(No Model.) 2 Sheets—Sheet 1.

S. F. SHELBOURNE.

INDUCTION TELEPHONE REPEATER.

No. 342,881. Patented June 1, 1886.

FIG. 1.

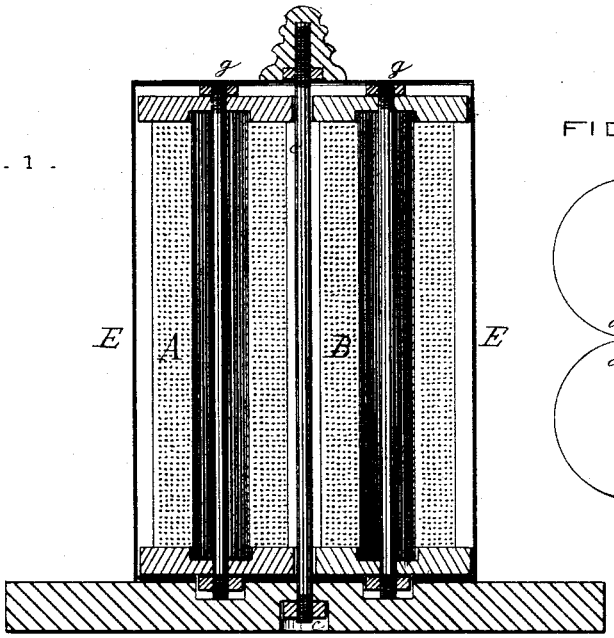


FIG. 3.

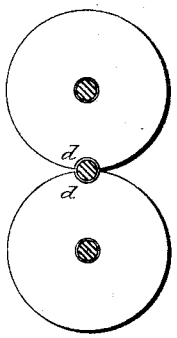


FIG. 2.

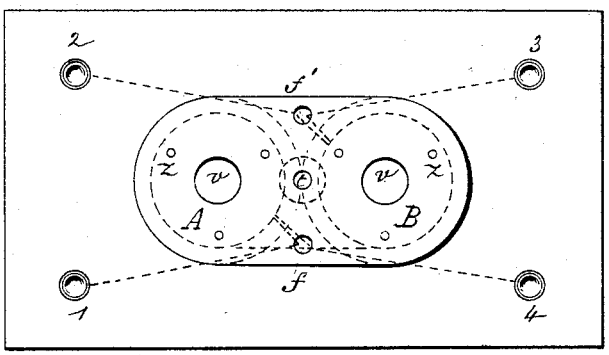
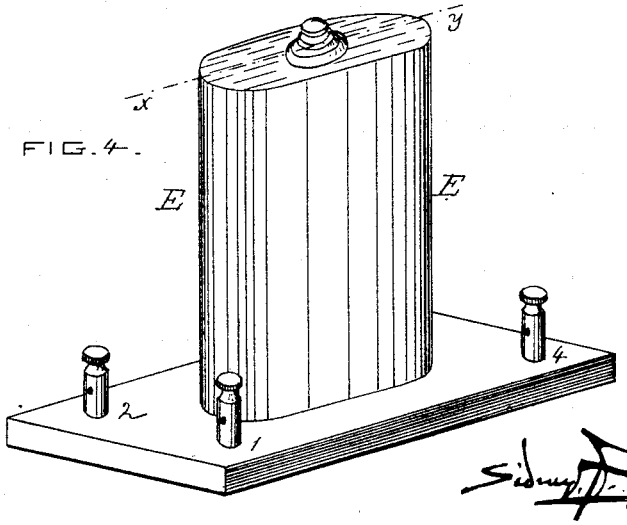


FIG. 4.



WITNESSES

Wm. H. Lowe

O. M. Earle

INVENTOR

Sidney F. Shelbourne

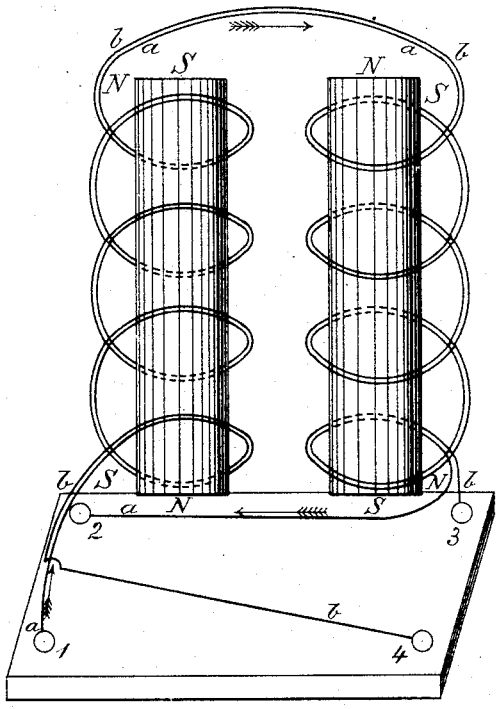
(No Model.) 2 Sheets—Sheet 2.

