Dec. 31, 1940. P. BAKER 2,226,891

TWO-WAY LOUD SPEAKING TELEPHONE

Filed Aug. 1, 1936 7 Sheets-Sheet 1

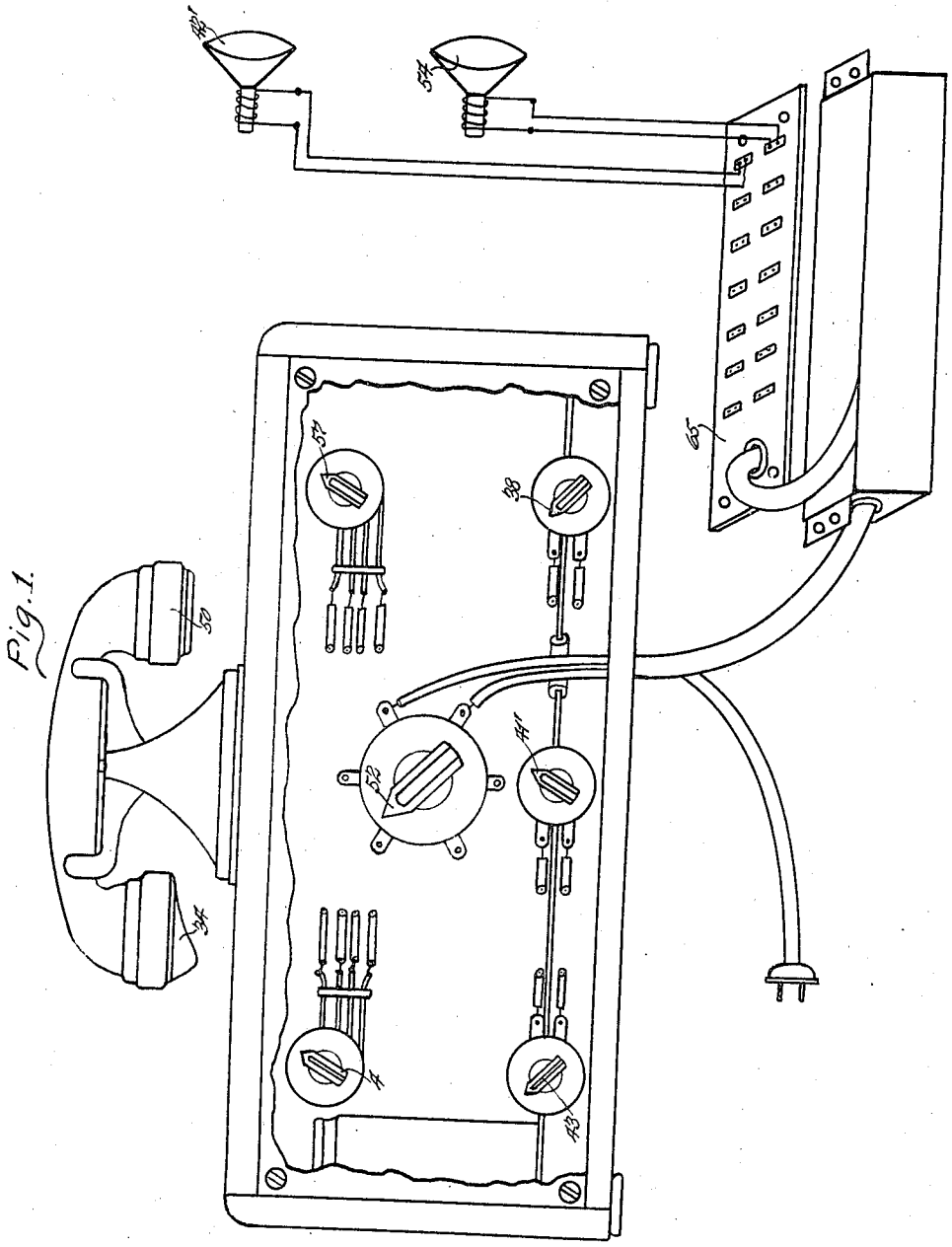


Fig. 1.

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TWO-WAY LOUD SPEAKING TELEPHONE

