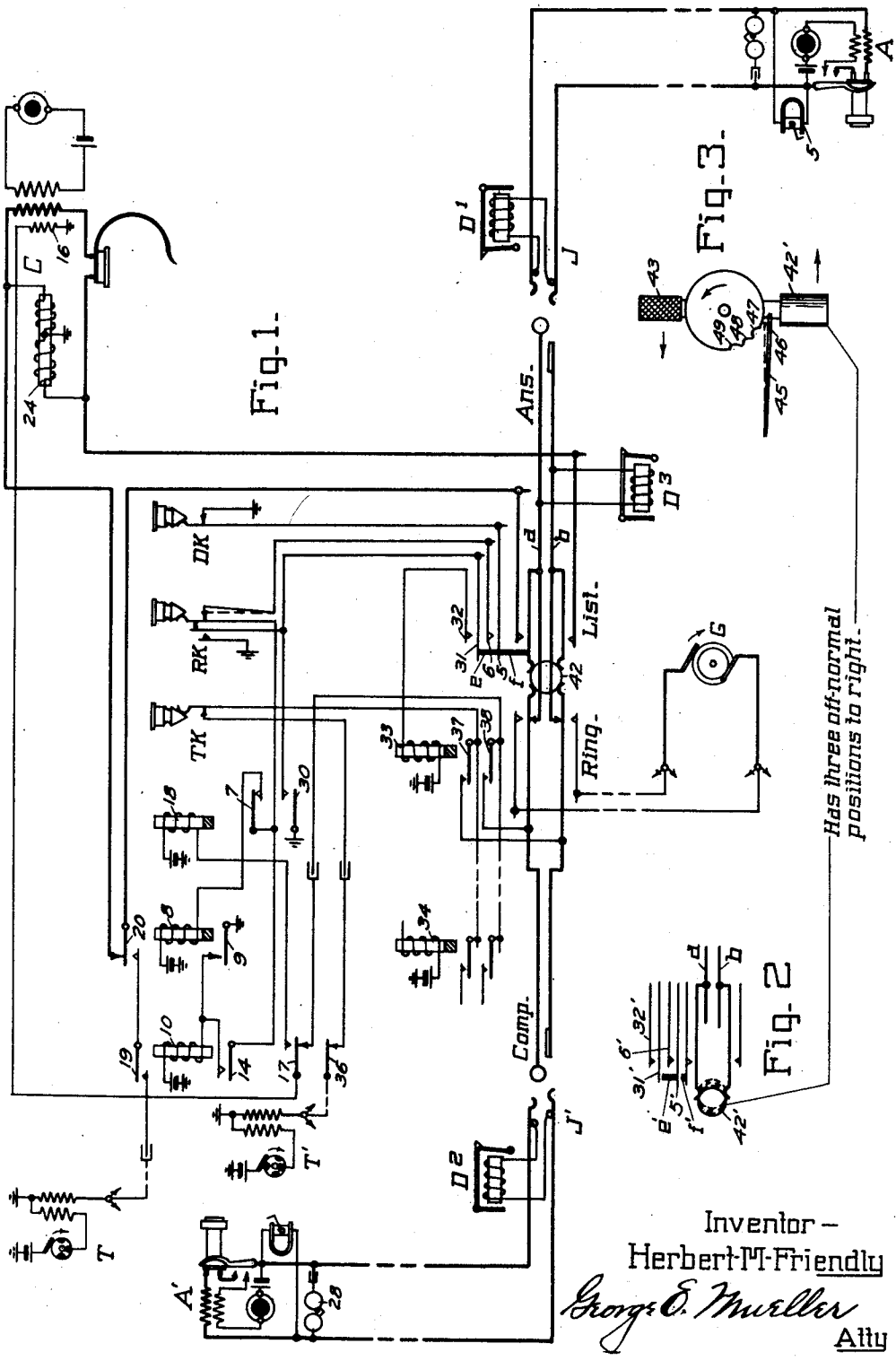
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TELEPHONE SYSTEM

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TELEPHONE SYSTEM.

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General objects.

The general object of the present invention is to enable a switchboard operator to respond to a subscriber's call, indicate to the calling subscriber that she awaits his instructions and thereafter obtain the desired telephone number from the calling subscriber and acknowledge the instructions as to the number of the telephone line wanted without herself orally communicating with the calling subscriber.

