Jan. 25, 1944. H. R. VAN DEVENTER 2,340,160

PRIVATE BRANCH EXCHANGE TELEPHONE SYSTEM EMPLOYING PHONOGRAPHS

Filed Jan. 13, 1942 2 Sheets-Sheet 1

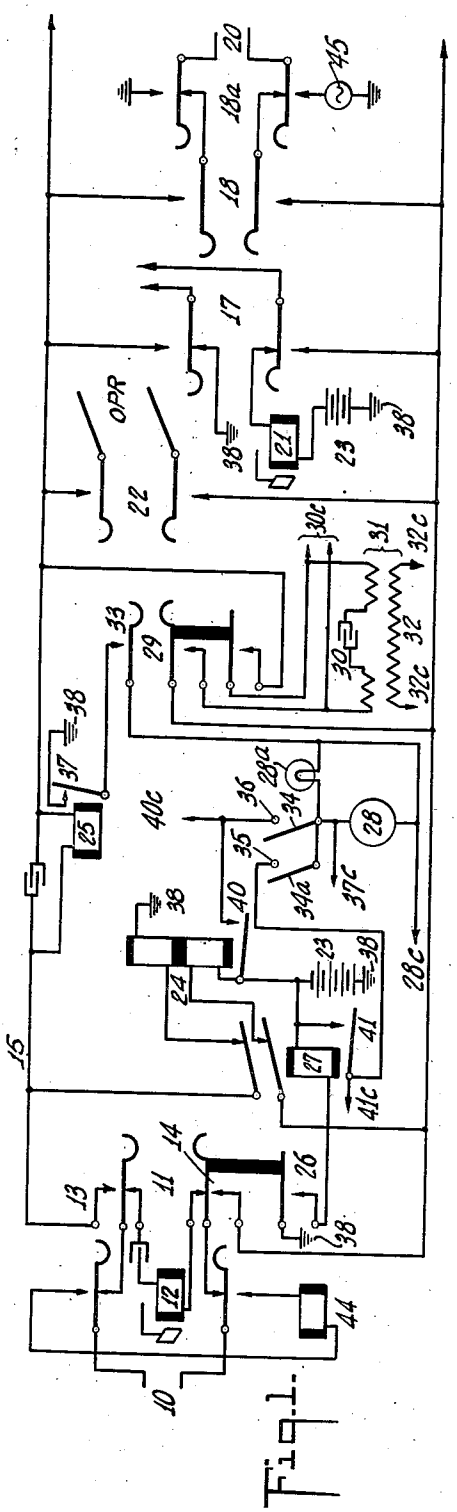


Fig. 1.