Filed Aug. 1, 1936 7 Sheets-Sheet 2

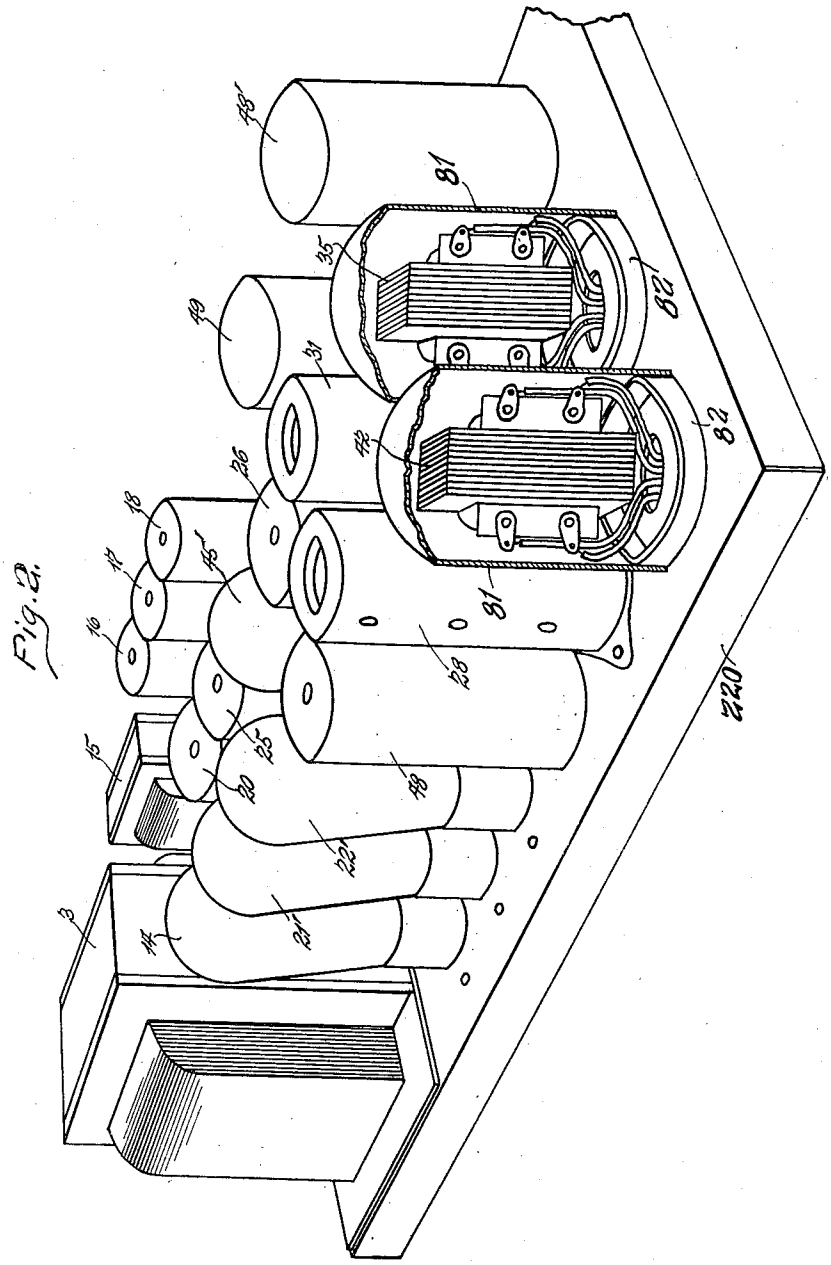



Fig. 2.

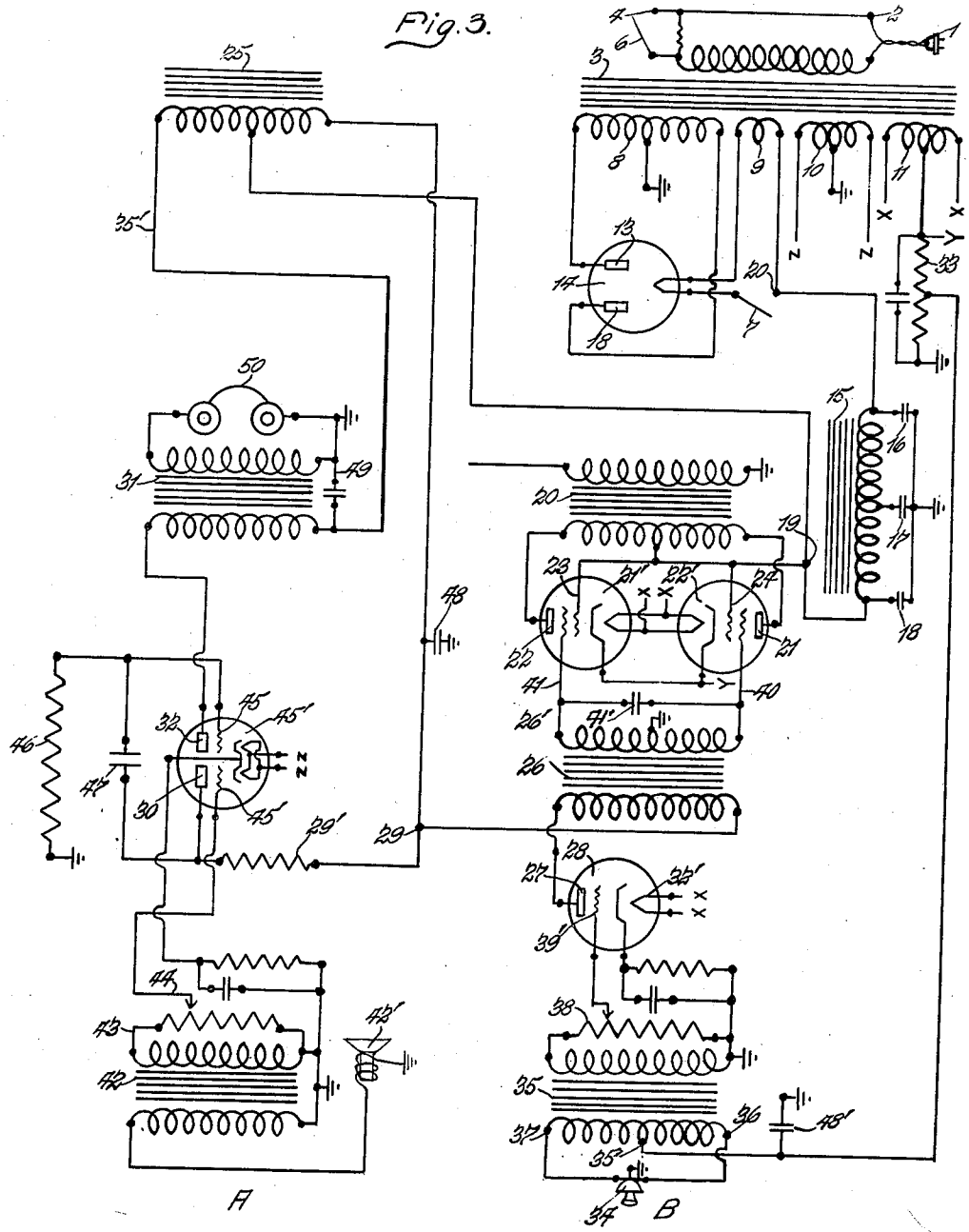
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TWO-WAY LOUD SPEAKING TELEPHONE

