No. 647,588. Patented Apr. 17, 1900.

G. K. THOMPSON.

COMBINED TELEPHONE AND ELECTROTHERMOSTATIC FIRE ALARM SYSTEM.

(Application filed Aug. 5, 1899.)

(No Model.) 2 Sheets—Sheet 1.

Fig. 1.

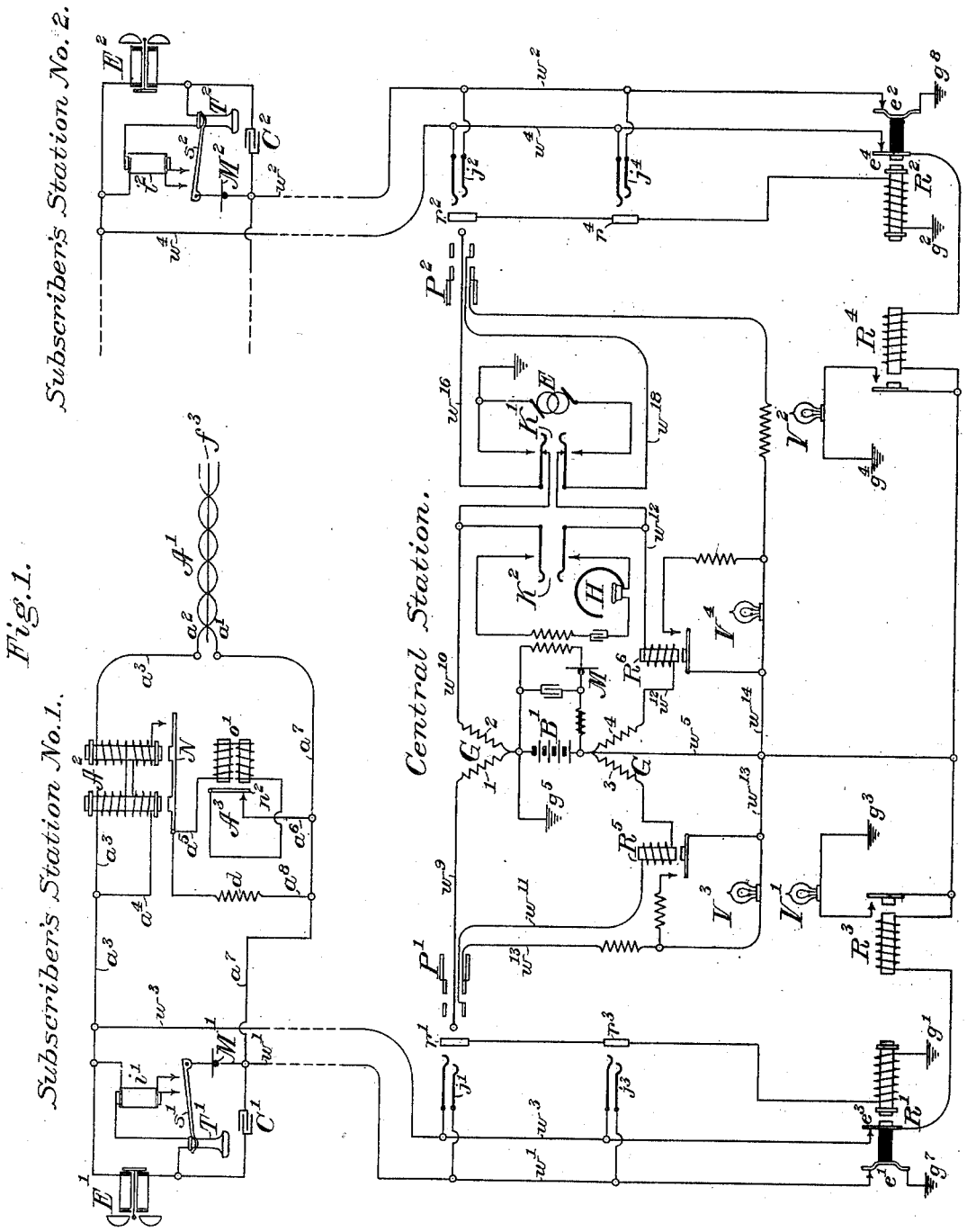

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Fig. 2.

