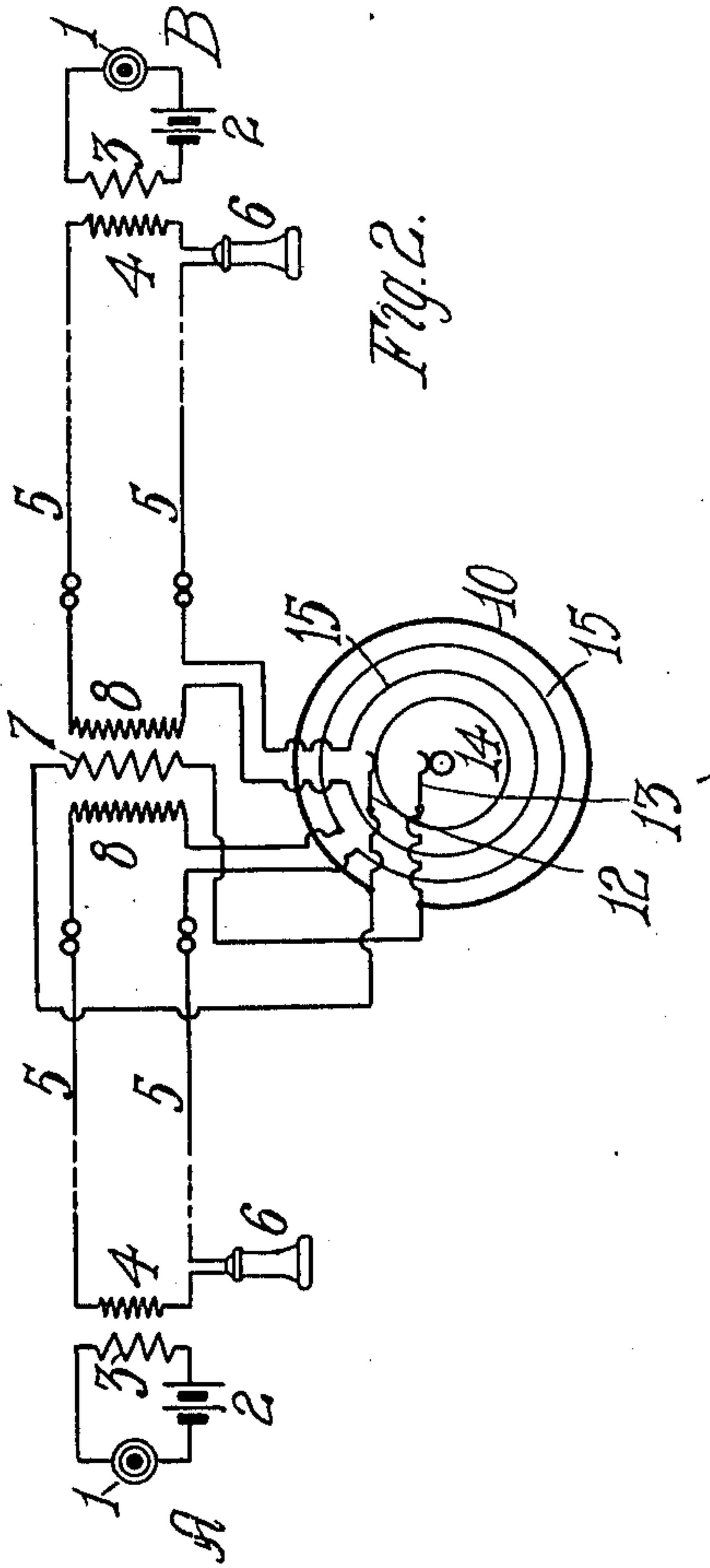
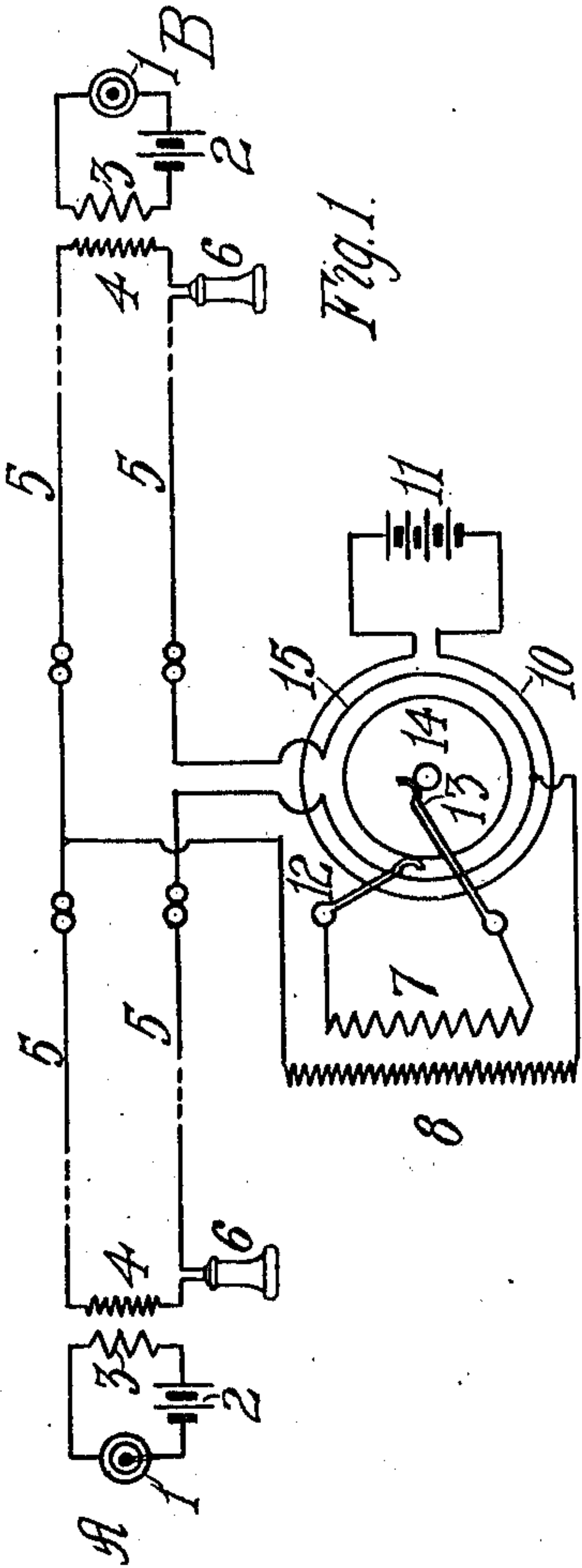