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Fig. 3.



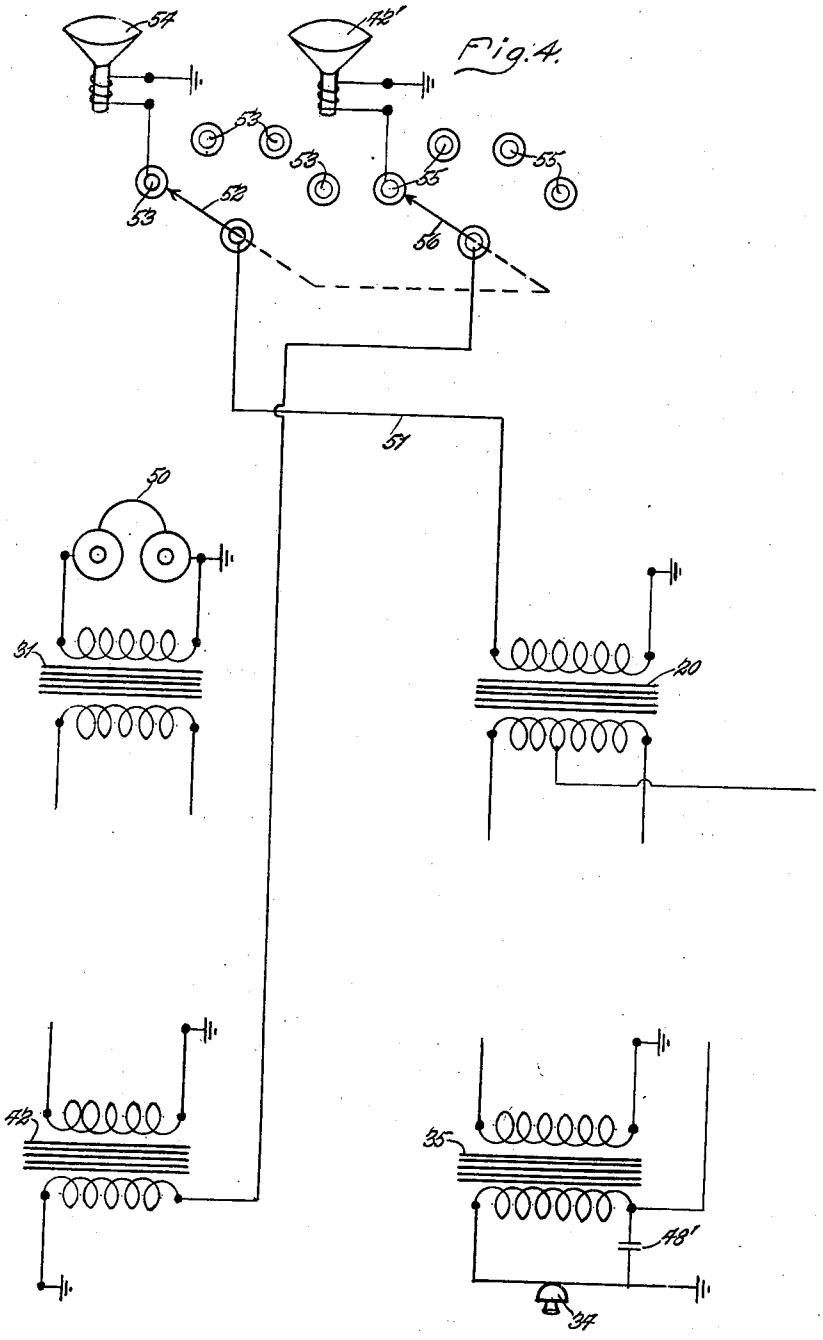

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TWO-WAY LOUD SPEAKING TELEPHONE

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Fig. 4.