S. F. SHELBOURNE.

INDUCTION TELEPHONE REPEATER.

No. 342,881. Patented June 1, 1886.

FIG. 5.



WITNESSES

Wm. A. Lowe

James Fitzsimons

INVENTOR

Sidney F. Shelbourne

UNITED STATES PATENT OFFICE.

SIDNEY F. SHELBOURNE, OF NEW YORK, N. Y.

INDUCTION TELEPHONE-REPEATER.

SPECIFICATION forming part of Letters Patent No. 342,881, dated June 1, 1886.

Application filed April 1, 1885. Serial No. 160,966. (No model.)

To all whom it may concern:

Be it known that I, SIDNEY F. SHELBOURNE, a citizen of the United States, residing in the city of New York and State of New York, have invented new and useful Improvements in Induction Telephone-Repeaters; and I hereby declare that the following is a full, clear, and exact description of the said improvements, reference being had to the drawings herewith, and making part of this specification.

The object sought to be attained by this invention is that telephonic speech may be transmitted or repeated from local single or grounded circuits between a subscriber and his adjacent central station upon and over a metallic circuit between said station and any other similar station, and thence again from said metallic circuit upon and over a single or grounded circuit to a subscriber related to the second central station, and vice versa, thus enabling a working telephonic system to be composed of a combination of many local single circuits employing the switch-boards now in use at the central stations, with trunk-lines between the stations constructed in metallic loops in underground cables, and thereby avoiding the expense of metallic circuits between the central stations and each related subscriber, and also the labor and expense of making double connections at each call of the subscribers, or, as an alternative, entering upon an entire change of the switch-board systems in the central stations.

Various attempts have been made with ordinary induction-coils to accomplish this object, but with indifferent and unsatisfactory results, such coils not being mutually and equally reciprocal in inductive action as between the primary and secondary of the same coil—*i. e.*, outwardly and inwardly—nor reciprocal when two coils, one at each end of a metallic circuit, are joined in that circuit through the secondaries of both, so that the sender on a ground-circuit at one end is transmitting by induction outwardly, while the receiver on a similar ground-circuit at the other end has to take the sound by induction from the secondary of the coil at his end of the line into the primary connected in his own ground-circuit.

To overcome the difficulties hitherto encountered the present invention consists of two or more magnet-cores, each containing two wires wound in parallel circuit; second, the combination of said magnet-cores so that their opposite and attractive poles shall be adjacent to each other; third, in providing said magnet-cores with polar plates of soft-iron separated from contact with the poles of the cores; fourth, the combination, with said magnet-cores and their polar plates, of a closely-inclosing case or box of soft iron corresponding in area and shape with the polar plates.

Reference is made to the drawings and their several figures, in which Figure 1 is a sectional view through the line X Y of Fig. 4. Fig. 2 is a plan view of the base of the instrument containing one of the soft-iron plates and showing some of the connections of the wires. Fig. 3 is a plan view of the heads of the spools, showing their relations to each other and to the brass rod which binds together the parts of the instrument; and Fig. 4 is a perspective view of the completed instrument. Fig. 5, Sheet 2, presents a diagrammatic illustration of the winding of the circuits about the magnetic cores, the continued and inductive relation of the two wires forming the circuits, and their separation from and connection with the binding-posts of the instrument forming to whatever extent the winding may be reduplicated two parallel and reciprocal induction-circuits.

Identical letters in each of the figures refer to the same parts.

Describing as follows more particularly the invention and its several parts, I employ two or more separate spools, each having a magnet-core of its own composed of a bundle of fine soft-iron wires filling a small paper tube of the same length as the wires. Through the central axis of the bunch of wires passes a larger and longer soft-iron wire with screw-threads on each end of it and small brass nuts for the same. This larger wire, with its nuts, serves to hold against each end of the paper tube inclosing the wire bundle small disks of wood or other material, which are recessed so as to receive and project inwardly over the ends of the paper tube and its contained wire bundle. Upon the wire-cored spools thus formed are wound two silk-covered magnet-wires, both of the same gage, usually from No. 30 to No. 34, continuously in parallel and by their silk insulation in contact relation with each

other to and fro along the magnet-core and between the heads of the spool until a proper thickness or depth of winding has been obtained, usually leaving the heads of the spool to be an eighth of an inch larger than the diameter of the windings of the contained magnet-wire. Assuming that two of these spools are employed to construct a repeater, a suitable base of hard wood or ebonite is next provided and fitted with an oval plate of soft iron equal in area to the combined heads of the two spools when placed side by side with continuing lines between their lateral diameters. This plate, having been perforated with holes, as shown at *f f*, *t*, and *v v*, Fig. 2, is fastened to the base by small escutcheon-pins, as at *z z* in the figure. The two spools are now placed on end on this plate, the lower nuts of each finding room in the recesses of the base below the holes *v v* of the plate. The spools having been wound exactly alike with the magnet-wire, attention must be given in placing them in position that when their wires are connected and a current is passing around the cores the north pole of the magnetized core of the one shall be at the same end as the south pole of the core of the other. A small brass rod, *c c*, passes up through the base and between the contact-perimeters of the heads of the spools, such heads having been cut away sufficiently to allow the passage of the rod, as shown at *d d*, Fig. 3.