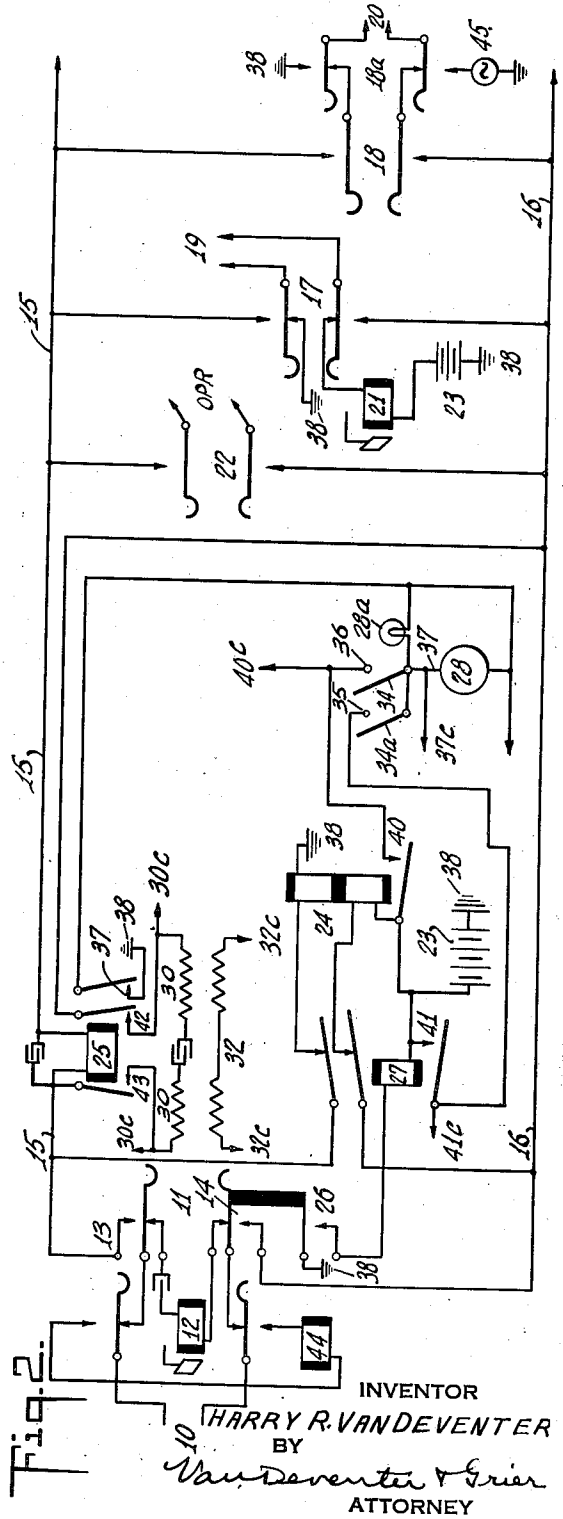


Fig. 2.

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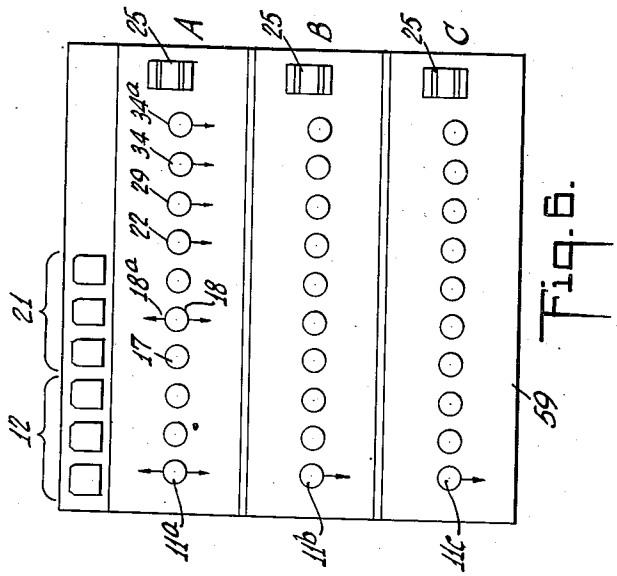


Fig. 6.

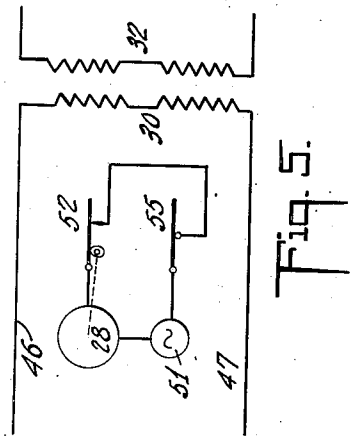


Fig. 5.