This is accomplished through the provision of automatic means for applying a momentary distinctive tone or current constituting a distinguishable sound to a random calling line, audible to the calling subscriber thereon, responsive to the operator manipulating the cord-pair listening key of a random one of her switching cord-pairs, after first inserting the answering plug thereof into the jack of the calling line. This tone apprises the calling subscriber on the calling line that the operator has responded to his initiated call and that she is ready to receive his instructions as to the number of the telephone line he desires connection with.

Moreover, when the operator has heard the instructions, a second and different distinctive tone is then applied audible to the calling subscriber indicative that the operator understood his instructions and has disconnected her operator's telephone set from the cord-pair and is proceeding with the completing of the connection. The last said tone is applied responsive to the key operation for disconnecting the operator's telephone. The physical energy of the operator is thus conserved, as well as obviating unnecessary conversation and incident delay to both the operator and the calling subscriber.

Drawing.

With reference to the accompanying sheet of drawings:—

Fig. 1 shows a random operator's cord-pair (of a plurality not shown) and the operator's telephone circuit and related circuits embodying the present invention.

Fig. 2 shows a preferred modification of the cord-pair listening key shown in Fig. 1.

Fig. 3 shows the preferred form of step-by-step locking arrangement for the cam for operating the listening key shown in Fig. 2.

Equipment.

The subscribers' lines shown in Fig. 1 are two random subscribers' lines of a system of the well known so-called magneto class, terminating in jacks and companion calling drops on an operator's switchboard. That is, the cord-pair shown to which the invention is applied is one of the simplest used in telephone systems, but serves to elucidate the invention, while not illustrating an excessive amount of irrelevant apparatus.

The cord-pair is adapted for interconnecting subscriber or other lines in the system in talking relation, as well as applying signaling current through the completing plug, as to the called one of the lines on the left. The usual bridged clearing drop is shown, as well as the usual listening key springs. However, the listening key has auxiliary springs for operating the circuits of the present invention in a manner as will be set forth presently.

The operator will have a plurality of such cord-pairs; ten or more, for instance. These will be common to the operator's telephone set C shown in the upper right-hand corner of the drawing. The operator's telephone circuit has associated with and specific to it a group of three relays (10, 8 and 18) common to her said plurality of cord-pairs for controlling the tone sources shown with respect to her cord-pairs; the tone sources being common to a plurality of operator's switchboards. The cord-pairs each have a specific relay for the latter said tone sources.

Operation.

The calling subscriber at station A will operate the central office drop D^1 by turning the winch of the hand generator 5. He will then remove the receiver from the switchhook in readiness to give the number of the desired telephone line on perceiving the tone from the tone source T. The operator upon observing the operated drop D^1 of the particular line calling will insert the answering plug (designated "Ans.") into the jack J. This

cuts off the drop D^1 and places the cord-pair in talking relation with the subscriber's telephone A on the calling line. The operator next manipulates the listening key (designated "List.") to place her operator's telephone set C in talking relation with telephone A on the calling subscriber's line.

The listening key has two pairs of auxiliary springs, so when it is operated ground from spring of key DK is applied through springs 5 and 6, springs of key RK, armature 7 to operatively energize the winding of slow-releasing relay 8. Grounded armature 9 operatively energizes the winding of relay 10, the latter relay locking through its armature 14 over the traced path to ground at key DK. Ground through the tertiary winding 16 of the operator's induction coil is applied through armature 17 to operatively energize the winding of slow-releasing relay 18, causing a battery click in the operator's telephone, also a battery click audible in the receiver of telephone A. The attraction of armature 7 disconnects the winding of relay 8, and the latter relay therefore retracts its armatures consistent with its releasing characteristic. However, while relays 8 and 10 are both attracted specific tone from source T is applied through armatures 19 and 20, the telephone A to ground at the center of bridged retardation coil 24, audible in the receiver of telephone A and also in the receiver of operator's set C. That is, a click, followed by a momentary specific tone is audible to the operator and to the party at the receiver of telephone A responsive to the manipulation of the listening key in responding to the call.

It will be noted, in this connection, that the armature 20 opens the operator's circuit while the tone is being applied from source T, and this serves to reduce the tone received by the operator; otherwise it need not be thus opened. This click and tone denotes to the subscriber at telephone A that the operator is on the line awaiting his instructions as to what telephone number he desires connection with, so he thereupon gives this information without oral request from the operator.

