No. 668,869.

Patented Feb. 26, 1901.

S. G. BROWN.

RELAY.

Application filed Nov. 14, 1899.

(No Model.)

2 Sheets—Sheet 1.

Fig. 3.

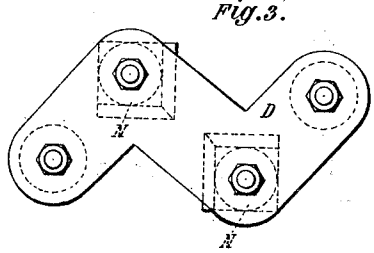


Fig. 2

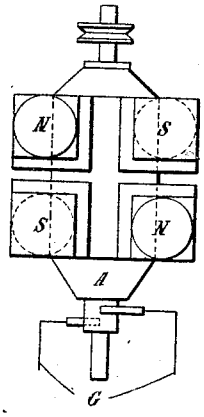


Fig. 1.

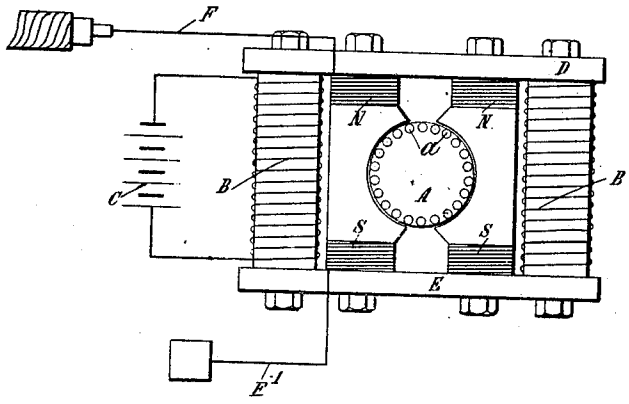


Fig. 5.

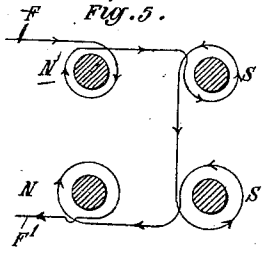
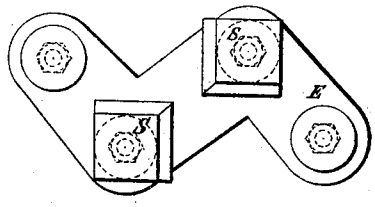


Fig. 4.



Witnesses.
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Inventor,
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No. 668,869. Patented Feb. 26, 1901.

S. G. BROWN.

RELAY.

Application filed Nov. 14, 1899.)

(No Model.) 2 Sheets—Sheet 2.

Fig. 6.

