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A. EKSTRÖM.

SIGNALING SYSTEM IN TELEPHONE PLANTS WITH CENTRAL BATTERY.

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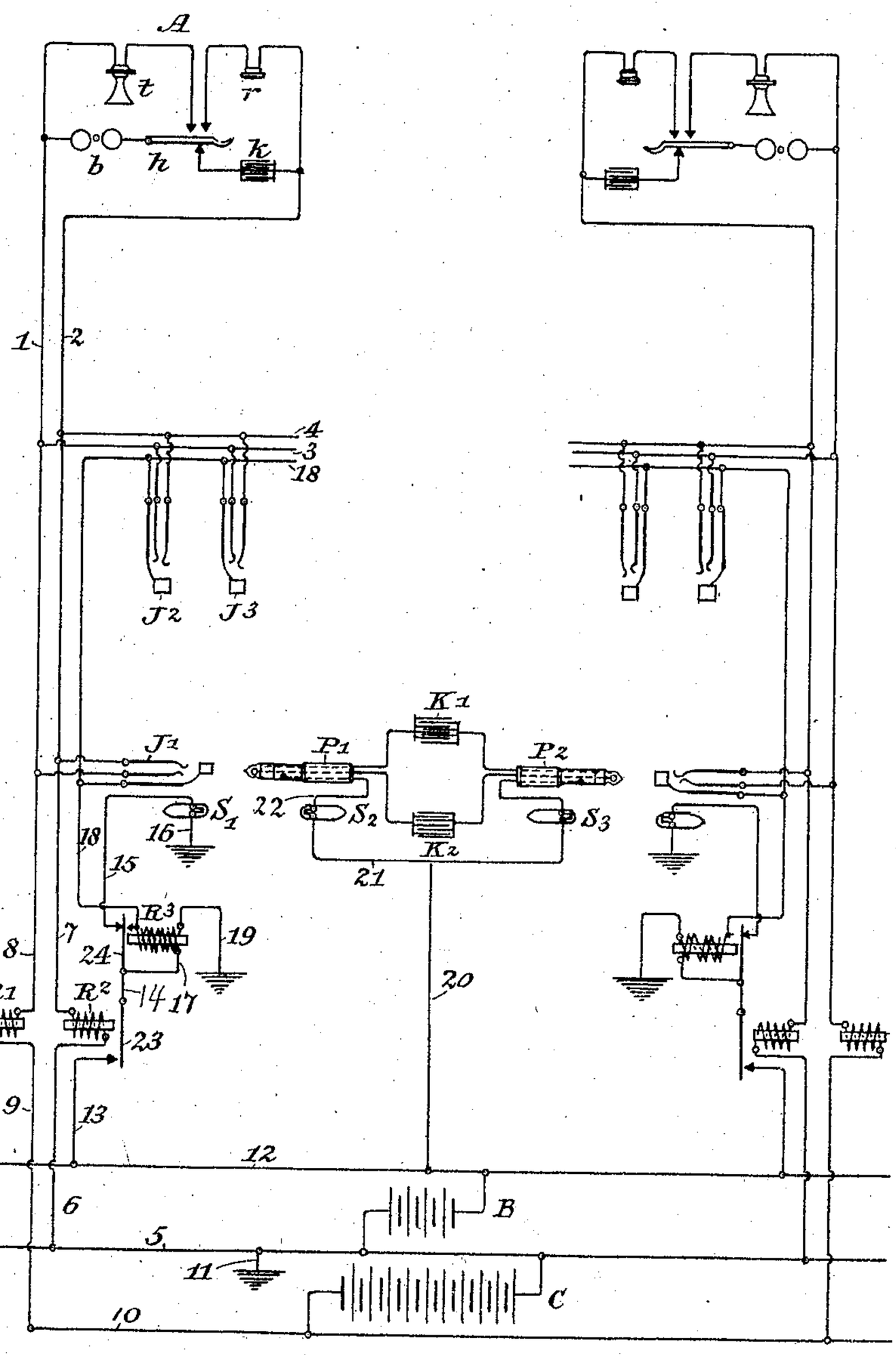

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UNITED STATES PATENT OFFICE.

