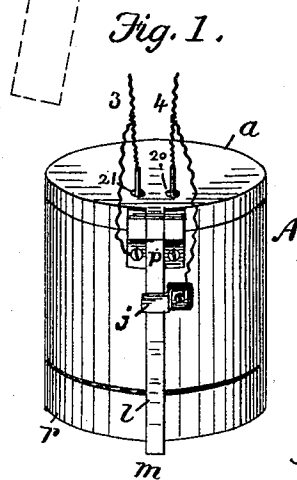
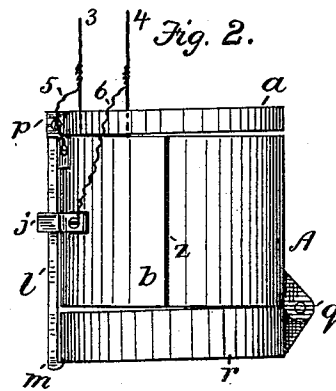
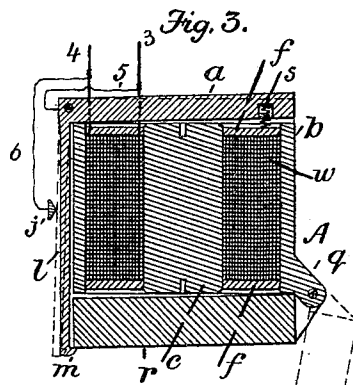
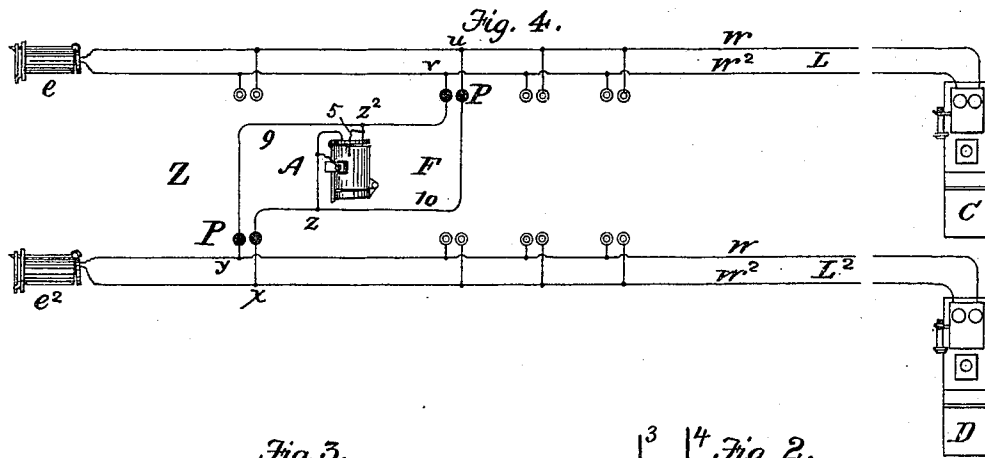


(No Model.)

F. W. DUNBAR.
ELECTRO MAGNETIC ANNUNCIATOR.

No. 469,995.

Patented Mar. 1, 1892.



Witnesses.
Jonathan C. G. G.
R. G. Watson.

Inventor.
Francis W. Dunbar.
By *Pollock & Mauro,*
his Attorneys.

UNITED STATES PATENT OFFICE.

FRANCIS W. DUNBAR, OF NEWARK, NEW JERSEY, ASSIGNOR TO THE AMERICAN TELEPHONE AND TELEGRAPH COMPANY, OF NEW YORK.

ELECTRO-MAGNETIC ANNUNCIATOR.

SPECIFICATION forming part of Letters Patent No. 469,995, dated March 1, 1892.

Application filed November 23, 1891. Serial No. 412,799. (No model.)

To all whom it may concern:

Be it known that I, FRANCIS W. DUNBAR, residing at Newark, in the county of Essex and State of New Jersey, have invented certain Improvements in Electro-Magnetic Annunciators, of which the following is a specification.

This invention relates to telephone-exchange annunciators, and comprises a form of annunciator the helices of which are practically opaque to voice-currents by reason of their high self-induction, while at the same time they present a comparatively low apparent resistance to the alternating ringing-currents sent from a sub-station magneto-generator, (these having relatively a low rate of alternation,) and are thus perfectly responsive to such signaling-currents.

