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A. B. FERDINAND.

TELEPHONE SYSTEM.

No. 471,352. Patented Mar. 22, 1892.

Fig. 2.

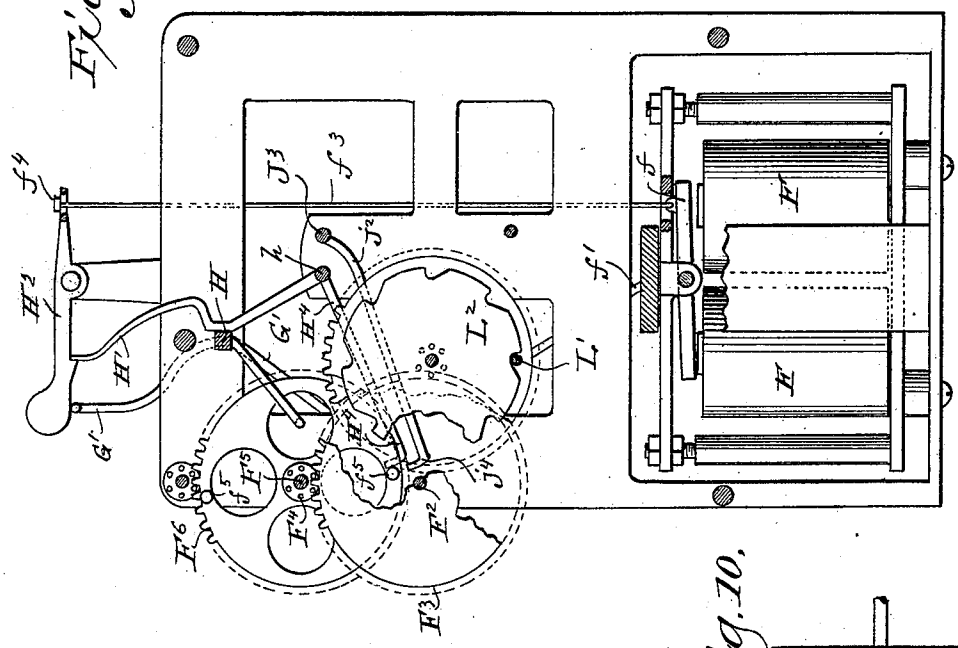

Fig. 10.

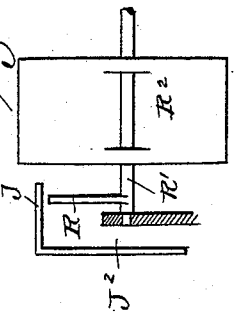

Fig. 1.

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TELEPHONE SYSTEM.

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Fig. 4.

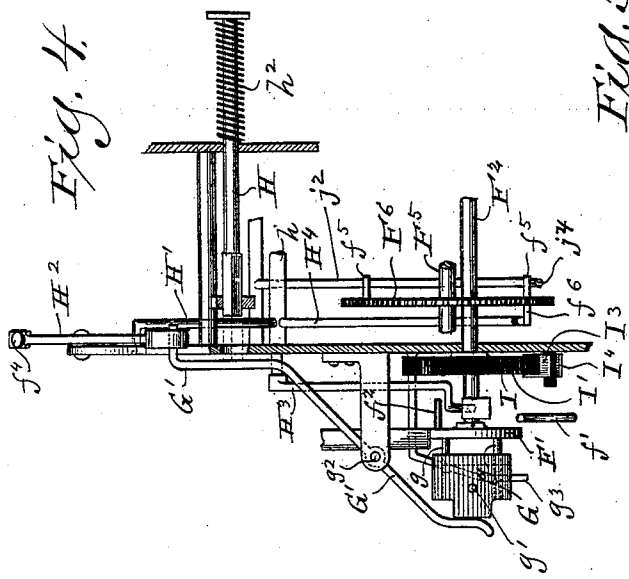

Fig. 5.

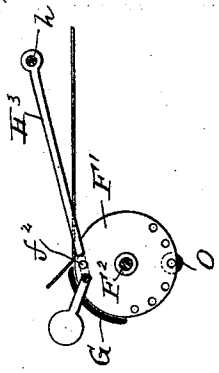

Fig. 3.