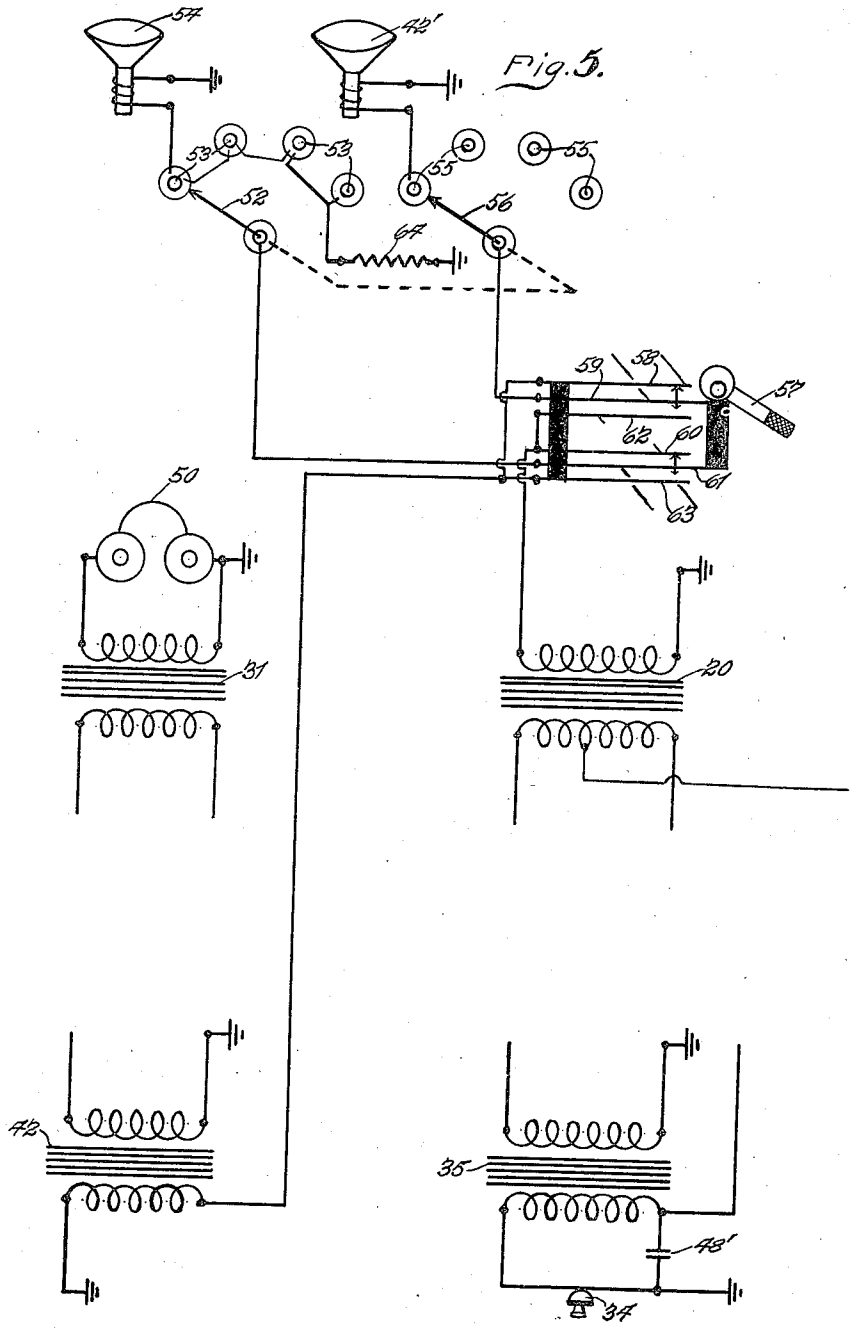



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TWO-WAY LOUD SPEAKING TELEPHONE

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Fig. 8.

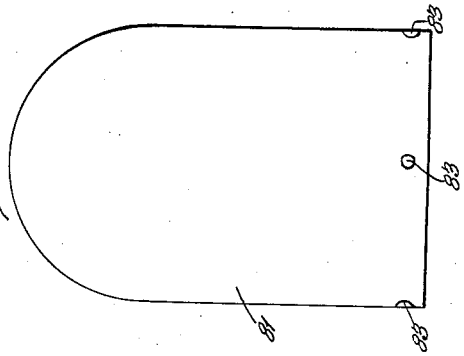



Fig. 9.

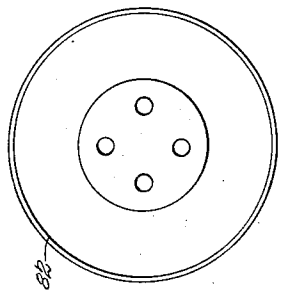



Fig. 7.

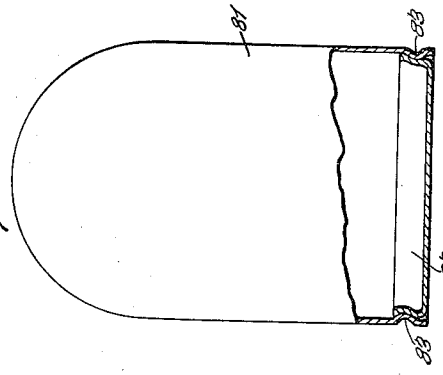
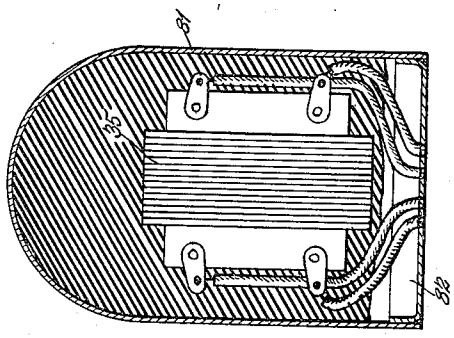



Fig. 6.



