No. 624,666. Patented May 9, 1899.

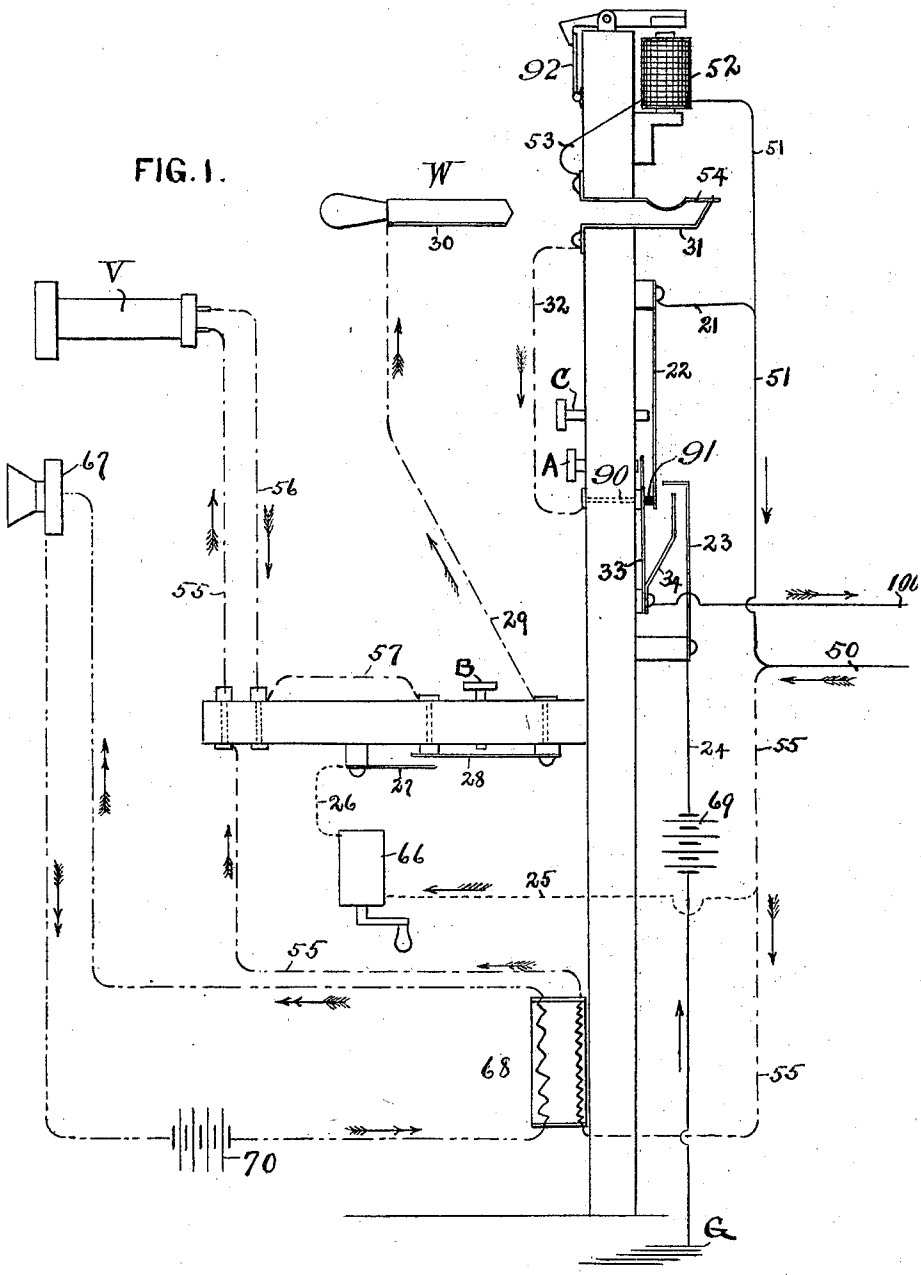
F. A. LUNDQUIST.

TELEPHONE SYSTEM.

(Application filed Sept. 20, 1897.)

(No Model.) 4 Sheets—Sheet 1.

FIG. 1.



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(No Model.) 4 Sheets—Sheet 2.