C. G. ASHLEY.
TELEPHONIC RELAY SYSTEM.
APPLICATION FILED JULY 24, 1909.

991,928.

Patented May 9, 1911.

2 SHEETS—SHEET 1.



Witnesses:

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Wm Berghahn.

Inventor:

Charles G. Ashley
By M. M. Miller
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2 SHEETS—SHEET 2.

Fig. 3.

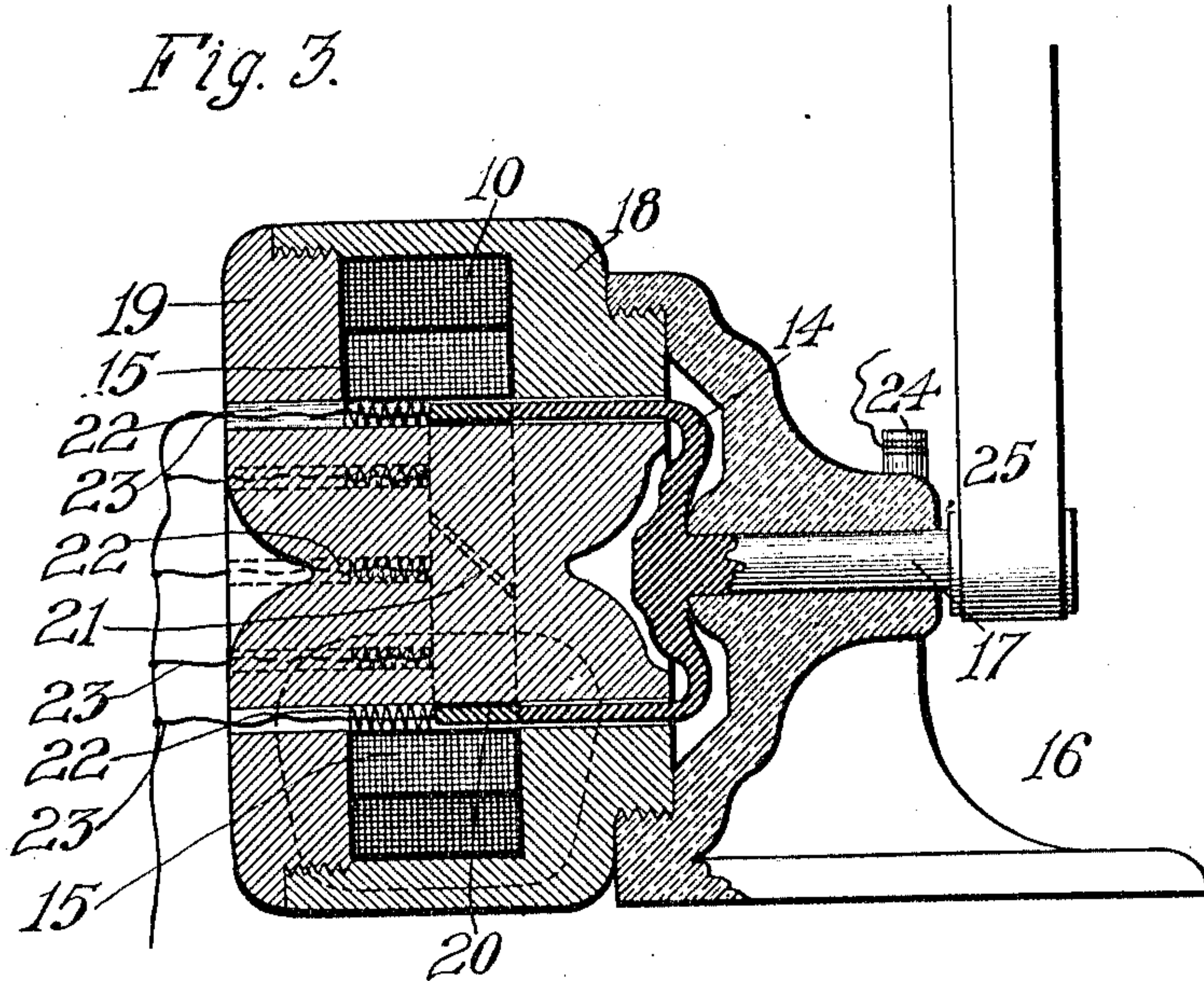
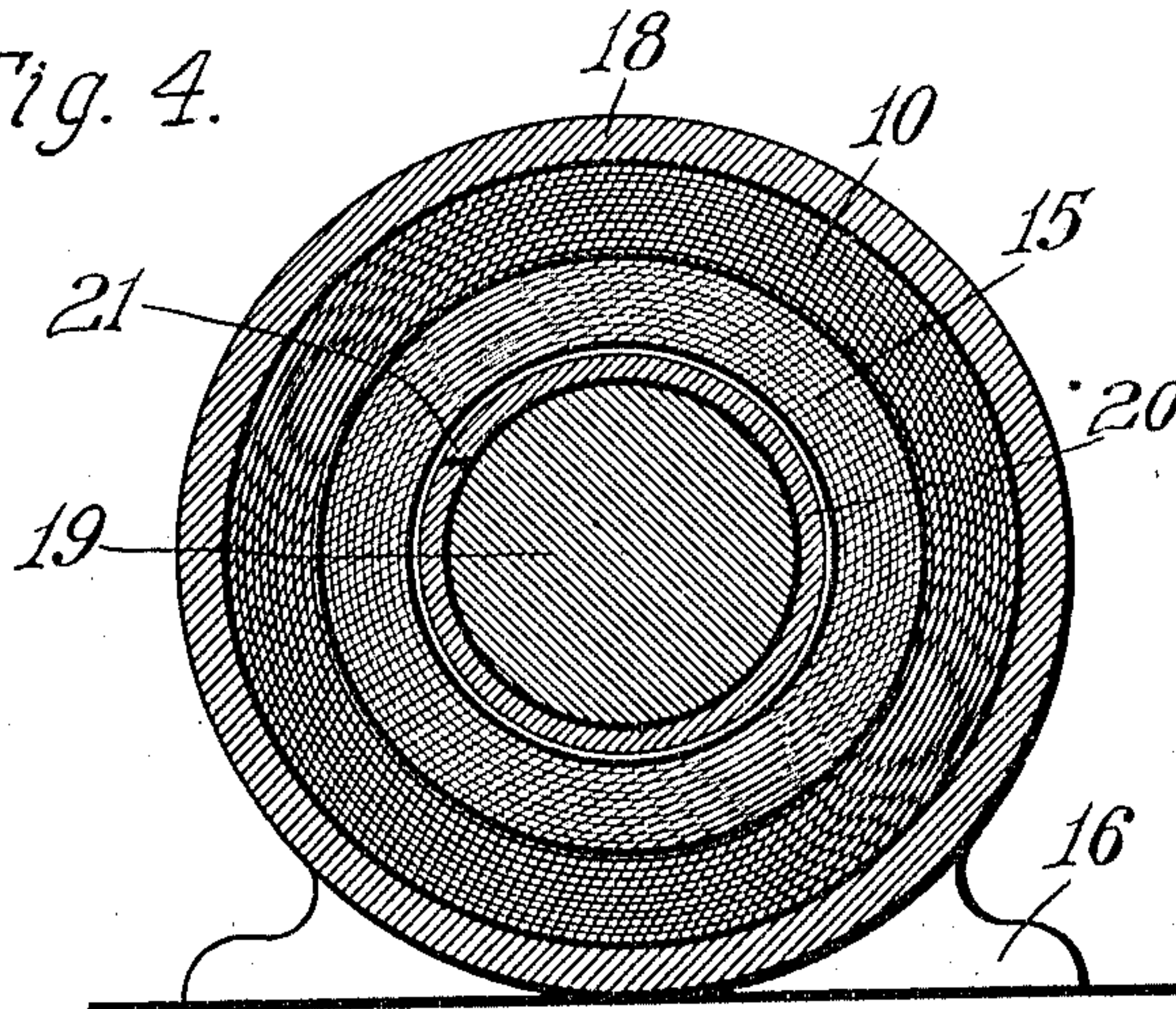


Fig. 4.



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UNITED STATES PATENT OFFICE.

CHARLES G. ASHLEY, OF CHICAGO, ILLINOIS.

TELEPHONIC RELAY SYSTEM.

991,928.

Specification of Letters Patent.

Patented May 9, 1911.

Application filed July 24, 1909. Serial No. 509,250.

To all whom it may concern:

Be it known that I, CHARLES G. ASHLEY, a citizen of the United States of America, and a resident of Chicago, county of Cook, and State of Illinois, have invented a new and useful Improvement in Telephonic Relay Systems, of which the following is a specification.

My invention relates to telephony, and has for its object the provision of apparatus for reinforcing telephonic currents, whereby conversation may be satisfactorily held over circuits possessing large capacity, as, for example, long distance telephone circuits, to which end, I impress current upon an inducing winding from a source independent of the telephonic current and modify this current by the telephonic current, there being an induced winding or member in association with this inducing winding that serves to impress current upon the telephonic circuit, which current corresponds telephonically to the telephonic current originally impressed, but which is of greater value, whereby the receiving telephone instrument is subject to a stronger telephonic current than that it would otherwise be subject to were it not for the employment of this inducing winding with its separate source of supply, the induced winding, and the agency whereby the telephonic current that is to be reinforced effects a modification of the current in the inducing winding.

