(No Model.) 5 Sheets—Sheet 1.

F. NISSL.

AUTOMATIC CENTRAL TELEPHONE SWITCH APPARATUS.

No. 535,806. Patented Mar. 12, 1895.

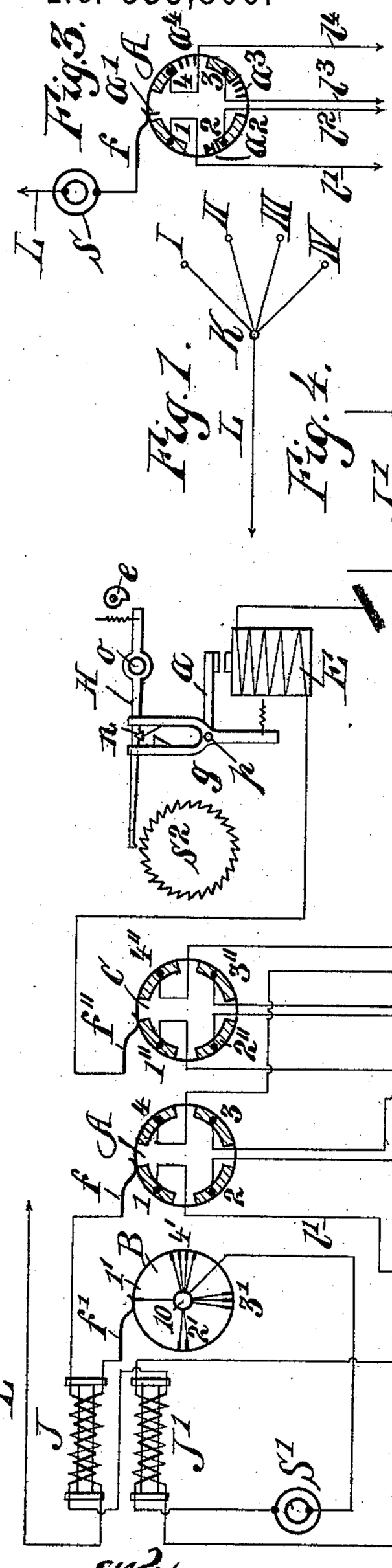

Fig. 3.

Fig. 1.

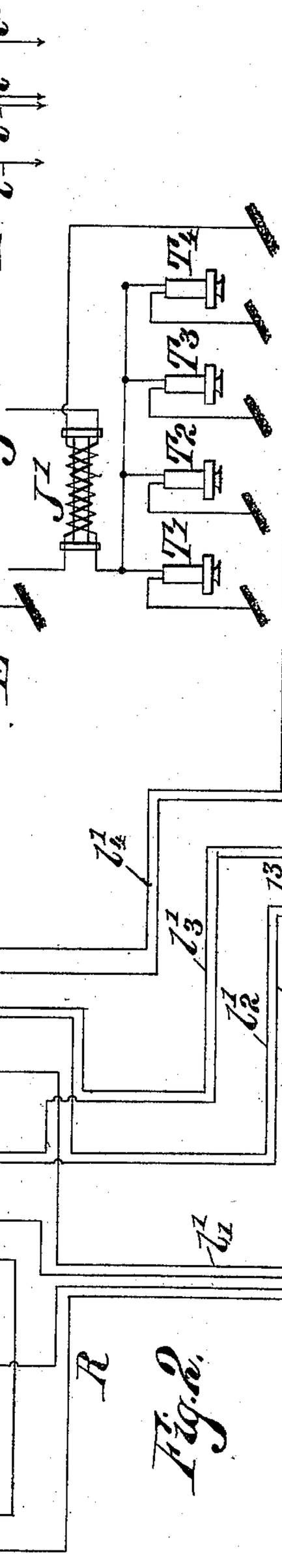

Fig. 4.

Fig. 2.

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by Henry Orth Atty

(No Model.) 5 Sheets—Sheet 2.

F. NISSL.

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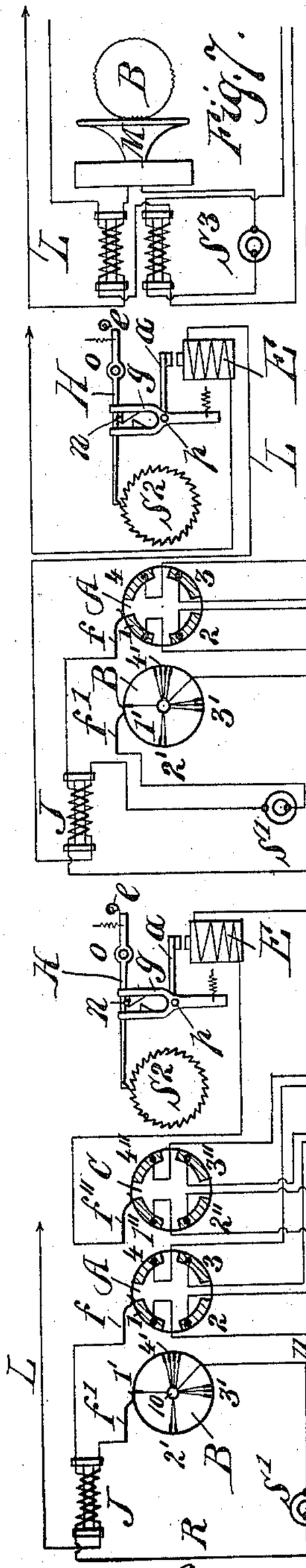

Fig. 7.

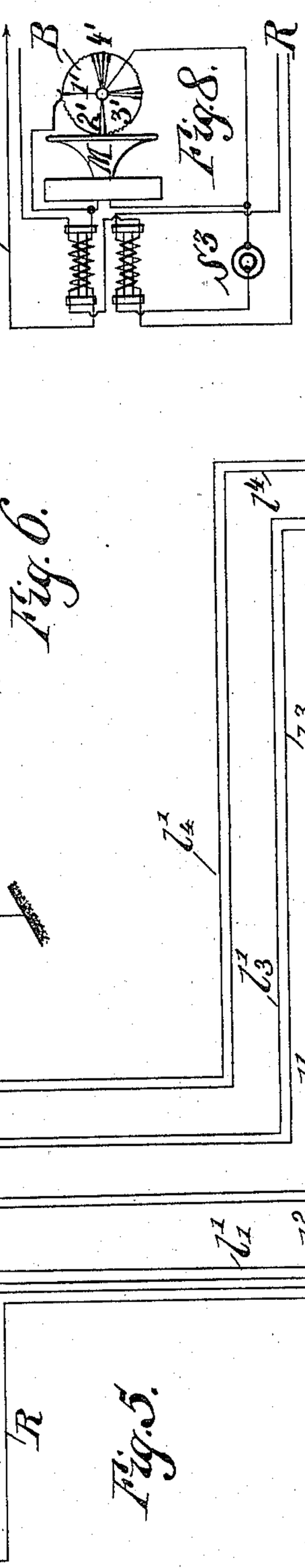

Fig. 8.

Fig. 6.

Fig. 5.

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(No Model.) 5 Sheets—Sheet 3.

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AUTOMATIC CENTRAL TELEPHONE SWITCH APPARATUS.

No. 535,806. Patented Mar. 12, 1895.

Fig. 9.

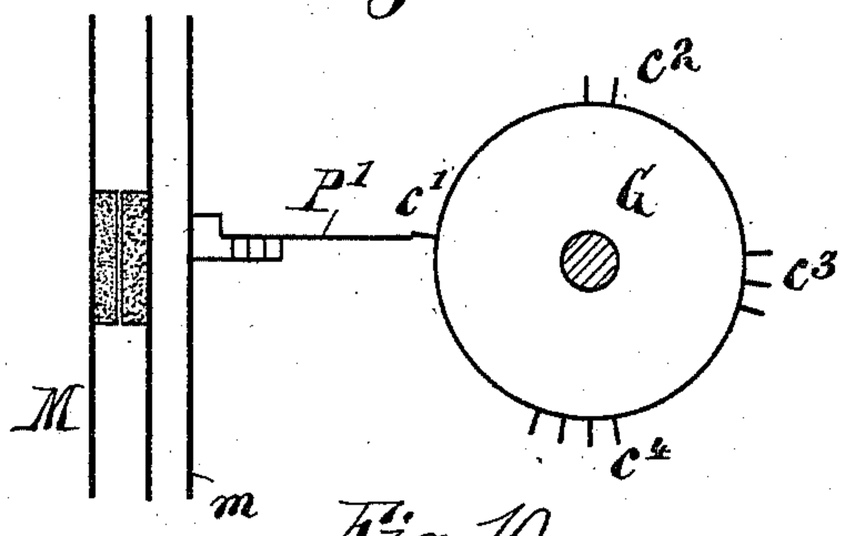


Fig. 10.