The connections of the magnet-wires are now made as follows: Allowing sufficient ends for connections with the binding-posts through the perforation *f* in plate and base and beginning with spool A, the wires commence next to the core at the bottom of the spool and end upon the outside at the top. Thence they are connected with the wires on spool B, which begin the winding of that spool next to its core at the top, the two parallel wires ending on spool B at the outside next to the bottom, and are thence carried down through the perforation *f'* to connections with the binding-posts. One of the wires at the bottom of A (it matters not which one) is carried down through perforation *f*, and connected with binding-post No. 1. The same-wire, when connected with and forming a continuous conductor with one of the wires of B, and passing down through the perforation *f'*, is carried to binding-post 2. In like manner the other wire, beginning at the bottom of A, is carried to post 4, and its remote end passing through *f'* is carried to post 3. The induction-circuits are thus associated about the two magnet-cores by joining posts 1 and 2 in ground-circuit, and 3 and 4 in metallic circuit, or vice versa, the two sides of the instrument being interchangeably reciprocal, as becomes apparent by following the lines and the connections of the two wires, as illustrated in Fig. 5 on the second sheet of the drawings. It is further apparent that when desirable either metallic or ground circuits may be used at both sides of the instrument.

The connections having been made as described, the soft-iron case E E is next placed over the spools, and fits snugly around the oval plate of soft iron fastened to the base of the instrument.

The polar plate *g g* of soft iron furnishes a cover for the case E E, pieces of paper varnished with shellac, or any other non-magnetic or insulating material, preventing metallic contact between said plate and the magnet-cores of the spools beneath.

The rod *c c*, passing up through the plates *g g*, is furnished with a nut above it, by which the parts of the instrument are held firmly together.

An ornamental cap of any desirable material may serve to cover and conceal the projecting end of the rod *c c* and its nut above the instrument.

The function of the soft-iron polar plates at the ends of the magnet-cores is to catch the lines of force which would diverge from the ends of the magnet-cores and turn them so as to converge and increase the volume of the lines of force contributing to form the interior magnetic circuit. The soft-iron box or case inclosing the spools serves also in like manner to catch and condense the lines of magnetic force passing between the outer edges of the attractive poles and between the bodies of the magnet-cores, and, further, by serving to give ease to the magnetic circuit without making that circuit a closed one, to increase the magnetic effect of each of the cores upon and consequently the sympathetic relation between, the parallel circuits with which they are wound under the influence of a given variable or intermittent current passing through either of them.

It being the purpose here to secure the best magnetic effect within the circuits about the cores, and not to determine the greatest lifting power of the magnet-cores outside of themselves, it will be seen that the relation of the spools so that their magnet-cores of opposite polarities are adjacent to each other will increase the facility of the magnetic circuits and the number and power of those lines of force cutting the coils about the magnetic cores. It will also be observed that the total magnetic effect to be obtained by a given current through a given resistance of wire will be much greater with two cores related to each other as herein shown by the further fact that the wire, and consequently the current, traverses the surface of the cores much more nearly than would the same length and resistance of wire on a single core.

Having thus fully explained my invention and the manner in which the same is to be carried out in practice, what is claimed as new is—

1. The combination of two or more separate magnetic cores and their surrounding coils in parallel circuits, said parts being in such relation that the opposite polarities of the cores

alternate in succession, substantially as and for the purpose set forth.

2. Two parallel circuits of substantially equal length and resistance in identical correlation with each other about two or more independent magnetic cores, forming induction giving and receiving circuits, (each to or from the other,) as herein described.

3. Two or more soft-iron wire bundles or cores, each within its separate coil of magnet-wire, and having opposite polarities in series, in combination with soft-iron plates extending across the poles of the same at the ends and insulated therefrom, as and for the purpose set forth.

4. Two spools, formed each with a magnet-core, and each wound with two insulated wires of substantially equal length and resistance and in parallel circuit with each other upon both the spools, being wound thereon in such a manner that the contained magnetic cores shall have opposite polarities at their adjacent ends, in combination with the polar plates and an inclosing case or box of magnetic material, such case being insulated from the magnet-cores, substantially as shown and described, for the purpose of repeating speech between telephone-circuits.

Subscribed, in presence of two witnesses, this 18th day of March, 1885.

SIDNEY F. SHELBOURNE.

Witnesses:

CHARLES RILEY,

H. F. WEED.