I have been able by means of my invention to construct an apparatus that will enable the conduct of conversation over a single telephonic circuit in both directions. The instrumentality that I prefer to employ for impressing the inducing winding with the current that is to be modified by the incoming telephonic current, is a well constructed form of the so-called uni-polar dynamo or generator, the terminals of which are connected with the terminals of the inducing winding (of very low resistance) to supply thereto current of comparatively large volume and small pressure, a uni-directional current of ten amperes with a pressure of five-tenths of a volt giving good results. Such current condition is maintained in said inducing winding when the telephone circuit is not in use, the means employed for the purpose of maintaining this current in the inducing winding preferably residing in a local circuit including a battery and an exciting coil producing a field

in which the armature of the generator rotates. This field, however, may be furnished by a permanent magnet. By rotating the armature at a uniform velocity through this field, which is of uniform flux density, a current of constant volume and pressure is impressed upon the inducing winding as long as the telephonic circuit is inactive. In order that the current in this inducing winding may be modified, I employ a modifying winding that is subject to the telephonic current initially impressed upon the telephonic circuit and which is adapted to produce in the same field of the uni-polar generator a supplemental flux that adds to and detracts from the flux density, according to the wave of the telephonic current. This augmentation and diminution of the flux density causes a corresponding change in the character of the current impressed upon the inducing winding, the voltage and the current both being changed. The induced winding, by reason of its inductive relation to the inducing winding, has impressed thereupon current whose pressure is determined by the ratio of transformation between the induced and the inducing winding, the induced current being stepped up in pressure, whereby outgoing telephonic current is impressed upon the telephonic circuit at the relay of far greater value than it is impressed upon the relay, to enable the proper operation of the receiving telephone or instrument that otherwise would only be subject to extremely weak telephonic current. Thus, a mechanical agency, the power that drives the armature of the uni-polar generator, is employed to step-up the telephonic currents at the relay and, in fact, this mechanical agency may alone be relied upon as the initial agency for this function, if the iron of the field is permanently magnetized, or, assuming that the armature has been brought to the proper speed, for in this case the field exciting battery or other equivalent source of current (and by "battery" I mean any suitable form of exciting source of current) may be replaced by a shunt connection with the brushes or terminals of the armature, though I prefer to employ the battery or separate field excitation. The induced winding may be a single coil in bridge between the sides of the telephonic circuit, in which case the inducing winding is also a single coil or said induced winding may be subdivided into two coils, one in association

with one telephone station and the other in association with the other telephone station or receiving station (for it is obvious that more than one instrumentality for relaying telephonic currents in a telephonic circuit may be employed at intervals along the circuit). Where the induced winding is subdivided into two coils, the inducing winding is preferably common thereto. Where the induced winding is in a single coil, it is preferably in bridge of the telephonic circuit, while the modifying winding is desirably in series in the telephonic circuit. In order that the inducing winding will not react upon the modifying winding, the said modifying winding is divided into two equal parts, the induced winding acting differentially upon these parts of the modifying winding, and acting thereby differentially upon the inducing circuit.

I will explain my invention more fully by reference to the accompanying drawings, in which—

Figure 1 diagrammatically represents one type of telephonic circuit and apparatus equipped in accordance with my invention. Fig. 2 illustrates another type of telephonic circuit and apparatus equipped in accordance with my invention. Fig. 3 is a longitudinal section of a uni-polar generator that is preferably employed in practicing the invention. Fig. 4 is a sectional view on line *a a* of Fig. 3.

Like parts are indicated by similar characters of reference throughout the different figures.

While I have illustrated but two embodiments of my invention, there may be many embodiments thereof, and I do not, therefore, wish to be limited to the two illustrated.

In each of Figs. 1 and 2 I have illustrated telephone sub-stations, A, B, but have omitted the telephone switch-hooks and other auxiliary apparatus thereat, as an illustration and description of such auxiliary apparatus is not necessary to an understanding of my invention, nor is my invention to be limited to the precise sub-station circuits illustrated. At each sub-station there is shown a telephone transmitter 1 included in a local circuit that contains a battery 2 and a primary 3 of an induction coil in inductive relation with the secondary winding 4 of comparatively many turns and included between the sides 5—5 of the telephonic circuit, a receiver 6 at each station A being serially included in a conductor 5. These sides 5 may be conductively continuous or they may be inductively united. In Fig. 1 they are made conductively continuous, as, for example, by a cord circuit properly constructed. In Fig. 2 they are inductively united, though, as a matter of fact, it is not necessary to provide a conductive or an inductive union be-

tween the sub-stations of the line, though in the system illustrated in Fig. 2 this is preferred, because the inducing winding 7 (hereinafter to be specified) may be common to the coils 8, that are in circuit with the receivers at stations A—B. The element 8 is the induced winding of many turns, as compared with winding 7, and which has impressed thereupon the reinforced telephonic current that is to operate the telephone receiver at the receiving station. This reinforced telephonic current is impressed upon the winding 8 through the agency of the inducing winding 7 that has current normally impressed thereupon of uniform value, by the uni-polar generator, which is diagrammatically shown in Figs. 1 and 2 and whose structure is illustrated in Figs. 3 and 4.