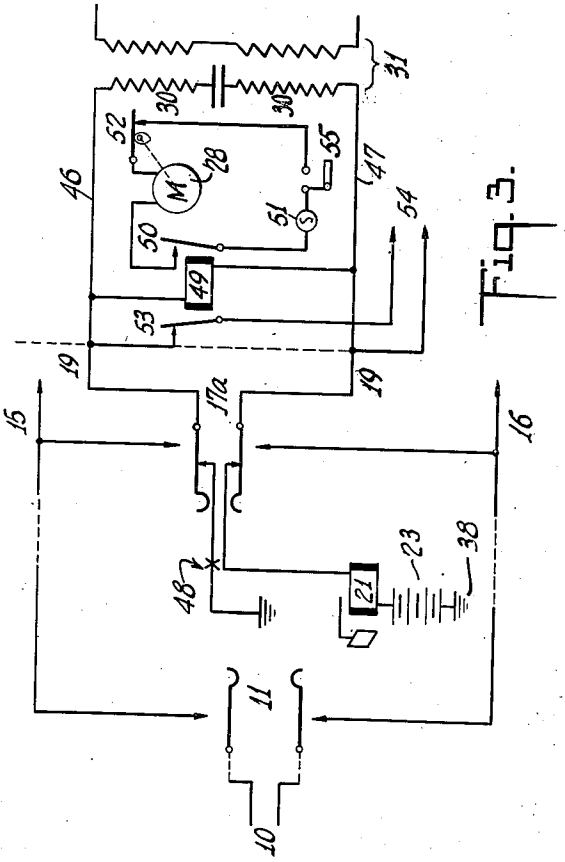


Fig. 3.

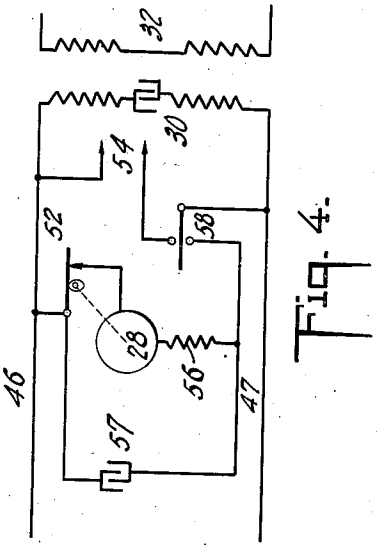


Fig. 4.

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# UNITED STATES PATENT OFFICE

2,340,160

## PRIVATE BRANCH EXCHANGE TELEPHONE SYSTEM EMPLOYING PHONOGRAPHS

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Application January 13, 1942, Serial No. 426,631

20 Claims. (Cl. 179—6)

This invention relates to a telephone system in which phonographs are used and has for one object the provision of a private branch exchange (hereinafter termed a P. B. X) where an operator can, at will, connect a phonograph to any trunk or extension line, or both, to deliver a message left on the phonograph and for recording telephone conversations.

Another object is to provide a system in which the phonograph will be automatically connected whenever an intercommunicating call is made, or whenever a trunk line is connected to an extension and in which the operator may connect the phonograph to record either or both classes of calls.

Other objects and advantages will be apparent from a perusal of the following specification and the accompanying drawings wherein is shown by way of illustration a P. B. X equipped in accordance with the invention.

Referring now to the drawings:

Figure 1 is a schematic diagram of circuits and apparatus embodying the invention wherein the operator uses manually operated recording keys to connect the phonograph to the various circuits.

Figure 2 is a modification of the circuit shown in Figure 1 wherein the operation of the phonograph is controlled by the operation of the telephone equipment and without the use of the recording keys shown in Figure 1.

Figure 3 is a schematic diagram of an alternate form of connecting circuit.

Figure 4 is a schematic diagram of a method of connecting a phonograph motor in a circuit such as that shown in Figure 3.

Figure 5 shows an alternate way of connecting a phonograph motor.

Figure 6 is a diagram showing the arrangement of the apparatus shown in the preceding figures at a P. B. X board.

The so-called cordless type of P. B. X designed for use in a common battery system, is usually provided with a plurality of trunk lines, one of which is shown at 10, terminating at the P. B. X in a switch key 11, to the inner contacts of which is connected a suitable signalling device, such as the ring-down drop 12, responsive to ringing current from a main exchange.

From the normally open contacts 13, 14, of key 11 extend common conductors 15, 16, to the normally open contacts of the extension switch keys 17, 18, connected to circuits 19, 20, leading to extension telephones. The wires 15, 16, constitute a connecting circuit between all keys in a bank as hereinafter described.

Each extension telephone line has a signal device 21, normally connected thereto via the inside contacts of the associated key as shown, whereby, when the line circuit is closed by removing the receiver of the extension telephone from the hook switch, the signal 21 will be operated to signal the operator at the P. B. X.