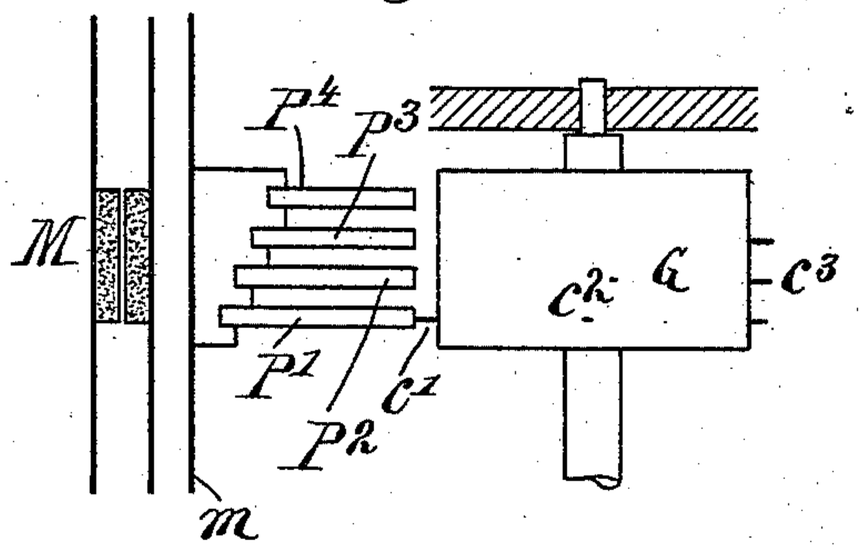


Fig. 18.

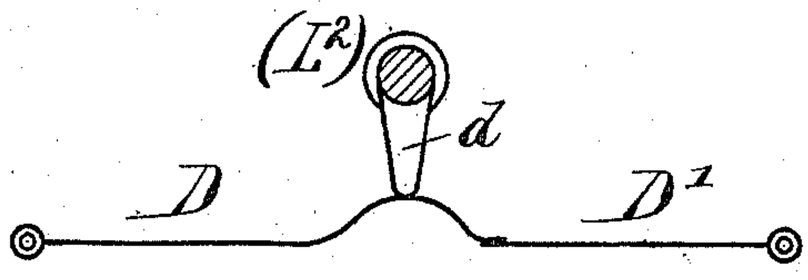


Fig. 19.

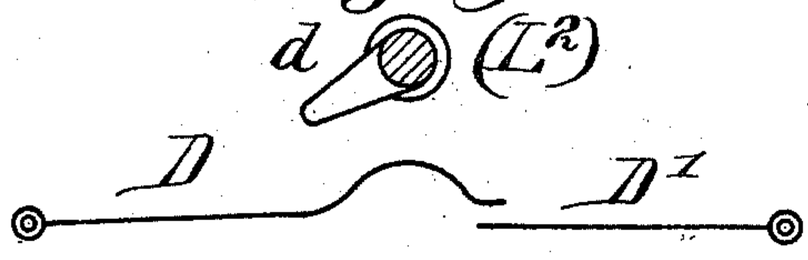
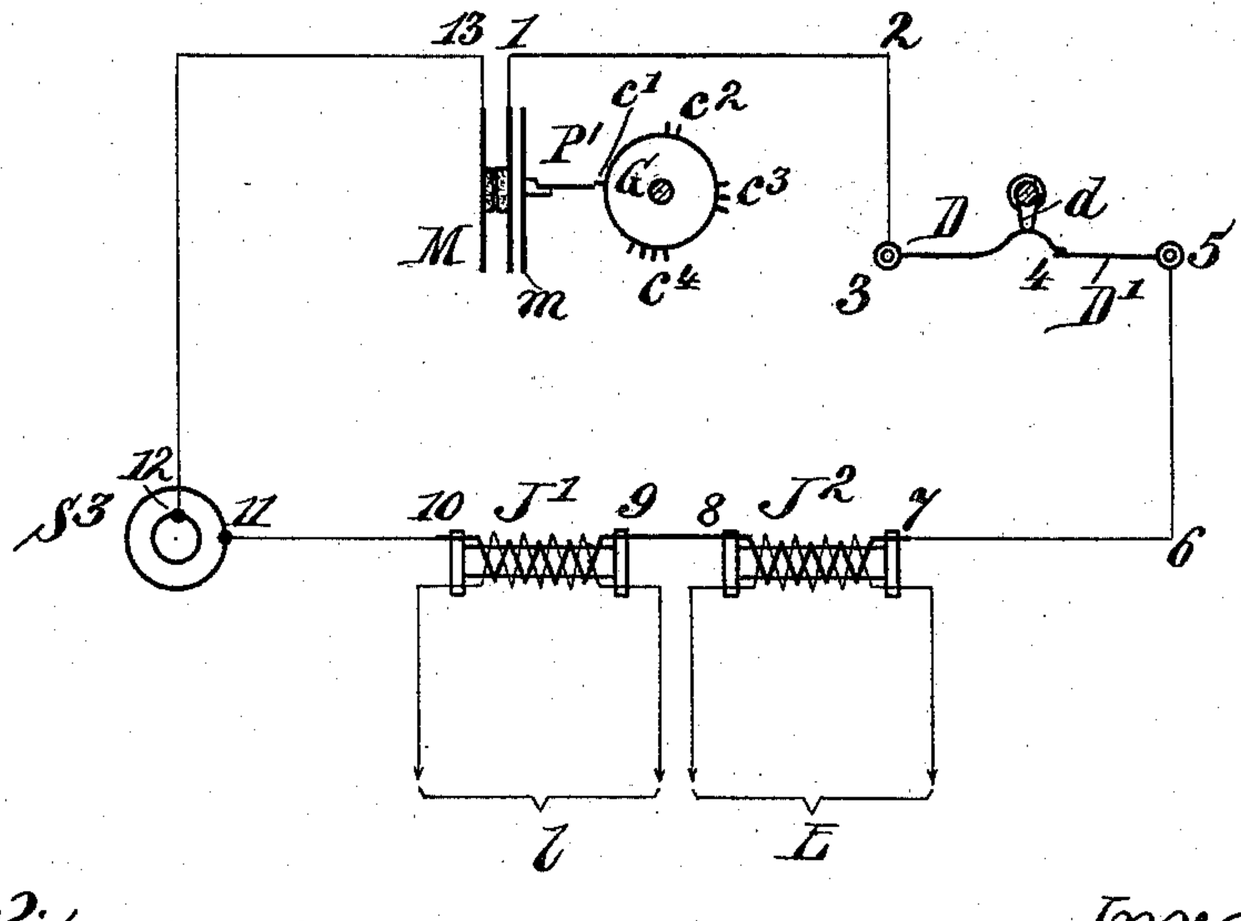


Fig. 20.



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AUTOMATIC CENTRAL TELEPHONE SWITCH APPARATUS.