The field winding 10 that may be employed to produce the flux which is of uniform density, may be supplied with a constant current from a battery 11, as indicated in Fig. 1, or by being connected between the armature brushes 12—13, as indicated in Fig. 2, it being assumed in the case of the system shown in Fig. 2 that the armature has been brought to the proper speed to maintain the field winding 10, there shown in shunt, sufficiently energized to produce the proper flux. In order that the current conditions in the coil 7 may normally be constant, the armature or inductor 14 from which the generator current is supplied, is rotated at a very high uniform peripheral velocity.

The modifying winding 15 is serially related with the telephonic currents initially impressed, this modifying winding being equally divided, so that the induced winding 8 will have differential effect thereupon, and thereby upon the inducing circuit, so that the said winding 15 is limited to the influence of the telephonic current led thereto from the transmitting station. In the system shown in Fig. 1 the winding 15 is looped in the conductor between the telephone stations. In the system shown in Fig. 2 the winding 15 is also in the circuit extending to the transmitting station, though the circuit between the stations of Fig. 2 is not conductively continuous.

The influence of the coils 10 and 15 and the structural characteristics of the preferred form of uni-polar generator will be more readily understood by reference to Figs. 3 and 4, wherein a base of non-magnetic metal 16 affords a bearing for the shaft 17 of the armature 14 and also a support for the field shell of the generator, that desirably is made up of two sections 18—19 separably connected, the section 18 being desirably separably united with the standard 16 for the purpose of easy assemblage of the parts and access to the windings of the gen-

erator. The portion of the frame or standard 16 that directly engages the section 18, is desirably ring-shaped and threaded to engage a correspondingly threaded shoulder 5 upon the section 18. The armature 14 is preferably, though not necessarily, of cup-shape and is desirably made of wrought iron of very high permeability in order to lessen the reluctance of the magnetic circuit, which 10 magnetic circuit includes the sections 18—19 of the field shell, which sections are preferably made of the same material and here constitute a tubular magnet. The reluctance due to the space between the sections 15 18—19 in which the armature 14 rotates, is made as small as possible, to which end, the air gaps between the armature and the pole faces of the sections 18—19 are made as small as practicable, whereby the reluctance 20 of the magnetic circuit (indicated by a dot and dash line in Fig. 3) is maintained at a minimum.

The shell section 19 is provided with a central projection extending toward the 25 armature, while the shell section 18 is provided with a recess that is closed by said projection to constitute an annular space in which the field windings 10 and 15 are disposed, the winding 10 being of fewer turns 30 preferably than the winding 15, particularly if this winding 10 is in shunt of the brushes or terminals of the machine. One brush of the machine is desirably in the form of a frictionless metal ring 20 that 35 is slotted at 21 to prevent eddy currents, which ring is insulated from, though supported by, the central projection or core portion of the element 19. This ring engages the inner peripheral edge of the armature 40 14, which engagement is desirably maintained by means of light springs 22. The ring 20 is thus stationarily mounted and a series of taps 23 are taken therefrom and are joined together with one conductor ex- 45 tending to one end of the winding 7. The other brush collecting current from the armature 14, is desirably the elongated bearing for the shaft 17, which may be equipped with a binding post 24, so that a conductor 50 may be connected with the other side of the winding 7. The armature may be driven in any suitable way, preferably of a safe limiting velocity, a driving belt 25 running at suitable velocity, being indicated for the 55 purpose.

A constant field, and thereby a uniform density of flux through the cylindrical portion of the armature 14, is maintained by the winding 10. This density of flux is increased 60 or diminished through the agency of the fluctuating voice currents passing through the winding 15, whereby the volume and pressure of the current impressed upon the winding 7 is variable whenever the said 65 winding 15 is subject to telephonic current,

which current is impressed upon the winding 8 that may be stepped up sufficiently so that the telephonic current received at the relay I have herein disclosed, may be suitably reinforced. The location of the relay, 70 where one only is employed, is preferably midway between the telephone sub-stations. It will be observed that the circuit of the modifying winding 15 is brought into inductive relation with the circuit of winding 7. 75

While I employ an exciting winding 10 for magnetizing the sections 18—19 of the generator, I do not wish to be limited to such a way of magnetizing these parts of the generator, as it is obvious that they may be 80 permanently magnetized, in which event the winding 10 will be dispensed with. The mechanical structure of such a device with the winding 10 eliminated may be exactly that illustrated. The iron, of course, is in 85 the form of hard steel to retain its magnetism.

In Figs. 1 and 2 are shown two types of single telephonic circuits uniting telephone stations, the circuit in Fig. 1 being 90 conductively continuous at the exchange, while in Fig. 2 the sections of the telephonic circuit are inductively united. It is obvious, therefore, that a variety of arrangements may be provided for effecting single tele- 95 phonic circuits between the telephone stations, and I do not, therefore, wish to be limited to either of the two ways shown, and in the claims I use the expression "single telephonic circuit" in this broad sense. 100

In the claims I refer to the inducing winding as the primary and the induced winding as the secondary.

