

June 2, 1942.

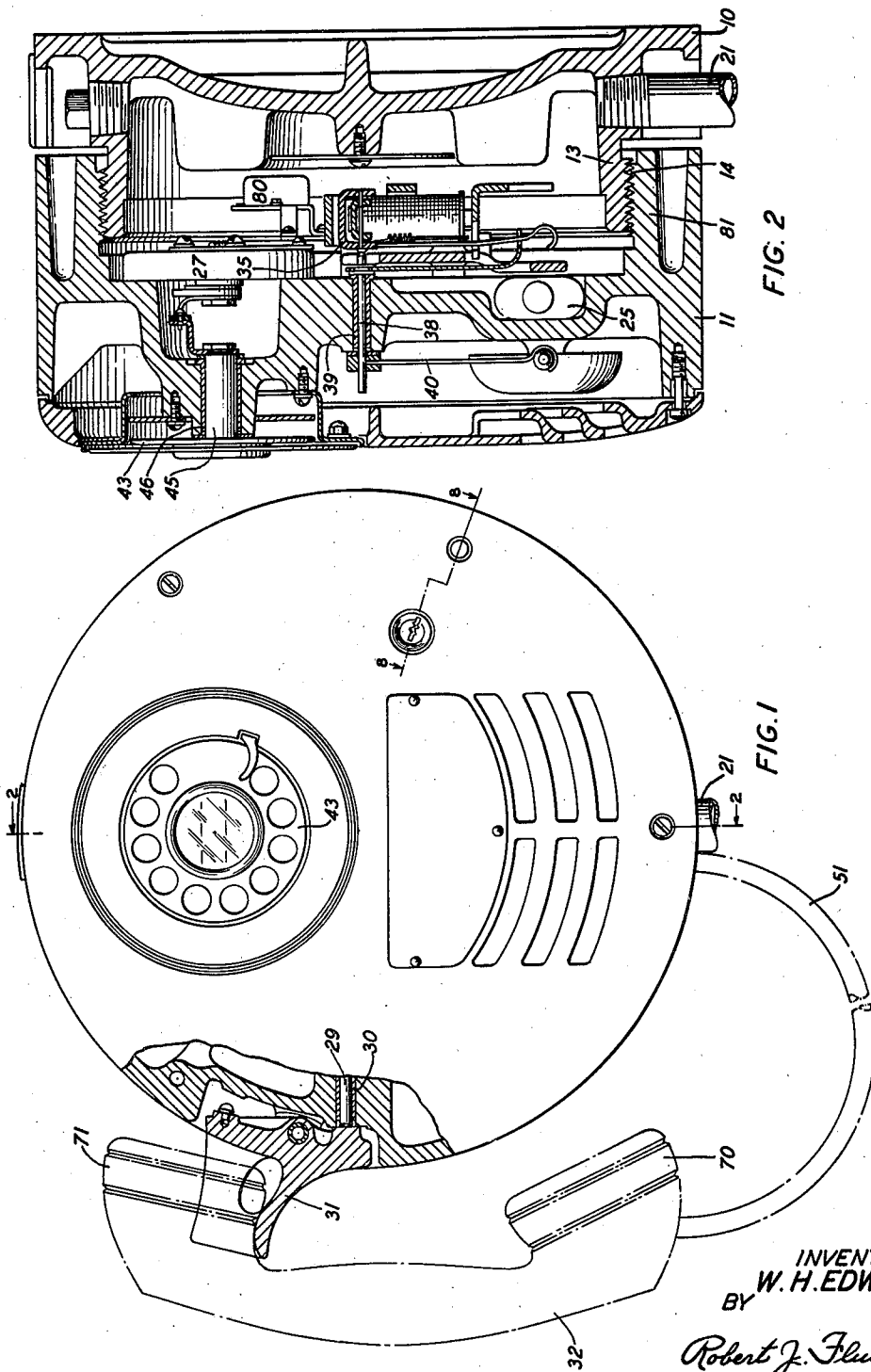
W. H. EDWARDS

2,285,022

TELEPHONE SUBSTATION APPARATUS

Filed Feb. 29, 1940

3 Sheets-Sheet 1



INVENTOR
W. H. EDWARDS
BY
Robert J. Fluskey
ATTORNEY

June 2, 1942.