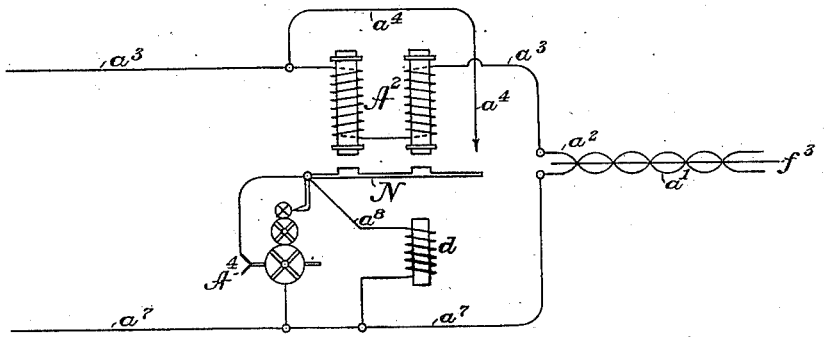


Fig. 3.

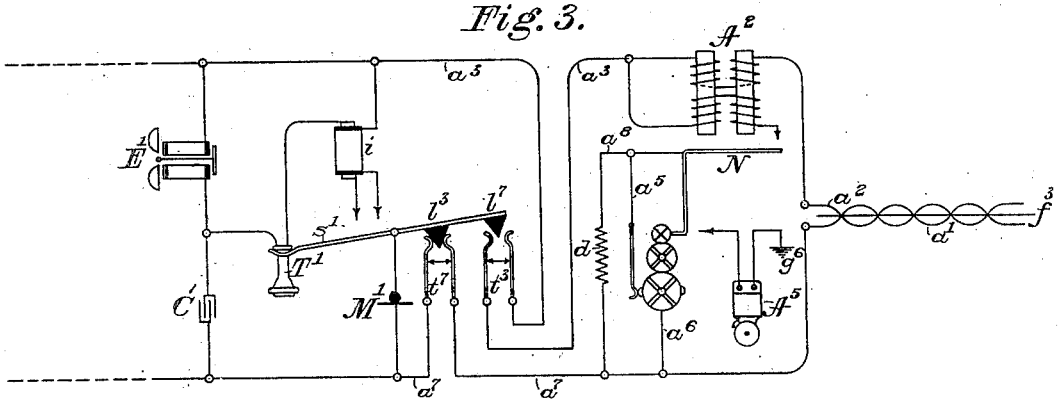
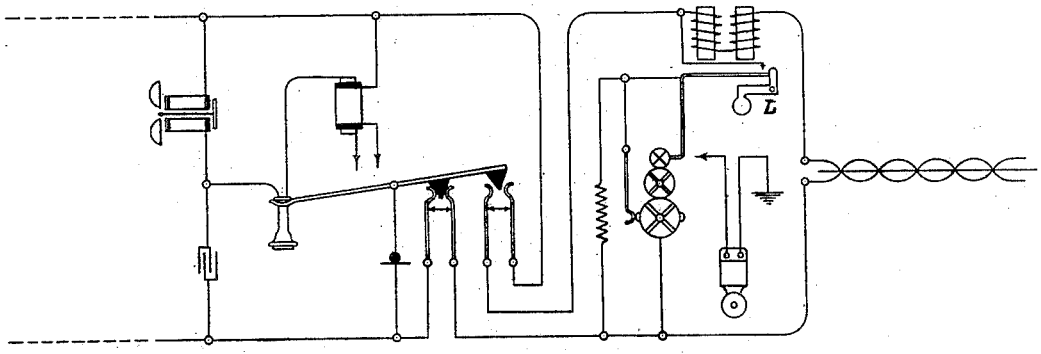


Fig. 4.



