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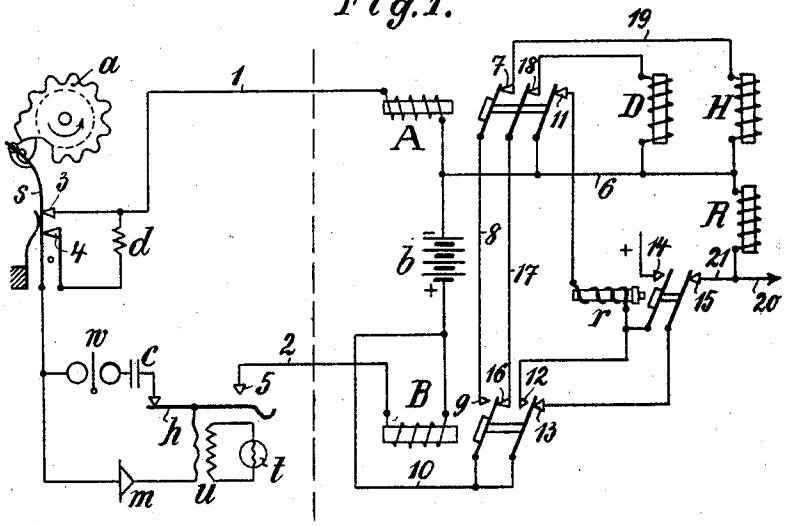
AUTOMATIC TELEPHONE SYSTEM.

APPLICATION FILED OCT. 8, 1910.

1,044,229. **Patented Nov. 12, 1912.**

Fig. 1.



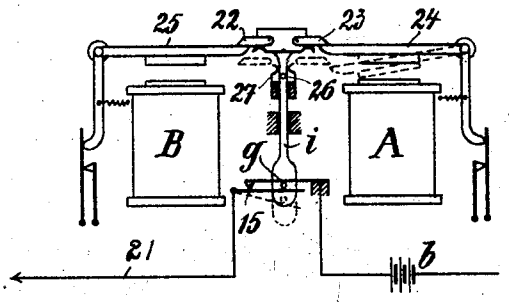


Fig. 2.

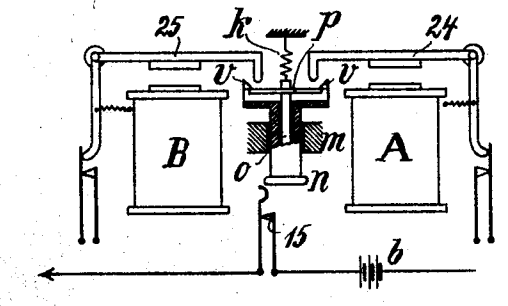


Fig. 3.

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AUTOMATIC TELEPHONE SYSTEM.

1,044,229. Specification of Letters Patent. Patented Nov. 12, 1912.

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To all whom it may concern:

Be it known that I, ERWIN NEUHOLD, engineer, a subject of the King of Hungary, and resident of Friedenau, near Berlin, Germany, have invented certain new and useful Improvements in Automatic Telephone Systems.

The subject of the invention is an improvement in automatic telephone systems which makes it possible to effect the release of the speaking connections by simply breaking the circuit in hanging up the receiver, and further to operate the control magnets of the selectors by means of two simple line relays in such manner that it is not necessary either to earth the lines at the subscriber's station nor to have the response of the relays retarded by retarding devices.

According to the invention the controlling device referred to is operated by the subscriber through a series of alternate decreases and increases of current and a subsequent interruption of the circuit occurring immediately after the previous weakening of the current. This regulation of the current is suitably effected by means of an automatically operating spring driven contact device at the subscriber's station and is repeated as often as is necessary to correspond with the digits of the desired subscriber's number or to correspond with the operations required at the central station for the connection of the desired subscriber.

The periodic alterations of current set the armature of one of the control relays in oscillation and the breaking of connections when this armature has been released for the last time also releases the armature of the other control relay which up till then remains in the attracted position. The first relay for example controls the lifting magnet of the selector while the other armature completes the circuit of the turning magnet once and this magnet is then connected in known manner either into the circuit of an interrupter so that the further turning of the selector may go on automatically, or into the place of the lifting magnet so that its further operations may be caused by the subscriber.

