E. E. CLEMENT.

TELEPHONE EXCHANGE SYSTEM.

APPLICATION FILED MAR. 3, 1905.

1,029,577.

Patented June 11, 1912

2 SHEETS—SHEET 1.

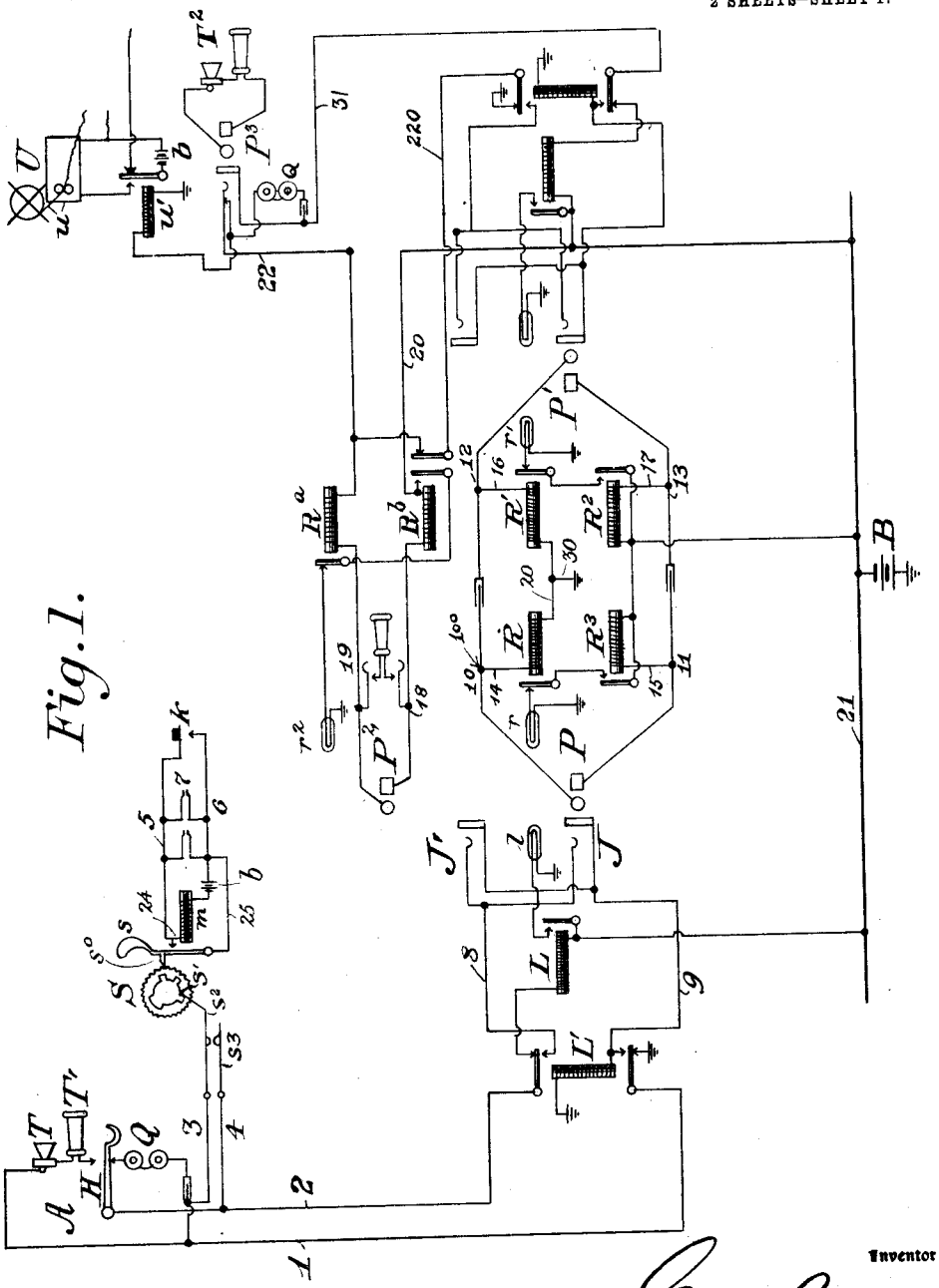

Fig. 1.