An operator's telephone is connected to an operator's key 22 as shown. As the circuit of this telephone is well known it is not shown in detail.

The circuits and equipment thus far described are in common use in P. B. X boards and can vary within wide limits. In principle, however, the arrangement is as shown, there being trunk signals and trunk keys and extension keys, usually arranged in groups or horizontal banks A, B, C, Figure 6, depending upon the number of trunks and extensions, with an operator's key for each bank. No attempt has been made to show all the ringing keys, such as 18a, Figure 1, night bell key and circuit, and other auxiliary circuits, as these play no part in the present invention and may be of any suitable type and arrangement.

For intercommunicating service between the extensions talking battery from the source 23 is supplied the common conductors 15, 16, to any one bank of keys via the windings of relay 24. A supervisory signal 25 is inserted in series with conductor 15 before it reaches keys 17, 18, 22, and this signal will be displayed when any extension telephone is in use, or when the operator's key 22 is thrown. By this arrangement the operator can talk to any extension and connect the extensions together for interconnection, and listen in on the two-way conversation.

On trunk conversations it is desirable to cut off the local battery supply 23 and relay 24, and supply the extension connected to the trunk with talking battery over the trunk circuit. This is accomplished in any suitable manner, for example by providing the trunk key 11 with contacts 26, which close when the key is thrown, completing a circuit through the cut-off relay 27, the contacts of which disconnect the relay 24 from the common conductors 15, 16. However, as battery current is supplied over the trunk line 10, it is available to the operator if key 22 is thrown, and to the extension telephones if keys 17, 18, are operated. As the supervisory signal 25 is in circuit with the trunk line, it will be operated

by the incoming battery current in the usual way.

To connect the phonograph 28 and signal lamp 28a to each pair of common wires 15, 16, a recording key 29 is provided as one of the keys in banks A, B, C, which, when thrown, connects the windings 30 of repeating coil 31 across the common wires 15, 16, of that bank as shown. The coil 31 has a second winding 32 connected to the talking circuits of the phonograph in any suitable and well known manner.

When key 29 is thrown contacts 33 thereon close, completing a circuit from battery 23 via contacts 40, or 41, switch 34 (when it is on one of the contacts 35, 36), conductor 37, the driving motor of phonograph 28, contacts 33 to contacts 37 on relay 25. If this relay has operated, which it will do if a receiver is off the hook at a connected extension, or if the operator's key 22 is thrown, the circuit is completed through to ground at 38 and the phonograph 28 and signal lamp 28a will operate.

When the supervisory signal 25 is not energized the phonograph circuit just described is broken at contacts 37 and the phonograph ceases operation. This circuit is also broken if the recording key 29 is restored to open circuit position by the operator.

By placing switch arm 34 on contact 36, the phonograph will only operate when connections are made between extensions and for the operator and not when a trunk is used, as relay 24 has contacts 40 which are only closed when relay 24 operates, and it does not operate on trunk calls as it is disconnected from the circuit by relay 27, as previously described.

By placing switch arm 34a on contact 35 the phonograph will only operate on trunk calls, the phonograph circuit being completed via contacts 41 on relay 27, which relay closes these contacts when the trunk key 11 is thrown, as previously described. The switch arms 34, 34a are independently movable, so by placing 34a on 35 and 34 on 36, the phonograph will operate on both trunk and intercommunicating calls.

In Figure 2 is shown an alternate form of circuit in which the recording key 29 is dispensed with, the connection of the phonograph being automatically controlled by the operation of the supervisory relay 25. Here the relay has two sets of contacts 42, 43, which close, thereby bridging the repeating coil windings 30, 30, across the common conductors 15, 16, to operate in the same manner as described in connection with Figure 1.

The foregoing circuits require special wiring and apparatus that differs from the standard P. B. X boards now in use and not employing phonographs, but in Figures 3 to 5 inclusive, is shown a circuit by which the phonograph or phonographs may be connected to a P. B. X such as now in use without rewiring the same or making any material change in the existing apparatus and circuits.