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SIGNALING SYSTEM IN TELEPHONE PLANTS WITH CENTRAL BATTERY.

SPECIFICATION forming part of Letters Patent No. 780,713, dated January 24, 1905.

Application filed October 20, 1902. Serial No. 127,958.

To all whom it may concern:

Be it known that I, ALFRED EKSTRÖM, doctor of philosophy, a subject of the King of Sweden and Norway, and a resident of Tegnersgatan 4, Stockholm, in the Kingdom of Sweden, have invented a certain new and useful Improved Signaling System in Telephone Plants with Central Battery, of which the following is a specification, reference being had therein to the accompanying drawing.

This invention relates to improvements in telephone-exchange systems of that kind where the voice-currents are supplied by a battery placed at the central station, said battery being common to all lines.

More especially the invention relates to that class of central-battery systems where a relay inserted in the line controls the calling as also the clearing-out signal, said relay being hereinafter called the "line-relay."

Further characterized, the invention relates to improvements in telephone-exchange systems of the kind specified for producing the calling and the clearing-out signal, as also for instantaneously signifying lines already in use to be "busied."

The characterizing feature of the invention consists in that the line-relay when being excited—*i. e.*, when the subscriber calls the station by removing his hand-microphone from its switch-hook—closes a circuit through the calling-signal, said circuit being opened as soon as the operator inserts a plug in a spring-jack connected with the calling-line, by which operation the clearing-out signal placed in the third conductor of the cord is simultaneously short-circuited through the armature of the line-relay. This short circuit, that is closed throughout the whole conversation, prevents the clearing-out signal from being active. When, however, the conversation is completed and the subscriber places his hand-microphone in its switch-hook, the armature of the line-relay will again take up its normal position and open the short circuit about the clearing-out signal, whereby the said signal becomes active and signifies that the lines connected together are to be disconnected. At the same time as the line-relay is excited one pole of the test-battery is connected with the test-conductor of the line, so that the line is signified to be busied.

The invention is illustrated in the accompanying drawing, which shows a diagram of two subscribers' lines and their connections with the central station, as also a cord for connecting the lines together. The coupling of the two lines is quite the same as regards the diagram at the substation, as also with regard to the connections with the exchange-office, and therefore the arrangement and operating of one line only need be more particularly described.

A is the substation. When the lever or switch-hook *h* takes up its lower position—*i. e.*, when the hand-microphone hangs in its hook—the signal-bell *b* and the condenser *k* are included in the line. When, on the contrary, the hand-microphone is removed and the lever or switch-hook *h* is in its upper position, the microphone *t* and the receiver or telephone *r* are in the line, the signal-bell *b* being then connected in parallel with the microphone *t*. In order to avoid any detrimental action upon the transmitting of the voice-currents, the signal-bell has a great resistance.

1 and 2 are the two branches of the line drawn from the substation to the exchange-office or central station. In the central station the line is connected partly through conductors 3 4 with the multiple jacks J^2 J^3, &c., and partly with the answering-jack J', as also with the inductive resistance R' R^2, the latter being connected at their other sides with the central battery C. One resistance R^2 is constructed as a relay and is hereinafter called the "line-relay." R^3 is another relay, hereinafter called the "cut-off" relay, said relay being connected with the armature of the line-relay and provided with two windings arranged in such a manner that a current flowing through the two windings in series does not actuate the armature 24 of the cut-off relay. The junction of the two windings is connected with the test-springs of the line-jacks.

S′ is the calling-signal.

P′ and P² are two plugs connected by a cord having three conductors. Interposed in the conductors corresponding to the branches of the line are condensers K′ K². The third conductor, whose middle point is connected with the battery B, includes the clearing-out signals S² S³, one for each plug. The battery B supplies the current for the signals and for the testing.