Witnesses

Raymond F. Barnes.

James H. Marr.

Inventor

Edward E. Clement

E. E. CLEMENT.

TELEPHONE EXCHANGE SYSTEM.

APPLICATION FILED MAR. 3, 1905.

1,029,577.

Patented June 11, 1912.

2 SHEETS—SHEET 2.

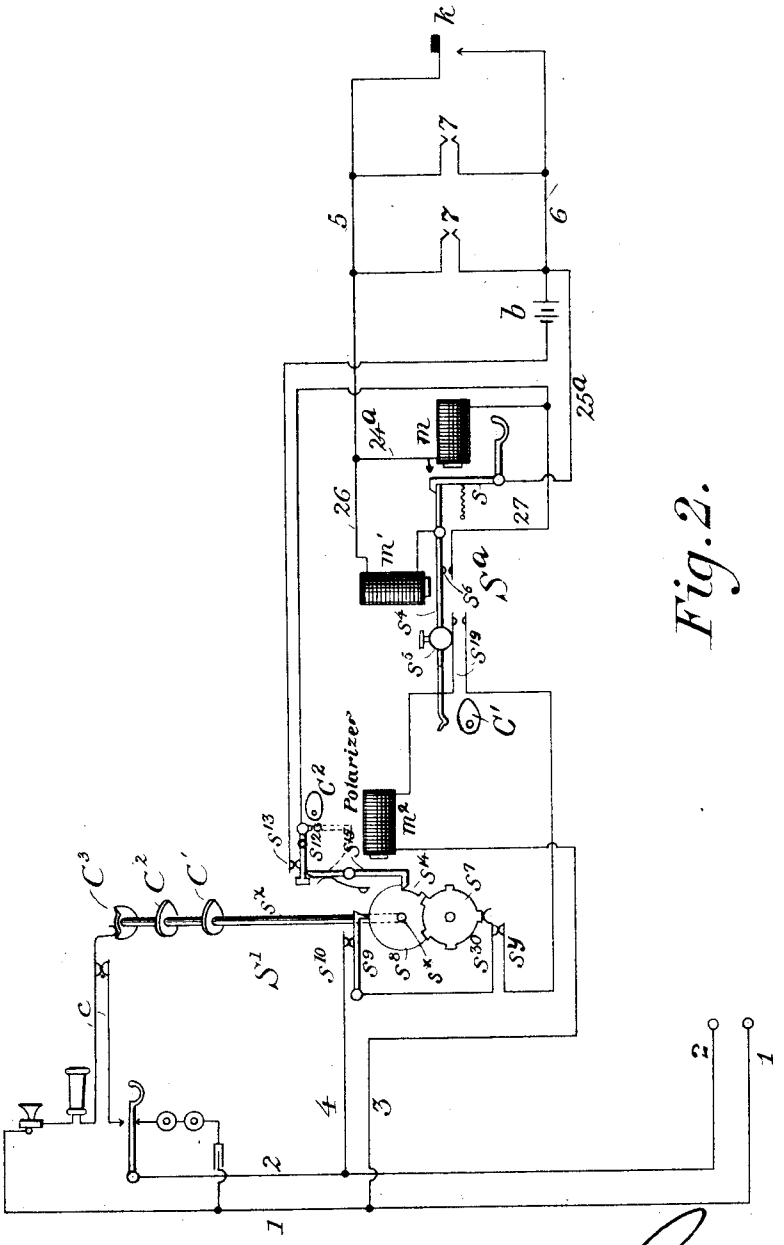

Fig. 2.

Witnesses

Raymond F. Barnes.

James H. Marr.