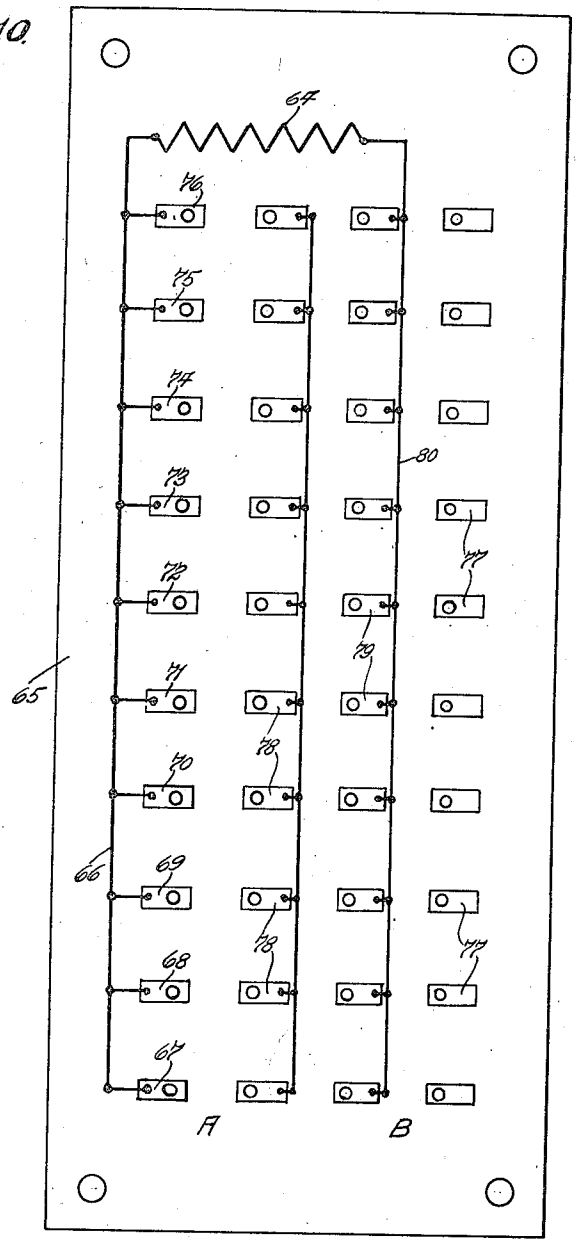

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Fig. 10.




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# UNITED STATES PATENT OFFICE

2,226,891

## TWO-WAY LOUD-SPEAKING TELEPHONE

Paul Baker, Redondo Beach, Calif., assignor to Lewis W. Christophel, Redondo Beach, Calif.

Application August 1, 1936, Serial No. 93,832

14 Claims. (Cl. 179—1)

This invention relates to a two-way loud-speaking telephone.

Objects of the invention are to provide an improved two-way loud-speaking telephone adapted for use in buildings and elsewhere to facilitate rapid communication between persons remote from each other and making it possible for a person at the instrument to communicate with any desired number of stations located at different points remote from each other and from the instrument; to provide an improved two-way loud-speaking telephone characterized by simplicity of construction, efficiency and economy of operation, and speed in effecting communication between the person at the instrument and any selected station or stations; to provide an improved two-way loud-speaking telephone adapted for installation and use in the manner suggested and hereinafter more fully disclosed for use in communicating between different departments of any business or industry, or between a central station and a number of different stations remote from the central station and from each other and by use of which the operator or person at the instrument can maintain constant communication with any department or with any station; to provide an improved two-way loud-speaking telephone by use of which costs and expenses of telephonic communication between different stations or departments is substantially reduced below costs and expenses in effecting such communications with present equipment; and to provide a telephone of the type and for the purposes suggested by which a person called from the instrument or central station may answer into the telephone from points remote from the transmitter and reproducer without performing any mechanical operation whatever in connection with the telephone or the transmitter and reproducer and while continuing with the work or service in which the person called was engaged.

Various other objects and advantages of this invention will be apparent from the following description, reference being made to the annexed drawings, in which—

Fig. 1 is a front elevation of the instrument with a part of the front panel broken away to disclose parts of the interior, and also diagrammatically illustrating the terminal box and board with one outgoing loud speaker and one incoming microphone.

Fig. 2 is a perspective view of the inner portion of the instrument, the cabinet being removed, and the cases for the two input transformers being in section.

Fig. 3 is a diagrammatic view of the complete system illustrating the circuits and their associated parts.

Fig. 4 is a diagrammatic view showing the switching sequence of this telephone, and also diagrammatically showing the rotative selector switches.

Fig. 5 is a diagrammatic view similar to Fig. 4 showing the instrument equipped with an optionally operable switch controlling the instrument for various uses, such, for instance, as a paging system or as a telephone, or as separate instruments, etc., the switch being shown in neutral or ineffective position.

Fig. 6 is a sectional view showing the assembly of one of the transformer cases before the parts are rigidly attached.

Fig. 7 is a similar sectional view showing the parts after they have been rigidly attached to show the transformer in its proper rotated position in which it is rigidly secured.

Fig. 8 is a side elevation of one of the transformer cases after the parts have been rigidly attached to support the transformer in its proper rotated and rigid position.

Fig. 9 is a plan view of the base member of any one of these transformer cases.

Fig. 10 is a diagrammatic view of the terminal board showing the terminal lugs and the wiring diagram of the dummy load resistor which is attached to the outgoing channel of the instrument.