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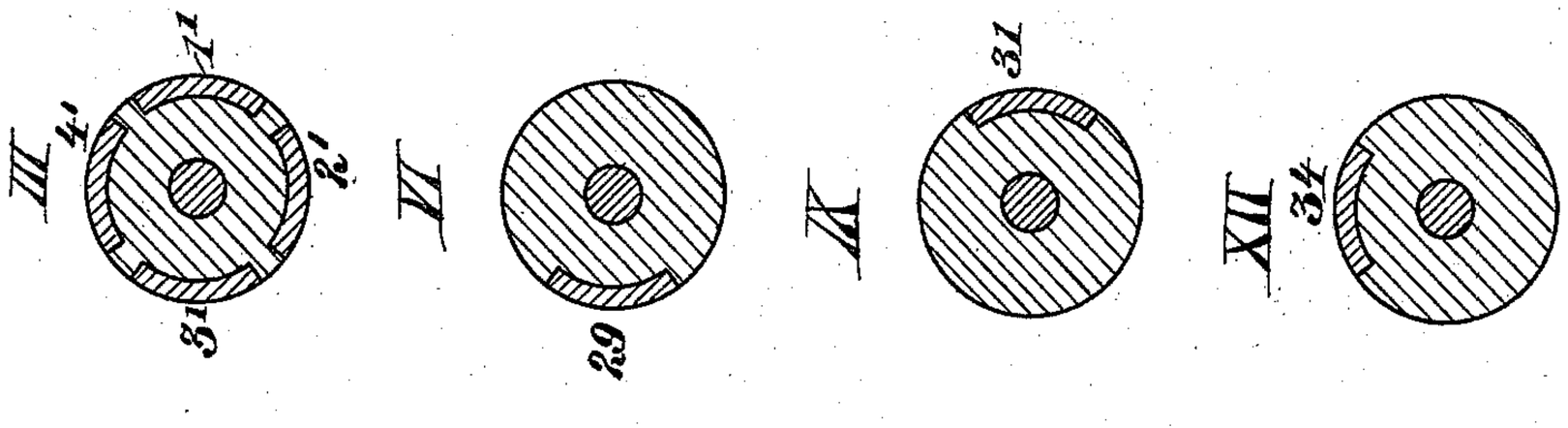


Fig. 12.

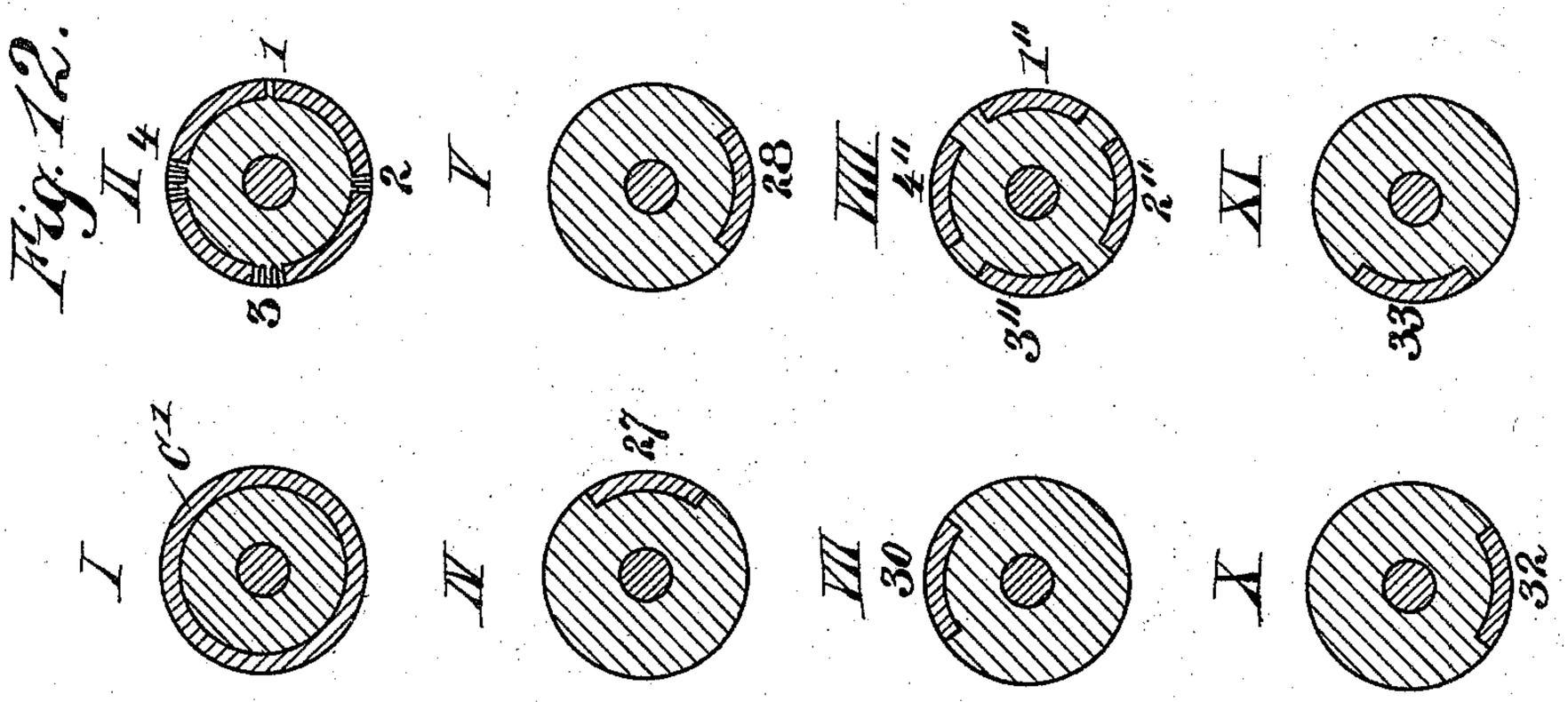


Fig. 11.

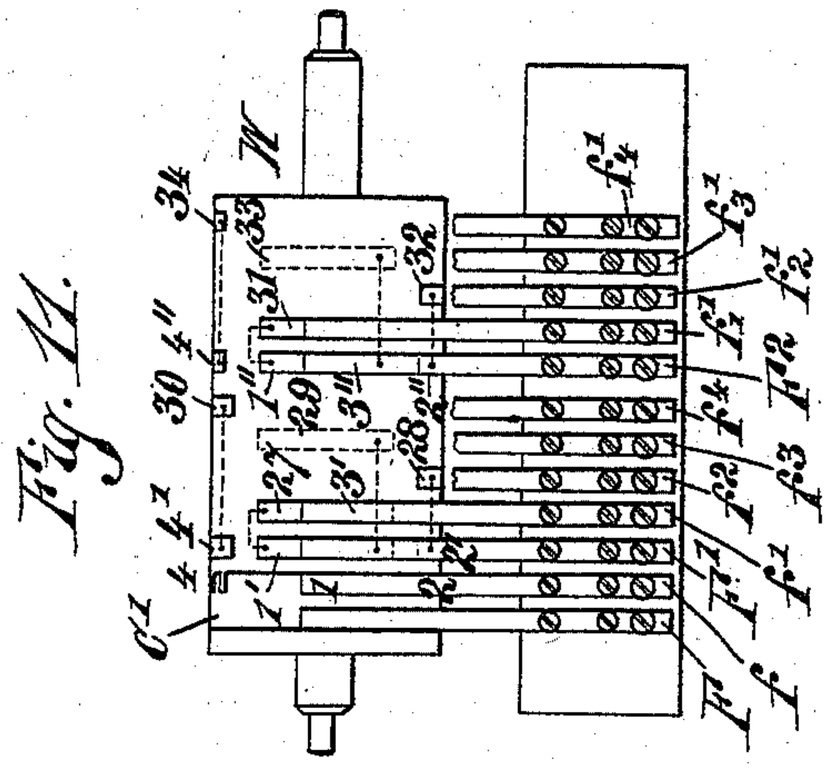
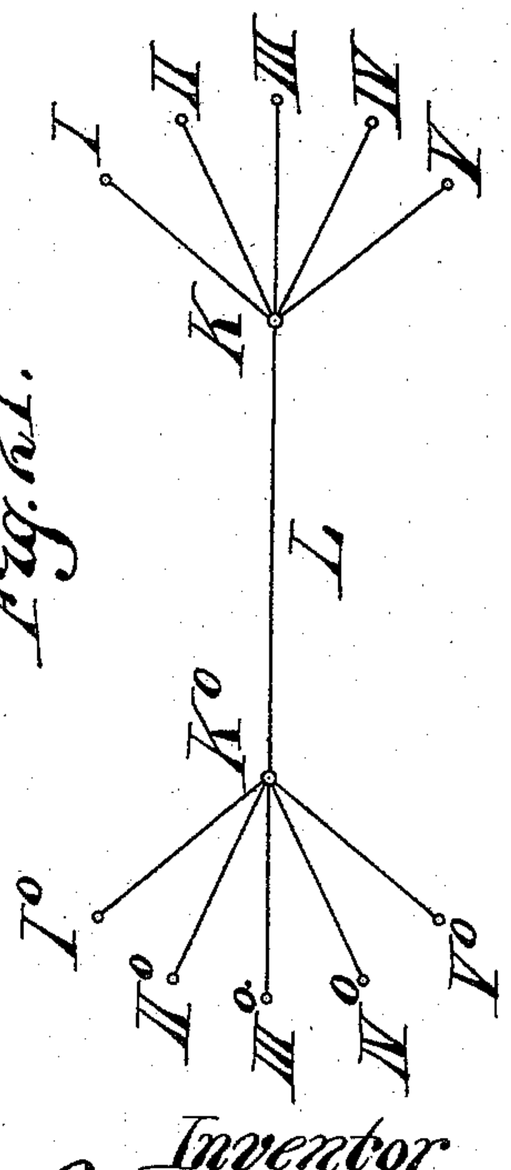


Fig. 21.