The release of the speaking connection is effected by interruption of the current which flows over the lines during the conversation,—which current may suitably supply the microphones—by restoration of the receiver to its movable hook. The two control relays then simultaneously release their armatures which now by suitable coöperation close the circuit of the release magnet or magnets.

In the drawing a few examples of construction according to the invention are illustrated which differ in the way in which the relay armatures coöperate to effect the release.

A double line 1, 2, extends from the battery *b* of the exchange to the subscriber's station which is connected in the usual manner for central microphone supply and is provided with a microphone *m*, a receiver *t*, an induction coil *u* and a bell *w* with a condenser *c*.

The current sending device consists of a toothed wheel *a* which has a series of teeth of equal size and at the end of this series a larger stepped tooth: this when rotated sets the switch *s* in oscillation. The back contacts 3, 4, of this switch normally short circuit the resistance *d* and are broken in the most open position of the switch so that the conductors 1, 2 are interrupted. The switch is brought into the most open position by the upper step of the large tooth of the wheel *a* after the smaller teeth and the lower step of the large tooth have brought the switch into intermediate positions in which only the contact 3 is opened while contact 4 remains closed. The wheel *a* is turned in the direction of the arrow against the action of a spring and during this movement since the revoluble nose on the switch blade yields in known manner the contacts 3, 4 remain closed; the wheel then turns back at a determined speed in which movement the small teeth of *a* insert the resistance *d* into the conductor each time, and at the end the large teeth interrupts the conductor.

When the receiver is taken down the two relays A—B, the first of which is marginal, are excited by current flowing over conductor 1, contact 3, microphone *m*, the front contact 5 on the receiver hook and conductor 2, and attract their armatures. At first no current impulse passes over the armatures. If, however, the resistance *d* is inserted in the conductor by the action of the current sender *a*, the relay A lets its armatures fall back a corresponding number of times and so periodically closes over its back contact 7 the circuit *b*, 6, H, 7, 8, 9, 10, *b* in which is

the lifting magnet H of the selector, and the selector is consequently lifted a corresponding number of steps. The circuit of the auxiliary slow acting relay r is at the same time completed over the front contact 12 of b through the back contact 11 of a; this at first has no effect. The relay r is deprived of current every time the armature of a is attracted. After the last insertion of the resistance d however, the armature of A remains in the unattracted position and the release of the armature of B occurring through the interruption of the conductor closes its back contact 13. At the same time contact 12 is opened but the relay r remains excited over the retaining contact 14 of its armature and over contact 11 of A. If this were not the case the release magnet R would be excited over 13, 15, 6 and would release the selector prematurely. On the contrary the closing of the back contact 16 of B causes the turning magnet D of the selector to receive current over 10, 16, 17, 18, D, 6, and this magnet responds. By this means as already mentioned the selector is turned one step in known manner (not illustrated) whereupon the switch operated by the selector shaft connects the turning magnet D either (at the group selector) to a conductor carrying a periodic current by which means the selector is automatically moved on, or (at the line selector) to the conductor 19 in place of the lifting magnet H, so that it may be further controlled by the subscriber in desired manner. These operations are well known in automatic telephone exchanges and need thus no further description. When the device a has run back the microphone circuit is again completed over the line so that during the conversation the relays A and B are excited. At the end of the conversation contact 5 is opened through the hanging up of the receiver on its hook, the lines 1 and 2 are interrupted and thus there results a sudden falling back of the armatures of both relays A and B. The relay r is not now excited since at the same time as or even before the contact 11 on the armature A is closed, the contact 12 on the armature B is opened. Consequently contact 15 remains closed and current now flows over 10, 13, 15, R and 6 and excites the release magnet R. This causes the selector to return in known manner to its position of rest. As the arrow 20 indicates, during the production of the speaking connection the release magnets of the other selectors used are also automatically connected in known manner to the contact 15 so that they are all simultaneously excited and all the selectors used are simultaneously released.