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UNITED STATES PATENT OFFICE.

GEORGE K. THOMPSON, OF MALDEN, MASSACHUSETTS, ASSIGNOR TO THE AMERICAN BELL TELEPHONE COMPANY, OF BOSTON, MASSACHUSETTS.

COMBINED TELEPHONE AND ELECTROTHERMOSTATIC FIRE-ALARM SYSTEM.

SPECIFICATION forming part of Letters Patent No. 647,588, dated April 17, 1900.

Application filed August 5, 1899. Serial No. 726,231. (No model.)

To all whom it may concern:

Be it known that I, GEORGE K. THOMPSON, of Malden, in the State of Massachusetts, have invented a new and useful Improvement in Combined Telephone and Electrothermostatic Fire-Alarm Systems, of which the following is a specification.

Many electrothermostatic systems for giving an alarm of fire automatically at a distance more or less remote from the immediate locality of the fire have been devised, and means have been devised for electrically connecting a local fire-alarm thermostat with a subscriber's circuit in a telephone-exchange, whereby heat causing a thermostat to open or close an electric circuit will cause a signal to be conveyed over a telephone-circuit to the central office of the telephone-exchange. Such devices and means, however, have included and required much additional electrical mechanism at both the subscriber's station and the central station and in most cases, if not all, have included and required additional signaling devices and even additional local batteries or similar additional sources of electromotive force. The present invention employs no additional source of electromotive force either at a subscriber's station or at the central station, no mechanism or apparatus of any sort in addition to the mechanism and apparatus in ordinary use at present at the central station in many telephone-exchanges, and only a very limited amount of electromechanism at a subscriber's station in addition to the telephone outfit in ordinary use thereat and a suitable electrothermostat.

The invention consists in the combination, with a subscriber's outfit at a subscriber's station in a common-battery telephone-exchange, the line connecting said subscriber's station with the central station of said exchange, the common source of electromotive force, and electromechanism at said central station adapted for ordinary use in connection with said subscriber's outfit, of an electrothermostat at said subscriber's station in a branch parallel or in multiple with the branches containing the several instruments of said subscriber's outfit, a continuously-acting circuit-modifier, and a magnetic device adapted to be energized by the operation of said electrothermostat in closing the branch in which said electrothermostat is located, and thereby bring into circuit with said common source of electromotive force said continuously-acting circuit-modifier.

The invention consists also in details of construction, more especially in means for continuing the action of the circuit-modifier at the subscriber's station if by chance the circuit is opened in the thermostat after having been once closed to give an alarm.

The invention consists, further, in a modification which may be employed at the subscriber's station whereby the subscriber may cut out the fire-alarm apparatus while holding telephonic communication with the central office.

In the drawings, Figure 1 is a diagram representing two subscribers' lines belonging to a common-battery telephone-exchange, with their substation outfits and so much of the apparatus at the central station as is used in connecting and disconnecting the said two lines for conversation, one of the said subscriber's substations being furnished with fire-alarm apparatus according to the present invention. Fig. 2 is a diagram representing a modification of the fire-alarm electromechanism employed at the subscriber's station in connection with the electrothermostat. Fig. 3 is a diagram representing more especially a device whereby the fire-alarm apparatus at the subscriber's station may be cut out while conversation is carried on by the central office with subscriber. There is also shown a local-alarm device at the subscriber's station. Fig. 4 represents a detail of construction, being substantially the same as Fig. 3 and for the same purpose, but employing a mechanical device in the place of an electric device.

Since a striking feature of the invention consists in the fact that the common-battery telephone-exchange upon which the fire-alarm system is engrafted continues to be operated as a telephone system in the same manner in which it has hitherto been operated in the absence of the fire-alarm system, it is of some importance to describe herein rather fully the construction and mode of operation of such common-battery telephone-exchange.