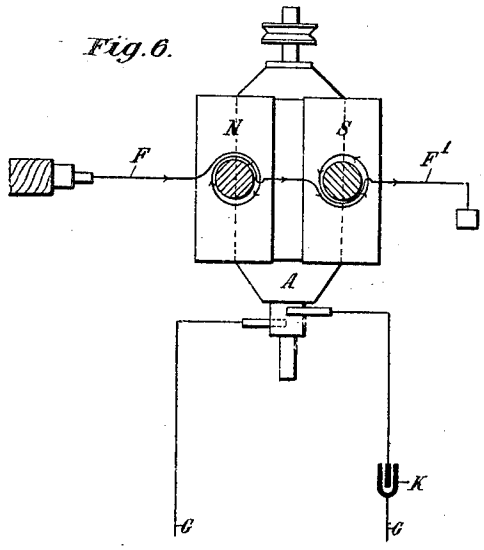


Fig. 7

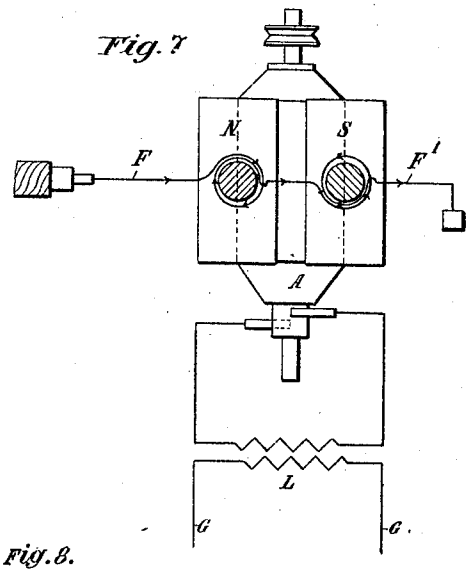
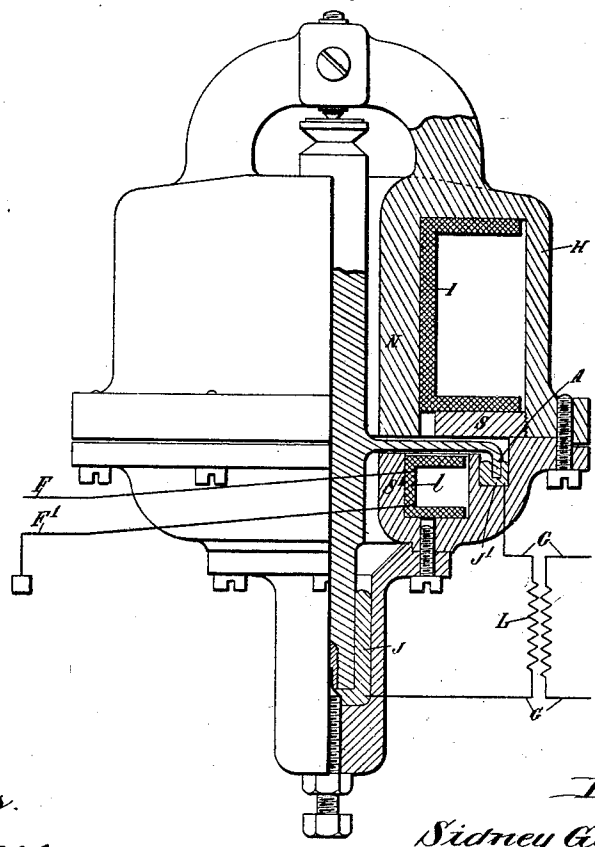


Fig. 8.



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UNITED STATES PATENT OFFICE.

SIDNEY GEORGE BROWN, OF BOURNEMOUTH, ENGLAND.

RELAY.

SPECIFICATION forming part of Letters Patent No. 668,869, dated February 26, 1901.

Application filed November 14, 1899. Serial No. 736,907. (No model.)

To all whom it may concern:

Be it known that I, SIDNEY GEORGE BROWN, electrician, a subject of the Queen of Great Britain, residing at Van Buren, Poole road, Bournemouth, in the county of Hants, England, have invented certain new and useful Improvements in Relays for Use on Telegraph, Cable, and other Lines, of which the following is a specification.

This invention relates to improvements in electrodynamic relays for use principally on telegraph or telephone lines, and has for its object the continuous amplification of the arrival signaling-currents, whereby more powerful effects are obtained, or, in other words, a volume of current smaller than hitherto necessary is required to operate the recording or other instruments.

According to my invention I induce a current in the relay-circuit by means of a dynamo and provide means whereby any current induced in the armature from initial excitation of the iron of said dynamo (which armature forms part of the relay-circuit) is prevented from affecting the recording or other instruments in the relay-circuit except when the arrival-currents are received from the line.

According to one form of construction the magnetic flux through the field-magnets of the dynamo divides at a part of the circuit into two or some multiple of two portions. The arrival-currents are led through auxiliary conductors wound on the magnetic pole-pieces, and the quantity of magnetic flux in each of the aforesaid portions is determined by controlling the electrical conditions in such manner that when no arrival-current is received no induced current passes to the relay-circuit.