Reference may be had to my co-pending application Serial No. 509,249, filed July 105 24, 1909.

It is obvious that many changes may be made in the embodiments of the invention disclosed, without departing from the spirit of my invention, and I do not, therefore, 110 wish to be limited to the precise arrangement and apparatus illustrated, but.

Having thus described my invention, I claim as new and desire to secure by Letters- 115 Patent:—

1. A system of telephony, including two telephone stations in a single telephonic circuit, a generator for propagating telephonic currents passing between the stations, said generator including an element producing a 120 magnetic field or flux, a winding subject to telephonic current modifying the effect of the said flux, an armature or inductor in the said flux, a primary supplied with current from said armature or inductor, and a 125 secondary serving to step up the pressure of the current supplied thereto by the primary and to impress the transformed current of increased pressure upon the telephonic circuit, the generator having a two part wind- 130

ing, with respect to which the induced current in said secondary acts differentially.

2. A system of telephony, including two telephone stations in a single telephonic circuit, a generator for propagating telephonic currents passing between the stations, said generator including an element producing a uniform magnetic field or flux, a winding subject to telephonic current modifying the effect of the said flux, an armature or inductor in the said flux, a primary supplied with current from said armature or inductor, and a secondary serving to step up the pressure of the current supplied thereto by the primary and to impress the transformed current of increased pressure upon the telephonic circuit, the generator having a two part winding, with respect to which the induced current in said secondary acts differentially.

3. A system of telephony, including two telephone stations in a single telephonic circuit, a uni-polar generator for propagating telephonic currents passing between the stations, a winding subject to telephonic current modifying the effect of the normal flux of the generator, a primary supplied with current by the armature or inductor of the generator, and a secondary serving to step up the pressure of the current supplied thereto by the primary and to impress the transformed current of increased pressure upon the telephonic circuit, the generator having a two part winding, with respect to which the induced current in said secondary acts differentially.

4. A system of telephony, including two telephone stations in a single telephonic circuit, a uni-polar generator for propagating telephonic currents passing between the stations, a winding subject to telephonic current modifying the effect of the normal flux of the generator, a primary supplied with current by the armature or inductor of the generator, and a secondary serving to step up the pressure of the current supplied thereto by the primary and to impress the transformed current of increased pressure upon the telephonic circuit, said secondary being connected in bridge or multiple between the sides of the telephonic circuit.

5. A system of telephony, including two telephone stations in a single telephonic circuit, a uni-polar generator for propagating telephonic currents passing between the stations, a winding subject to telephonic current modifying the effect of the normal flux of the generator, a primary supplied with current by the armature or inductor of the generator, and a secondary serving to step up the pressure of the current supplied thereto by the primary and to impress the transformed current of increased pressure upon the telephonic circuit, the said secondary being differentially associated with the circuit

of the primary, said secondary being connected in bridge or multiple between the sides of the telephonic circuit.

6. A system of telephony, including two telephone stations in a single telephonic circuit, a uni-polar generator for propagating telephonic currents and serving to produce current of substantially uniform volume and pressure, a winding subject to telephonic current modifying the effect of the normal flux of the generator, a primary supplied with current by the armature or inductor of the generator, and a secondary serving to step up the pressure of the current supplied thereto by the primary and to impress the transformed current of increased pressure upon the telephonic circuit, the generator having a two part winding, with respect to which the induced current in said secondary acts differentially.

7. A system of telephony, including two telephone stations in a single telephonic circuit, a uni-polar generator for propagating telephonic currents and serving to produce current of substantially uniform volume and pressure, a winding subject to telephonic current modifying the effect of the normal flux of the generator, a primary supplied with current by the armature or inductor of the generator, and a secondary serving to step up the pressure of the current supplied thereto by the primary and to impress the transformed current of increased pressure upon the telephonic circuit, said secondary being connected in bridge or multiple between the sides of the telephonic circuit.

8. A system of telephony, including two telephone stations in a single telephonic circuit, a uni-polar generator for propagating telephonic currents and serving to produce current of substantially uniform volume and pressure, a winding subject to telephonic current modifying the effect of the normal flux of the generator, a primary supplied with current by the armature or inductor of the generator, and a secondary serving to step up the pressure of the current supplied thereto by the primary and to impress the transformed current of increased pressure upon the telephonic circuit, the said secondary being differentially associated with the circuit of the primary, said secondary being connected in bridge or multiple between the sides of the telephonic circuit.

9. A system of telephony, including two telephone stations in a single telephonic circuit, a generator for propagating telephonic currents passing between the stations, said generator including an element producing a magnetic field or flux, a winding subject to telephonic current modifying the effect of the said flux, an armature or inductor in the said flux, a primary supplied with current from said armature or inductor, and a secondary serving to step up the pressure

of the current supplied thereto by the primary and to impress the transformed current of increased pressure upon the telephonic circuit, the said modifying winding being in two parts with respect to which the induced current in the secondary acts differentially.

10. A system of telephony, including two telephone stations in a single telephonic circuit, a generator for propagating telephonic currents passing between the stations, said generator including an element producing a uniform magnetic field or flux, a winding subject to telephonic current modifying the effect of the said flux, an armature or inductor in the said flux, a primary supplied with current from said armature or inductor, and a secondary serving to step up the pressure of the current supplied thereto by the primary and to impress the transformed current of increased pressure upon the telephonic circuit, the said modifying winding being in two parts with respect to which the induced current in the secondary acts differentially.

