the armature, when against its back contact, shunts the local battery from its coil.

7. A series of electro-magnets whose oppositely-wound coils are in main and local circuits, substantially as described, local batteries for the local circuits, armatures arranged to shunt the local batteries on their back contacts, and devices in the main circuit for varying the current strength, whereby the armature of any electro-magnet may be released, so as to fall upon its back contact.

8. A series of differential electro-magnets whose coils are in main and local circuits, as described, local batteries and resistances so arranged as to produce different and determinate magnetizing effects on the local coils, in combination with armatures arranged to shunt said batteries on their back contacts, and devices in the main circuit for adjusting the current strength in the main circuit to different corresponding determinate degrees.

9. The combination, in a single circuit, of a series of differential electro-magnets controlled in part by the main circuit and in part by local circuits and generators, adapted to produce in the various electro-magnets of the series magnetic effects opposite in kind, and means upon the main circuit for changing the polarity of the current upon the main circuit at will, substantially as described.

10. The combination, with a main electric circuit, of a series of differential electro-magnets, each controlled in part by the main and in part by an individual local circuit, and means upon the main and local circuits for charging them with currents of different strength, substantially as described.

11. The combination, in one and the same electric circuit, of two or more electro-magnets, each having one coil thereof in a local circuit of graded power, substantially as described.

12. The combination, with two or more electro-magnets, one coil of each being in a local circuit, of a main circuit and devices at a single station for charging the same with currents of opposite polarity.

13. The combination, with a main electric circuit of a series of stations, each of which includes a signaling-magnet in the main line, which is adapted to respond to a definite tension of current different for each station, and to currents of one direction, but not to those of an opposite direction, of means at a signaling-station for manipulating the currents, charging the circuit to reverse and vary said currents, as shown and set forth.

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Witnesses:
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E. T. FOOTE.