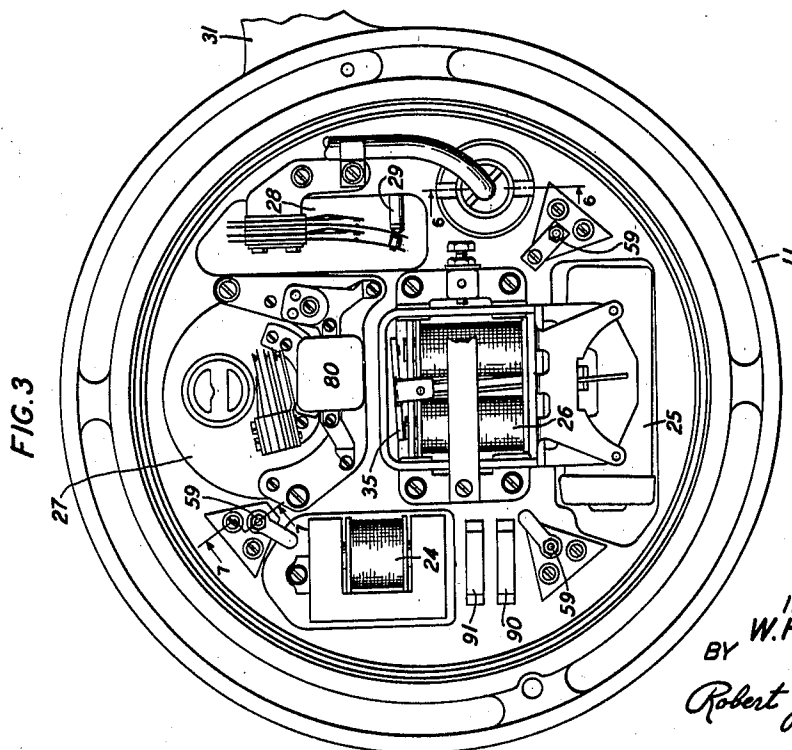
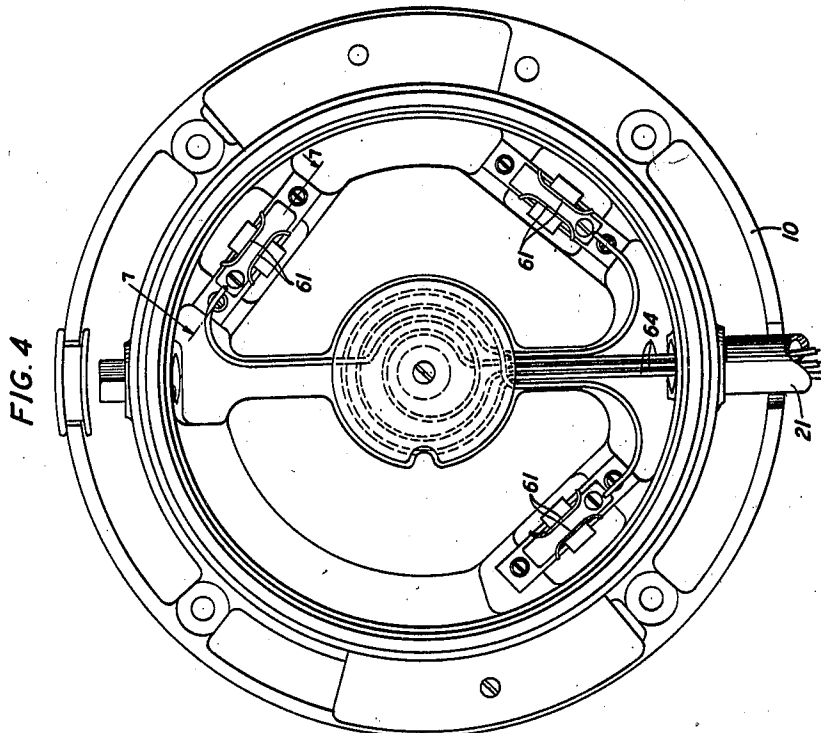
W. H. EDWARDS

2,285,022

TELEPHONE SUBSTATION APPARATUS

Filed Feb. 29, 1940

3 Sheets-Sheet 2



INVENTOR
BY W.H. EDWARDS
Robert J. Fluskey
ATTORNEY

June 2, 1942.