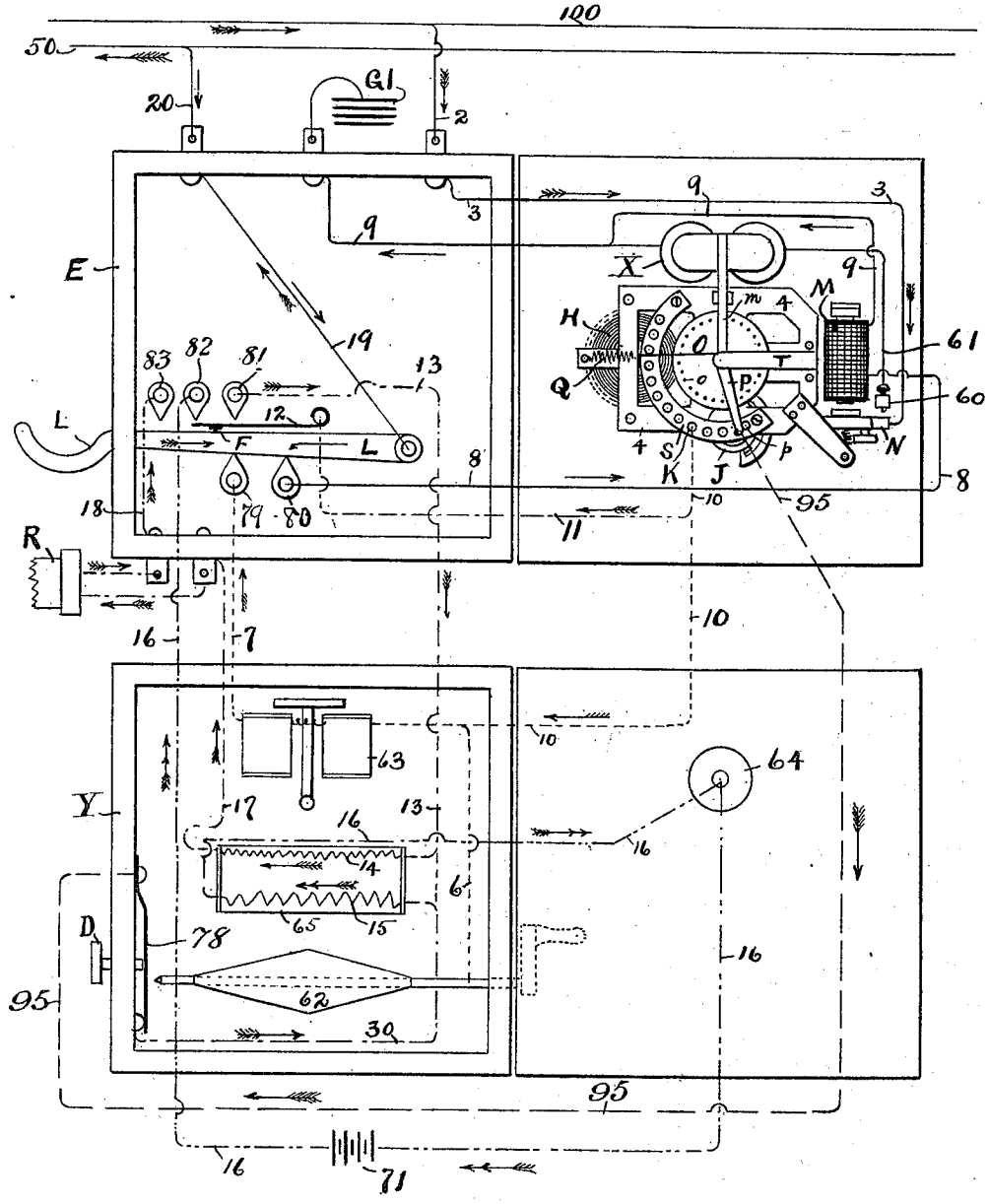

FIG. 2.

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(No Model.) 4 Sheets—Sheet 3.