As before stated, such a system is represented at Fig. 1, where, as indicated, are shown the central station and two subscribers' stations No. 1 and No. 2. Subscriber's station No. 1 is connected with the central station by line-wires w' and w^2 and is there represented in the usual manner by multiple spring-jacks, of which two, j' and j^3, are shown. There is also shown at the central station in Fig. 1 as belonging particularly to the connecting-wires w' w^3 of subscriber No. 1 a cut-off relay R', the winding of whose magnet is grounded at g' and connects, as shown, with the test-rings r' and r^3 of the spring-jacks j' and j^3, respectively. So, too, is shown the line-relay R^3, adapted to operate a call-signal V', which in this instance is an incandescent lamp grounded at g^3, as shown.

The subscriber's outfit at station No. 1 contains, as is usual in common-battery telephone systems, the microphone M', hand-telephone T', polarized bell E', induction-coil i', and telephone-switch s', the latter adapted to complete both the primary and secondary circuits through the said induction-coil when the telephone is off the hook or to open the same when the telephone is on the hook, as indicated. C' is a condenser in the primary circuit of the induction-coil i', its office being to break the circuit of the normal battery-current through the bell. Similar letters with even numbers indicate like instruments at subscriber's station at No. 2, which is connected with the central station by wires w^2 w^4 at spring-jacks j^2 j^4. So likewise test-rings r^2 r^4, cut-off and line relays R^2 R^4, and call-signal V^2 to be used in connection with subscriber's station No. 2 correspond to like instruments already described.

At the central station B' is the common battery or the source of electromotive force common to all the subscribers' circuits and also common to all the circuits of the operators' cords. Of these cords but one pair is shown, although each operator has several pairs. One pole of the battery B' is grounded at g^5, and every subscriber's circuit has at the central station a wire w^5, leading from the opposite or live pole of the battery through the winding of the magnet of the line-relay R^3 to a contact-plate e^3 of the cut-off relay R', which contact-plate normally makes contact with wire w^3, leading to subscriber's station No. 1. Another contact-plate e' normally makes contact with wire w', also leading to subscriber's station No. 1 and grounded at g^7, as shown. When the subscriber takes his hand-telephone T' from the hook, a circuit is made from the ground g^5 of the common battery B' through wire w^5 and the winding of the magnet of line-relay R^3, contact-plate e^3, wire w^3, the secondary of induction-coil i', microphone M', wire w', and contact-plate e' to ground g^7, and the current established therein energizes the magnet of line-relay R^3 and shunts current, as indicated, to operate the call-signal V'.

One cord of each pair of the operator's cords is called the "answering-cord." It contains three wires w^9, w^{11}, and w^{13}, insulated each from the others and connecting with a separate part of the answering plug P'. Thus w^9 connects with the tip of the plug designed to make contact with the lower spring of spring-jacks j' j^3, &c., while its other end passing through one winding 1 of a repeating-coil G makes electrical connection with the grounded pole of the battery B'. Wire w^{11} connects with an insulated ring on plug P', which is designed to make contact with the upper spring of spring-jacks j' j^3, &c., while the other end of the said wire passing through the winding of the magnet of the disconnecting-relay R^5 and also through winding 3 of repeating-coil G makes electrical connection with the live pole of battery B'. The third wire w^{13} makes contact at one end with the sleeve of the plug P', through which it is designed to make electrical connection with the test-rings r' r^3, &c., of the spring-jacks j' j^3, &c., while its other end passes through the disconnecting-signal V^3, in this instance an incandescent lamp, and makes electrical connection with the live side of the battery, a branch from said wire w^{13} being provided with a contact, as shown, to shunt current from the said disconnecting-signal. Going now to the other or answering cord of the pair we have wires w^{10}, w^{12}, and w^{14}, of which wire w^{10} leads from the grounded side of the common source of electromotive force B', through winding 2 of the repeating-coil G, and through the ringing-key K' and wire w^{16} to the tip of the plug P^2, which is designed to make contact with the lower spring of the spring-jacks j^2 j^4, &c. Wire w^{12} leads from the live side of the battery B', through the winding 4 of repeating-coil G, the winding of the magnet of disconnecting-relay R^6, through the ringing-key K', and wire w^{18} to the ring on plug P^2, which is designed to make contact with the upper spring of the spring-jacks j^2 j^4, &c. Wire w^{14} leads from the live side of the battery B' through the disconnecting-signal V^4 to the sleeve of the calling-plug P^2, designed to make contact with the rings r^2 r^4, &c., of the spring-jacks j^2 j^4, &c.

