

(No Model.)

J. S. STONE & G. K. THOMPSON.
TELEPHONE SPEAKING TUBE SYSTEM.

No. 556,034.

Patented Mar. 10, 1896.

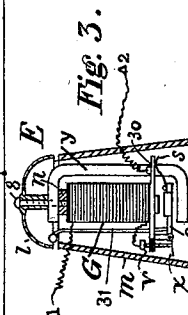
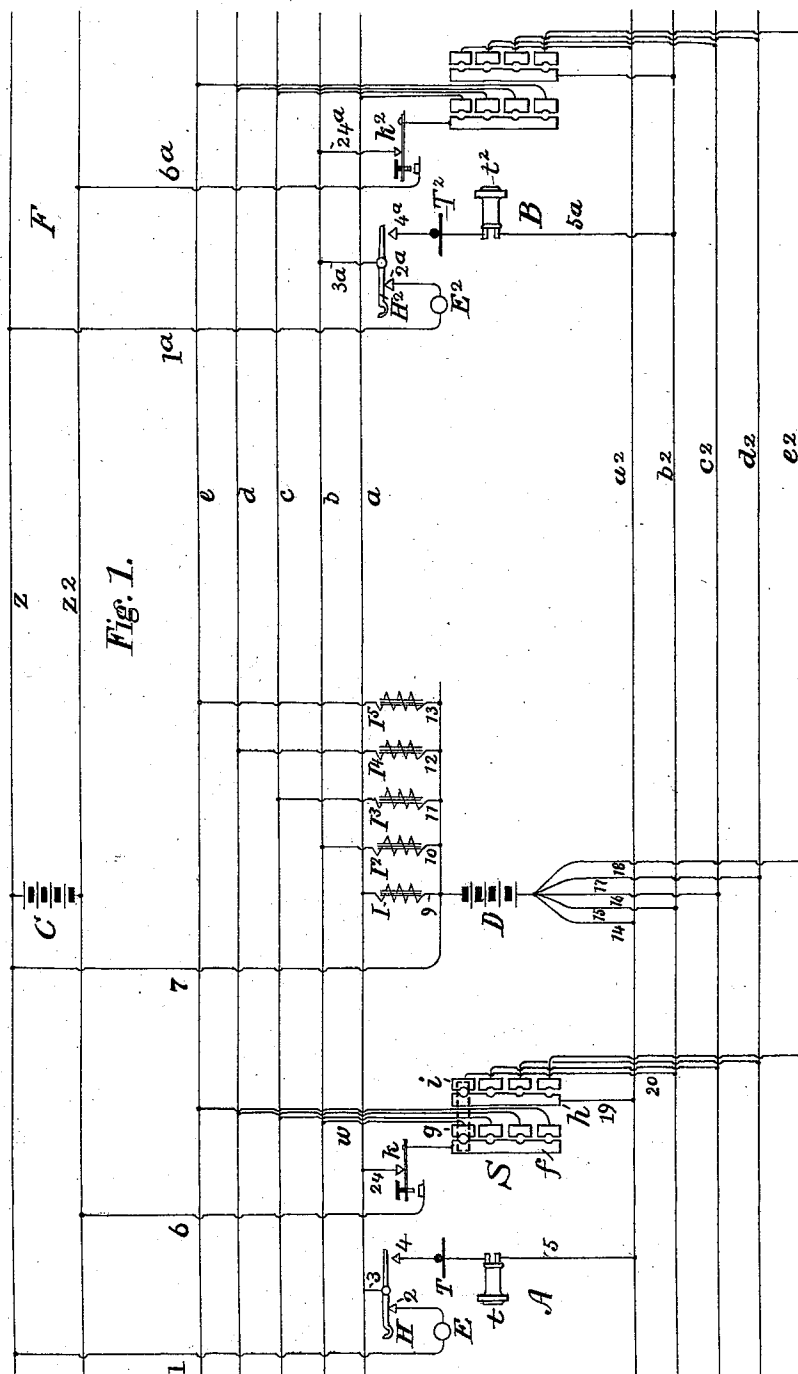


Fig. 3.

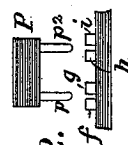


Fig. 2.

Attest,
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Grover's Pence.

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UNITED STATES PATENT OFFICE.