The operator now having the instructions, may forthwith restore the listening key and proceed to complete the connection in the well known manner for magneto systems by inserting the completing plug (designated "Comp.") into jack J' and then applying signaling current from the source G by the ringing key (designated "Ring.") to operate the bell 28 of the called line as a calling signal.

Going back to the condition of the circuits at the time the operator first manipulated her listening key of the random cord-pair shown in Fig. 1, it will be noted that when relay 18 operated, its armature 30 applied ground through auxiliary listening key springs 31 and 32 to the winding of slow-releasing relay 33, the latter relay being specific to the said random cord-pair, there being a similar relay, as 34, specific for each other cord-pair of the operator's position connected in a similar manner to the auxiliary listening key spring corresponding to 32 of the said random cord-pair. The relay 33 thus operates responsive to the first said manipulation of the listening key in responding to a call.

Having in mind the slow-releasing characteristic of the relays 18 and 33, it will be clear that at the time the operator restores the listening key relay 10 deactuates before relay 33, so that tone from source T' is thereupon momentarily applied through armature 36, springs of key TK, armature 37 to the sleeve conductor of the cord-pair through the receiver of telephone A and to ground through armatures 38 and 17 and the tertiary winding 16, audible to the subscriber at telephone A and also in the operator's telephone, though the talking conductors of the operator's telephone set had just previously been disconnected from talking relation with the said random cord-pair and calling line. This specific tone from source T' denotes to the subscriber at telephone A that the operator has disconnected from the talking connection, having understood his instructions as to the line number wanted. The latter thus obviates an oral acknowledgment by the operator of the subscriber's instructions.

In this connection, it will be noted that of the four auxiliary springs (the two pairs) of the listening key, all but spring 32 are in multiple relation with correspondingly placed springs on the listening keys of the other cord-pairs of the operator's position, the springs corresponding to 32 being independently connected to its corresponding relay as 32.

From the foregoing, it is clear that when the operator responds by manipulating her listening key, a click and momentary specific tone from source T is transmitted to the calling subscriber (and also the operator) indicative that the operator has come in on the line. Also, that when the operator restores the listening key a momentary specific tone from source T' is transmitted to the calling subscriber's telephone and also to the operator's telephone which latter telephone has beforehand been disconnected, indicative to the subscriber that the operator has disconnected from his line.

It will be noted that by operating the key DK the operator circuit relays 8, 10 and 18 and the cord-pair relays as 33 and 34, etc., are disabled so that the said tones will then not be applied responsive to manipulating any of the listening keys. The button of this key (DK) may be depressed part way to open its grounded spring, whereupon it will self-restore when the pressure is removed. If it is depressed further down it will lock so that it will require a special pull to unlock

it. Key DK may be depressed before manipulating a listening key when it is desired to listen-in on a connection while not introducing a click or tone.

The key RK among other objects is provided in case the operator wishes to repeat the tone from source T, should the subscriber not immediately give his order, for instance. The operator will momentarily depress the button of this key (RK) to open the conductor leading from the armatures 7 and 14 and thus apply ground to the conductor leading from the make contact cooperative with the armature 30, having in mind that the right-hand pair of springs of the key RK are adjusted to follow so that the said ground is applied before the said opening occurs. The momentary depressing of the button of key RK thus causes the relay corresponding to 33 companion to the listening key operated to sustain and therefore not apply the tone from source T' to the calling line, and it causes the relays 10 and 18 to momentarily restore and relay 8 to momentarily actuate, thereby applying a momentary tone from source T (proceeded and followed by a battery click) audible to the party on the calling line and the operator. The key RK may be momentarily depressed or it may be sustained depressed mechanically locked as long as desired. The first battery click occurs when the button of key RK is depressed when armature 17 retracts and the last battery click and tone occurs when the button of key RK is released.

In the use of the key RK, the tone from source T' is not applied because the relay (as) 33 is not deenergized; at least not deenergized long enough to retract its armatures.

In this connection, it will be noted that if the operator but momentarily depresses the button of key RK the tone applied from the source T resultant thereto will be the same as if it were depressed longer. This because when relay 10 retracts its armature 14 the relay 8 cannot be thereafter energized to attract armature 20 until relay 18 has first retracted its armature 7. Then, when armature 7 retracts, the relays 8 and 10 will apply tone for the period determined by the slow-releasing characteristic of relay 8. Thus the duration of the tone applied from source T will always be the same.