Referring to Figure 3, a trunk switch key is shown at 11 and an extension switch key at 17a, and circuit connections thereto may be of any type. The numerals 15, 16, denote the common connecting wires for a bank of keys, as described in connection with the preceding figures. A line normally connected to a local or extension telephone is shown at 19, and a local telephone may be connected thereto when this line is used for a phonograph as presently described, in any suitable manner. Preferred arrangements of connecting the telephone are shown in Figures 3 and 4.

Assuming that key 17a represents an idle key not in use for connecting a telephone to the P. B. X, use may be made of it to connect a phonograph. The wires 46, 47, connect to the line terminals of line 19 in the switchboard, and the only change made therein is to open the signal circuit to the inside contacts of key 17a. This can be done by cutting off the ground connection at 48 or in any other manner.

Assuming key 17a to be one of a bank A, B, or C, Figure 6, should any trunk key 11 and local key 17, or two local keys 17, 18, be thrown, together with key 17a, the motor control relay 49 will close its contacts 50 and connect the local source of current 51 to phonograph motor 28, the talking circuits of which connect to the winding 32 of the repeating coil 31, the other winding 30 of which connects across the conductors 46, 47, and consequently across the common wires 15, 16. The resistance of motor controlling means such as the relay 49 is such that it will operate the supervisory relay 25 (Figures 1 and 2) or the supervisory relay at the outer end of trunk 10 on a trunk call.

The cam switch 52 may be cyclically operated by the motor 28 same as the cam switch shown and described in the copending application 333,268, filed May 4, 1940, or application 412,410, filed September 26, 1941, to either limit the length of any recording, or stop motor 28 when a record disc is filled, or in any other manner limit or control the operation of the phonograph.

Another set of contacts 53 on relay 49 opens the line 54, to which an extension telephone of any type (not shown) may be connected so that the extension telephone cannot use the circuit while the phonograph is in operation.

A manual switch 55 may be provided by which the operator can further control the phonograph.

In operation, assuming a trunk to be connected to a local line, the operator desiring to record the conversation would merely throw key 17a, thus bridging the phonograph across the lines connected, leaving switch 55 closed. Upon the supervisory signal indicating that the conversation had terminated, the operator will restore key 17a to normal, thus stopping the phonograph.

In Figure 4 the phonograph motor 28 is connected across the conductors 46, 47, and the relay 49 of Figure 3 is omitted. In Figure 4 the motor 28 is operated by the battery current coming into the circuit 46, 47, either from the P. B. X battery supply or over a trunk line from the main central office. The resistance of the motor circuit 28 is such that the P. B. X and main exchange supervisory signals will be operated in the usual manner.

A choke coil 56 and condenser 57 may be placed in the motor circuit as shown, to prevent noise.

A manual switch 58 is provided to control the phonograph in one position, and connect the phone line 54 in the other position.

In Figure 5 the phonograph motor 28, switch 55 and cam switch 52 are in series with a source of current 51. Supervision is obtained by the fact that the winding 30 of the repeating coil is bridged across the circuit 46, 47, as long as key 17a is thrown.

In Figure 6 is shown an arrangement of the apparatus described in connection with the preceding figures. Here the numeral 59 denotes the front or face of the P. B. X board and 12 indi-

cates the ring-down drops or trunk signals, 21 the local line or extension signals. Each trunk line signal has a number of two-position trunk keys 11a, 11b, 11c. If the board is to have the equivalent of three connecting circuits then three such keys, 11a, 11b, 11c, would be supplied for each trunk arranged one above the other, as shown. If thrown upwards these keys connect the holding coils 44, Figure 1, across the trunks in the usual manner. If thrown downwards each trunk is connected to the wires 15, 16, common to all the keys in that horizontal bank, A, B, or C. One supervisory signal 25 is furnished for each bank of keys and located in any suitable position on the face of the switchboard. Each bank also has one operator's key 22 and one recording key 29 if same is used.

The switches 34, 34a, are also provided, one each for each bank of keys.