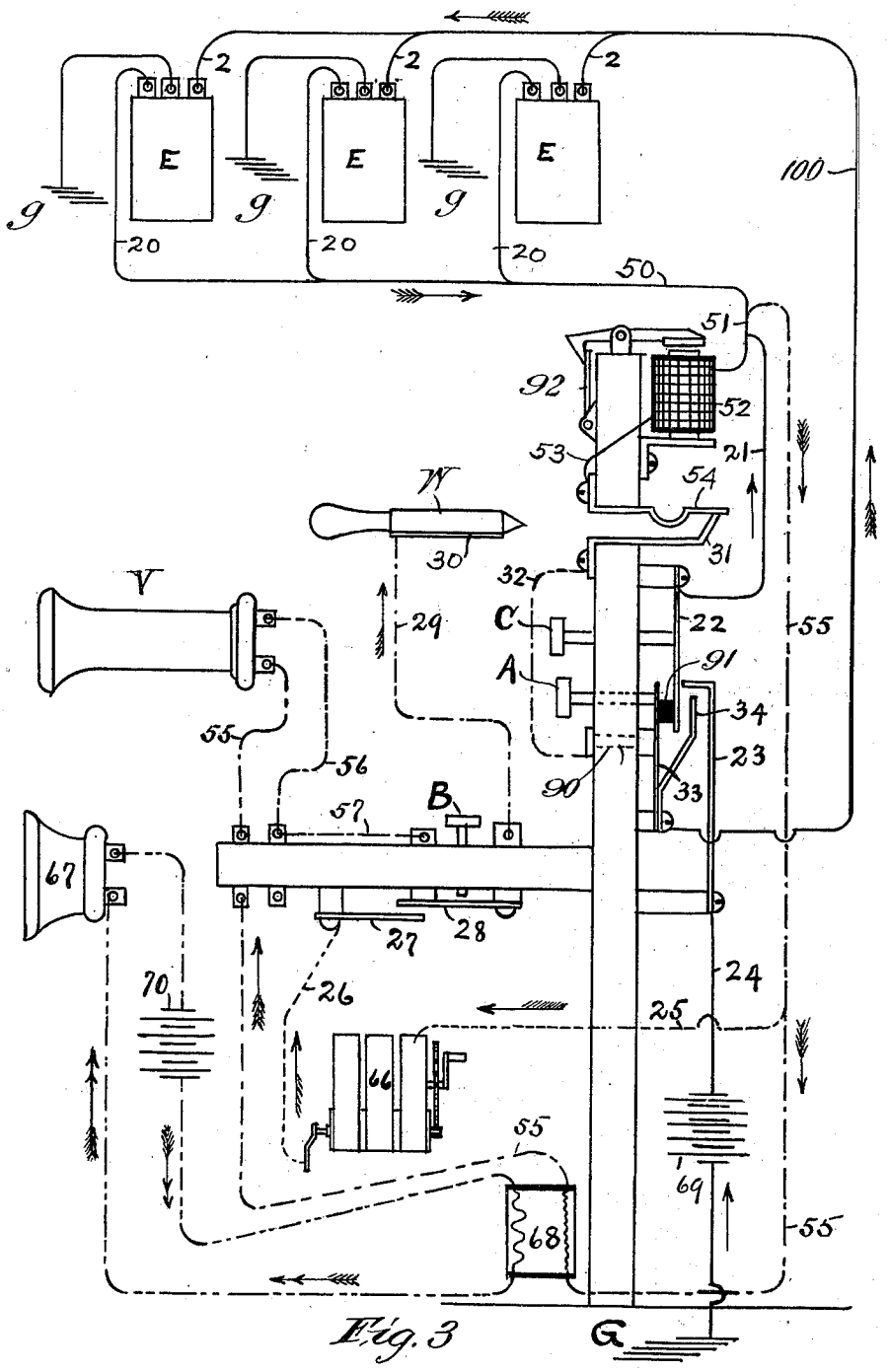

Fig. 3

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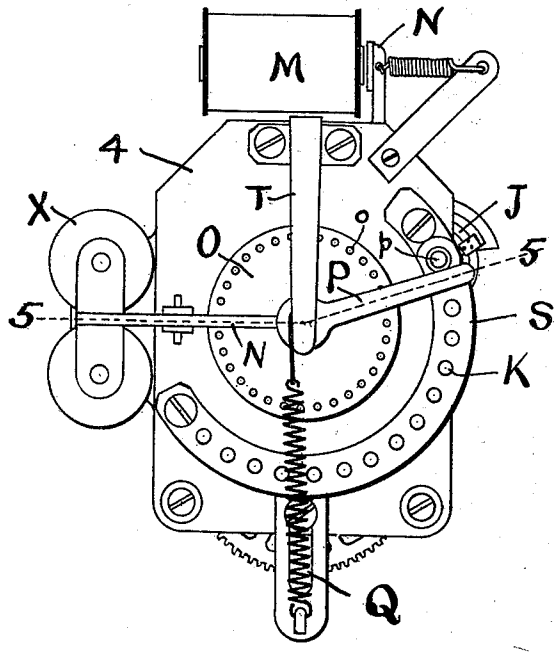
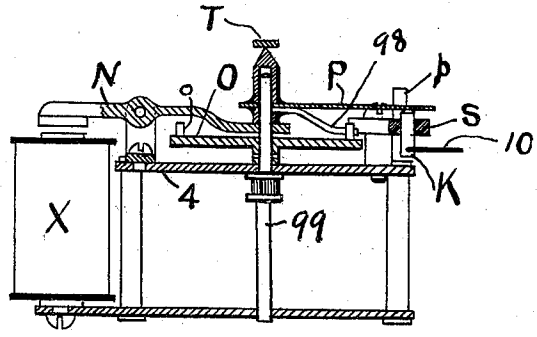


FIG. 4

Fig. 5



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UNITED STATES PATENT OFFICE.

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TELEPHONE SYSTEM.

SPECIFICATION forming part of Letters Patent No. 624,666, dated May 9, 1899.

Application filed September 20, 1897. Serial No. 652,330. (No model.)

To all whom it may concern:

Be it known that I, FRANK A. LUNDQUIST, a citizen of the United States, residing at Chicago, in the county of Cook and State of Illinois, have invented certain new and useful Improvements in Telephone Systems, of which the following is a specification.

My invention relates to telephones used on a toll-line, and has for its object certain improvements in the construction and arrangements that will be more fully described hereinafter.

In the accompanying drawings, Figure 1 is a diagrammatic view of the electrical connections at a central station. Fig. 2 is an interior view of the telephone-boxes at one of the toll-stations, with electrical connections shown diagrammatically. Fig. 3 is a view similar to Fig. 1, showing the connections from the central to several stations. Fig. 4 is an enlarged plan of the switch located at each telephone, and Fig. 5 is a partial section on line 5 5 of Fig. 4.

In carrying out my invention I provide a central station, at which is located an operator, and from this station run two main wires 50 and 100. To these wires each telephone is connected by the branches 2 and 20. There is a ground connection G at the central and similar ground connections *g* from each telephone. There are batteries 69 and 70 at the central station and a battery 71 at each local station. There is also a switch located at each telephone and under control of the operator at central, by which she makes the proper connections for permitting any two subscribers to converse.

When any subscriber wishes to talk to another, he calls the operator at the central station and tells her to whom he wishes to talk. She then moves the switches in each telephone connected to the lines 50 and 100 to the position that is special for the person to be called, which gives the lines 50 and 100 into the exclusive possession of these two subscribers. By the arrangement of the circuits, however, the operator at central can listen into the