In order that my invention may be clearly understood and readily carried into effect, I will proceed to describe the same more fully, with reference to the accompanying drawings, in which—

Figure 1 is a side view of the relay apparatus. Fig. 2 is a plan of the armature and its magnetic pole-pieces. Figs. 3 and 4 are plan views, respectively, of the top and bottom bars of the apparatus with the magnetic pole-pieces attached to them. Fig. 5 is a diagram showing the winding of the auxiliary coils on the magnetic pole-pieces shown in Figs. 1, 2, 3, and 4 and hereinafter referred to. Figs. 6 and 7 are diagrammatic views of modifications of the apparatus shown in the preceding figures. Fig. 8 shows the application of the invention to a unipolar form of dynamo.

Referring to Figs. 1 to 5, A is the armature, which is rotated by any suitable mechanical means. B B are the electromagnets, having pole-pieces N N and S S, the former of which are of north polarity and the latter of south polarity. These pole-pieces are arranged diagonally with relation to one another, as shown in Fig. 2. C is a battery or equivalent means for exciting the magnets up to a critical stage. D is a bent iron strip or bar for connecting all the north poles of the magnets, and E is a similar bent iron strip or bar for connecting all the south poles of the magnets. The line conductor F is connected to auxiliary coils wound around the magnetic pole-pieces, which coils are connected to earth by the conductor F′. The armature A has slots or tunnels *a a* near its periphery to receive the wire with which it is wound in order that it may run with but small clearance between the magnetic pole-pieces. G G represent the relay-circuit.

It is obvious that the magnets B B may be permanent magnets or may be excited by an alternating or fluctuating current, if preferred.

The magnetic flux from the magnets B B divides between and enters the two magnetic pole-pieces N N, passes through the armature A, and leaves by the magnetic pole-pieces S S. When the armature is in rapid rotation and the auxiliary coils are not excited, no current is induced in the armature, because although the two pairs of pole-pieces may be strongly magnetized yet they are equal in strength and are arranged so as to direct their magnetic flux through the armature in opposite directions. The auxiliary coils are so wound, however, as shown in Fig. 5, that when the arrival signaling-currents from the line pass through them one pair of the pole-pieces is strengthened and the other pair weakened. This results in a current being induced in the armature, which induced current passes to the relay-circuit G G. By this arrangement the magnetism in a small mass

of iron only need be varied, for if the diminution of flux in one pair of the magnetic pole-pieces is counteracted by an equal gain in the other pair of magnetic pole-pieces the magnetic flux need not vary at all in the rest of the outside circuit in order to obtain an induced current. Thus a very sensitive instrument is obtained.

It is obvious that means other than those described above may be employed for neutralizing any current induced by the initial excitation of the magnets without departing from my invention. For instance, the armature A may run between only one pair of magnetic pole-pieces, the neutralizing of any current induced when no current is received from the main line being effected by outside means, such as a condenser or a transformer placed in series in the relay-circuit. Figs. 6 and 7 show the armature A arranged to thus run between one pair of magnetic pole-pieces which are provided with auxiliary coils. The line conductor F is connected to these auxiliary coils, and F′ is the conductor connecting the said coils to earth, as in the preceding figures. In both these figures the electromagnets B B and the strips or bars D and E have been removed for the sake of clearness. In Fig. 6 a condenser K is shown placed in series in the relay-circuit G G, and in Fig. 7 a transformer L is shown placed in series in the relay-circuit G G, the transformer L or condenser K being placed between the dynamo and the instrument or instruments in the relay-circuit. When the armature rotates and no arrival signaling-currents pass through the auxiliary coils, a regular even current is induced in the armature A, which regular current cannot pass the condenser K or the transformer L, as the case may be, and cannot therefore affect the instrument or instruments in the relay-circuit. Upon arrival-currents from the line, however, circulating in the auxiliary coils irregularities are produced in the current induced in the armature, which irregularities enable the said induced current to pass the condenser K or the transformer L, as the case may be, and the received signals thus magnified or amplified can then operate an instrument or instruments in the relay-circuit G G.