W. H. EDWARDS

2,285,022

TELEPHONE SUBSTATION APPARATUS

Filed Feb. 29, 1940

3 Sheets-Sheet 3

FIG. 9

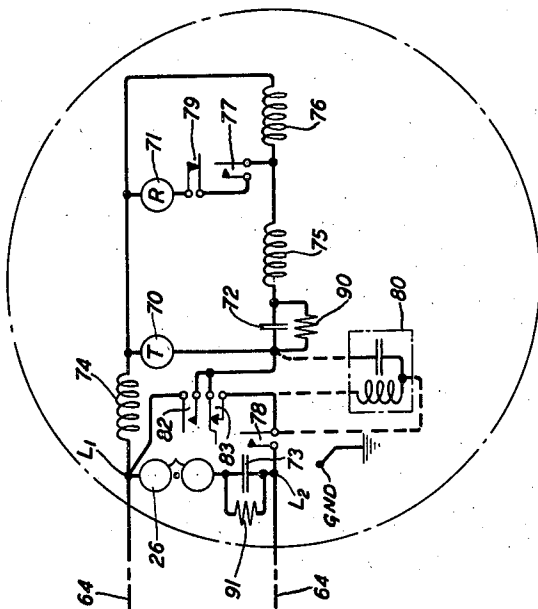


FIG. 5

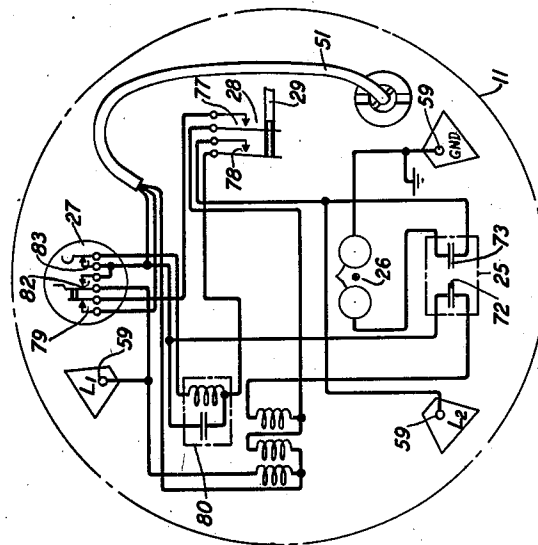


FIG. 8

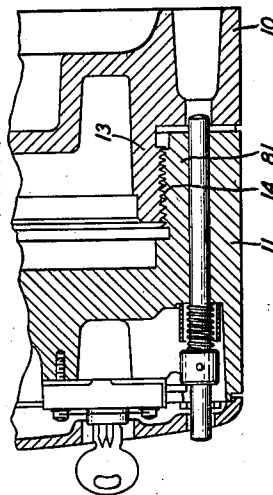


FIG. 7

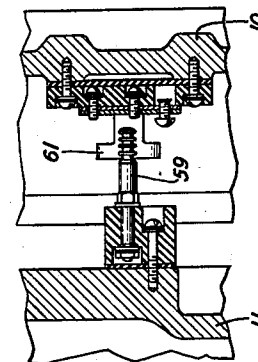
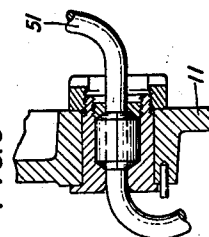


FIG. 6



INVENTOR
W. H. EDWARDS
BY
Robert J. Fluskey
ATTORNEY

UNITED STATES PATENT OFFICE

2,285,022

TELEPHONE SUBSTATION APPARATUS

William H. Edwards, Great Neck, N. Y., assignor
to Bell Telephone Laboratories, Incorporated,
New York, N. Y., a corporation of New York

Application February 29, 1940, Serial No. 321,365

9 Claims. (Cl. 179—81)

This invention relates to telephone set circuits and, more particularly, to circuits for telephone sets to be used in environments or atmospheres potentially dangerous, e. g., explosive, inflammable, or combustible, as in gas works, chemical plants, mills, mines, or the like.