talking-circuit between the two subscribers, and when she finds that they have ceased talking she presses a button, by which is made an electric circuit that returns all switches to their normal position and leaves the lines 50 and 100 free to be taken up by any other two subscribers through communication to central. By this means the operator at central knows every time the line is put into use and can make the proper charge against each subscriber so using it.

Theoretically there may be an indefinite number of telephone-boxes E connected by the branches 2 and 20 to the lines 50 and 100; but as the lines 50 and 100 are the only wires used between two talking-telephones there is a practical limit to a number that will not cause too much interference between persons using the same lines. Each box E is provided with the customary lever or hook L, on which to hang the receiver R. When the receiver is on its hook, the lever L is in contact with the points 79 and 80; but when the receiver is removed it rises into contact with the point 83 and also closes the connection between 81 and 82 by means of the spring 12, which is separated from the lever L by the insulation F. On the inside of the cover of the box E is a metal frame 4 for supporting a clock mechanism provided with a motor-spring H. (See Figs. 2, 4, and 5.) The spring H is connected by a train of gears to an escape-wheel J, that is controlled by a magnet M through the armature and lever N. Secured near the top of the spindle 99 of one of the intermediate gears, between the motor-spring H and the escape-wheel J, is a disk O, provided with a series of pins *o*. Loosely mounted on the top of the spindle 99 is a pointer P, which is normally held in contact with a stop-pin *p* by the spring Q. Secured to the under side of the pointer P is an arm 98, adapted to enter the space between two adjacent pins *o* on the disk O. When an electric current is sent through the magnet M for the purpose of releasing the escape-wheel J one notch, the spring H turns the spindle 99, and consequently the disk O, which carries with it the pointer P, moving the said pointer in a direction away from the stop-pin *p*. The pin *p* is supported on a segment of a ring S, that is secured to but insulated from the frame 4. On the segment S are a series of insulated contact-points, one of which is marked K. These contact-points have a spacing that corresponds to the spacing of the pins *o* on the disk O, so that as the pointer P