The armature A might obviously be replaced by a rotating disk or drum, as in a unipolar form of dynamo construction, the various electrical connections being made with the said disk or drum by mercury, the magnetic circuit in this case being, as before, constructed so that any gain of magnetism passing through the disk or drum and inducing current therein when the arrival-currents are received from the line shall diminish by a corresponding amount the flux passing through another and parallel part of the magnetic circuit, so that no change need be induced in any other part of the magnetic circuit in order that the amplified signals may be conducted to the instrument or instruments in the relay-circuit, a very sensitive instrument being thus obtained.

Referring to Fig. 8, the armature A consists of a metal disk mounted on a spindle and driven by any suitable mechanical means. H is the magnet, within which the armature A rotates. N is the north pole of said magnet, and S S′ are south poles of said magnet. I is a coil for exciting the magnet H, and *i* is an auxiliary coil wound in the pole S′, to which pole the main line F is connected. F′ is the lead connecting the coil *i* to earth. J is a cup containing mercury, in which the lower end of the armature-spindle rotates. The edge of the armature A is turned down, so as to form a flange which rotates in mercury contained in a cup J′. G G are the relay-circuit conductors, connected, respectively, to the mercury in the troughs J and J′. L is a transformer placed across the leads G G and between the dynamo and the instrument or instruments in the relay-circuit. As the armature A rotates the magnetic flux divides into two parts, one of which parts passes from the pole N to the pole S and the other of which parts passes from the pole N through the armature to the pole S′. When no arrival-currents are received from the line F, a regular current is induced in the armature, which current cannot pass the transformer L, and therefore does not affect the instrument or instruments in the relay-circuit. When arrival-currents are received from the line F and pass through the coil *i* to the lead F′, the pole S′ is strengthened, so that that part of the magnetic flux which passes through the armature to the pole S′ is increased, while that part of the magnetic flux passing to the pole S is diminished, thereby setting up irregularities in the induced current and enabling said current to pass the transformer L and the received signals thus magnified to operate an instrument or instruments in the relay-circuit G G. When the arrival signaling-currents are received, therefore, the increase in the amount of flux passing through the one part of the magnetic circuit is equal to the diminution in the amount of flux passing through the other part of said circuit, and the flux need not vary at all in the remainder of the magnetic circuit in order to obtain an induced current that will pass the condenser or transformer.

The form of apparatus shown in Fig. 8 is especially adapted for use on telephone-lines.

What I claim is—

1. In dynamo-electric relay apparatus, the combination of the line conductors, the armature, the field-magnets, means for initially exciting said magnets, a relay-circuit including the said armature, an instrument or instruments in the said relay-circuit, and means for controlling the conditions of the magnetic field in such manner that induced currents pass from the armature to the relay instruments at such times only as signaling-currents are received from the line, substantially as described, for the purpose specified.

2. In dynamo-electric relay apparatus, the combination of the line conductors, the field-magnets, the means for initially exciting said magnets, the armature, the relay-circuit including said armature, the instrument or instruments in said relay-circuit, auxiliary pole-pieces on said magnets, auxiliary coils which are wound on said auxiliary pole-pieces and through which the signaling-currents from the main line pass, and means for conducting currents induced in the armature to the instruments in the relay-circuit at such times only as signaling-currents are received from the line, substantially as described, for the purpose specified.

3. In dynamo-electric relay apparatus, the combination with the line conductors, the armature forming part of the relay-circuit, the field-magnets, and means for exciting said field-magnets, of two pairs of diagonally-arranged magnetic pole-pieces between which the armature revolves, and auxiliary coils connected to the line conductors and wound on said pole-pieces in such manner that when the arrival-currents are received from the line one pair of the said magnetic pole-pieces is strengthened and the other pair of magnetic pole-pieces is correspondingly weakened, substantially as described for the purpose specified.

In testimony whereof I have hereunto set my hand, in presence of two subscribing witnesses, this 24th day of October, 1899.

SIDNEY GEORGE BROWN.

Witnesses:
T. W. McLELLAN,
FRED DAWES.