The invention further comprises an annunciator whose normal coefficient of self-induction is greatly diminished as soon as it has responded to a call by disclosing its visual signal, and whose apparent resistance to signaling-currents decreases thereby to compensate for any accidental or inadvertent increase of current due to acceleration of the speed of the generator or to other causes.

It consists, also, in the construction of an annunciator which when at rest has an approximately-closed magnetic circuit adapted, however, to be broken by the act of giving the signal, in the combination of an automatically made and broken shunt-circuit to the electro-magnet of such an annunciator, and in certain other details of construction.

The object of the invention is to furnish a telephone-annunciator magnet which will oppose great apparent resistance to the passage of telephonic or voice currents, and which at the same time presents a comparatively low apparent resistance to ringing-currents of the usual character, which apparent resistance is still further diminished after the annunciator has responded to the ring.

In one form of multiple telephone switch-board lately designed it has been found possible to connect any two circuits together without breaking the original calling-circuit through the line-annunciator. Under these conditions, when two circuits are so connected

the line-annunciators (one for each line) are, it is evident, left in bridge-circuits extending between the direct and return conductors of the compound talking-circuit thus formed; but they may be, and in practice often are, located at different sections of the switch-board, and it is therefore requisite to provide also a disconnecting or "clearing-out" annunciator connected in still a third bridge between the main conductors at that switch-board section where the connection between the lines is made. In any event these several bridges must be so proportioned with respect to their resistance and self-induction that their presence will not tend to short-circuit the voice-currents passing over the main lines; and it has also been found necessary to devise and apply some means whereby disconnecting-signals sent from either sub-station of any two connected lines shall manifest themselves in the disconnecting-annunciator only, the two line-annunciators remaining perfectly irresponsive thereto. A number of plans for the solution of this problem have been devised, one of which is described in Patent No. 463,544, dated November 17, 1891, issued to Frank A. Pickernell for multiple telephone switch-boards. The plan there proposed is to construct the disconnecting-annunciator with a resistance low relatively to that of the line-annunciators and with self-induction relatively high, and it is suggested that the said annunciator may be provided with an iron core and tubular iron casing.

The annunciator which embodies my invention is particularly well adapted for use as the disconnecting-annunciator in connection with the hereinbefore-described system, and may, in fact, be considered as a specific improvement upon the annunciator generally suggested in the said application for patent.

In the drawings which accompany and form a part of this specification, Figure 1 is a perspective view of an annunciator embodying my invention. Fig. 2 is a side elevation thereof. Fig. 3 is a cross-sectional elevation, and Fig. 4 is diagram showing its method of use.

The annunciator A (shown in Figs. 1, 2, and 3) has a heavy and thick solid iron core *c*, the

self-induction being, *ceteris paribus*, dependent upon the amount of iron in the core and sheath. Around the said core, upon a suitable spool or within end flanges *f*, is wound
 5 the wire of the magnetizing-helix *w*, which, as before stated, is to be of resistance relatively low to that of the regular line-drop helix. The ends of this helix 3 and 4 emerge through
 10 holes 20 and 21 in the armature, these being insulated and made sufficiently wide to prevent mechanical interference. The magnet so prepared is now provided with a soft-iron
 15 sheath *b*, whereby it is incased, the said sheath being, however, preferably slitted longitudinally, as at *z*. The core *c* may also be slitted or grooved longitudinally, if desired.

At one end of the iron-incased magnet a heavy plate of iron *r* is pivotally hung, as shown in a bracket *g*, which may be formed on
 20 the sheath. This is the shutter which serves as the visual signal. At the other end of the magnet is a second but lighter iron plate *a*, forming an armature therefor, which also is hung in
 25 pivots on a bracket *p*. The armature has a lever extension-rod 1 projecting at a right angle therefrom to the shutter end of the magnet and ending there in a trigger or catch
 30 *m*, which normally engages the edge of the shutter *r* and holds it in the position indicated by Figs. 1 and 2 and by the full lines of Fig. 3, the armature being unattracted by
 35 the core and preferably held away therefrom by any suitable spring *s*. Upon the attraction of the armature the lever 1 releases the plate *r*, and the latter falls away into the position indicated by the broken lines, Fig. 3, making a wide gap in the magnetic circuit.