In the illustrated arrangement of the invention, an electrical connector, such as a plug 1, is adapted to be attached to a source of electrical energy or supply and has wires 2 (Fig. 3) leading to connection with a power transformer device 3 of a commercially known type through a switch actuator 4 supported on the panel board of the casing of the instrument. This instrument is designed and adapted to be located or mounted conveniently accessible to the person who may desire to communicate with selected points or stations remote from the operator. The switch actuator 4 operates the switch element 6 and also the switch element 7. The switch element 6 controls the circuit leading to the power transformer 3. The power transformer 3, which is of a commercially known type, includes the usual high voltage winding 8, the usual filament winding 9 for the rectifier tube, the usual filament winding 10 for the circuit for one of the amplifiers, and the usual winding 11 for the circuit for another amplifier. This transformer is not further illustrated in detail because it is of known and standard design.

The winding 8 is connected to the two plates 12 and 13 of the rectifying tube 14, which rectifies the current from A. C. to D. C. When the switch elements 6 and 7 are closed, the two amplifiers, one of which is in what I designate as the outgoing channel A and the other of which is in what I designate as the incoming channel B are conditioned for use. The electrical energy

then passes through the plate supply filter choke 15 and thence is bypassed by three condensers 16, 17 and 18. From the choke 15 the electrical energy passes through a connection 19 to the output transformer 20 of channel A, supplying plate current and voltage to the plates 21 and 22, and also screen voltage to the screens 23 and 24 to the power tubes 21' and 22'. The electrical energy continues on to a center tap choke 25 and returns to an audio transformer 26 which is connected to the plate 27 of an audio tube 28. An electrical connection 29 on the same circuit continues through a resistor 29' to a plate 30 of the first stage of audio in the channel A. The opposite wire 25' of the center tap choke 25 continues to the output transformer 31 in the channel A which furnishes the plate supply to the plate 32 for the output stage in the channel A. The filament winding 10 is connected to the filament winding NN in the channel B.

The filament winding 11 is connected to the two power tubes 21' and 22' and the same winding is also connected to the filament winding on the first audio tube 32' in the channel A through the connections XX.

A biasing resistor 33 to supply the proper microphone current in the hand-set 34 is tapped to the center tap 35' on the input transformer 35. Through this input transformer 35 the electrical current is returned to the two buttons 36 and 37. A potentiometer 38 is connected across the secondary of the transformer 35 and is connected to the grid 39' of the tube 28. This potentiometer 38 controls the volume of the outgoing conversation through the channel B. The transformer 26 has a secondary winding 26' which is grounded as indicated in Fig. 3.

The two outside windings of the transformer 26 are connected to the grids 40 and 41 respectively of the output tubes 21' and 22' in the outgoing channel B, and are shunted by a condenser 41' which acts as a tone control to raise and lower the pitch of the speaker's voice in the outgoing channel. The input transformer 42 in the channel A is connected to the incoming microphone 42'. A potentiometer 43 is connected across the secondary winding of the input transformer 42 and is provided with a variable tap 44 which is connected to the first grid 44' of the twin tube 45'. This potentiometer controls the incoming signal from the incoming microphone 42'. The second grid 45 in the twin tube 45' is the grid in the last stage and is connected through a resistor 46 to ground. A coupling condenser from the first plate 30 excites the second grid 45 of the last stage. A bypass filter condenser 48 and a bypass filter condenser 49 are provided in the circuit for smoothing out A. C. riffles.

The earphone 50 (Fig. 4) in the handset is connected directly across the secondary of the output transformer 31 in the channel B. This receives the incoming signal from the microphone 42' after the instrument has been placed in operative use by the person at the central station, as hereinbefore explained.

The output transformer 20 has electrical connection 51 through a switch 52 with a series of contacts 53. The switch 52 is operative to engage the contacts 53 selectively and an outgoing loud-speaker 54 is connected with each of the contacts 53. These loud speakers are mounted in different locations remote from the operator of the instrument and remote from each other, and the diagrammatic illustration in Fig. 4 should be sufficient to disclose the optional arrangement.

Also, Fig. 4 illustrates a series of contacts 55 optionally engageable by a switch 56 which is connected with the input transformer 42 in the channel A. The incoming microphone 42' is connected with each of the contacts 55 which are remote from the operator of the instrument and remote from each other. The switch 56 is movable optionally into engagement with the respective contacts 55, so that communication may be established from the operator of the instrument to persons accessible to the respective incoming microphone 42'.

Fig. 5 diagrammatically illustrates the instrument equipped with an optionally operable key 57 for controlling the instrument for various uses. As shown, the key 57 is in neutral position, the contacts 58 and 59 being in contact with each other and the contacts 60 and 61 being in contact with each other, so that the instrument is usable as an incoming telephone only. The contact 59 is in electrical communication with the switch 56 which is movable optionally into contact with the respective contact members 55; and the contact 61 is in electrical communication with the switch 52 which is movable optionally into engagement with the respective contact members 53.

When the switch 57 is moved to effective position, the contact member 59 is moved into electrical contact with a member 62 and the contact member 61 is moved into electrical contact with a contact member 63, thus transforming the instrument into a paging system, which is the equivalent of a one-way telephone. The member 62 is electrically connected with the member 60, and the member 58 is electrically connected with the member 63.