11. A system of telephony, including two telephone stations in a single telephonic circuit, a uni-polar generator for propagating telephonic currents passing between the stations, a winding subject to telephonic current modifying the effect of the normal flux of the generator, a primary supplied with current by the armature or inductor of the generator, and a secondary serving to step up the pressure of the current supplied thereto by the primary and to impress the transformed current of increased pressure upon the telephonic circuit, the said modifying winding being in two parts, with respect to which the induced current in the secondary acts differentially.

12. A system of telephony, including two telephone stations in a single telephonic circuit, a uni-polar generator for propagating telephonic currents and serving to produce current of substantially uniform volume and pressure, a winding subject to telephonic current modifying the effect of the normal flux of the generator, a primary supplied with current by the armature or inductor of the generator, and a secondary serving to step up the pressure of the current supplied thereto by the primary and to impress the transformed current of increased pressure upon the telephonic circuit, the said modifying winding being in two parts, with respect to which the induced current in the secondary acts differentially.

13. A system of telephony, including two telephone stations in a single telephonic circuit, a generator for propagating telephonic currents passing between the stations, said generator including an element producing a magnetic field or flux, a winding serially related to the telephonic circuit for modifying

the effect of the said flux and divided into two parts, an armature or inductor in the said flux, a primary supplied with current from said armature or inductor, and a secondary in bridge of the telephonic circuit, one terminal of said secondary being connected between the parts of the modifying winding and the other with the opposite side of the telephonic circuit.

14. A system of telephony, including two telephone stations in a single telephonic circuit, a generator for propagating telephonic currents passing between the stations, said generator including an element producing a magnetic field or flux, a winding serially related to the telephonic circuit for modifying the effect of the said flux and divided into two parts, an armature or inductor in the said flux, a primary supplied with current from said armature or inductor, and a secondary in bridge of the telephonic circuit, one terminal of said secondary being connected between the parts of the modifying winding and the other with the opposite side of the telephonic circuit, said secondary serving to step up the pressure of the current supplied thereto by the primary.

15. A system of telephony, including two telephone stations in a single telephonic circuit, a generator for propagating telephonic currents passing between the stations, said generator including an element producing a magnetic field or flux, a winding subject to telephonic current for modifying the effect of the said flux and divided into two parts, an armature or inductor in the said flux, a primary supplied with current from said armature or inductor, and a secondary for impressing reinforced telephonic current upon the telephonic circuit, the induced currents in the secondary acting differentially with respect to the parts of the aforesaid modifying winding.

16. A system of telephony, including two telephone stations in a single telephonic circuit, a generator for propagating telephonic currents passing between the stations, said generator including an element producing a magnetic field or flux, a winding subject to telephonic current for modifying the effect of the said flux and divided into two parts, an armature or inductor in the said flux, a primary supplied with current from said armature or inductor, and a secondary for impressing reinforced telephonic current upon the telephonic circuit, the induced currents in the secondary acting differentially with respect to the parts of the aforesaid modifying winding, said secondary serving to step up the pressure of the current supplied thereto by the primary.

17. A system of telephony including two telephone stations in a single telephonic circuit, a generator for propagating telephonic currents passing between the stations, said

generator including an element producing a magnetic field or flux, a winding subject to telephonic current passing from the stations in either direction over said single telephone circuit modifying the effect of the said flux, an armature or inductor in the said flux, an inducing winding supplied with current from said armature or inductor, and an induced winding serving to step up the pressure of the current supplied thereto by the inducing winding and to impress the transformed current of increased pressure upon the telephonic circuit.

18. A system of telephony including two telephone stations in a single telephonic circuit, a generator for propagating telephonic currents passing between the stations, said generator including an element producing a uniform magnetic field or flux, a winding subject to telephonic current passing from the stations in either direction over said single telephonic circuit modifying the effect of the said flux, an armature or inductor in the said flux, an inducing winding supplied with current from said armature or inductor, and an induced winding serving to step up the pressure of the current supplied thereto by the inducing winding and to impress the transformed current of increased pressure upon the telephonic circuit.

19. A system of telephony including two telephone stations in a single telephonic circuit, a uni-polar generator for propagating telephonic currents passing between the stations, a winding subject to telephonic current passing from the stations in either direction over said single telephonic circuit modifying the effect of the normal flux of the generator, an inducing winding supplied with current by the armature or inductor of the generator, and an induced winding serving to step up the pressure of the current supplied thereto by the inducing winding and to impress the transformed current of increased pressure upon the telephonic circuit.

20. A system of telephony including two telephone stations in a single telephonic circuit, a uni-polar generator for propagating telephonic currents and serving to produce current of substantially uniform volume and pressure, a winding subject to telephonic current passing from the stations in either direction over said single telephonic circuit modifying the effect of the normal flux of the generator, an inducing winding supplied with current by the armature or inductor of the generator, and an induced winding serving to step up the pressure of the current supplied thereto by the inducing winding and to impress the transformed current by increased pressure upon the telephonic circuit.