Referring to the diagram Fig. 4, C and D are two telephone sub-stations connecting, respectively, by metallic circuits L and L² with a
 40 central station Z, to which any number of such circuits may converge and where the said circuits may be united in pairs for through communication. At the central station the lines L
 45 L² each have an annunciator *e e*² at some one section of the multiple switch-board where the calls of the said lines as manifested by the said annunciators are to be answered, and these call-receiving annunciators are each wound to
 50 comparatively high resistance. Each line entering the central station is also represented at every section of the multiple switch-board by a pair of plug-sockets, constituting normally discontinuous branch terminals of the
 55 two main conductors W and W². Obviously the two sockets of any circuit can at any switch-board section be connected by suitable link-conductors with the two sockets of any other circuit, and in the diagram such an arrangement is indicated, the two circuits L
 60 and L² being connected with each other by the two conductors 9 and 10 of the link-conductor F. In practice this is a double-conductor flexible cord, terminated at each end
 65 by a double-plug connector P. The disconnecting-annunciator A, which forms the subject of my invention, is in a bridge-circuit

from one of the link-conductors 9 to the other 10. The circuits being arranged as shown, the sub-station C is now connected with sub-station D by means of the central-station link-
 70 connector F, although during the continuance of such connection there are three derived circuits at the central station—viz., from the points *u v* on L through the line-annunciator *e*, from the points *x y* on L² through the
 75 line-annunciator *e*², and from the points *z z*² of the link-conductor F through the disconnecting-annunciator A. All of these must be practically opaque to currents having a
 80 high rate of alternation, such as voice-currents, and the disconnecting-annunciator A must be perfectly responsive to the exclusion of the other annunciators during the continuance of the connection to calling-currents
 85 which have a relatively low rate of alternation. This is accomplished by my invention in the manner hereinbefore referred to, by providing that the disconnecting-annunciator A shall, like the line-annunciators *e* and *e*²,
 90 be connected so as to present a high-apparent resistance with respect to telephonic currents, but, unlike them, shall present a low and decreasing resistance to ringing-currents. By
 95 employing the ordinary "tubular drop," so called, wound up to a high resistance (I have found eleven hundred ohms to answer) for the line-annunciators, and by employing for the disconnecting-annunciator one constructed
 100 as herein described, I achieve the desired result. In other words, the disconnecting-drop shunts the calling-drop for currents of low rates of alternation.

A disconnecting-annunciator made in accordance with my invention and wound to
 105 but sixty ohms resistance with wire of Nos. 28 or 29 Brown & Sharpe gage (the line-drops having a resistance of eleven hundred ohms) and provided with an iron core five-eighths
 110 of an inch thick and one and one-quarter inches long, the thickness of the armature being about three-sixteenths of an inch and that of the shutter about five-sixteenths of an inch, was found to operate satisfactorily. This
 115 drop in outside dimensions was two inches long and its diameter was one and three-quarter inches. These figures are, however, purely illustrative, and it is to be understood that they will vary widely in practice with
 120 varying conditions. It is, however, evident that an annunciator of this kind constitutes, when quiescent, an almost completely-closed magnetic circuit of iron through its core, casing, armature, and shutter. The core is made
 125 heavy in order to secure a high apparent resistance to currents having a high rate of alternation. The outer casing is provided as an induction-screen to prevent cross-talk between two circuits whose disconnecting-annunciators are adjacent and to secure a maximum
 130 difference in the apparent resistance of the drop when the iron shutter farther opens the magnetic circuit. The shutter is made heavy in order to secure quick action in fall-

ing when released. The armature is made comparatively light in order to secure quick responsive action. The helix is wound to a comparatively low resistance to secure a low resistance for ringing-currents.