The operation of the system described is the following: When the hand-microphone hangs in its switch-hook at substation A, the condenser *k* is included in the line and provides a break for the continuous current from the central battery C. When, however, the subscriber calls the station by removing his hand-microphone from its switch-hook, a circuit is closed from the battery C through conductors 5 and 6, relay R², conductor 7, branch 2 of the line, receiver *r*, signal-bell *b*, and microphone *t* in parallel, branch 1 of the line, conductor 8, resistance R′, and conductors 9 and 10 back to the battery C. The relay R² will thus be energized and attract its armature 23, by which the following circuit is established: earth conductor 11, battery B, conductors 12 13, armature 23, conductor 14, armature 24, conductor 15, calling-signal S′, and earth conductor 16. The lamp S′ will then glow and announce the calling. A shunt-circuit is also closed through the wire 14, both windings of the cut-off relay R³, and earth conductor 19. The two windings of the cut-off relay counteract each other, and the armature 24 is therefore not attracted. The junction of the two windings being, however, connected through conductor 18 with the test-springs of the jacks, the thimbles or test-rings of the jacks appertaining to the line are supplied with current. The moment the subscriber calls the station his line is thus signified to be busied. The operator when inserting a plug in the answering-jack J′ establishes the following circuit: earth conductor 11, battery B, conductors 20 21, lamp S², conductor 22, third conductor of plug P′, thimble and test-spring of jack J′, conductor 18, one winding of the cut-off relay R³, and earth conductor 19. This causes the armature 24 to be attracted and held in its attracted position as long as the plug remains in the jack. The attraction of armature 24, however, creates a short circuit about the signal-lamp S² through wires 12 and 13, armature 23, conductor 14, and armature 24, so that only a weak current will pass through lamp S² and the latter will not glow. The short circuit about the clearing-out signal-lamp is, however, dependent on the position of armature 23 of the line-relay R². The latter being controlled directly from the apparatus at the substation, it is obvious that when the subscriber after having finished his conversation places the hand-microphone in the switch-hook (whereby the condenser *k* establishes a break for the continuous current from battery C through the line and the relay R² releases its armature 23, which falls back in its normal position) the short circuit about the clearing-out-signal lamp S² is broken. The whole current from battery B will then pass through lamp S², which is illuminated, and announces the conversation to be finished. As soon as the operator removes the plug from the jack the circuit through the clearing-out-signal lamp is broken, and the lamp goes out.

The part of the operation relating to the cord for the plug P²—*i. e.*, the method of connecting the calling subscriber with the required number—has not been particularly described, said method not differing in any way from that generally employed.

In the drawings the calling-signals, as also the clearing-out signals, have been illustrated in the form of lamps; but it is obvious that any other suitable signals might be used.

Having now described my invention, what I claim as new, and desire to secure by Letters Patent, is—

1. In a central-battery telephone system, a line-relay R² excited during the whole time the telephone-receiver is removed from its switch-hook, a cut-off relay R³ actuated when a plug P′ is inserted in the subscriber's jack, a calling-signal S′, means controlled by the cut-off relay for cutting out the calling-signal S′ when the plug is inserted, a clearing-out signal S², means controlled by the cut-off relay for establishing a short circuit about the clearing-out signal S² when the plug is inserted, and means controlled by the line-relay for breaking the said short circuit when the line-relay becomes inactive on account of the telephone-receiver being replaced upon its hook, substantially as described.

2. In a central-battery telephone system, a line-relay R² excited during the whole time the telephone-receiver is removed from its switch-hook, a cut-off relay R³ having two windings the junction of which is connected with the test-conductor 18 of the line, said relay R³ being inactive for currents through both windings in series, whereas it is actuated by a current through one winding, means for supplying both windings of the cut-off relay with current in series, when the line-relay is operated, whereby the test-conductor is supplied with current and marks the line busy by the subscriber's calling of the exchange, means for supplying the one winding of the cut-off relay with current, when a plug P′ is inserted in the subscriber's jack, a calling-signal S′, means controlled by the cut-off relay for cutting out the calling-signal S′ when the plug is inserted, a clearing-out signal S², means controlled by the cut-off relay for establishing a short circuit about the clearing-

out signal S^2 when the plug is inserted, and means controlled by the line-relay for breaking the said short circuit when the line-relay becomes inactive on account of the telephone-receiver being replaced upon its hook, substantially as described.

In witness whereof I have hereunto signed my name in the presence of two subscribing witnesses.

ALFRED EKSTRÖM.

Witnesses:
ERNST SVANGVIST,
AUG. SÖRENSON.