An object of this invention is to insure that static charge accumulated by a circuit component of the telephone set circuit or the associated line conductors will be dissipated, discharged or rendered innocuous before such charge can create a spark, or spark discharge, that might initiate combustion, flame or explosion within, or in the vicinity of, the set.

A more specific object of the invention is to insure that charge accumulated by the capacity components of a telephone set circuit embodied in an explosion-proof telephone set, is dissipated or rendered innocuous prior to the dismantling or opening of the telephone set structure for repairs, replacements or maintenance in an explosive environment or atmosphere.

A fuller understanding of this invention will be derived from the specific description that follows, taken in conjunction with the accompanying drawings, wherein:

Fig. 1 is a front view of a telephone set embodying the invention;

Fig. 2 is a view in cross-section of the set of Fig. 1, taken along line 2—2 thereof;

Fig. 3 is a view of the interior of the set casing portion having an interiorly threaded flange and showing set circuit components supported thereby;

Fig. 4 is a view of the interior of the base of the telephone set of Fig. 1, showing the line and ground conductors and their spring terminals;

Fig. 5 is a schematic of the telephone set circuit prior to the embodying of the invention therein;

Figs. 6, 7 and 8 are sectional views of details of the telephone set structure along the lines 6—6, 7—7 and 8—8 of Figs. 3, 4 and 1, respectively;

Fig. 9 is a schematic of the telephone set circuit embodying the invention.

In D. H. King Patent No. 2,236,973, issued April 1, 1941, for Telephone substation apparatus, there is disclosed a typical telephone set in which this invention may be embodied; and, except as noted herein, the telephone set presently described and that of the aforementioned patent are identical. The set there disclosed comprises a casing or container for enclosure and for support of the instrumentalities or components ordinarily or necessarily to be found in or at a

telephone substation, i. e., calling dial mechanism 27 (if the substation is included in an automatic, or in a private branch exchange, system); a transmitter 70 and a receiver 71, the receiver and transmitter having a common support in a hand telephone or handset 32; an induction coil 24; a condenser 72 for keeping battery supply current out of the receiver circuit; station signaling or ringer apparatus 26; a condenser 73 in the ringing circuit for keeping battery supply current out of the ringing circuit; a filter 80 for high frequencies generated by operation of pulsing springs of the calling dial; switching springs 28 associated with the handset hook 31 for opening and closing the listening and talking circuits of the substation; and terminals 59, 61 for connecting such components to the line conductors.

In the telephone set of the King Patent No. 2,236,973, issued April 1, 1941, provision has been made for minimizing the possibilities of explosion in a surrounding explosive atmosphere because of flames or hot gases that might be generated in the enclosed space, or chamber, defined by the casing and leak out to the surrounding atmosphere during use of the set, while it is being installed, or while it is being disassembled for repairs, replacements, or maintenance. The finger-wheel 43 of the calling dial is coupled to the dial mechanism 27 through a long rod 45; and the clapper 40 of the ringer 26 to the armature 35 of the ringer electromagnet, and the switchhook springs 28 to the hand telephone hook 31 by similar rods 38, 29 in closely fitting bushings or sleeves 46, 49, 30, respectively, that provide such long, restricted passages for flames or hot gases that these latter are extinguished or cooled sufficiently in their passage from the interior to the atmosphere surrounding the set so that the atmosphere is not ignited.

The casing, furthermore, is defined by two interengaging or interfitted portions 10, 11, the portion 11 having an interiorly threaded flange 81, and the portion 10 having an exteriorly threaded flange 13 which, when threaded together, define a junction or joint 14 providing a flames-extinguishing or gases-cooling path of predetermined or pre-assigned length or dimension. In the specific set, five revolutions of the portion 11 are required before the contacts or terminals 59 thereon engage with the contact or terminal springs 61 on the portion 10, and three additional revolutions are required to give the desired complete inter-engagement of the two casing portions and the contacts.