A dummy load resistor 64 is connected from the contacts 53 to ground. This instrument equipped with the dummy load resistor 64 prevents undesired noise in operation when the instrument is used as a combination paging system and telephone and also prevents the output transformer 20 from being without a load. It also keeps the load on the input transformer 42 and, as the two amplifiers are reversed from input to output, it keeps a constant load on the idle channel.

The terminal board 65 illustrated in Fig. 10 is wired for use in a paging system and telephone combined having the wire 66 in the outgoing channel A connected with respective terminal lugs 67, 68, 69, 70, 71, 72, 73, 74, 75, 76, and through the dummy load resistor 64 to complementary grounded terminal lugs.

In some instances, the terminal lugs 72, 73, 74, 75 and 76 are unattached to the wire 66 and are out of electrical communication with the dummy load resistor. A loud-speaker may be attached to any one or to the respective ones of the terminal lugs 72, 73, 74, 75 and 76 at the option of the user, thus producing an efficient two-way loud-speaking telephone. The terminal lugs 77 are electrically connected with the respective contact members 55, and the terminal lugs 78 are electrically connected with the respective contact members 53. The terminal lugs 79 have electrical connection 80, in the incoming channel B, with the dummy load resistor 64 and are electrically connected to the incoming microphones 42'; and the terminal lugs 78 are electrically connected with the incoming speaker 54.

The input transformers 35 and 42 are of

duplicate construction, each comprising a housing 81 in which the respective transformers are supported in solidified electrically non-conductive plastic material. On the chassis 220, a base 82 for each housing 81 is rigidly attached. After the transformers have been assembled in the housings 81 and attached to the wiring system and are embedded in the electrically non-conductive solidified plastic material, the housings are telescoped onto the respective bases 82 and are rotated or turned to proper adjusted positions to prevent inductive coupling, feed-back, oscillation and humming noise; when turned to proper adjusted positions, audio coupling between the loud-speaking telephone in channel A and the incoming telephone in the channel B is prevented, thus enabling these two channels to be located side by side and utilizing practically all of the space on the chassis.

After the housings have been turned to their proper adjusted positions in the manner described, they are rigidly attached to the respective bases 82 in any appropriate manner, as by forming or pressing interlocking indentations 83 in the lower portions of the housings 81 and the enclosed portions of the bases 82. This will positively prevent the input transformers from becoming dislocated and will hold them rigidly in proper adjusted positions so that the instrument may be transported from one place to another without possibility of damage. This arrangement permits a single power supply to furnish plate and filament current to both channels A and B and permits them to be coupled closely together in a comparatively small space to form an easily portable and compact instrument.

In mounting the device for use, the plug 1 is inserted in an appropriate socket and thereby connected with a source of electrical energy. To use the instrument, the actuator for the switch elements 6 and 7 is operated to close the switches of which said switch elements are a part. A familiar control for the condenser 41' may be then operated to raise and lower the pitch of the speaker's voice passing into the outgoing channel through the hand-set 34, and the actuator for the potentiometer 38 may be operated to control the volume of the outgoing conversation. Also, the actuator for the potentiometer 43 in the channel B may be operated by the person at the main instrument to control the volume of the incoming conversation. The switch 52 is operative by the person at the main strument to engage the contacts 53 selectively through any selected loud-speakers 54 which are connected to said respective contacts 53. Since these loud-speakers are mounted in different locations remote from the operator of the instrument and remote from each other, they may be utilized optionally. The switch 56, which is connected with the input transformer 42 in the channel B, is operated to control the respective incoming microphones 42' one of which is connected to each of the contacts 55 and all of which are remote from the operator of the instrument and remote from each other. The switch 56 is movable optionally by the operator into engagement with the respective contacts 55, thus making it possible for the operator to establish communication with persons accessible to the respective incoming microphones 42'. The key 57 is provided for the purpose of controlling the instrument for various uses. When the key 57 is in the position shown in Fig. 4, the contacts 58 and 59 are in contact with each other and the contacts 60 and 61 are in contact with each other, thus conditioning the instrument for use only as an incoming telephone. When the key 57 is moved to effective position, the contact member 59 is moved into electrical contact with the member 62 and the contact member 61 is moved into electrical contact with a contact member 63, thus transforming the instrument into a paging system, which I designate as the equivalent of a one-way telephone.

The various resistors and other elements arranged and combined in this novel assembly function for their designated and intended purposes, so that the instrument is well designed and adapted for application to many uses some of which have been specifically mentioned. Thus, in the use of this instrument, all operations of the various switches and keys are performed by the person at the main instrument where the hand-set 34 is located. The instrument may well be used for paging purposes through the various loud-speakers, or selectively through chosen ones of the loud-speakers, and may be used as a one-way telephone or a two-way telephone as desired.

From the foregoing, it should be understood that this invention attains all of its intended objects and purposes in a highly efficient and satisfactory manner. It can be manufactured and installed within permissible limits of cost and constitutes a great convenience when mounted and used in the manner herein disclosed. Of course, the instrument may be varied in numerous particulars without departure from the nature and principle of the invention as defined by the appended claims.

I claim:

1. A two-way loud-speaking telephone system comprising outgoing and incoming channels arranged in close relationship and including in the outgoing channel a filter choke and a series of condensers; an output transformer in electrical communication with the filter choke in the outgoing channel; an input transformer in the incoming channel, means for supporting said transformers adjusted in rigid relationship to prevent inductive coupling and humming noise, and switch elements at one end of said system for opening and closing the circuits for two-way conversation.