It will be clear that if the battery clicks are not desired, the relay 18 will be disconnected and the armature 30 and its make contact placed on relay 10, and the resting contact of armature 7 placed as a resting contact on armature 14. One of the purposes of relay 18 is to insure that any tone applied from source T' will be of not less than a predetermined minimum length because the relay 10 cannot be reenergized to cut off any tone being applied until the relay 18 has had time to retract its armature 7 to reestablish the energizing path to the winding of relay 8.

Preferred modifications.

The listening key shown in Figs. 2 and 3 disclose the preferred modification embodiment relating to the listening key and auxiliary springs thereof in Fig. 1. The difference in the operation of the listening key which is shown in Fig. 1 from the one shown in Figs. 2 and 3 relates to the control of the auxiliary springs thereof. That is, in place of the two sets of auxiliary springs 5—6 and 31—32 being effectively operated practically coincident with the effective operation of the listening springs of the key, the insulation members *e* and *f* in Fig. 1 are shortened as shown by corresponding members *e'* and *f'* in Fig. 2. The designated parts in Figs. 2 and 3 corresponding to parts in Fig. 1 are primed. Also, the member *e'* is operated by the upper listening key spring, while the member *e* is operated by the second from the top listening spring. The upper listening spring in Fig. 2 is made slightly longer than shown in Fig. 1 to accommodate this modification.

This modification of the members *e'* and *f'* admit of operating the listening key cam shown in Fig. 3 for operating the key springs by stages. That is, a limited operation of the cam 42' operates only the listening springs; a further operation of the cam 42' operates only the lower set of auxiliary springs 5'—6' (in addition to the operated listening springs, of course) to cause the tone source T to be applied to apprise the calling party that the operator has come in on his line. A still further operation of the cam 42' operates the set of springs 31—32 in addition to other said operated springs, so that when the cam 42' is restored to its first antecedent position or its normal position, the tone source T' will be applied.

From the foregoing, it will be clear that it is optional with the operator in manipulating her listening key lever (attached to cam 42') to: 1. To simply listen in on the cord talking conductors. 2. To, in addition to the latter, also apply a specific tone from source T so that the calling party will thereby know the operator is in listening relation to his line, into which the answering plug is inserted. 3. To, in addition, prepare the circuits by a further operation of the listening key so that when the cam 42' is restored to the first antecedent position or to the normal position, a specific tone from source T' will apprise the subscriber of the condition. In the latter instance, the operator would normally restore the cam 42' to normal position from the extreme or third off-normal position.

The operator may, to apply the tone T a

second time, if no response is had from the calling party, perhaps, restore the cam to the first off-normal position and then return it to the second or third off-normal position to cause the tone from source T to be again applied.

The operator may accustom herself to the "feel" of the lever of cam 42′ when operating it so that she will appreciate from the varied resistance when the stages have been reached. The structure shown in Fig. 3 has a spring 45 having a catch-knob 46 which is adapted to register with notches 47, 48 and 49, corresponding to the positions of the cams in the first, second and third off-normal position, respectively. As the cam is moved off-normal into the various off-normal said positions, the catch-knob 46 will in falling or following into the notches under tension vary the obstruction offered the operator in moving the cam lever 43 and thus she is informed of the position the cam is assuming. The said notches 47 to 49 are so curved that the return of the cam finds less abrupt shoulders to flex the spring 45 by, so that the effort required to return the cam to normal position is more uniform than when moving it from normal position. The key levers and cams generally like shown in Fig. 3, but without the notches 47 to 49 and the spring 45, are old in the art for operating key springs.

In general operation, the operator will first throw the lever 43 into the third or extreme off-normal position to produce the effect of the listening key as shown in Fig. 1, but there will be times when the operator may desire to effect a variation as by not applying any tone when listening in on an established connection or when desiring to re-apply a tone from source T, for example, and the preferred embodiment incorporating the disclosures in Figs. 2 and 3 lends to this end, though the keys TK, RK and DK are provided as an alternative means by which the operator may attain some of the advantages of the said preferred features involved in Figs. 2 and 3, and other features.

It will be noted that if the operator restores cam 42′ from the third off-normal position to the first off-normal position and returns it to the third off-normal position quickly before relay 33 has had time to retract its armature the tone from source T′ will not then be applied, though tone from source T will be applied for its normal momentary duration, governed by relay 8.