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TELEPHONE SPEAKING-TUBE SYSTEM.

SPECIFICATION forming part of Letters Patent No. 556,034, dated March 10, 1896.

Application filed September 28, 1895. Serial No. 564,005. (No model.)

To all whom it may concern:

Be it known that we, JOHN S. STONE, residing at Boston, in the county of Suffolk, and GEORGE K. THOMPSON, residing at Malden, in the county of Middlesex, State of Massachusetts, have invented certain Improvements in Telephone Speaking-Tube Systems, of which the following is a specification.

This invention relates to improvements in telephone speaking-tube systems, in which there are a plurality of stations, each of which is provided with means for connecting, signaling, and speaking with every other station.

The general nature of the system, upon which our invention is an improvement, is disclosed in United States Patent No. 531,078, granted to Thomas C. Wales, Jr., December 18, 1894, to which reference is made.

In the patent mentioned a common source of electric current, preferably a battery, is employed for signaling and conversational purposes, from the poles of which branches in pairs extend to the two conductors of each circuit. One of each of these pairs of branches connects with a common pole of the said battery, and with the upper or hook switch conductor of each of the circuits, and includes the helices of an electromagnetic retardation or choking coil, and from the same common pole of the battery-circuit a branch wire which includes the helix of a simple resistance-coil connects to a common call-wire which extends to all of the stations and has branches to the lower contact of each hook-switch, and includes the helices of a vibrating call-bell. The calling device at each station consists of a key or press-button bridged in between the conductors of each home circuit.

In the practical operation of this system, when the distances between the several stations vary greatly and the stations are increased in number, certain defects in operation have developed which do not appear when the circuits are few and the stations are of approximately even distances apart. The principal trouble has been that after the call-key is pressed to ring the bell of a called station, the circuit of which has been switched to the calling-circuit, and when the telephone is removed from its hook and placed to the ear the bell continues to ring if the battery is strong enough, notwithstanding that the

simple resistance referred to is inserted in said branch wire. To explain more fully the cause of such trouble: when the signaling-key is released the circuit is opened at the said key but is closed again immediately by the removal of the telephone-receiver from the automatic switch, as both the signaling-key and automatic switch-lever are in parallel branches of the same circuit at the home station. It is true that the automatic or hook switch in closing its branch introduces the moderate resistance of the telephones into the circuit, but this cannot be depended upon to so reduce the strength of current passing through the bell of the called station that the said bell will not continue to ring; and the latter condition differs from the former only in the presence of a slightly greater resistance, which slight increase is, however, wholly inadequate to prevent the continued ringing of the bell of the called station. Experience, however, has shown that the continuous ringing of the bell of the called subscriber is disadvantageous and troublesome to the subscriber who has made the original call, who, having placed his telephone at his ear, is annoyed by the rattle produced by the protracted vibratory operation of the said bell.

In carrying out our improvement the several circuits consisting of twisted pairs are led through the several stations and normally open branches are led to terminals on the switching device at each station. A signaling-circuit with a common calling-battery or of a common magneto-generator in circuit therewith extends through each station, with a branch leading to one side of a polarized vibrating bell and another branch to a ringing-key at each station, the other terminal of the bell being normally connected to one conductor of the home or particular circuit.

We provide a separate common source of electricity, preferably a battery, for conversational purposes, permanently bridged, by means of independent branches from each pole thereof, to the two conductors of each circuit, there being in each branch from the positive pole a separate electromagnetic resistance or choking-coil, so that the talking-current will take the path through the telephone set of the calling-station rather than through the battery, in a manner described

in the United States Patent No. 507,568, issued to John S. Stone.

When there are a small number of stations in circuit it becomes necessary to connect the opposite poles of the two batteries by a conductor in order to shunt current from the bells of the stations not called, but when a large number of stations are in circuit their retardation coils and bells in series forming collectively a branch circuit effect this result, all of which we will now proceed to describe, and point out in the appended claims.

Of the accompanying drawings, Figure 1 is a diagram illustrative of our invention. Fig. 2 is a sketch showing a form of switching device, and Fig. 3 is a vertical section of a polarized vibrating bell used at each station.