For further description of the apparatus of which use is made at the central station in the ordinary process of connecting two subscribers for conversation and disconnecting them after conversation it is not necessary to say more than that E is the ringing-generator, whose two poles are brought into connection with wires w^{16} and wire w^{18} by key K' and so through the circuit w^2 w^4 of subscriber's line No. 2 with the bell and condenser at station 2, and that M is the operator's microphone, always in circuit, while H is the operator's head-telephone brought into circuit by key K^2.

It is hardly necessary to point out that when plug P' is inserted in a spring-jack j'

belonging to line of subscriber No. 1 cut-off relay R′ operates to break subscriber's line-wire circuits at contact-plates e' and e^3, and the two wires w' and w^3 become connected up with the windings 1 and 3 of the repeating-coil G. Similarly when plug P^2 is inserted in a spring-jack of the line of subscriber No. 2 the two wires w^2 and w^4 become connected up with windings 2 and 4 of the repeating-coil G. Thus the insertion of the two plugs in the proper spring-jacks creates a talking-circuit when both of the subscribers' receiving-telephones are removed from their respective hooks.

It remains to describe the fire-alarm apparatus of the subscribers' stations and its mode of operation in connection with the apparatus of the central station, whose normal operation in the telephone system has been minutely described in order that it may manifest that it is not disturbed by the provisions made for the operation therewith of the thermostatic fire-alarm system.

Confining the description to Fig. 1, except where otherwise especially mentioned, A′ is the electrothermostat. Any form of thermostat adapted to close an electric circuit at a required temperature would answer the purpose of this invention; but the form of thermostat shown in the drawings is a cable thermostat, preferred because it is readily placed anywhere and everywhere in the subscriber's station, the same consisting of two copper wires a' a^2, insulated from each other, and a third wire f^3 of readily-fusible material wound with a' and a^2 and adapted to close a circuit between a' and a^2 by fusing at any required temperature.

A^2 is an electromagnet belonging to the fire-alarm system. The upper winding of its two cores or the winding where but one is used, as shown in Fig. 2, is connected up at its two ends in or with wire a^2, which may be regarded as a prolongation of wire a^2 of the thermostat, and connects with one of the wires w^3 of the subscriber's telephone-circuit.

A^3 is the circuit-modifier, the form shown at Fig. 1 being the well-known buzzer, consisting, essentially, of an electromagnet o' and vibratory armature n^2. The pivot of the armature N is connected with the pivot of the armature n^2 by a wire a^5, which includes the winding of electromagnet o'. The armature n^2 makes contact with a contact-point in a wire a^6, branching from wire a^7, which may be regarded as a prolongation of the thermostat-wire a', and is connected up at all times with wire w' of the subscriber's circuit. A wire a^8, containing a resistance d, as shown, also connects wire a^7 with the pivot of the armature N.

When the wires a' and a^2 of thermostat A′, Fig. 1, are electrically connected, a fire-alarm circuit is established as follows: beginning with the ground g^5 of the common battery B′, through the battery, wire w^5, magnet-winding of line-relay R^3, contact-plate e^3, wire w^3, wire a^3, upper winding of electromagnet A^2, thermostatic wires a^2 a', wire a^7, wire w', and contact-plate e' to ground at g^7. The current of the circuit thus established energizes the magnet of the line-relay R^3 and operates the line-signal V′. The current also energizes electromagnet A^2, whereby the armature N is so attracted as to close a contact with branch wire a^4, thereby establishing a shunt-circuit from wire w^3 at subscriber's station through wire a^3, branch wire a^4, lower winding of electromagnet A^2, armature N, wire a^5, winding of electromagnet o', armature n^2, branch wire a^6, wire a^7, and wire w' at subscriber's station. This, as will readily be traced at Fig. 1, operates the buzzer A^3, and the operator at the central station on responding to the call-signal given at V′ will hear in operator's head-telephone the noise of the buzzer, indicating a fire at subscriber's station No. 1.