Inventor

Edward E. Clement

By

Attorney

UNITED STATES PATENT OFFICE.

EDWARD E. CLEMENT, OF WASHINGTON, DISTRICT OF COLUMBIA.

TELEPHONE-EXCHANGE SYSTEM.

1,029,577. Specification of Letters Patent. Patented June 11, 1912.

Application filed March 3, 1905. Serial No. 248,306.

To all whom it may concern:

Be it known that I, EDWARD E. CLEMENT, a citizen of the United States, residing at Washington, in the District of Columbia, have invented certain new and useful Improvements in Telephone-Exchange Systems, of which the following is a specification, reference being had therein to the accompanying drawing.

My invention relates to electrical signaling systems, and particularly to such systems as are used in conjunction with or combined directly in telephone exchange systems.

It has for its object the provision of means for giving a special indication to a telephone or other central office operator by means of which some calls or signals may be differentiated from others and connections which require special or extra attention will receive preference in ordinary course of business and with the least possible delay due to the manipulation of apparatus.

Briefly stated my present invention comprises special connective circuits provided at the central office, or special connections for the ordinary connective circuits, and special transmitting means at the substations, whereby in case of fire or robbery or the like at the substation, the lamp on the switch board at central will flash in a characteristic manner, whereupon the operator will immediately plug the line to fire or police headquarters and the signal will there be received on a proper receiving apparatus such as a Morse register, giving the exact location of the house or building in which the trouble exists.

My invention is illustrated in the accompanying drawing, wherein—

Figure 1 is a diagram showing one substation of a telephone system, equipped with common battery apparatus, and the central station, with such additional apparatus as serves for the practice of my invention; and Fig. 2 is a diagram of a modified form of substation apparatus and connections.

Referring first to Fig. 1, A is a subscriber's station, equipped with the usual telephone transmitter T, receiver T′, hook switch H, ringer Q^m, and condenser. From the substation line wires 1 and 2 pass to the central office, where they are connected to contacts of the cut-off relay L′ and thence under normal condition of use of the line, by wires 8 and 9 to the answering jack J and the multiple jacks J′. In disuse, the line goes from the contacts of the cut-off relay to the line relay L and battery bus 21 on one side, and to ground or dead side of battery B on the other. The circuit I have chosen for illustration is the so-called "two-wire multiple", but any type of circuit is available, there being no special apparatus whatever, and no special circuit, at central for the alarm attachment. The ordinary connection cord circuit and plugs P and P′ are used when the line is to be connected with another for telephonic conversation, and may be used for special alarms, although I prefer to employ for the latter a special cord, always available. In the cord circuit the conductors 10—12, 11—13, pass from tip to tip and sleeve to sleeve, respectively, of the plugs P and P′, being broken intermediate the plugs by condensers. To the answering end of the cord the control relay R^3 and supervisory relay R are connected, in branches 15 and 14 to battery. To the calling end similar relays R^2, R′ are connected through branches 17—16 from battery. The first pair of relays controls the supervisory lamp *r* and the second the lamp *r*′.

All the construction thus far described is common and well known, and it is o[ne] of the salient objects of my invention to produce attachments for alarm purposes which will not require any change in existing circuits and which will work on any telephone circuits in use. At the substation I provide such an alarm apparatus, S, consisting of a normally wound clock train, with a break wheel *s*′ bearing on its periphery teeth arranged according to any desired code to represent the number of the house or other building wherein it is placed. Attached to this and governing the movement of the train is a detent wheel having teeth regularly disposed around its periphery. Adapted to take into and hold the detent wheel from turning, thereby detaining the train and the break wheel *s*′, is a tooth s^o on a pivoted lever *s*, controlled by a magnet *m* connected in a local circuit 5—6 and energized by a battery *b*. When the lever *s* is pulled up by the magnet *m* it closes a short circuit around the latter including the battery, so the magnet is "self-locking", that is when the lever once releases the wheel the latter is free to rotate until it runs down, which

may be after ten revolutions, or twenty, or any desired number, depending on the train and spring used.