The key TK is to disable the tone from source T′ being applied to any cord-pair of the operator's switchboard. The button of said key TK may be slightly depressed to operate self-restoring or way-down to mechanically lock; the keys TK, RK and DK being similar in mechanical operation and wherein one key of each kind serves for the operator's switchboard common to all the cord-pairs thereof.

The battery clicks may be eliminated by energizing the winding of relay 18 from ground placed on armature 17 on relay 10 in place of through winding 16. However, the click has been introduced as an auxiliary indication supplementing the tone.

The embodiment chosen to exemplify the present invention, as before stated, involves a magneto telephone system cord-pair; one of the simplest cord-pairs used in the commercial telephone art. It will be understood that the present invention is not limited to the specific said type or class of cord-pair and that therefore common-battery or other types of cord-pairs may be employed involving the present invention, as well as modifying the details of the operator's switchboard circuits, without departing from the scope of the present invention as defined by the subjoined claims.

What is claimed is:—

1. In a telephone system, a telephone line, a jack terminating said line, an operator's connecting plug for connective cooperation with said jack, an operator's telephone, an answering key manually operated for connecting the operator's telephone to the plug to thereby effect a talking connection from said telephone to said line, a tone source, and automatic means made effective responsive to said key operation for momentarily applying said tone source to said line.

2. In a telephone system, a telephone line, a jack terminating said line, an operator's connecting plug for connective cooperation with said jack, an operator's telephone, an answering key manually operated for connecting the operator's telephone to the plug to thereby effect a talking connection from said telephone to said line, a tone source, a source of battery current, and automatic means made effective responsive to said key operation for momentarily applying said tone source and an impulse from said battery source to said line.

3. In a telephone system, a telephone line, a jack terminating said line, an operator's connecting plug for connective cooperation with said jack, an operator's telephone, an answering key manually operated for connecting the operator's telephone to the plug to thereby effect a talking connection from said telephone to said line, a tone source, automatic means made effective responsive to said key operation for momentarily applying said tone source to said line, another tone source, and means for momentarily applying last said tone source to said line responsive to restoring said key.

4. In a telephone system, a telephone line, a jack terminating said line, an operator's connecting plug for connective cooperation

with said jack, an operator's telephone, an answering key manually operated for connecting the operator's telephone to the plug to thereby effect a talking connection from said telephone to said line, a tone source, automatic means made effective responsive to said key operation for connecting and disconnecting said tone source to said line while maintaining the operator's telephone in connection with said line, another tone source, and means for momentarily applying last said tone source to said line responsive to restoring said key.

5. In a telephone system, a telephone line, a jack terminating said line, an operator's connecting plug for connective cooperation with said jack, an operator's telephone, an answering key manually operated for connecting the operator's telephone to the plug to thereby effect a talking connection from said telephone to said line, a tone source, automatic means made effective responsive to said key operation for momentarily applying said tone source to said line, another tone source, means for momentarily applying last said tone source to said line responsive to restoring said key, and means for operating said key to disconnect the operator's telephone without applying last said tone source to said line.

6. In a telephone system, a telephone line, a jack terminating said line, an operator's connecting plug for connective cooperation with said jack, an operator's telephone, an answering key manually operated for connecting the operator's telephone to the plug to thereby effect a talking connection from said telephone to said line, a tone source, automatic means made effective responsive to said key operation for momentarily applying said tone source to said line, another tone source, means for momentarily applying last said tone source to said line responsive to restoring said key, means for enabling the restoring of said key for disconnecting the operator's telephone without applying last said tone source to said line, and means then enabling the operating of said key to re-connect the operator's telephone and for thereby applying first said tone source to said line.

7. In a telephone system, a telephone line, a jack terminating said line, an operator's connecting plug for connective cooperation with said jack, an operator's telephone, an answering key manually operated for at will connecting and thereafter restored at will for disconnecting the operator's telephone with relation to the plug to thereby effect and subsequently destroy talking connection between said telephone and said line, a tone source, and automatic means made effective by said key restoration for momentarily applying said tone source to said line.

8. In a telephone system, a telephone line, a jack terminating said line, an operator's connecting plug for connective cooperation with said jack, an operator's telephone, an answering key manually operated for at will connecting and then restored in one manner at will for disconnecting the operator's telephone with relation to the plug to thereby effect and subsequently destroy talking connection between said telephone and said line, a tone source, and automatic means made effective by restoring said key in another manner different from said one manner for connecting and thereafter disconnecting said tone source with relation to said line while maintaining the operator's telephone in connection with said line.