It will be observed that when the shunt-circuit just described is established by the armature N making contact with the contact-point of branch wire a^4 if such shunt-circuit is maintained it is immaterial whether or not thereafter the circuit remains closed in the electrothermostat. In fact, the electrothermostat may itself be destroyed without causing the fire-alarm call or signal, once given, to cease. It is obvious that the shunt-circuit can be maintained in many ways—for instance, let the contact-point with which N makes contact be furnished with a latch which will receive and hold the armature when the latter is attracted by its magnet. Such a device is shown at L, Fig. 4. At Fig. 1 an electrical device is shown for maintaining the shunt, consisting of wire a^8, furnished with a suitable resistance, connecting wire a^5 with wire a^8. A continuous circuit is thus maintained through the magnet of the line-relay R^3 at the central office, and the call-signal at V′ is also maintained notwithstanding the breaks in the operation of the buzzer or circuit-breaker at the subscriber's station until the operator at the central station responds by inserting the plug P′ in one of the jacks j' of the subscriber's circuit, when on operating the listening-key K^2 the clicks or noise due to the makes and breaks in the buzzer or circuit-modifier A^3 at the subscriber's station will be heard in the head-telephone H. The current at all times flowing through the wire a^8, including its resistance d, is sufficient to energize the magnet of the line-relay R^3 whether the circuit through the buzzer is closed or open.

In Fig. 2 the second winding of the magnet A^2 is omitted, and the armature N, under the attraction of the said magnet, makes contact with a contact-point at the end of wire a^4, leading directly from wire a^3. In this instance there is no provision for maintaining the circuit if it is broken in the electrothermostat after the alarm-signal has once been sent in. Within the invention, broadly con-

sidered, it is not necessary to make special provision for this maintenance of the circuit, as a contact of sufficient duration is expected to be made in the thermostat; but at the same time it is well to make such special provision, and accordingly the armature N in Fig. 2 may be provided with the latch mechanism shown at L, Fig. 4. At Fig. 2, also, a circuit-breaker A^4, operated by clock mechanism, as indicated, takes the place of the buzzer of Fig. 1. It is unnecessary to trace the circuits. The clock mechanism is released when the armature N is attracted by its magnet A^2. The wire a^8 and resistance d in Fig. 2 serve the same purpose as in Fig. 1 in regard to the maintenance of a steady current through the line-relay R^3.

In Fig. 3, besides the apparatus at the subscriber's station already described, the switch operated by taking the hand-telephone from the hook for the purpose of establishing the telephone-circuit is made to do the further duty of cutting out the fire-alarm apparatus at the subscriber's station. Two spring-contacts l^3 and l^7 in wires a^3 and a^7, respectively, both normally closed, are opened by two non-conducting plugs l^3 and l^7 when the telephone at subscriber's station is taken from the hook, as indicated. This permits conversation to be carried on between subscriber and operator after a fire-alarm has once been given without the annoyance of noise in the circuit-breaker. There is also shown at Fig. 3 a special alarm-signal A^5 at the subscriber's station. This is an ordinary vibrating bell grounded at g^6 and brought into circuit with the common battery at the central station by the movement of the armature N, as indicated. It is unnecessary to trace the circuit.