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(No Model.) 5 Sheets—Sheet 5.

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AUTOMATIC CENTRAL TELEPHONE SWITCH APPARATUS.

No. 535,806. Patented Mar. 12, 1895.

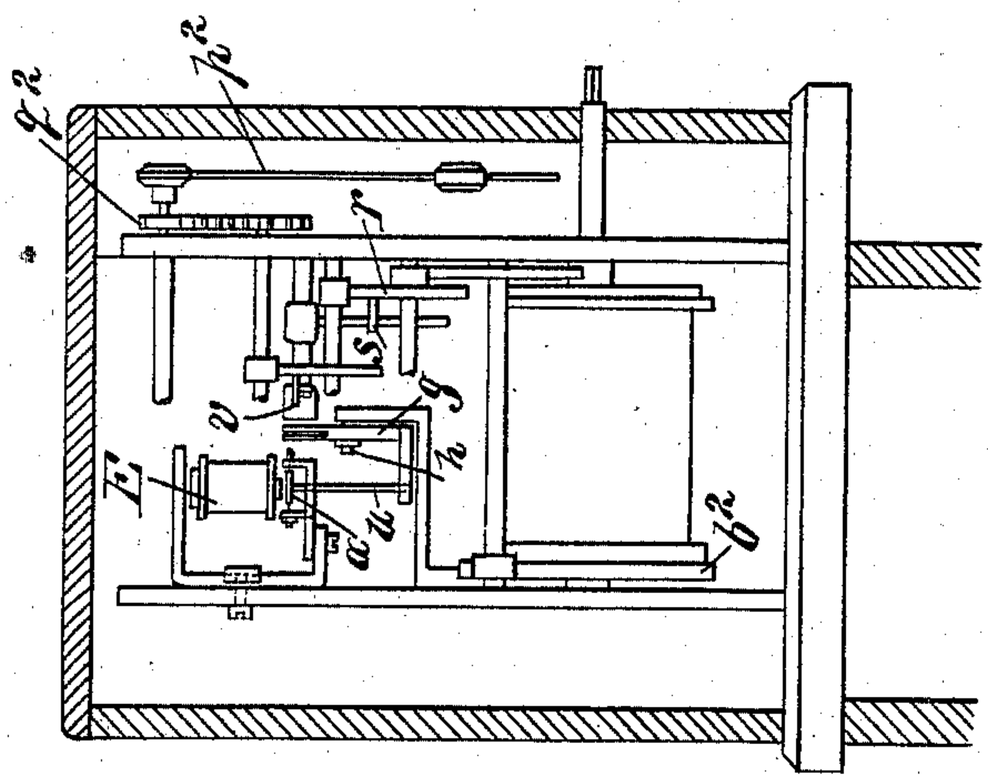

Fig. 15.

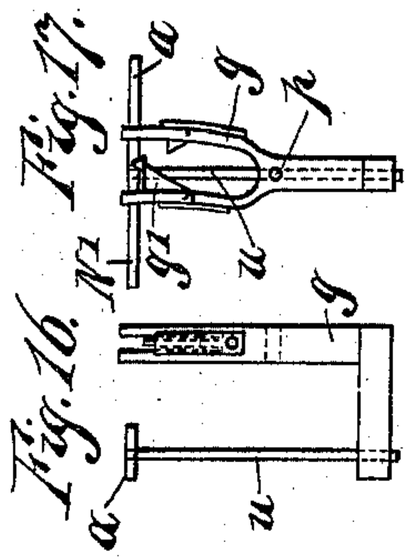

Fig. 16.

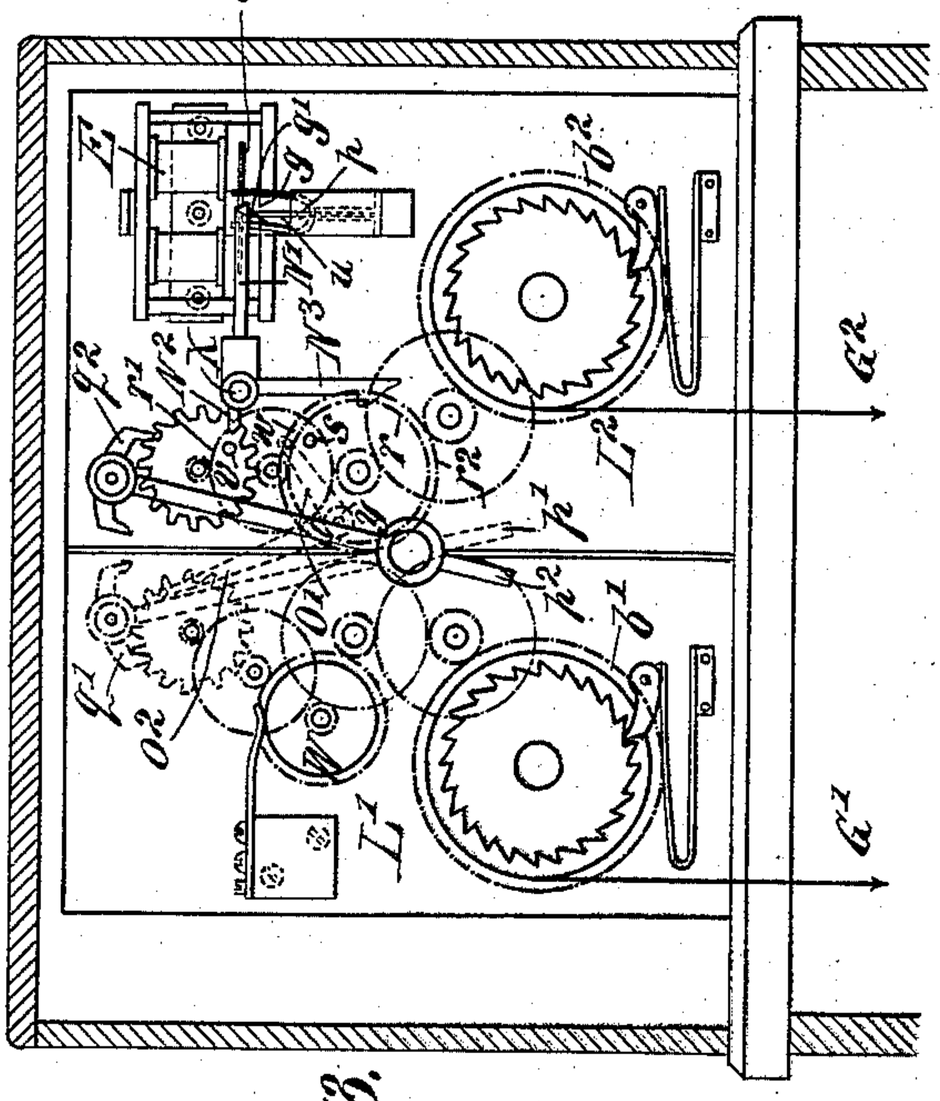

Fig. 13.