The local line keys 17, 18, are each adapted to be thrown upward (18—A, non-locking), to connect the ringing current source 45, Figure 1, to the lines, and where thrown downwards connect the local line such as 20, to the common wires 15, 16, of that bank of keys.

If the operator throws key 22, the operator's set will also be connected across the common wires 15, 16. If the recording key 29 is used, upon throwing same the phonograph circuits will be connected to the bank of keys A, B, or C, in which key 29 is positioned, as previously described.

From the foregoing it will be seen that a P. B. X, as described, can be equipped with one phonograph connected to all the banks of keys, or a separate phonograph can be connected to each bank. If only one phonograph is used, then wires 28c, 32c, 37c, 40c and 41c, are common to all keys and connections throughout the board as shown, but if a separate phonograph is used for each bank of keys A, B, C, then these wires connect only to the keys and equipment common to that bank. By providing a separate phonograph for each bank of keys all three of the connecting circuits and phonographs can be in use at the same time. The phonographs can also be arranged as shown in connection with Figures 3 to 5, inclusive, in which event key 17—A, Figure 3, would replace key 29, and the switches 55 and 58, Figures 3, 4, and 5, would replace 34, 34A, Figure 5.

The usual night bell key and circuits, generator cut-off and battery supply keys, etc., used in the auxiliary circuits commonly employed in these boards are not shown, as they play no part in the present invention and may be of any suitable type and arrangement.

Other means can be substituted for the keys 11, 17, 18, or any suitable connecting means can be used to switch the several circuits at will. Such modifications are deemed to be within the scope of the invention as they are obvious to those skilled in the art.

What is claimed is:

1. In combination with a switchboard for connecting telephone lines, means for connecting said lines, including a bank of switching keys having a common connecting circuit, a key common to said bank and circuit, and a phonograph controlled by said last key and connected to said common circuit thereby.

2. In combination with a switchboard for connecting telephone lines, means for connecting said lines, including a bank of switching keys having a common connecting circuit, a phonograph, means for starting and stopping said phonograph, and means for connecting said phonograph to any of said lines via said keys and the common connecting circuit connected thereto.

3. In combination with a switchboard for connecting telephone lines, means for connecting said lines, including a bank of switching keys having a common connecting circuit, a supervisory signal common to said keys, a phonograph, means for connecting said phonograph to any of said lines via said keys and the common connecting circuit connected thereto, and means under the control of said supervisory signal for starting and stopping said phonograph.

4. In combination with a switchboard for connecting telephone lines, including trunk and local lines, switching means for connecting said lines, a supervisory signal adapted to indicate when any two lines are connected, a current supply for said local lines whereby same may be used independently of said trunk lines, means under the control of said switching means for disconnecting said current supply from any associated line upon the connection thereof to a trunk line, a circuit including a phonograph and a source of energy for operating the same controlled by the operation of said last means whereby said circuit is conditioned and said phonograph is connected to said source of energy ready to operate, and means under the control of said supervisory signal to complete said circuit to permit current to flow therein and operate said phonograph.

5. In combination with a switchboard for connecting telephone lines including trunk and local lines, switching means for connecting said lines, a supervisory signal adapted to indicate when any two lines are connected, a current supply for said local lines whereby same may be used independently of said trunk lines, a relay included in a circuit connectible to one of said local lines via said switching means, and a phonograph having driving means conjointly controlled by said relay and supervisory signal and having its talking circuits connected to one of said local lines.

6. In combination with a switchboard for connecting telephone lines including trunk and local lines, a connecting circuit for connecting said lines, a relay in said circuit, a repeating coil having a winding, means controlled by said relay for connecting said winding across said connecting circuit, a second winding on said repeating coil, and a phonograph connected to said second winding.

7. In combination with a switchboard for connecting telephone lines including trunk and local lines, a connecting circuit for connecting said lines, a relay in said circuit, a repeating coil having a winding, means controlled by said relay for connecting said winding across said connecting circuit, a second winding on said repeating coil, a second relay having a winding connected to said connecting circuit and supplying current thereto, and means controlled by said second relay for energizing said phonograph.