9. In a telephone system, a telephone line, a jack terminating said line, an operator's connecting plug for connective cooperation with said jack, an operator's telephone, an answering key manually operated for at will connecting and thereafter restored at will for disconnecting the operator's telephone with respect to the plug to thereby effect and subsequently destroy talking connection between said telephone and said line, a tone source, and automatic means made effective by said key restoration for momentarily applying said tone source to said line after the said disconnection of the operator's telephone.

10. In a telephone system, a telephone line, an operator's telephone, an answering key operated for connecting the operator's telephone to said line, a tone source, and automatic means made effective responsive to said key operation for momentarily applying said tone source to said line.

11. In a telephone system, telephone lines, an operator's telephone, an answering key operated for connecting the operator's telephone to a desired one of said lines at will, a tone source, and automatic means made effective responsive to said key operation for momentarily applying said tone source to said line.

12. In a telephone system, a telephone line, an operator's telephone, an answering key operated for connecting the operator's telephone to said line, a tone source, automatic means made effective responsive to said key operation for momentarily applying said tone source to said line, another tone source, and means for momentarily applying last said tone source to said line responsive to restoring said key.

13. In a telephone system, a telephone line, an operator's telephone, an answering key manually operated for connecting the operator's telephone to said line, a tone source, automatic means made effective responsive to said key operation for momentarily applying said tone source to said line, another tone source, means for momentarily applying last said tone source to said line responsive to restoring said key, and means for operating said key to disconnect the operator's telephone without applying last said tone source to said line.

14. In a telephone system, a telephone line, an operator's telephone, an answering key manually operated for connecting the operator's telephone to said line, a tone source, automatic means made effective responsive to said key operation for momentarily applying said tone source to said line, another tone source, means for momentarily applying last said tone source to said line responsive to restoring said key, means for restoring said key for disconnecting the operator's telephone without applying said tone source to said line, and means for then operating said key to re-connect the operator's telephone and for momentarily re-applying first said tone source to said line.

15. In a telephone system, a telephone line, an operator's telephone, an answering key manually operated for connecting the operator's telephone to said line, a tone source, automatic means made effective responsive to said key operation for momentarily applying said tone source to said line, another tone source, means for momentarily applying last said tone source to said line responsive to restoring said key, means including a slow-acting relay for restoring said key for disconnecting the operator's telephone without applying last said tone source to said line, and means for then operating said key to re-connect the operator's telephone and for thereby momentarily re-applying first said tone source to said line.

16. In a telephone system, a telephone line, an operator's telephone, an answering key manually operated for at will connecting and thereafter restored at will for disconnecting the operator's telephone with relation to the line to thereby effect and subsequently destroy talking connection between said telephone and said line, a tone source, and automatic means made effective by said restoration for momentarily applying said tone source to said line.

17. In a telephone system, a telephone line, an operator's telephone, an answering key manually operated for connecting the operator's telephone to said line, a tone source, automatic means made effective responsive to said key operation for momentarily applying said tone source to said line, another tone source, means for momentarily applying last said tone source to said line responsive to restoring said key, and automatic means for enabling said key to re-apply first said tone source without applying second said tone source.

18. In a telephone system, a telephone line, an operator's telephone, an answering key manually operated for connecting the operator's telephone to said line, a tone source, automatic means made effective responsive to said key operation for momentarily applying said tone source to said line, another tone source, means for momentarily applying last said tone source to said line responsive to restoring said key, and automatic means for enabling restoring and re-operating said key to thereby apply only first said tone source to the line.

19. In a telephone system, a telephone line, an operator's telephone, an answering key manually operated for connecting the operator's telephone to said line, a tone source, automatic means made effective responsive to said key operation for applying said tone source to said line, another tone source, means for applying last said tone source to said line responsive to restoring said key, and automatic means for enabling restoring and re-operating said key to thereby apply only first said tone source to the line.

20. In a telephone system, a telephone line, an operator's telephone, an answering key manually operated for at will connecting and thereafter restored at will for disconnecting the operator's telephone with relation to the line to thereby effect and subsequently destroy talking connection between said telephone and said line, a tone source, and automatic means made effective by said restoration for applying said tone source to said line.

In witness whereof, I hereunto subscribe my name this ninth day of May, 1927.

HERBERT M. FRIENDLY.