Fig. 1 shows diagrammatically an intercommunicating system comprising five circuits, $a a^2 b b^2 c c^2 d d^2 e e^2$, the apparatus at two of the stations only being indicated. C is the common source of electricity for calling purposes and may be either a battery or a magneto-generator bridged between the conductors $z z^2$ of the circuit F, which extends through all the stations and is connected by branches 6 from its positive pole to the anvils of the calling-keys k , and also by branches 1 from its negative pole to the under contacts 2 of the hook-switches H, including the call-bell, at all stations. The switches H are connected to their respective conductors $a b c d e$ by wires 3. Referring to the apparatus at station A, the back contact of the calling-key k is connected to the conductor a of the home-circuit by wire 24, and the key itself is connected to the metal plate f of the switching device S. Any suitable switching device, such as four-point spring-jacks, arranged in a strip, may be used; but for clearness of illustration we have shown a double plug-connecting device. Arranged along the sides of the plate f are plates g , respectively connected to the conductors $b c d e$ of the associated circuits. The conductor a^2 of the station A is connected to the plate h by the wire 19, and the plates i are respectively connected with the conductors $b^2 c^2 d^2 e^2$ of the circuits. The telephones T and t are in the normally open branch wire 5 from the conductor a^2 , which terminates at the back contact 4 of the hook-switch H.

Fig. 2 shows a plug P consisting of two metal pins p and p^2 inserted in a block or handle of insulation, and shown in Fig. 1 in dotted lines as connecting stations A and B together. The talking-battery D is in parallel between each pair of conductors of the several circuits, from the negative pole by means of branches 14, 15, 16, 17 and 18, and from the positive pole by means of branches 9, 10, 11, 12, and 13. In each of the latter branches is placed an electromagnetic retardation-coil I. A wire 7 connects the positive pole of the talking-battery D with the negative pole of the calling-battery.

Fig. 3 is a vertical section of a polarized

bell used as a call-bell at each station, and can be operated by currents from a common source whether of battery or of a magneto-generator. It consists of an outer case and support of metal open at its bottom, and also at the top, with the exception of a bar n , which may be integral with the case. γ is a U-shaped permanent magnet secured to the top of the bar n by means of the screw 8, which also holds the gong l in place. The screw 8 may also hold one or more helices G to the under side of the bar n . 30 is a metal plate on the end of the helix G, to one end of which is pivoted the armature o , from the rear of which extends a spring x which with the insulated screw v constitutes the circuit-breaker. A spring s from the front of the armature bears upon the plate 30 and serves to make electrical contact therewith. 31 is the bell-hammer secured to the inner end of the armature o and projecting from the end of the casing near to the gong l .

In the operation of our invention, when a conversation is desired the plug P is inserted in between the plates f and h and the plates g and i of the station wanted. For instance, say that station A calls station B, the plug P is inserted, as indicated in dotted lines, and the key k is pressed. A circuit will be established from the positive pole of battery C by conductor $z z^2$, wire 6, key k , plates f and g , wire w , conductor b , wire 3, hook-switch H² of station B, contact 2^a, bell E², wire 1^a, conductor z to the negative pole of the battery. When the key is released the bell ceases to ring, and the telephone at station A is removed to listen in. To answer the call at station B the telephone is removed from the hook.

When the key is released and the telephone removed at the calling-station, current from the calling-battery is cut off and current from the talking-battery circulates in the home circuit, as traced from wire 9, retardation-coil I, conductor a , wire 3, hook-switch H, wire 5, conductor a^2 , wire 14 to the negative pole of the battery. A portion of the current of the talking-battery also circulates through a derived circuit over the following route: From one pole of the battery in parallel circuit through the choking-coils I of all of the circuits which are not in use, then to the upper conductor $c d e$, &c., and in parallel through the bells E at their several stations, (not shown,) thence their several wires 1^b 1^c, &c., to the conductor z of the calling-circuit, thence (it being assumed, as shown, that the bell E² at station B is being rung) by wire 1^a, bell E², hook-switch H², wire 3^a, conductor b , wire w , plates g and f , of plug-switch S, key k , wire 24, conductor a , wire 3, hook-switch H, branch 5, conductor a^2 , and wire 14 to the other pole of the battery. This current is slight but sufficient to cause vibrations of the bell E² at station B, and a disagreeable noise is produced in the receiver at the calling-station. To avoid this the form of bell described

is employed which rings for current passing through it in one direction and not for currents of opposite direction.