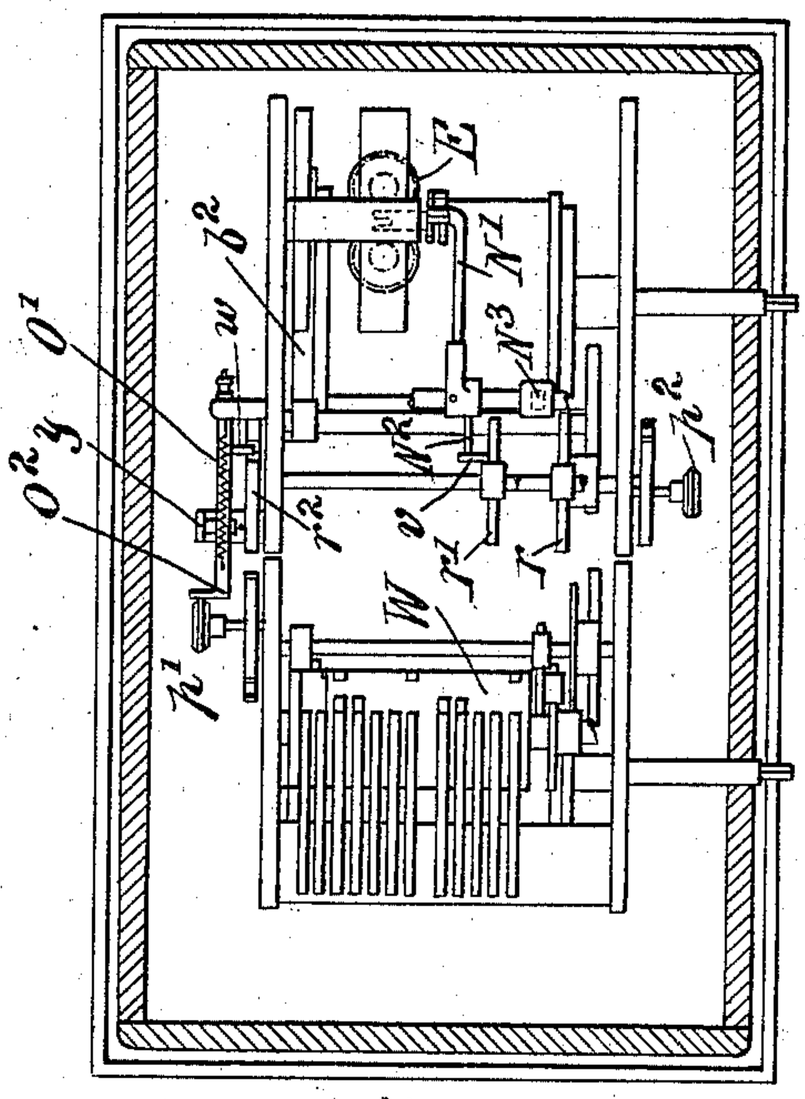

Fig. 14.

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UNITED STATES PATENT OFFICE.

FRANZ NISSL, OF VIENNA, AUSTRIA-HUNGARY.

AUTOMATIC CENTRAL TELEPHONE-SWITCH APPARATUS.

SPECIFICATION forming part of Letters Patent No. 535,806, dated March 12, 1895.

Application filed February 17, 1894. Serial No. 500,471. (No model.) Patented in Belgium October 17, 1893, No. 106,776.

To all whom it may concern:

Be it known that I, FRANZ NISSL, engineer and electrician, a subject of the Emperor of Austria-Hungary, residing at Vienna, in the Province of Lower Austria, in the Empire of Austria-Hungary, have invented certain new and useful Improvements in Automatic Central Telephone-Switch Apparatus, (for which a patent has been obtained in Belgium, dated October 17, 1893, No. 106,776;) and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same, reference being had to the accompanying drawings, and to letters and figures of reference marked thereon, which form a part of this specification.

This invention relates to apparatus whereby a single main circuit can be employed for connecting several speaking stations situated at comparatively short distances from each other to a central station, so as to obviate the considerable costs and inconveniences arising from the use of a separate circuit for each speaking station.

This apparatus, which offers the advantage of great simplicity and reliability as compared with arrangements hitherto proposed for effecting the same purpose, consists mainly of a switch apparatus which is introduced at a point of junction of the several line wires of a group of subscribers with the said common main circuit, and is so arranged that each of the speaking stations can enter automatically and consecutively into communication with the central station, which can in like manner enter into communication with the separate speaking stations without inconveniencing the other subscribers. The position for the time being of this switch apparatus is indicated both at the central station and at the several speaking stations by means either of audible or visible signs, or by both combined, so that the central station can call separately any one of the subscribers connected to the switch apparatus, and each subscriber can, when the turn comes round to him enter into communication with the central station, and through this with any other subscriber. The central telephone switch also contains arrangements for controlling or stopping its motion, either from the central station or from a subscriber's station, and also appliances for automatically putting the same into action again, whereby conversations of greater duration are rendered possible.

I will proceed to describe the said apparatus in connection with the accompanying drawings, in which—

Figure 1 shows a diagram of the general arrangement, and Fig. 2 a diagram of the construction of the automatic central telephone switch. Figs. 3 and 4 show views of detached parts of the switch and its mode of action. Figs. 5 and 6 show two other modes of action of such a switch. Figs. 7 and 8 show diagrams of two devices for giving audible indications of the shifting of the switch. Figs. 9 and 10 show a side view and a plan of another arrangement of the device for giving audible signals. Fig. 11 represents to an enlarged scale the commutator roller of the switch, and Fig. 12 shows cross sections thereof on lines I to XII. Figs. 13, 14 and 15 show a front view, plan and side view of a special construction of the central telephone switch with the stopping and starting devices. Figs. 16 and 17 show a side view and a front view of a part of the releasing mechanism. Figs. 18 and 19, show in two different positions, a contact device which is preferably employed in connection with the device shown in Figs. 9 and 10, in order to indicate whether the mechanism governing the commutator roller is at rest or in motion. Fig. 20 shows a diagram of the electric connections of this device. Fig. 21 shows a diagram of an arrangement for bringing two separate groups of subscribers' stations into communication without the use of a central station.

As shown at Fig. 1 there is a common main circuit L for a group of subscribers I, II, III, IV, the number of which can vary according to the average extent of use of the telephone, such circuit L leading from the central station to the point of junction K, at which the automatic switch apparatus is applied. From this the separate lines extend to the several subscribers.

The central telephone switch apparatus situated at K consists of a commutator which is actuated by a suitable motor so as to bring automatically and consecutively, each of the

several connected subscribers' stations in connection with the common main line, for a certain length of time. Fig. 2 shows the arrangement of the switch for this purpose, it being assumed that four subscribers I to IV are connected to the same. It consists of the disks or rollers A, B, C situated on one common axis or on separate axes and which can be combined to form a single roller. These disks or rollers are rotated by a motor and carry contact pieces, which, during their motion, establish consecutively the connection between one of the subscribers' stations and the central station. The disk A has for this purpose the contacts 1, 2, 3, 4, with which the contact spring *f* sliding on A, consecutively makes contact, whereby the subscribers I, II, III, IV, are consecutively put in communication with the main line for a certain length of time.

As shown by Fig. 3, the position, for the time being of the spring *f* or disk A can be indicated both at the receivers at the central station and at those of the subscribers' stations by means of special contacts or interruptions a' a^2 a^3 a^4 on the disks A, a source of current S being at the same time introduced into the line L, which however must not influence the indicating apparatus at the central station. As by this arrangement the subscriber is not informed of the position for the time being of the central telephone switch and only receives an indication when the contact of his apparatus is already made, which would result in imperfect observation of the indication and loss of time, it is advantageous to provide a special or ring circuit R, extending from the central telephone switch in such a manner that all the subscribers' stations are included in it so that in the latter the position for the time being of the commutator can at all times be observed. For this purpose the secondary coil of an induction apparatus J is included in the circuit from the spring contact *f* to L, while the ring circuit R contains the secondary coil of a second induction apparatus J'.

The primary coils of both apparatus J and J' are connected to the current producer S', the spring contact *f'* and *seriatim* to the contacts 1' 2' 3' 4' of the rotatable disk B. The contact pieces 1' 2' 3' 4' are fixed upon the disk B in such manner as to have a certain relative position to the contact pieces on the disk A, that is to say, when or shortly before the spring *f'* comes upon the corresponding contact piece 1' the spring *f* will come in contact with 1 on disk A, and this position will be indicated in the telephones which are introduced into the secondary coils of the induction apparatus J J' and in the main line L and ring circuit R, by means of one, two or more sharp sounds at the first, second and following contacts, owing to the inclusion or exclusion of the current generator S. The receiving apparatus T' T^2 T^3 T^4 in the subscribers' stations are in this arrangement connected in parallel in the ring circuit. They could however of course also be arranged in series; also, in place of a metallic circuit, earth can be used for the return current, as shown at Fig. 4. The arrangement can also be such that the ring circuit R is connected to the primary coil of the induction apparatus J in which case the second apparatus J' can be dispensed with. In place of the telephone galvanometers other electric optical indicators can be used for these indications at the subscribers' stations.