moves forward by the escapement of the wheel J the said pointer moves into successive contact with the contact-points on the segment S. There are as many of these contact-points on S as there are telephones connected to the lines 50 and 100, but only one contact-point (represented by K) on each switch is used, the others being simply blanks. The particular point K is in each switch a different distance from the normal position of the pointer P in contact with the stop-pin *p*. Thus for the first telephone (which may be supposed to be telephone No. 1) of the series the contact K is the first point from the normal position. For the second telephone it is the second point, and so on. From the contact K a wire 10 is run, as shown in the drawings, Fig. 2, and will be hereinafter described. The reason for having a whole series of contact-points on the segment S when only one is to be used is to provide means for readily placing any telephone anywhere in the series by running the wire 10 to any contact-point. I may, however, use a removable contact K, which may be inserted in any one of a series of holes located where these contacts are represented to be. Located by the side of the frame 4 is a magnet X, the armature of which is on a lever *m*, that engages the under side of the pointer P. When a current passes through X, the lever *m* raises the pointer P, so as to release the arm 98 from the pins *o* and permit the spring Q to return the said pointer P to its normal position against the pin *p*. A resilient arm T, located over the pointer P, serves to again depress said pointer with its arm 98 into contact with and between the pins *o* when the current is broken through magnet X. A current sent through line 50 passes by way of 20 to magnet M, and then, as hereinafter described, to ground *g*. It therefore follows that a switch having its magnet M connected between line 50 and ground will have its pointer P moved forward one step each time a current is sent through 50, and also that if a number of such switches are connected to line 50 in the same way a current will cause the pointer of each one to move forward simultaneously with all of the others. It will be evident that with a number of switches connected in this way and with the contact K of a different distance from normal position on each only one switch will have electrical connection through its pointer P and that the particular switch so connected will depend upon the number of successive currents sent through line 50.

In the lower box Y of the telephone are located the customary generator 62, the ringer 63, the transmitter 64, and the induction-coil 65. At the central station are also located generator 66, transmitter 67, receiver V, induction-coil 68, gravity-drop 92, and a plug W, adapted to be inserted in the spring-jack composed of the parts 54 and 31 to separate them and thereby break the connection between them. The plug W is provided with a metal strap 30 for making electrical contact with the part 31. Batteries 69 and 70 are located at the central station and a battery 71 at each of the local stations. There are also ground connections G at the central and *g* at each of the local stations. These various elements are connected by wires, as shown in the drawings, the various lines being illustrated as much as may be by full, broken, or dotted lines and the different currents further designated by plain, feathered, half-feathered, and double-headed arrows.