The annunciator A may be mounted vertically with its shutter at the lower end, or it may be mounted horizontally, the hinge of its shutter being on the under side. Its operation is as follows: The conversation passing over two connected lines being concluded, the subscriber rings off by turning the generator, which must necessarily start at a low speed. The disconnecting-annunciator A completely shunts the calling-annunciators e and e^2 at this low rate of alternation, but being itself responsive its armature is attracted and its heavy iron shutter falls, giving the ringing-off signal. This action instantly opens widely the magnetic circuit, which heretofore has been nearly closed, and the apparent resistance of the annunciator-magnet A to the currents which are operating upon it therefore immediately decreases, taking a still lower value. The calling or line drop is thus prevented from being released by any increase in the speed of the generator during the "ringing-off" operation. In Figs. 1, 2, and 3 another feature is also shown, which further aids in confining the results of the ringing-off operation to the drop A. A branch conductor 5 extends from the conductor 3 to the bracket p , and thus connects with the lever 1. A second branch 6 extends from the wire 4 to the back contact-stop j , which is insulated from the metallic shell, and may be furnished, if desired, with a spring, so that the contact is made before the completion of the stroke of the armature, and these two wires together form a normally-open shunt-circuit around the magnetic helix w . This short-circuiting device acts as soon as the armature moves, lowers the resistance of the bridge in which it is included to zero momentarily, and thus forms an additional safeguard against the undesirable operation of the calling-drop, while the acquired inertia of the armature a carries it to the completion of its forward stroke, even though its actuating-magnet be short-circuited.

Upon the cessation of the disconnecting-ring the annunciator-circuit has its normal condition restored, and thus forestalls any danger of the lines being short-circuited by the accidental falling of the disconnecting-drop, as might happen if the formation of the shunt-circuit was dependent upon the fall of the shutter.

I claim—

1. An annunciator-magnet whose helices have a relatively high coefficient of self-induction when the signal-shutter is in its resting position and a relatively low coefficient of self-induction when the said signal-shutter is released to give the signal.

2. An annunciator-magnet offering a relatively high apparent resistance to alternating

signaling-currents when its signal-shutter is in place and a much lower apparent resistance to similar currents on the displacement of the said shutter by the act of giving the signal.

3. An annunciator having an electro-magnet which when at rest has an approximately complete iron magnetic circuit adapted to be opened widely by the act of operation.

4. An electric annunciator adapted to give a visual signal by causing the attraction of its armature to release a drop or shutter whose core and iron casing form part of a substantially closed magnetic circuit and whose helix offers a relatively high apparent resistance to alternating signaling-currents when the shutter or drop is in place, but which has the said magnetic circuit widely opened and the apparent resistance of its helix to the said currents materially decreased upon the release and fall of the said drop or shutter.

5. An annunciator for telephone-circuits, comprising an iron-incased electro-magnetic helix surrounding a heavy iron core and provided at one end with a relatively light iron plate adapted to serve as an armature and at the other end with a heavier iron plate held in place normally by a hook-lever extending from the said armature, but adapted to be released by the attraction of the said armature and thereupon to fall away and to serve as a visual signal, substantially as hereinbefore described.

6. In an annunciator for telephone-circuits, an electro-magnetic helix whose iron core and casing form part of a magnetic circuit nearly closed normally by iron plates provided at the ends, serving one as the armature and the other as the shutter-signal, and which therefore has when at rest a coefficient of self-induction which decreases when the perfection of the said magnetic circuit is impaired by the falling away of said shutter-plate to give the signal, substantially as described.

7. In an annunciator for telephone-circuits, an electro-magnetic helix whose iron core and casing form part of a magnetic circuit nearly closed normally by means of iron plates provided at the ends and serving one as the armature and the other as the shutter-signal, but adapted to be widely opened by the separation of the shutter-plate from the said core and casing in the act of giving the signal, combined with a normally-open shunt-circuit for the said helix, extending from the main conductors leading thereto through the armature-lever thereof and back-stop therefor and adapted to be closed by the contact of said armature-lever with said stop, substantially as and for the purposes specified.

8. In a disconnecting annunciator for telephone-circuits, the combination of the heavy iron core c , the helix w , adapted for inclusion in an electric circuit surrounding the same, an iron case surrounding the said helix, the iron armature a , hung on said case at one end thereof and extending across the end of

the core to connect the same magnetically
with the said casing, the said armature hav-
ing a hook-lever attachment extending to the
other end of said casing, and the heavy iron
5 plate *r* hung on the said other end of the cas-
ing and normally held by the said hook-lever
in close juxtaposition thereto and to the core,
thereby approximately completing the mag-
netic circuit, but adapted to be released by
10 said hook-lever and thereupon to fall away
from the said core and to widely open the

said magnetic circuit upon the attraction of
the armature, substantially as described.

In testimony whereof I have signed my
name to this specification, in the presence of 15
two subscribing witnesses, this 20th day of
November, 1891.

FRANCIS W. DUNBAR.

Witnesses:

F. DE LYSLE SMITH,
CHARLES R. BANGS.