Coöperating with the break wheel s' is a normally separated pair of spring pens s^2—s^3, the former having a long end reaching to the break wheel and when the latter is idle lying in the recess between two teeth. When the wheel rotates the spring rides over the teeth, closing the circuit as it passes each tooth. The rate of motion of this wheel should be rapid for the first few revolutions, at least, in order to make and break the line circuit rapidly to flash the line lamp, l.

Connected across the local circuit 5—6 I have shown thermostats 7, and a push button k. The number of these devices may be multiplied indefinitely and their character varied at will. For the thermostats burglar circuit closers on doors or windows may be substituted, or all together may be used. At central, I preferably provide a special plug or pair of plugs on each position of the switchboard, connected to a line leading to fire headquarters, or more accurately to the switchboard in the operating room of the fire department. This line may be similar in all respects to a subscriber's line, as I have shown it in part in Fig. 1.

In order to be sure of having a cord free in emergencies, and also for the reason that the cord employed is likely to be tied up for some time, as well as for reasons of efficiency, I usually prefer to provide at each position of the telephone switch board a special plug P^2 and cord conductors 18—19. Telegraph circuits are series circuits, of necessity, and in this case, while I provide supervisory relays R^a and R^b as usual for the cord 18—19, they are in series, and not in battery branches. Relay R^a is in the tip side 19, and relay R^b is in the sleeve side. The latter closes the circuit of the supervisory lamp r^2 when it pulls up, and the former when it is deënergized. Cord strand 18 is connected through wire 20 to the battery bus 21, and the strand 19 to wire 22 which passes to the fire headquarters or operating room. Where this wire 22 is to be used for conversational purposes I run a twin wire 31 back to central, there connecting the two, as previously stated, in the usual manner to line terminals, etc., as shown clearly in Fig. 1. There is this difference, however, that the sleeve side of the fire department line is normally to battery instead of the tip side as shown of line 1—2. The reason for this is that the tip side, 22, is used for the relay u' of the register and other receiving apparatus at the fire office U. For the same reason the ground usually on the mate side of line, 22 in this case, is put on through a contact of relay R^b. When the fire-chief or other person at station U calls in, he plugs in and bridges the telephone set T^2, so as to complete a circuit from ground at central through the wire 220 to the wire 22, back through wire 31, to the line relay, and to battery. At the telephone central office an operator's listening key is provided as usual for the cord 18—19 to cut in when desired.

The operation of my improved system as thus far described is as follows: Subscriber A calls for telephone service, and is served, in the usual and well understood way, which needs no description. Assuming his telephone apparatus to be in disuse, however, and an alarm of fire to be desired. He pulls the hook s, which releases the wheel s' and by making the back contact at point 24 locks the lever back. Interrupter S then takes control of the line, and through contacts s^2—s^3 sends rapid makes and breaks, which cause the line relay L to attract and release its armature and flash the lamp l. The operator perceiving the character of the signal at once drops her other work on hand long enough to stick plug P^2 in jack J, whereupon the line 1—2 is prolonged to the fire station U, and as the wheel s' continues to send makes and breaks the relay u' at station U picks them up and works the register, u. It may also start a repeater, or in first coming in affect the ordinary "joker" apparatus and circuits, afterward repeating on the gong circuits of its own district. All these matters relate to detail which will be at once apparent to those skilled in the fire-alarm art upon inspecting the invention. The circuit 22—31 can be treated from the telephone manager's standpoint as a telephone subscriber's line, while from the fire-alarm operator's standpoint it may be treated as a box loop or alarm circuit. It is both. The present apparatus in use at fire-alarm central offices for both signaling and telegraphing is available for this circuit without change; and the same may be said of the present apparatus at the central office of the telephone system. I have simply taken the two and combined them so as to make a coöperative and harmonious arrangement. The wheel, s', rotates rapidly when first started, but is then slowed down by any suitable mechanism. The fast sending is to flash the lamp l, the slow sending is for the relay u', as registers and repeaters are usually not designed for anything but low speeds.