In the arrangement shown at Fig. 5 one induction apparatus is arranged in the central telephone switch and induction apparatus are also arranged in the subscribers' stations. The ring circuit R (with metallic or earth return conductor) contains the primary coil of the induction apparatus J, the spring contact *f'* of the disk B, consecutively the contact pieces 1' 2' 3' 4', the current-generator S' and the primary coils of the induction apparatus J' J^2 J^3 J^4 of the subscribers' stations. There may also be included in the same the galvanometers or other electric optical indicators B' B^2 B^3 B^4. The telephones T', &c., are in the same circuit that contains the secondary coils of the induction apparatus J' J^2 J^3 J^4. The inductions are rendered visible at the subscribers' stations by the galvanometers and audible by the telephones. The induction apparatus J', &c., can be so combined with the induction apparatus i' i^2, &c., which are under any circumstances required in the subscribers' stations, and the telephones be so combined with the receivers for ordinary telephonic working by suitable means such as by switches, as to serve for both purposes.

If the subscriber I (Fig. 2) desires to communicate with the main circuit L, he puts the telephone T' to his ear and waits until the determined sign for his own station is given. This will be the case as soon as the current from the contact spring *f'* flows through the primary coil of the induction apparatus J thence through the primary coil of the other induction apparatus J' to the battery S' and back to the contact 1' and spring.

In all the telephones the corresponding sign will be heard, for example a single snapping sound which is produced by the introduction and immediate exclusion of the current-generator S' into and out of the primary circuit. The telephones are preferably included in the ring circuit by the indicated bridge connection but they may also be excluded in the position of rest and only be included by the act of listening at the particular station.

The course of the current in the circuit L is as follows: From the contact spring *f* into the secondary coil of the induction apparatus J, into the main circuit L to the central station, into earth or along the return wire to E' of station I, through the short circuited inductor K', the electromagnet *k'* and the wire *l'* to the contact piece 1 of disk A and back to the

spring contact *f*. The central station will consequently also hear the sign for the subscriber I when the telephone is in circuit. The subscriber I, as soon as he hears the particular sign, is in a position to enter into communication with the central station. By bringing into action the current-generator, turning the crank handle of the magneto inductor, or otherwise producing a current, the subscriber I can call the central station; similarly the central station can call the subscriber I. The commutator disk revolves with a certain speed in order that all subscribers may successively be put in position to call the central station or vice versa. The duration of each contact is determined according to the number of the subscribers and the corresponding conditions of working, but is as a rule not sufficiently long for carrying on a telephonic conversation. Each subscriber must therefore be in a position to maintain the contact position which connects him with the main circuit L for a certain length of time. For readily effecting this purpose the subscriber can stop the motion of the commutator for a certain time when his turn comes round. For this purpose the disk C Fig. 2 with its contact pieces 1'' 2'' 3'' 4'' is provided, which come consecutively into contact with the sliding contact *f''* by rotation of the disk C, this action being made to correspond accurately with the contacts of disk B. The contact pieces 1'' 2'', &c., are in communication with the corresponding subscribers I, II, III, IV. From the contact spring *f''* a wire leads to the electromagnet E whose armature *a* is connected to a disengaging device, so that by the motion of the armature this device comes into action and at the same time the further motion of the disks A, B, C, is retarded or entirely stopped. The armature *a* is for this purpose provided with a fork *g* mounted on pivots *p* which fork on the electromagnet E being rendered active, causes the lever H, which, in a state of rest bears with a stud *n* on projections on the fork, to drop off. The lever is thus caused to engage with a ratchet wheel S^2 on the axis of the commutator so as to stop the motion of the latter. If therefore station I desires to communicate with the central station, the subscriber will at once bring the commutator to a stand still by sending a current through the wire *l'*, disk C and contact 1'' and through the electromagnet E. The course of the current is then as follows: From the magnet-inductor K' or other current producer, on the depression of key *t'* to contact 1'', spring *f''* to the electromagnet E and through the return wire or earth back to the inductor K' After the speaking is finished the central station or the subscriber can set the commutator in motion again, or the clockwork controlling the commutator can be connected with a current-generator which after a certain lapse of time automatically transmits to the central station the sign for breaking the connection; but as in the first above mentioned case the one or other subscriber might occupy the line too long, while in the second case the apparatus would be too complicated, and the subscriber, in order to hold a longer conversation would first have to apply to the central station to be reconnected, it is preferable to combine with the disconnecting mechanism a clockwork which raises the lever H into the normal position after a certain time, for example three or five minutes, so that the commutator can start again. This is effected, as shown at Fig. 2, by means of a cam *e*. If therefore the subscriber requires to speak for some time, he does not ring off. The central station then maintains the connection, and if no other subscriber of the same group signals during the interval, the subscriber who is connected up can again speak for the fixed length of time when his contact piece comes round again. On the termination of the speaking the subscriber rings off in the usual manner.

In Fig. 2 the electromagnet E is in the local circuit of the particular subscriber, and not in the main circuit. It might however be arranged in the main circuit, as at Fig. 6, whereby on the one hand the number of the requisite wires would be diminished and the commutator simplified. On the other hand however, irrespective of the fact that the electromagnet would always remain in the line, the motion of the commutator would be stopped each time the central station signaled which would be disadvantageous because frequently a subscriber does not reply at once and this interval of time is consequently lost for the other subscribers. If namely the central station signals a subscriber with the arrangement as at Fig. 2, the commutator continues to move forward with the determined speed, and only the subscriber can stop the same, this having to take place before answering the signal. If the called subscriber does not at once answer, but allows the contact to move past, he must wait with his answer until his turn comes round again.

With a larger number of subscribers in each group the arrangement may be such that with the commutator disk or roller there is combined a phonograph (Figs. 7 and 8). The respective contact point will then be indicated by a certain sound or word, or simplest, by the calling of the number, which particularly facilitates the working at the central station. As it is here only a question of a few regularly recurring sounds, such phonograms could be easily produced.

The roller B provided with the corresponding phonograms has a microphone M placed opposite it in such manner that its membrane is vibrated either directly or indirectly. By means of the microphone and its battery S^3 the corresponding sounds are transmitted into the main line L or through the ring circuit R into the subscribers' stations.

The phonograms on the commutator roller must of course correspond with the positions

of the commutator plates. They might however, as shown at Fig. 8 be employed in combination with contact pieces 1′ 2′ 3′ 4′, if in addition to the spoken word also the before mentioned signs, consisting of a snapping of the telephone or an oscillation of the galvanometer are to be produced. The arrangement can be effected according to the diagrams either at Fig. 2 or Fig. 5, and will be readily understood without further description.

In order to allow of the position of the commutator roller for the time being to be recognized in a perfectly reliable manner by the delivery of audible signals, a device may also be employed provided with sounding reeds, as shown in Figs. 9 and 10. For this purpose, upon the shaft which bears the commutator roller or which is rotated together with the same, is arranged a disk or drum G provided with pins or projections c' c^2 c^3 c^4 at those points from which it is intended to deliver indications to the subscribers' stations and to the central station. When the disk or drum G is rotated the said projections strike against the reeds P′ P^2 P^3 P^4 and produce the sounding of the same. The number of these projections and of the reeds can be varied at will, according as will be found necessary and opportune. The reeds are fastened upon a membrane m by means of a small block or are arranged in any other suitable manner. The sounds produced by the reeds are acting in a suitable manner upon the microphone M arranged in the automatic switch. Instead of by the reeds the signal sounds can be produced by any other known means, such as for instance by the striking of bells or other sound-giving bodies (in which case the pins will act upon suitably arranged levers).