To make connections to the proper station, the operator at the central presses the button A. This breaks the connection between 90 and 33 and closes it between 22 and 23, 22 and 33 being insulated from each other by 91. The current then flows from ground G through 69, 24, 23, 22, 21, 51, 50, 20, 19, L, 8, M, and 9 to ground *g*. This permits the motor and its escapement to move the pointer P from one contact-point to the next, and she repeats the pressure on button A until the proper station is reached. This circuit is illustrated by full lines and plain arrows. She then inserts the plug W, presses the button B to close the connection between 27 and 28, and turns the crank of the generator 66. This sends the current from 66 through 26, 27, 28, 29, 30, 31, 32, 33, 100, 2, 3, N, 4, P, K, 10, 63, 7, L, 19, 20, 50, 55, and 25 back to 66. This current is illustrated by half-feathered arrows and serves to ring the bell at the local station to call the subscriber. The subscriber being called he removes his receiver, and then the current at the local station, passing from the battery 71 through 16, 82, 12, 81, 13, primary 15, 16, and 64, or the similar one at the central passing through 67 and 70, both of which are illustrated by double-headed arrows, sends the current along 100, 2, 3, N, 4, P, K, 10, 11, 12, 81, 13, 14, 17, R, 18, 83, L, 19, 20, 50, 55, V, 56, 57, 28, 29, 30, 31, 32, and 33 back to 100. This is the talking-circuit between the subscriber and the operator at central. When through talking, the subscriber does not ring off; but when he hangs up his receiver the operator presses the button C, which not only breaks the connection between 90 and 33 and closes that between 22 and 23, but also closes it between 22 and 34. The result of this is that both lines 100 and 50 are closed to ground and the current not only flows as described in the first instance and illustrated by plain arrows, but a second current flows from G through 69, 24, 23, 34, 100, 2, 3, N, 60, 61, X, and 9 to *g*. This operates magnet X to release P from the pins *o* and permit the spring Q to return it to the normal position, when everything is ready for calling some other subscriber.

When the subscriber at any local station wishes to call central, he pushes button D and turns the crank of generator 62. This sends the curent from 62 through 6, 63, 7, L, 19, 20, 50, 51, 52, 53, 54, 31, 32, 33, 100, 2, 3, N, 4, P, 95, and 78 to 62. This operates the

drop 92, controlled by magnet 52, and calls central. He then takes down his receiver and the operator inserts the plug W. The secondary current then flows over 100, 2, 3, N, 4, P, 95, 78, 30, 14, 17, R, 18, 83, L, 19, 20, 50, 55, V, 56, 57, 28, 29, 30, 31, 32, 33, and 100. While subscriber is waiting with receiver off, the operator at the central pushes the button A a sufficient number of times to move the pointers P at the several stations until the right one is on the contact K, to which the line 10 is connected. As the particular subscriber who is waiting with his receiver removed from its hook has the electrical connection between L and 80 broken, the pointer P of his instrument does not move, but stays in contact with the line 95, (which finally connects with line 10 at the secondary,) and consequently he has the proper connection with the other subscriber with whom he wishes to talk. When the subscribers hang up their receivers, the operator at the central again pushes button C and the pointers P return to normal position. As any subscriber may connect directly to central and as the central may make connections to any particular subscriber on a line, it will be evident that any subscriber on one line may be connected to any subscriber on another line when both lines enter the same central station.

What I claim is—

1. A series of local stations each one provided with a pointer and a series of insulated contact-points, a driving mechanism consisting of a motor-spring and an escapement for moving said pointer step by step over said contact-points, a magnet for releasing said pointer from its driving mechanism, a spring for returning said pointer to its normal position when so released, a central station, main connecting-lines as 100 and 50 extending from said station to proximity to said local stations, a connection from one of said main lines to each pointer of the series, a second connection from the other main line to one of the contact-points of each local station, the connected contact-point being a different distance from the normal position in each station, and a circuit-breaker, as the lever L, located in the said second connection of each station.

2. A pointer and a series of insulated contact-points, a clock mechanism consisting of a motor-spring and an escapement, a disk rotated by said clock mechanism and provided with pins adapted to engage said pointer so as to move it step by step over said contact-points, a second magnet provided with connections adapted to raise said pointer so as to release it from the pins on said disk, a spring for returning said pointer to a normal position when so released, and a second spring, as T, for returning said pointer to engagement with said pins.

3. A series of local stations each one provided with a pointer and a series of insulated contact-points, mechanism controlled by a magnet for moving said pointer step by step over said contact-points, means for releasing the connection between said pointer and its propelling mechanism, a spring for returning said pointer to a normal position when so released, a central station, main connecting-lines as 100 and 50 extending from the central to proximity to the local stations, a connection from one of the main lines to each pointer of the series, a second connection from the other main line to one of the contact-points in each series, said connected contact-point being a different distance from the normal position of said pointer in each station, a bell-ringing device located in said second connection, a branch connection as 11 between the same points as the second connection but excluding the bell-ringing device, and a circuit-breaker located in said branch connection and operated by a receiver-hook.

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