To get a complete message of four rounds is usually the work of at least twenty seconds, and often thirty; this being fast enough for the systems wherein it takes nearly a minute under the most favorable conditions for the engines, etc., to get out for a run. It would be too slow to flash the lamp l however, in all probability. That is, the operator would get the first lighting of the lamp and would plug in before the break came. However this is a matter of

detail and I leave its regulation to the designer to meet conditions in particular cases. The wheel s' may run at a uniform speed without affecting the nature of the invention. Upon plugging the number of the house-box pulled, the operator can cut in her telephone across wires 18—19 and if the box S has run down the line will then be available for conversation. If the subscriber pulled the box himself, the receiver can be taken down and the telephone used to communicate specific information to the telephone office or fire authorities. In case the telephone is taken down before the box S is run down, the latter would be shunted, of course, and while the signal might be perceptible to the ear if a telephone were cut in on the line at fire-central, it would hardly affect the relay u'. To guard against this, I may provide the box apparatus S with a cam or other device, as shown in Fig. 2, to cut off the telephone connection until the box has run off the predetermined number of rounds. This arrangement is not shown in Fig. 1 because there the apparatus, which is rudimentary, is supposed to run down before it stops. In Fig. 2, however, I have shown a higher development of the invention, wherein a definite sequence in operations is established and the line restored to usable condition after them.

Referring now to Fig. 2, the substation and central station are telephonically the same as in Fig. 1, and the central station and fire station telegraph equipment are supposed to be exactly the same. The figure shows a different alarm equipment for the substation however, which is more positive in its action. Only the substation equipment is shown in the figure. Here the branch wires 3—4 pass from the line first to a standard fire or police alarm number transmitter S', then to the vibrator S^a. The auxiliary circuit 5—6 contains the controlling magnets m—m' for the vibrator, and is bridged by the thermostats or burglar circuit closers 7, and the key k. The number transmitter comprises a normally wound clock train having a driving arbor s^6, carrying a controller or cam wheel s^8, and driving the number wheel s^7 which is geared to make several revolutions for one of the cam wheel s^8. The wheel s^8 has a notch s^{14} in which normally takes the toe of a detent lever s^{15} controlled by the magnet m^2, which is polarized and included in the wire connection 3 of the main transmitting circuit. The normal connection of battery to the line 1—2 at central is such that current flowing in the line when the circuit is closed at the substation to call central, is of the wrong direction to affect magnet m^2 operatively. The upper end of lever s^{15} takes the end of or a projection on a shutter s^{12}, which it normally holds up, closing the circuit of the auxiliary battery b through contact s^{13}. The wire 4 passes to a contact s^{10} normally touching the locking lever s^9 whose toe when the apparatus is set rests as shown on the smooth periphery of the cam wheel s^8. This lever is connected to contact s^{30}, which with its twin contact s^{31} forms the pair controlled by the number wheel in transmitting, normally closed when set. The wire 3 passes to the magnet m^2, and thence with wire 4 to the terminal springs s^{19}, controlled by the vibrator S^a, and normally open. The vibrator consists of a swinging lever s^4, which may be roughly tuned like a reed by means of the weight s^5. This lever is pivoted and is normally held up to open all its contacts by a detent s, controlled by the magnet m, a manual pull hook being also connected to this detent, as before. When the detent is drawn back it makes contact so as to connect wires 24^a and 25^a, thereby locking the relay m and itself, and providing a closed return path from battery b through wire 26 to the vibrator magnet m'.