A suitable construction of the commutator device is shown at Figs. 11 and 12. On the cylindrical surface of a roller W of insulating material there are provided, separate from each other the above mentioned contact pieces for the disks A, B, C. On this roller slide the insulated spring metal strips (contact springs or brushes) which on the rotation of the roller W come into conducting contact with the corresponding contact pieces at the corresponding places. The arrangement of the contact pieces is according to the diagram at Fig. 2. The sliding contact F corresponds to the contact point marked 10 of B Fig. 2, and is always in conducting contact with the ring shaped piece C′ Fig. 12 while the spring f passes over insulated parts of this ring C′, so that the current is broken and closed again during certain intervals of time, whereby the before mentioned audible or visible signals are given.

In the case of the employment of phonographs the corresponding phonograms are provided on the commutator roller or on a special roller revolving at the same speed. The arrangement of the other contact pieces and sliding springs is such that the circuits belonging to the corresponding signs are for the time being put in conducting communication. Thus to the sliding contacts F and f is connected the circuit with the battery S′ and the primary coils of the induction apparatus J and J′; to F^2 the circuit of the electromagnet E; to f_1 f_2 f_3 f_4 and f'_1 f'_2 f'_3 f'_4 the circuits l_1 l_2 l_3 l_4 and l'_1 l'_2 l'_3 l'_4 of the subscribers and to F′ the main circuit L, with the secondary coil of the induction apparatus J. For example, if the commutator has given the sign for the subscriber I, there must be connected with the main line L the circuit l_1 of the subscriber I, and at the same time also, the circuit of the electromagnet E must be connected with the local circuit l'_1 of the subscriber I. This is effected by the contact 1′, by means of the spring contact F′ with L and as 1′ is in constant conducting communication with 27, from 27 to spring f_1 through l_1 to station I; furthermore simultaneously through the contact 1″ by means of spring F^2 to E and, as 1″ is in constant communication with 31, from 31 through f'_1 and l'_1 to station I. The contacts 1″ 2″ 3″ 4″ and 31, 32, 33, 34 are advantageously made somewhat shorter than 1′ 2′ 3′ 4′ and 27, 28, 29, 30, in order that it may not occur that at the last moment of the contact on 1″ or 2″, &c., the commutator be stopped and the respective contacts 1′ 2′, &c., and 27, 28, &c., have already passed their corresponding contact springs.

The following contact pieces are always in conducting connection: 1′—27, 2′—28, 3′—29, 4′—30; 1″—31, 2″—32, 3″—33, 4″—34. The main line L is, in the commutator position shown in Figs. 2 and 12, connected for a certain time with circuit l_1 to the subscriber I, and at the same time the electromagnet E's circuit is connected with circuit l'_1 of subscriber I. This interval of time depends upon the speed of rotation of the roller W. The particular subscriber can stop the motion of this roller for a certain time, after which the clockwork is automatically released, and the roller continues its motion. For this purpose a train of wheels may be employed of which one part is stopped simultaneously with the commutator, and is then set in motion again. Greater reliability is however obtained by means of two trains in connection with each other, as shown at the central telephone switch, Figs. 13 to 15, where the driving motion is obtained for example by weights G′ and G^2, which might however be replaced by springs or other motive power. The train L′ drives the commutator roller W and the train L^2 contains the electromagnet E and prevents after the releasing has been effected, the further motion of the train L′ for a certain time. One of the trains is consequently always in motion while the other is at rest. The weight G′ acts on the first motion wheel b' of the train L′, and through a suitable train and through escapement q' and pendulum p' the desired speed is obtained for the commutator roller W. The train L^2 with the first motion wheel b^2 and the weight G^2 has such a train with

escapement q^2 and pendulum p^2 that the wheel r will revolve once during the interval of time fixed for telephonic speech. The arrangement whereby on the release of the train L^2 the train L′ is stopped until the wheel r has performed one revolution consists of a three-armed lever $N' N^2 N^3$, fixed on the axis of the train L^2. The arm N′ is so weighted that it tends to turn the axis X in the direction of the hands of a clock, and when at rest, it lies with its bent chisel-edged end upon the shoulder g' of the releasing fork g (Figs. 16 and 17). If the fork, which is pivoted at p, be moved to and fro, the arm N′ will fall, turning the axis X and thereby the arms N^2 and N^3. The oscillation of the fork is effected by the current sent through the electromagnet E, the armature a of which engages with its rod u in a slot of the fork g, as shown. The wheel r' of the train L^2 bears with a pin v against the arm N^2 when the train L^2 is at rest. On the upward motion of N^2 the pin is released and wheel r' and consequently the train L^2 can turn. On the axis Y is a two-armed lever $O' O^2$ whose arm O′ bears with a pin w in a notch of the disk r^2 which rotates with the axis X. As soon as disk r^2 turns, the arm O′ is raised on its periphery, and the other arm O^2 is moved in the contrary direction to the hands of a clock. The latter arm is so formed that during this motion it stops the oscillation of the pendulum p' and consequently the motion of the train L′. The train L′ now remains at rest as long as the train L^2 is in motion. When the pin s of wheel r has reached the hook shaped end of the lever arm N^3, this arm and with it $N' N^2$ are moved in the contrary direction to the hands of the clock, whereby the arm N′ will be again lifted on to the shoulder of the fork and the pin v will again bear against arm N^2. At the same time lever arm O′ falls into the notch of disk r^2 and pendulum p' is released. Consequently the train L′ is set in motion again while L^2 is stopped.

In order to have a control as to whether the train L′ which imparts motion to the commutator roller W is in motion or is at rest, use is made of the contact device represented by Figs. 18 and 19. This device consists of two contact springs D and D′ which are either kept in contact by the pressure of the lever d, or are separated from each other as soon as the said lever d which rotates with the axis of the second train L^2, is moved away from the same. This contact device is preferably used in connection with the device for delivering audible signals described above with reference to Figs. 9 and 10, and viz: in such a manner that during the rotation of the drum or disk G lever d is maintaining the contact of the springs D D′, the train L^2 being at rest; but as soon as the drum G ceases to rotate lever d moves away from the springs D D′, which are separated from each other and their metallic contact is interrupted. The way in which the said device is functionating is clearly to be seen from the diagram, Fig. 20.

M is the microphone.

P′ P^2 P^3 P^4 are the sound emitting reeds.

G is the drum or disk with its pins c' c^2 c^3 c^4.

D D′ are the contact springs and d is the lever fastened upon the axis of the train L^2.

J′ J^2 are the induction bobbins.

l is the circuit line to the subscriber.

L is the line to the central station and S^3 is the microphone-battery.

Train L^2 is at rest. The lever d will therefore hold the contact springs D D′ closed. Train L′ is in motion, wherefore the drum or disk G with its pins will rotate and will produce the sounding of the reeds. The sounds emanating from the reeds are propagated by the microphones in such a manner that they become audible in the telephones inserted in the secondary coils of the induction apparatus J′ J^2. The course of the current is then as follows: from one contact of the microphone to 1, then through 2, 3 to the spring D, the closed contact 4, the spring D′, through 5, 6, 7 into the primary coil of the induction bobbin J^2, through 8, 9 into the primary coil of the induction bobbin J′, through 10 to the battery S^3 and through 11, 12, 13 back to the second contact of the microphone.

In the telephones inserted in the secondary coils of the induction apparatus J′ J^2 the sounds emitted by the reeds become audible, whereby both the subscribers and the central station are enabled to ascertain the position for the time being of the commutator, the motion of which is in connection with the motion of the drum G. As soon as the train L′ is stopped, the train L^2 and the lever d are commencing their motion, the contact between D and D′ is interrupted and the circuit of the battery current also becomes interrupted. This circumstance is of particular importance for the reason that both the subscribers and the central station are in this manner enabled to ascertain whether at any given moment the train L′ is moving simultaneously with the switch or not. When the circuit of the battery current is closed, then in the telephones will be audible not only the particular signaling sounds intended to characterize the position for the time being of the commutator roller, but also the noises caused by the movement of the train L′, such as for instance the noise of the pendulum, &c. When train L′ is at rest and train L^2 is in motion the circuit of the microphone will be interrupted and consequently the said noises will not be audible in the telephones.

By means of the described central telephone switch apparatus two separate groups of subscribers only connected by a common main line can be brought into reciprocal communication without the use of a central station.