2. A two-way loud-speaking telephone system comprising outgoing and incoming channels arranged in close relationship and including in the outgoing channel a filter choke and a series of condensers; switches at one end of the system controlling operation of the telephone to different stations remote from each other for two-way conversation, output and input transformers in the outgoing and incoming channels respectively, electrically non-conductive supporting means for said transformers, and devices for holding said supporting means in rigid relationship to prevent inductive coupling, feed-back, and humming noises.

3. In a two-way loud-speaking telephone system having an outgoing channel and an incoming channel, switch elements at one end of said system for opening and closing circuits through said channels, actuating means at said end of said circuit for operating said switch elements to condition the telephone system for two-way conversation, a casing, an output transformer in the outgoing channel mounted in said casing, electrical non-conductive means in said casing holding said transformer rigid therein, and a support upon which said casing is mounted rigidly in a

selected position to prevent inductive coupling, oscillation, and humming noises.

4. In a two-way loud-speaking telephone system having electric wiring forming outgoing and incoming channels, a combined loud-speaker and transmitter device mounted in a stationary position at one end of the system, a transmitter located at the opposite end of the system, a potentiometer controlling the volume of the outgoing conversation through said second transmitter and the outgoing channel, a second potentiometer controlling the volume of the incoming conversation, and means at the end of the system opposite from said combined loud-speaker and transmitter controlling operation of the telephone for two-way conversation while said loud-speaker and transmitter remain stationary.

5. In a two-way loud-speaking telephone system having electric wiring forming outgoing and incoming channels, a combined loud-speaker and transmitter device mounted in a stationary position at one end of the system, a transmitter located at the opposite end of the system, a potentiometer controlling the volume of the outgoing conversation through said second transmitter and the outgoing channel, a second potentiometer controlling the volume of the incoming conversation, means at the end of the system opposite from said combined loud-speaker and transmitter controlling operation of the telephone for two-way conversation while said loud-speaker and transmitter remain stationary, and an optionally operable key device for conditioning the system for use as a paging device conducting signals or conversation in one direction only, or as a two-way telephone device conducting conversation in both directions.

6. In a two-way loud-speaking telephone system having outgoing and incoming channels, an output transformer in the outgoing channel, a casing enclosing said transformer, a support having rigid connection with said casing and holding said casing in selected adjusted positions, and insulating means rigid in said casing embedding and supporting said transformer spaced and insulated from both said casing and said support.

7. In a two-way loud-speaking telephone system having outgoing and incoming channels arranged in close proximity, a support, a transformer electrically connected with each of said channels, casings rigid with said support and enclosing said transformers respectively, and electrically non-conductive means enclosed by and attached to said casings embedding and supporting said transformers spaced and insulated both from said casings and said support.

8. In a two-way loud-speaking telephone system having outgoing and incoming channels in close proximity, a transformer electrically connected with each of said channels, electrically non-conductive means embedding and supporting said respective transformers, casings rigidly attached to said means for adjusting and supporting said means and thereby said transformers in selected positions, and a key at one end of the system controlling said channels to transform the telephone system into a one-way telephone system or a two-way telephone system as desired.

9. In a telephone system of the character described having outgoing and incoming channels, a key at one end of said system adjustable in one position to condition the telephone system for use as a one-way system and adjustable in another position to condition the system for use as a two-way telephone system as desired.

10. In a telephone system of the character described having outgoing and incoming channels, a terminal board, a series of terminal lugs on said board permanently connected with said channels respectively, another series of terminal lugs on said board detached from said channels for optional connection therewith or not as desired and for connection with a speaker, a resistor adjacent to said board connecting said channels, a key, and means operative by said key for controlling said channels for use as a one-way or a two-way telephone as desired.

11. A telephone of the character described having outgoing and incoming channels, a handset at one end of the outgoing channel, an incoming microphone at the outer end of the incoming channel, an outgoing loud-speaker at the outer end of the incoming channel, a key controlling said channels to transform the telephone from a one-way to a two-way telephone as desired, and a dummy load resistor connected with said channels through said key to keep a load on the idle channel.

12. In a telephone system of the character described having outgoing and incoming channels arranged in close relationship, a power transformer supplying the operating voltages and operating current to both channels, a key controlling said channels to transform the telephone system from a one-way to a two-way telephone system as desired, and a dummy load resistor connected with said channels through said key to keep a constant load on the idle channel.

13. In a telephone system of the character described, outgoing and incoming channels arranged in close relationship, a transformer electrically connected with each of said channels, electrical non-conductive supports for said respective transformers, casings enclosing said supports and secured in rigid positions, a power transformer supplying the operating voltages and operating current to both channels, a terminal board, a series of terminal lugs on said board certain of which are permanently connected with the channels and others of which may be connected with the channels or not as desired and are also adapted for connection with a loud-speaker, a key controlling said channels to transform the telephone from a one-way to a two-way telephone as desired, and a dummy load resistor connected with said channels through said key to keep a constant load on one of said channels.

14. In a telephone system of the character described having outgoing and incoming channels, a switch at one end of said system for conditioning the system for use as a one-way telephone system and also for conditioning the system for use as a two-way telephone system, and means for operating said switch to said first position in which the telephone can be used only as a one-way system, and to said second position in which the telephone may be used as a two-way system while said switch remains in said second position.

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