After such a set has been installed, or has been

in use, it may be necessary to disassemble it, or to take it apart, in the explosive atmosphere in which it has been installed, to check trouble, to make necessary repairs, to replace components, or for general maintenance purposes. The circuit arrangement of the set of the King Patent 2,236,973, issued April 1, 1941, is shown in Fig. 5 thereof and of the drawings of this application. The condensers 72, 73 may have accumulated a charge that may discharge and create a gas-igniting spark as the interfitting portions are being rotated for disengagement, or as they are disengaged, with the consequent danger of explosion from that source. Such a possibility is guarded against and such accumulated charge rendered innocuous by procedure in accordance with this invention.

In Fig. 9, the circuit of the telephone set is presented in slightly different aspect from that of Fig. 5. The circuit is of the anti-side tone type, e. g., such as is disclosed in J. W. Gooderham 1,901,958, patented March 21, 1933, Figs. 1 and 1A. The windings 74, 75, 76 comprise the induction coil 24; condenser 72, in series with winding 75, and condenser 73, in series with the ringer 26, constitute the condenser 25; the circle labeled T is the transmitter 70, and the circle labeled R is the receiver 71 of the hand telephone 32; the pairs of contacts 77, 78 constitute the switching springs 28; the pair of contacts 79 constitute the normally closed dial springs, contacts 82 the normally open dial springs and contacts 83 the normally closed pulsing springs of the dial 27. The broken lines 64 represent the line conductors incoming to the set through the conduit 21 and connecting the set at line terminals 59 (L₁ and L₂) with the central office or other source of line current, pulsing current, talking current, ringing current, etc. The circuit shown is arranged for bridged ringing, but grounded ringing may be provided for by disconnecting that side of the ringer connected to terminals L₁ and by connecting it to the ground terminal (GND) provided in the set. Resistances 90, 91 are connected in shunt with the condensers 72, 73 for a purpose to be explained more fully hereinafter. As shown, the circuit is not in use, i. e., the hand telephone 32 is on the hook 31. Removal of the hand telephone from the hook results in the closure first of springs 78 and then of springs 77. The dial contact springs are arranged so that, during pulsing, contacts 79 open and contacts 82 are closed, closure of contacts 82 short-circuiting the substation listening and talking circuits. The operation of the circuit of Fig. 9 in initiating a call and terminating it is well known and need not be described here.

In the normal operation of a telephone set having a typical anti-side tone circuit, the following voltage conditions may leave a charge on the ringing and on the talking circuit condensers, if the shunt circuit around it is open because of trouble or other causes; line battery, pulsing battery, talking battery, ringing voltage, and silent interval tripping battery, assuming the connection is broken at a time when the potential exists.

If there should be occasion, therefore, for repairs, replacements or maintenance, to open a telephone set located in an explosive atmosphere, the condensers should first be discharged. Ordinarily, the tip and ring sides of the line would be opened at the substation and the wires grounded to discharge the condensers. However, if the line conductors or the ringer winding were

open, as might be the case at the time of a trouble visit, such procedure would not discharge the condensers. Furthermore, the step of grounding the conductors might be overlooked by the repairman. If the set were opened under such condition, the condensers might discharge and cause an explosion.

Connection of the resistances 90, 91 in shunt with the condensers, results in the charges on the condensers being automatically drained off as the voltage source is disconnected. Under these conditions, even if the line wires were not opened, the contacts with the line conductors in the base of the set would be broken when the front portion is being unscrewed or disengaged, and the condensers would be practically discharged by the resistances thereacross before the set could be opened entirely and the explosive atmosphere combine with that of the interior of the set.

These resistances should be of sufficiently high resistance so that they will have a negligible effect on transmission, ringing, tripping, dialing and supervision, and sufficiently low to insure discharge of the condensers in a short time, preferably in a few seconds. In the circuit of a set constructed in accordance with the invention, a one megohm resistance in shunt with each condenser gave the desired result; the ringing circuit condenser was .5 microfarad; and the receiver circuit condenser was 2 microfarads. The resistance 91 could be supplemented, if desired, with an inductance in series or in parallel with it.