I have thus far shown and described the line connecting the subscriber's station with the central station as a metallic circuit-line, and I have shown for the apparatus employed at the central station that which is employed in common-battery exchanges where the subscribers' lines are either all metallic or part metallic and part grounded; but it is obvious that the invention is equally applicable to common-battery telephone-exchanges in which the subscriber's lines may all be grounded. So, too, the only circuit-modifying instruments shown and described as operating to be heard in the central operator's head-telephone when the electrothermostat-circuit is closed at the subscriber's station have been well-known forms of circuit-breakers; but it is obvious that other circuit-varying instruments may be substituted therefor if so arranged as to be energized by the common battery or common source of electromotive force at the central station. Again, it would be within a substantial part of the invention to omit the branch line a^8 and resistance d of Fig. 1 and depend upon the character of the visual signal at V^3 to determine whether a regular call is sent in from station 1 (a steady light) or a fire-alarm call, (a flash or wavering light.)

I claim—

1. In a common-battery telephone-exchange, the combination with a subscriber's outfit at a subscriber's station, the line leading therefrom to the central station, the common source of electromotive force, and the electromechanism at said central station adapted to be used in connection with said subscriber's outfit, of an electrothermostat at said subscriber's station, in a branch parallel or in multiple with the branches containing the instruments of said subscriber's outfit, a continuously-acting circuit-modifier, and an electromagnet device adapted to be energized by the operation of said electrothermostat in closing the branch in which said electrothermostat is located and thereby bring into circuit with said common source of electromotive force said continuously-acting circuit-modifier, substantially as described.

2. In a common-battery telephone-exchange, the combination with a subscriber's outfit at the station including said outfit and a common source of electromotive force, of an electrothermostat in a branch parallel or in multiple with the branches containing the instruments of said outfit, a continuously-acting circuit-modifier, and an electromagnetic device adapted to be energized by the operation of said electrothermostat in closing the said branch in which said electrothermostat is located, and thereby bring into the common circuit of the exchange over subscriber's line, said continuously-acting circuit-modifier, substantially as described.

3. In a common-battery telephone-exchange, the combination with a subscriber's line, the outfit at the subscriber's station and a common source of electromotive force, of an electrothermostat in a branch parallel with the branches containing the instruments of said subscriber's outfit and adapted when operated by heat to close a circuit over the subscriber's line and set up therein a current from the source of electromotive force of the exchange, an electromagnet so arranged that the said current established by the operation of the thermostat passes through its winding, a conductor leading from the branch in which the thermostat is connected, in advance of the magnet, an armature for said electromagnet adapted when attracted by said electromagnet to make electrical connection with said conductor, and a circuit-modifier in electrical connection with said armature adapted with said armature and said conductor to short-circuit said thermostat, substantially as described.

4. In a common-battery telephone-exchange, the combination with a subscriber's line, the outfit at the subscriber's station and a common source of electromotive force, of an electrothermostat in a branch parallel with the branches containing the instruments of said subscriber's outfit and adapted when operated by heat to close a circuit over the said subscriber's line and set up therein a current

from the source of electromotive force of the exchange, a double-wound electromagnet so arranged that the said current established by the operation of the thermostat passes through one winding thereof, an armature for said electromagnet adapted when attracted by said electromagnet to make permanent electrical connection with the second winding thereof, and a circuit-modifier in electrical connection with said armature, and adapted with said armature and said second winding to permanently short-circuit said thermostat, substantially as described.

5. In a common-battery telephone-exchange, the combination with a subscriber's outfit at a subscriber's station, the line leading therefrom to the central station, the common source of electromotive force, and the electromechanism at said central station adapted to be used in connection with said subscriber's station, of an electrothermostat, in a branch parallel with the branches containing the instruments of said subscriber's outfit, adapted when operated by heat to close a circuit over said subscriber's line and set up therein a current from said common source of electromotive force, a continuously-acting circuit-modifier, an electromagnet so arranged that the said current established by the operation of said thermostat will pass through its winding, and an armature for said electromagnet in electrical connection with said continuously-acting circuit-modifier and so arranged that, when attracted by said electromagnet, it will make electrical connection with said winding and thereby bring into circuit with said common source of electromotive force said continuously-acting circuit-modifier, substantially as described.

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Witnesses:
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