8. In a telephone switchboard having a key bank including trunk switching and local line switching keys for connecting local and trunk lines via a connecting circuit common to all said keys, a phonograph and means for connecting same to said connecting circuit, means under control of any local line connected to said connecting circuit for controlling said phonograph, a supervisory signal connected to said connecting circuit, and means controlled by said supervisory signal for controlling said phonograph.

9. In a telephone switchboard having a key bank including trunk switching and local line switching keys for connecting local and trunk lines via a connecting circuit common to all said keys, a phonograph and means for connecting same to said connecting circuit, means under control of any local line connected to said connecting circuit for controlling said phonograph, means controlled by any of said trunk switching keys for disconnecting said last means from said connecting circuit and for controlling said phonograph, a supervisory signal connected to said connecting circuit, and means controlled by said supervisory signal for controlling said phonograph.

10. In a telephone switchboard having a key bank including a trunk switching means, a local line switching means, a connecting circuit common to said means, a phonograph, and means connectible by the conjoint action of said switching means for connecting said phonograph to said connecting circuit to record conversations thereon.

11. The combination, as claimed in claim 10, where said last means includes a supervisory relay adapted to be placed in circuit by the operation of any of said trunk or local switching means in said key bank.

12. In a telephone switchboard having trunk switching means and local line switching means, a circuit common to both said means for connecting or inter-connecting the same, phonograph talking circuits connected to said common circuit, a phonograph motor, and controlling means responsive to current flowing in said common circuit from either of said first two means for starting and stopping said motor.

13. The combination, as claimed in claim 12, wherein said controlling means also opens and closes a branch circuit leading from said common circuit to a telephone.

14. The combination, as claimed in claim 12, wherein said phonograph motor is operated by a local source of current and has a manually controlled switch for stopping said motor after same has started by said control means.

15. The combination, as claimed in claim 12, wherein the phonograph motor operates a switch whereby the operation of said motor is cyclically controlled.

16. In a telephone switchboard having trunk switching means and local line switching means, a circuit common to both said means for connecting or inter-connecting the same, phonograph talking circuits connected to said common circuit, a phonograph motor connected to said common circuit and adapted to be operated by current supplied thereto via either of said means, and manually operable means in circuit with said motor for stopping same independently of the operation of either of said first two means.

17. In a telephone switchboard having trunk switching means and local line switching means, a circuit common to both said means for connecting or inter-connecting the same, phonograph talking circuits connected to said common circuit, a phonograph motor connected to said common circuit and adapted to be operated by current supplied thereto via either of said means, a phonograph motor, a source of current for operating the same, and a manual switch for controlling said motor operable independently of either of said first two means.

18. In a P. B. X switchboard having trunk and local connecting keys arranged in horizontal banks, the keys in each bank adapted via a connecting circuit common to all said keys to connect and inter-connect trunk and local lines, a supervisory signal in said connecting circuit, a phonograph connected to said common circuit via a circuit extending outwardly from one of said local connecting keys, and manual switching means independent of all said keys for controlling the operation of said phonograph in accordance with the indications of said supervisory signal.

19. In a P. B. X switchboard having trunk and local connecting keys arranged in horizontal banks, the keys in each bank adapted via a connecting circuit common to all said keys to connect and inter-connect trunk and local lines, a supervisory signal in said connecting circuit, a phonograph connected to said common circuit via a circuit extending outwardly from one of said local connecting keys, manual switching means independent of all said keys for controlling the operation of said phonograph in accordance with the indications of said supervisory signal, and a telephone instrument bridged across the phonograph circuit.

20. In a P. B. X switchboard having trunk and local connecting keys arranged in horizontal banks, the keys in each bank adapted via a connecting circuit common to all said keys to connect and inter-connect trunk and local lines, a supervisory signal in said connecting circuit, a phonograph connected to said common circuit via a circuit extending outwardly from one of said local connecting keys, manual switching means independent of all said keys for controlling the operation of said phonograph in accordance with the indications of said supervisory signal, a branch circuit controlled by said manual switching means, and a telephone instrument connected to said branch circuit.

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