In Fig. 2 is illustrated a solution of the problem in which an auxiliary device mechanically actuated by both relay armatures is used instead of the auxiliary relay r, this device serving to open the normally closed contact 15 of the release conductor 21 on the excitation of one or other or both of the relays A and B. The figure shows the position in which the relays are without current. In this position the armatures support a weight g resting on them by means of arms 22, 23 which weight is guided by a rod i and on falling opens contact 15. The weight falls if one of the armatures, *e. g.* 24 is attracted since in that case the cross arm turns about the pivot 26 toward the side of the fallen armature. It thus slips below the armature 25 and is restored to the central position by the springs 27. The arm 23 remains above the attracted armature 24. This latter as it rises and falls from time to time brushes past the arm turning it a little about the pivot 26 without lifting the weight g. If the armature 25 is attracted also it passes beneath the left hand arm 22 as well. (In the form of connections according to Fig. 1 both armatures are simultaneously attracted at the beginning so that the weight g simply sinks with them.) If now both relays are simultaneously deprived of current, since the cross arm cannot deflect the armatures they carry the weight up with them and close the release contact 15. If on the other hand the armature of B only falls when the armature of A has already returned to the position of rest, the cross arm of g deflects and the contact 15 remains open. This is what happens on the interruption of the line at contact 4 of Fig. 1. In order that the arms 22, 23 may be reëngaged when both armatures are simultaneously attracted again after the interruption of the lines as is necessary for the subsequent raising on release above described, the arms are pivoted and spring pressed in such a way that they can deflect downward but not upward if the two armatures press on them with equal force.

Fig. 3 shows another form of the mechanical auxiliary device. In this case the armatures themselves press down a hollow body n sliding frictionally in the guide m when they are both simultaneously attracted. The release contact 15 is thus opened. When the two armatures simultaneously fall back a cross bar p pivoted on the rod o follows them under the attraction of spring k and this cross arm striking against the spring projections v on body n lift this latter so that contact 15 is closed. This lifting does not occur if the armatures move only one at a time for then the cross bar p sets itself in sloping position. (The rod o slides loosely in n.) The projections v are spring mounted in order that the cross rod p may again engage under them when the armatures are simultaneously attracted. This corresponds to the pivotal mounting of the arms 22, 23 in Fig. 2.

The invention is not restricted to the form of construction illustrated for a great number of different forms are possible. The operation of the line relays A and B in accordance with the invention as well as that of the auxiliary relay r or of an equivalent auxiliary electrical device may be secured not only by the resistance variation of the lines 1, 2 described but also for example by earthing the separate lines so that the invention may be suited to this older method of operation also.

I claim:—

1. In an automatic telephone system an exchange containing a selector provided with a lifting, a turning and a release magnet, two relays coördinated to each subscriber's station, a battery common for all relays, conductors connecting the lifting and turning magnets over the contacts and armatures of both said relays with the common battery, lines for connecting each subscriber's station with the exchange and containing in the latter the said two relays and the common battery, a plurality of subscribers' stations each containing in series the usual subscriber's set and a switching apparatus adapted to connect the subscribers' lines either directly or over a resistance or to disconnect said lines, substantially as and for the purpose set forth.

2. In an automatic telephone system an exchange containing a selector provided with a lifting, a turning and a release magnet, two relays coördinated to each subscriber's station, a battery common for all relays, conductors connecting the lifting and turning magnets over the contacts and armatures of both said relays with the common battery, means for opening the circuit of the release magnet of a selector, when one or both coördinated relays attract their armatures and for closing said circuit only, if the armatures of both relays return simultaneously into their position of rest, lines for connecting each subscriber's station with the exchange and containing in the latter the said two relays and the common battery, a plurality of subscribers' stations each containing in series the usual subscriber's set and a switching apparatus adapted to connect the subscribers' lines either directly or over a resistance or to disconnect said lines, substantially as and for the purpose set forth.

3. In an automatic telephone system an exchange containing a selector provided with a lifting, a turning and a release magnet, two relays coördinated to each subscriber's station, a battery common for all relays, conductors connecting the lifting and turning magnets over the contacts and armatures of both said relays with the common battery, a third relay controlled by said two relays and adapted to open the circuit of the release magnet of a selector when one or both coördinated relays attract their armatures and for closing said circuit only, if the armatures of both relays return simultaneously into their position of rest, lines for connecting each subscriber's station with the exchange and containing in the latter the said two relays and the common battery, a plurality of subscribers' stations each containing in series the usual subscriber's set and a switching apparatus adapted to connect the subscribers' lines either directly or over a resistance or to disconnect said lines, substantially as and for the purpose set forth.

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

ERWIN NEUHOLD.

Witnesses:
HENRY HASPER,
WOLDEMAR HAUPT.