The operation of this modified system will now be understood. With the telephone line and central office equipment shown in Fig. 1, assumed to be in normal condition, and the substation equipment of Fig. 2, all the parts of which are in normal position as shown, the box S' being wound, assume that one of the circuit closers 7 or k in the protected structure acts to cross together the wires 5—6. Current from battery b will immediately energize magnet m, which will pull back detent s, releasing the lever s^4 so that the latter will drop and close the contacts s^6 and s^{19}. Magnet m' then takes current and again draws up the lever, breaking at s^6 and dropping it again, and so on in periodic movements whose rate is determined by the adjustment of the weight s^5. When the lever s^4 first drops it closes the line circuit to central at the contacts s^{19}, and thereafter as it vibrates it makes and breaks this circuit and flashes the line lamp l. The operator perceiving this signal inserts the special plug P^2 by preference, putting battery on to the cut-off relay L', which pulls up and connects the line wires 1—2 to the jack spring and sleeve, the connections being such (the line relay being normally to tip side) that battery current is then reversed on the line, and magnet m^2 at the substation pulls up, swinging the lever s^{15} (the upper end of which is rounded to form a cam surface arranged to engage behind the enlarged end of the shutter s^{12}) to pull its toe out of the notch s^{14}, and at the same time dropping the shutter s^{12}, which may then appear before a window to show the subscriber that his call has been attended to. This shutter may bear any desired inscription. The box apparatus S' being now released, the wheels s^7 and s^8 commence to rotate, the springs s^{19} remaining closed by reason of the contacts

s^{12}—s^{13} being separated and the circuit of battery b thereby broken. As the number wheel s^7 revolves it transmits the proper impulses to the fire station U to indicate the location of the building in trouble (or to the police headquarters if the system is used for police purposes). The number of rounds that goes in as determined by the gearing of the wheels s^7 and s^8 is intended to be the same as those of any ordinary fire or police box. In addition, I may provide for tests by inspectors in the usual fashion by sending only one round. When the proper number of rounds has gone in, the notch s^{14} reaches the toe of lever s^9, which drops into the notch, breaks the circuit 3—4, and holds the box from further running. It will be observed that in this condition the auxiliary circuits are both open, the battery b is not in danger of running down, even if a thermostat is closed and the main telephone line is left clear for ordinary use. When the firemen or police come in response to the call, the levers s^9 and s^4 are lifted, and the apparatus is thereby restored to normal condition, the shutter s^{12} being also replaced at the same time. Means for re-setting these devices are so well known in the art that I have not thought it necessary to do more than indicate them.

If it is desired to have the apparatus automatically re-set itself, it is only necessary to provide suitable cams C' and C^2, etc., on the arbor s^x, which after a complete rotation of the wheel s^8 will lift the lever s^4 and the shutter s^{12}. These cams are shown in Fig. 2 in duplicate, that is they are shown on the arbor and also in connection with the pieces of apparatus which they control. This is for convenience only, so the diagram can be read more easily. They can also lift the lever s^9 if it be used, but in automatic restoring it is superfluous, and in fact its use as a contact is not obligatory in any case, because if it stops the wheels a little short of their normal position this can be determined so as to bring the pen s^{30} between two teeth of wheel s^7, leaving the circuit open between s^y and s^{30}. I have stated that in case the telephone be taken down before the wheels have finished sending the number, this would be interfered with. I may prevent this positively as shown in Fig. 2 by providing a cam disk C^3 controlling springs c in the telephone circuit, so as to keep them separated while the number is being sent. The notch in the disk is made long enough to permit closure during the interval between the stop by lever s^9 and the normal stop by s^{15}. Where service of this kind is to be given generally, the operating company should maintain one or more special operators, and these would soon become so expert, as in fact fire and police operators are now, that as the first round of the signal would come in they would instantly deduce the following necessary information for quick relief: (1) the nature of the relief desired; (2) the location of the calling subscriber; (3) the location of the nearest engine house, precinct police station, or emergency doctor. To complete the connection to the necessary point would be but the work of an instant; and those familiar with the results attained by subscribers' telephone operators after some experience, will understand that this service would be at once more reliable and quicker than ordinary selection and connection by the subscribers' directions over the telephone.