When the telephones at each station are off the switches H, the current-supply circuits for the telephones are closed through their respective retardation-coils and the generator D. The talking-circuit, having been arranged for in part by the insertion of the plug P into the switch S, is completed when the called-station telephone is removed from its hook.

It will be seen that the insertion of plug P into the switch S, as previously described, gives a short-circuit connection between the circuits of the two stations, as set forth in the aforementioned patent, No. 507,568, and may be traced from hook-switch H at station A, telephones T and *t* in wire 5, conductor *a*², wire 19, plate *h*, pin *p*² of plug P, plate *i*, wire 20, conductor *b*², wire 5^a at station B, telephones T² and *t*², hook-switch H², wire 3^a, conductor *b*, wire *w*, plate *g*, pin *p* of plug P, plate *f*, key *k*, wire 24, conductor *a*, and wire 3 to the hook-switch H.

Circuit-conductors *a a*² and *b b*², &c., form twisted pairs, and in order to prevent cross-talk at any point the two wires of a pair must be of equal and opposite potential, respectively, and this result is obtained by the circuit-connections herein set forth.

Where a small number of stations are associated together it becomes necessary to connect the opposite poles of the calling and talking batteries together, as by the wire 7, in order to shunt current from the bells of the stations not called during the act of calling. Where a large number of stations are connected together their retardation-coils operate to produce this result.

Having described the invention, we claim—

1. In a telephone speaking-tube system comprising a plurality of stations, the combination of a plurality of circuits; a call-circuit with a source of electricity for calling purposes bridged between its conductors, with a branch from each conductor at each station, one of which includes a polarized call-bell, and is normally in contact with the hook-switch, the other being normally open at a call-key; each station being provided with telephones in a normally open bridge of the home-circuit conductors and with a switching device consisting of open branch terminals from each circuit-conductor and means for switching any two circuits together, and a calling-key; a talking-battery in a permanent bridge between the two conductors of each circuit, with an electromagnetic resistance between the positive pole of the said battery and one conductor of each circuit; whereby when any two circuits are switched together, upon the closure of the calling-key with the said open branch of the call-circuit, the bell at the called station is operated.

2. In a telephone speaking-tube system

comprising a plurality of stations, the combination of a plurality of circuits; a call-circuit with a source of electricity bridged between its conductors, with a branch from each conductor at each station, one of which includes a polarized call-bell and is normally in contact with the hook-switch, the other being normally open at a call-key; each station being provided with telephones in a normally open bridge of the home-circuit conductors, and with a switching device consisting of open branch terminals from each circuit-conductor, and means for switching any two circuits together, and a calling-key; a talking-battery in a permanent bridge between the two conductors of each circuit, with an electromagnetic resistance between the positive pole of the said battery and one conductor of each circuit; a connecting-wire between the poles of the said batteries; whereby when any two circuits are switched together, upon the closure of the calling-key with the said open branch of the call-circuit, the bell at the called station is operated.

3. In a telephone speaking-tube system, comprising a plurality of stations, and a plurality of metallic circuits; a circuit between a calling and a called station, consisting of a talking-battery in a bridge between the conductors of each circuit, with an electromagnetic resistance between one pole of the battery and one conductor of each circuit; a call-circuit with a branch at each station normally in contact with the hook-switch, and which includes a polarized call-bell; with telephones in a bridge between the conductors of the home circuit, and switching apparatus connecting the home circuit with the talking-battery, and also with a shunt-circuit around the battery, which circuit includes the polarized call-bell at the called station and in which current from the said battery circulates of a polarity opposite to that required to operate the bell.

4. A polarized call-bell, consisting of a hollow metal casing open at both ends, with a bar across one end, a permanent magnet inclosed in said casing and secured by one pole to the said bar; an electromagnet within the casing between the poles of the permanent magnet, and secured to the under side of the bar, having attached to its free end a pivoted armature and a circuit-breaker, the armature carrying a bell-hammer which extends through the casing into proximity with a gong secured thereto.

In testimony whereof we have signed our names to this specification, in the presence of two subscribing witnesses, this 7th day of September, 1895.

JOHN S. STONE.

GEORGE K. THOMPSON.

Witnesses:

GEO. WILLIS PIERCE,

FRANK C. LOCKWOOD.