21. A system of telephony including two

telephone stations in a single telephonic circuit, a generator for propagating telephonic currents passing between the stations, said generator including a modifying winding subject to the telephonic current passing from the stations in either direction over said single telephonic circuit, and a transformer whose primary receives current from the armature of the generator and whose secondary impresses the current received from the primary upon the telephonic circuit.

22. A system of telephony including two telephone stations in a single telephonic circuit, a generator for propagating telephonic currents passing between the stations, said generator including a modifying winding subject to the telephonic current passing from the stations in either direction over said single telephonic circuit, and a transformer whose primary receives current from the armature of the generator and whose secondary impresses the current received from the primary upon the telephonic circuit, the said secondary serving to impress the transformed current upon the telephonic circuit at increased pressure.

23. A system of telephony including two telephone stations in a single telephonic circuit, a uni-polar generator for propagating telephonic currents passing between the stations, said uni-polar generator including a modifying winding subject to the telephonic current passing from the stations in either direction over said single telephonic circuit, and means whereby the current produced by the uni-polar generator may be impressed upon the telephonic circuit.

24. A system of telephony including two telephone stations in a single telephonic circuit, a uni-polar generator for propagating telephonic currents passing between the stations, said uni-polar generator including a modifying winding subject to the telephonic current passing from the stations in either direction over said single telephonic circuit, and a transformer whose primary receives current from the armature of the uni-polar generator and whose secondary impresses the current received from the primary upon the telephonic circuit.

25. A system of telephony including two telephone stations in a single telephonic circuit, a uni-polar generator for propagating telephonic currents passing between the stations, said uni-polar generator including a modifying winding subject to the telephonic current passing from the stations in either direction over said single telephonic circuit, and a transformer whose primary receives current from the armature of the uni-polar generator and whose secondary impresses the current received from the primary upon the telephonic circuit, the said secondary

serving to impress the transformed current upon the telephonic circuit at increased pressure.

26. A system of telephony including two telephone stations in a single telephonic circuit, a generator for propagating telephonic currents passing between the stations, the generator, when not operating in conjunction with the modifying winding, serving to produce uni-directional current of uniform value, said generator including a modifying winding subject to the telephonic current passing from the stations in either direction over said single telephonic circuit, and means whereby the current produced by the generator may be impressed upon the telephonic circuit.

27. A system of telephony including two telephone stations in a single telephonic circuit, a generator for propagating telephonic currents passing between the stations, the generator, when not operating in conjunction with the modifying winding, serving to produce uni-directional current of uniform value, said generator including a modifying winding subject to the telephonic current passing from the stations in either direction over said single telephonic circuit, and a transformer whose primary receives current from the armature of the generator and whose secondary impresses the current received from the primary upon the telephonic circuit.

28. A system of telephony including two telephone stations in a single telephonic circuit, a generator for propagating telephonic currents passing between the stations, the generator, when not operating in conjunction with the modifying winding, serving to produce uni-directional current of uniform value, said generator including a modifying winding subject to the telephonic current passing from the stations in either direction over said single telephonic circuit, and a transformer whose primary receives current from the armature of the generator and whose secondary impresses the current received from the primary upon the telephonic circuit, the said secondary serving to impress the transformed current upon the telephonic circuit at increased pressure.

29. A system of telephony including two telephone stations in a single telephonic circuit, a generator of current having added thereto a modifying winding subject to telephonic current passing from the stations in either direction over said single telephonic circuit, and means whereby the current of the generator is impressed upon the telephonic circuit.

30. A system of telephony including two

telephone stations in a single telephonic circuit, a generator of current having added thereto a modifying winding subject to telephonic current passing from the stations in either direction over said single telephonic circuit, and a transformer whose primary receives current from said generator and whose secondary increases the pressure of and impresses the modified current upon the telephonic circuit.

31. A system of telephony, including two telephone stations in a single telephonic circuit, a means for producing a magnetic field of uniform flux density, a means for modifying said magnetic field by inductive effect of telephonic currents emanating from either of the stations of said single telephonic circuit; an inductor moving in said magnetic field producing a current corresponding to the modified flux density of said magnetic field, means for increasing the pressure of the thus modified current, and impressing same upon said telephonic circuit.

32. A system of telephony, including two telephone stations on a single telephonic circuit, a generator for propagating telephonic currents emanating from either station of said single telephone circuit; an element included in said generator producing a magnetic field of uniform flux density; a winding, subject to said telephonic currents, and producing a modifying effect of said magnetic field; an inductor in said magnetic field, a primary winding supplied with current from said inductor and a secondary winding, serving to increase the pressure of the current supplied by said primary winding, and to impress the amplified and transformed current upon the telephonic circuit.

33. In a system of telephony, a device for propagating telephonic currents emanating from either station of a single telephone circuit, comprising a generating element; an element included in said generating element, serving to produce a constant magnetic field; a means for subjecting said constant magnetic field to inductive action of telephonic currents emanating from said stations of said single telephone circuit, and a means for transforming the resultant current, produced by action of said generator and the modifying effect of said telephonic currents, and impressing same upon said telephonic circuit.

Signed by me at Chicago, county of Cook and State of Illinois this fifteenth day of July, 1909.

CHARLES G. ASHLEY.

Witnesses:

DAVID S. HULFISH,
HARRIET L. SMITH.