In this case, as shown at Fig. 21 there is provided in each of the points of junction K K_0 one of the switch apparatus. If for example subscriber I of group I—V desires to speak with subscriber V_0 of the other group I_0—V_0, subscriber I first brings the commutator of switch K to a standstill at the right moment, whereby he is put in lasting connection with line L, and is enabled to hear on his instrument the signs of the other switch apparatus at K_0. As soon as the sign of station V_0 is heard, subscriber I rings up station V_0. The latter then first stops the commutator K_0, rings back to I and speech can then take place. After the prescribed time has elapsed, both subscribers are automatically cut out again by the resumed motion of the commutators of both switch apparatus, thus affording other subscribers the opportunity of using the line.

It will of course be understood that the subscribers of one and the same group are enabled by the central telephone switch apparatus to speak with each other.

I claim—

1. An automatic telephone system comprising a main line including a central station, a plurality of branch lines converging to said main line, each including a subscriber's station, and means at the point of convergence of the aforesaid lines, adapted to automatically and successively connect the subscribers' lines with the main line for a definite period of time, of mechanism controllable from any of the stations adapted to prolong the period of connection, and means beyond the control of any of the stations adapted to automatically interrupt such connection, for the purpose set forth.

2. An automatic telephone system comprising a main line including a central station, a plurality of branch lines converging to said main line, each including a subscriber's station, means at the point of convergence adapted to automatically and successively connect the subscribers' lines with the main line for a definite period of time, and mechanism beyond the control of either the central or the subscribers' stations adapted to automatically interrupt such connection, in combination with a signaling circuit including the main and subscribers' lines, and means adapted to automatically indicate at all the stations the particular subscriber's station connected with or about to be connected with the main line, for the purpose set forth.

3. An automatic telephone system comprising a main line including a central station, a plurality of branch lines converging to said main line, each including a subscriber's station, means at the point of convergence adapted to automatically and successively connect the subscribers' lines with the main line for a definite period of time, and mechanism beyond the control of either the central or subscribers' stations adapted to automatically interrupt such connection, in combination with a signaling circuit including the main and subscribers' lines, and means adapted to automatically indicate at all the stations by a visible or audible signal, or both, the particular subscriber's station connected with or about to be connected with the main line, for the purpose set forth.

4. An automatic telephone system comprising a main line including a central station, a plurality of branch lines converging to said main line, each including a subscriber's station, means at the point of convergence adapted to automatically and successively connect the subscribers' lines with the main line for a definite period of time, and mechanism beyond the control of either the central or subscribers' stations adapted to automatically interrupt such connection, in combination with a signaling circuit including the receivers at all the stations and sound transmitting devices adapted to indicate the particular subscriber's station connected with or about to be connected with the main line, for the purpose set forth.

5. An automatic telephone system comprising a main line including a central station, a plurality of branch lines converging to said main line, each including a subscriber's station, and a commutator at the point of convergence of said lines provided with a suitable contact for each subscriber's line, and a circuit closer co-operating with the commutator and adapted to close the main line circuit successively through said contacts for a definite period of time, in combination with a signaling circuit including a current generator, the primaries of two induction coils, a definite number of contacts for each subscriber's line, and a circuit closer adapted to operate in harmony with the circuit closers of the commutator and close the signaling circuit successively through its contacts, said circuit closers, the main line and the receivers at all the stations being included in the secondaries of the induction coils, for the purpose set forth.

6. An automatic telephone system comprising a main line, including a central station, a plurality of branch lines converging to said main line and including each a subscriber's station, a commutator at the point of convergence of said lines, provided with a suitable contact for each of said subscribers' stations, a circuit closer connected with the main line and co-operating with the commutator to successively connect the subscribers' stations with the main line, and a primary time motor adapted to revolve the commutator, in combination with a stop mechanism controllable from any of the stations and adapted to stop the primary time motor, and an auxiliary time motor beyond the control of any of the stations adapted to re-start the primary time

motor after a predetermined period, for the purpose set forth.

7. An automatic telephone system comprising a main line, including a central station, a plurality of branch lines converging to said main line and including each a subscribers' station, a commutator at the point of convergence of said lines, provided with a suitable contact for each of said subscriber's stations, a circuit closer connected with the main line and co-operating with the commutator to successively connect the subscribers' stations with the main line, and a clock mechanism adapted to revolve the commutator, in combination with an auxiliary clock mechanism, an electrically operated stop adapted to be controlled from any of the stations and normally locking said auxiliary mechanism into operation, an auxiliary stop controlled by said auxiliary clock mechanism and adapted to stop the primary clock mechanism whenever said auxiliary clock mechanism is released, and means controlled by the last mechanism and beyond the control of any of the stations adapted to re-start the primary clock mechanism, for the purpose set forth.

8. An automatic telephone system comprising a main line including a central station, a plurality of branch lines converging to said main line and including each a subscribers' station, a commutator at the point of convergence of said lines, provided with a suitable contact for each of said subscribers' stations, a circuit closer connected with the main line and co-operating with the commutator to successively connect the subscribers' stations with the main line, a primary clock mechanism adapted to revolve the commutator, in combination with an auxiliary clock mechanism, an electrically operated primary stop lever, normally in engagement with one of the gear wheels of the train of said auxiliary clock mechanism, said stop lever controllable from any of the stations, an auxiliary stop lever adapted to engage the pendulum of the primary clock mechanism, said auxiliary lever actuated by the auxiliary clock mechanism to stop the vibrations of said pendulum whenever the auxiliary clock mechanism is released from its primary stop lever, and to automatically disengage the auxiliary stop lever from the aforesaid pendulum irrespective of the operation of the primary stop lever, whereby one or the other of said clock mechanisms is always in operation, for the purpose set forth.

9. In an automatic telephone system, a main line including a central station, a plurality of branch lines converging to said main line, each including a subscriber's station, a commutator comprising a revoluble disk or roller provided with a contact for each of said subscribers' lines, a circuit closer trailing on said roller, a signal line including a current generator, one of the coils of an induction device, a microphone, a revoluble sounding device co-operating therewith and adapted to emit a specific sound or number of sounds for each subscriber's station, and the receivers of all the stations, the circuit closer for the commutator and the main line being included in the other coil of the induction device, in combination with a primary time motor for the commutator and sounding device, an auxiliary time motor, an electrically operated primary stop lever normally in engagement with the auxiliary motor gear, said lever controllable from any station, an auxiliary stop lever, operated by the auxiliary motor and adapted to stop the primary motor whenever said auxiliary motor is released from its stop lever, and again release said primary motor after a fixed period independently of the operation of the primary stop lever, substantially as and for the purpose set forth.

10. In an automatic telephone system, a main line including a central station and a plurality of branch lines, each including a subscriber's station and converging to a terminal of the main line, in combination with a commutator W, provided with contacts 1, 2, 3, &c., suitable contact springs included in the main line, contacts 1′, 2′, 3′, &c., and suitable contact springs included in a signal circuit including also the receivers at all the stations, contacts 1″, 2″, 3″, &c., and suitable contact springs in a main line or in a local line including all the stations and an electro-magnet, in combination with a motor for the commutator, a stop lever adapted to arrest the movements of the commutator, said lever controlled by the aforesaid electro-magnet and controllable from each station, and appliances beyond the control of any station adapted to automatically re-start the commutator, substantially as and for the purpose set forth.

11. The combination with the clock mechanism L′ and its pendulum, the clock mechanism L^2, and the lever O^2 controlled by said clock mechanism L^2 and controlling the clock mechanism L′, of a stop lever, N, N′, N′, normally in engagement with a gear of the clock mechanism L^2, the actuating fork *g*, the electro-magnet E and its armature *a*, said devices being arranged and operating substantially as described for the purposes specified.

12. In an automatic telephone system such as described, a signaling circuit, two normally disconnected contact springs D, D′, constituting the circuit terminals, in combination with a commutator adapted to operate as set forth, a primary motor for the commutator, an auxiliary motor, an auxiliary stop lever adapted to arrest the movements of said primary motor, said auxiliary stop lever controlled by the auxiliary motor, an electrically operated primary stop lever normally in engagement with a gear of the auxiliary motor, said primary stop lever controllable from any of the stations, and a cam controlled by the

auxiliary motor adapted to move the springs D, D′ into contact with each other when said primary motor is in motion, to release said springs when said auxiliary motor is released to arrest the movement of the primary motor, whereby the signaling circuit is automatically interrupted, for the purpose set forth.

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

FRANZ NISSL.

Witnesses:
D. B. MASON,
J. BELMONT.