When, and if, a dial filter, such as filter 80, is associated with the telephone set, it will be observed that, if, because of some trouble, dial springs 83 should be or remain open, at least two discharge paths are available for any charge that may have accumulated on the condenser of the filter, which, in actual practice, is usually of very small capacity, for example, of the order of .1 microfarad. As an ultimate of precaution, however, the filter condenser, also, may have a high resistance similar to resistances 90, 91 connected in shunt therewith. The filter 80 is shown added by dotted lines in Fig. 9. It will be understood, of course, that the inductance element thereof would replace the full-line connection shown between the right spring of contacts 78 and the lower spring of contacts 83.

Although the invention has been disclosed with reference to a specific telephone set and circuit therefor, it will be evident to the skilled in the art that it is capable of application in specifically different sets and circuits therefor where equivalent conditions to be corrected may exist. It is to be understood, therefore, that it is not intended to limit the invention other than as may be necessary in view of the state of the prior art.

What is claimed is:

1. A circuit for a telephone set to be used in an explosive atmosphere, and in which one or more condensers are included, comprising means connected permanently across the condenser for enabling a charge on the condenser to be dissipated irrespective of the condition of any circuit opening and closing contacts in the set.

2. A circuit as claimed in claim 1 in which said means comprises an impedance connected in shunt with said condenser.

3. A circuit as claimed in claim 1 in which said means comprises a resistance connected in shunt with said condenser.

4. A telephone set circuit comprising a receiver

ing circuit including a receiver, a transmitting circuit including a transmitter, a multiwinding induction coil whose windings are included in said receiving and transmitting circuits, a condenser in series with one winding of said coil, a ringing circuit including a condenser, normally open circuit-closing contacts in said receiving and transmitting circuits, and resistances connected permanently in parallel with said condensers to dissipate, independent of the open and closed conditions of said contacts, any charge that may accumulate on said condensers.

5. A telephone set comprising a casing having a plurality of interengaging portions each of which supports some components of the telephone set circuit, one or more of said components being normally shielded from the atmosphere surrounding the set but exposed to such atmosphere when the set portions are disengaged, one of said components comprising a condenser, and means connected permanently across said condenser for dissipating prior to disengagement of said interengaged set portions any charge accumulated by said condenser irrespective of the condition of any circuit opening and closing contacts in the set.

6. A telephone set comprising a casing having a plurality of interengaging portions each of which supports some components of the telephone set circuit, one or more of said components being normally shielded from the atmosphere surrounding the set but exposed to such atmosphere when the set portions are disengaged, two of said components comprising condensers, one associated with other components comprising an anti-side tone circuit and another being associated with ringing means, and means connected permanently across each of said condensers for dissipating prior to disengagement of said interengaged portions any charge accumulated by said condensers.

7. A telephone set comprising a casing having a plurality of interengaging portions each of which supports some components of the telephone set

circuit including one or more pairs of circuit-closing contacts, one or more of said components being normally shielded from the atmosphere surrounding the set but exposed to such atmosphere when the set portions are disengaged, one of said components comprising a condenser, and a resistance permanently in parallel with said condenser for dissipating prior to disengagement of said interengaged set portions any charge accumulated by said condenser irrespective of whether said contacts are in open or closed condition.

8. A telephone set comprising a casing having a plurality of interengaging portions each of which supports some components of the telephone set circuit, one or more of said components being normally shielded from the atmosphere surrounding the set but exposed to such atmosphere when the set portions are disengaged, two of said components comprising condensers, one associated with other components comprising an anti-side tone circuit and another being associated with ringing means, and a resistance connected permanently in parallel with each condenser for dissipating prior to disengagement of said interengaged portions any charge accumulated by said condensers.

9. A telephone set comprising a housing enclosing all elements of the set circuit including circuit-closing contacts which could originate electric discharges that might initiate an explosion in an explosive atmosphere in which the set might be in use, said housing normally confining any such discharges within itself, so that they are ineffective outside the housing, one of said set circuit elements comprising a condenser, and a resistance connected permanently in parallel with said condenser to dissipate, irrespective of whether said contacts are open or closed, any charge on said condenser in a time less than that required to open said housing sufficiently to allow the explosive atmosphere to combine with the atmosphere within the housing.

WILLIAM H. EDWARDS.