Having thus described my invention, what I claim and desire to secure by Letters Patent is:

1. In a combined telephone and fire-alarm system, a plurality of subscribers' stations and a central station, a telephone set at each sub-station and means for interconnecting the lines at the central office, a fire-alarm station, telegraphic receiving apparatus thereat, a line-circuit extending therefrom to the central office and there provided with a line-terminal similar to those of subscribers' lines, means at a subscriber's station to send a telegraphic signal over the line-circuit to central, and special means controlled by an operator to connect the alarm station line with said subscriber's station line, whereby the subscriber may transmit a telegraphic signal direct to the alarm station.

2. In a combined telephone and signaling system, a plurality of subscribers' stations, a central station, line-circuits extending from the sub-stations to the central station and having connection terminals thereat, means to transmit signals over a subscriber's line, a signal receiving station having a line-circuit extending to the central station with a connection terminal thereat, operator's connective circuits for interconnecting the various line-terminals, and special terminal means for the line from the signal receiving station, apart from the regular connection terminals, adapted to connect said line direct with the terminals of the subscribers' lines.

3. In a combined signal and telephone system, a plurality of subscribers' lines having sub-station telephone sets and signal devices, a central office switchboard and terminals for the lines thereon, coöperating operators' terminals for interconnecting the same, a common alarm receiving station and line also provided with a switchboard terminal similar to the line-terminals, whereby it may be connected to other lines in the ordinary manner, and a special terminal device for said alarm receiving line controlled by an operator and adapted to coöperate directly with the subscribers' line terminals.

4. In a combined telephone and signaling

system, a central telephone exchange and a signal receiving headquarters, a plurality of subscribers' stations and line circuits extending therefrom to the telephone exchange, with terminal jacks therefor, operators' cord circuits and plugs for interconnecting said jacks, a line circuit extending from signal headquarters to the telephone exchange and also provided thereat with a jack; and a special plug terminal for said signal line adapted to connect the same direct to any calling subscribers' jack.

5. In an electrical signaling system, a substation comprising the following instrumentalities: a signal train and make-and-break devices governed thereby to send a code signal, a detent for said train normally restraining the same, circuit connections extending thereto and having an extension or branch, with initial or primary controlling means for said branch normally maintaining the same open, additional means operable from without the substation for releasing the code-signal train, a central station signal arranged to be operated by said signal train on the closure of said branch and an auxiliary station signal arranged to be operated by said signal train when the latter is released.

6. In an electrical signaling system, a signaling train and a code signal wheel driven thereby, a locking device for said train and an electro-magnet controlling the same operable from without the substation, circuit connections extending to said signal wheel and to said controlling magnet, together with an initial or primary controlling device having a local circuit with a suitable circuit closer adapted when actuated to close the main signal circuit.

7. In an electrical signaling system, a subscriber's substation provided with a telephone set, a fire alarm station provided with signal receiving devices, a central exchange having an operator's cord circuit, line circuits connecting said sub-station and said fire alarm station with said central exchange, and means at said sub-station for sending signals to the main exchange and additional means jointly controlled by the first-named means and by the operator for sending signals to the fire alarm station.

8. In an electrical signaling system, a subscriber's substation provided with a telephone set, a fire alarm station provided with signal receiving devices, a central exchange having an operator's cord circuit, line circuits connecting said substation and said fire alarm station with said central exchange, and means at said substation for sending signals to the main exchange and other means at said substation actuated from the central exchange for sending signals to the fire alarm station.

9. In an electrical signaling system, a substation provided with a signal train, a central station signal, an auxiliary station signal, means at said substation for actuating said central station signal, additional means at said substation jointly controlled by the first-named means and the central station operator for actuating said auxiliary station signal.

In testimony whereof I have affixed my signature in presence of two witnesses.

EDWARD E. CLEMENT.

Witnesses:
RAYMOND F. BARNES,
JAMES H. MARR.