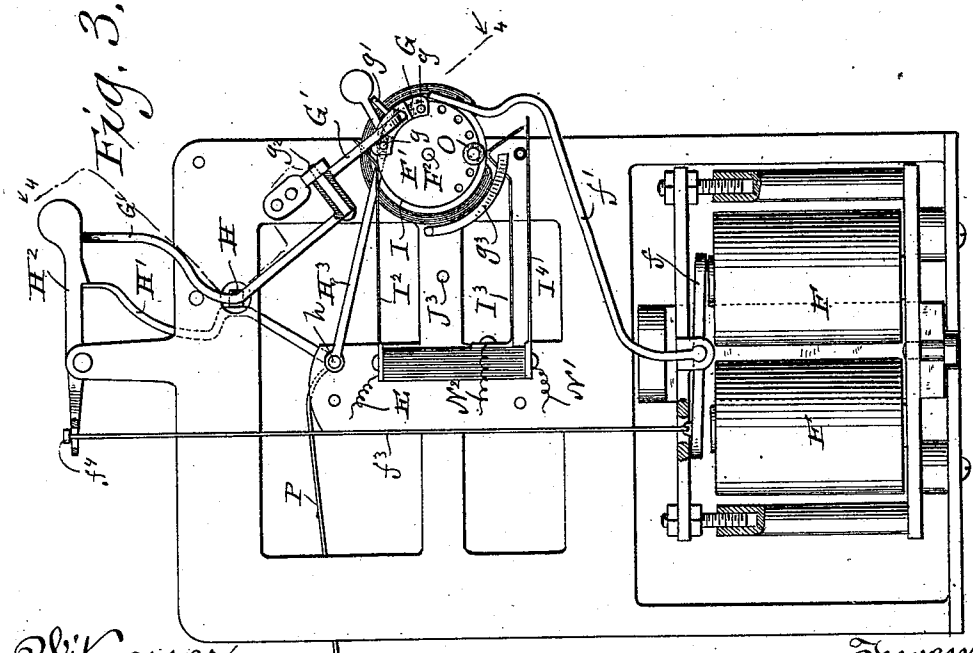

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Fig. 9.

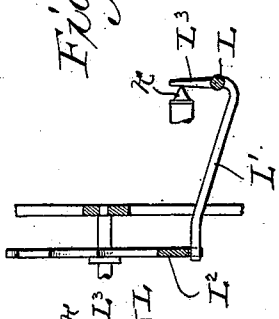


Fig. 7.

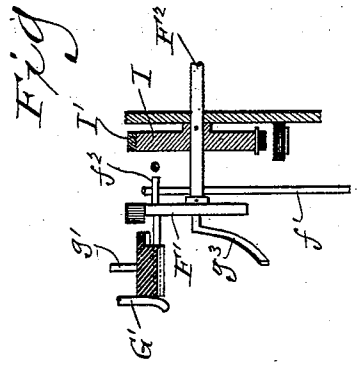


Fig. 8.

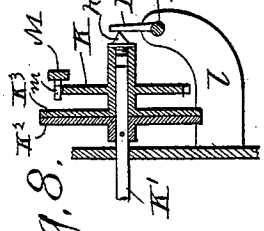
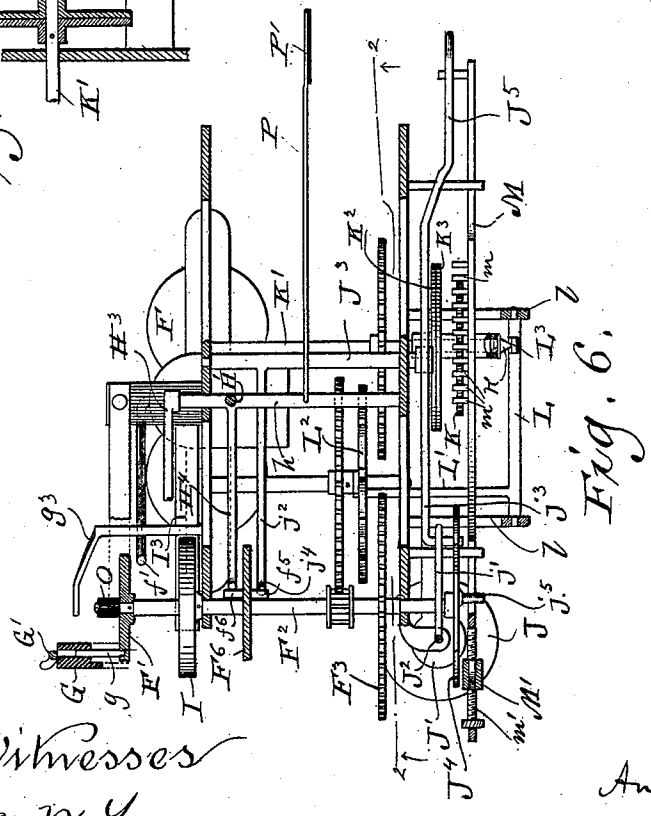


Fig. 6.



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TELEPHONE SYSTEM.

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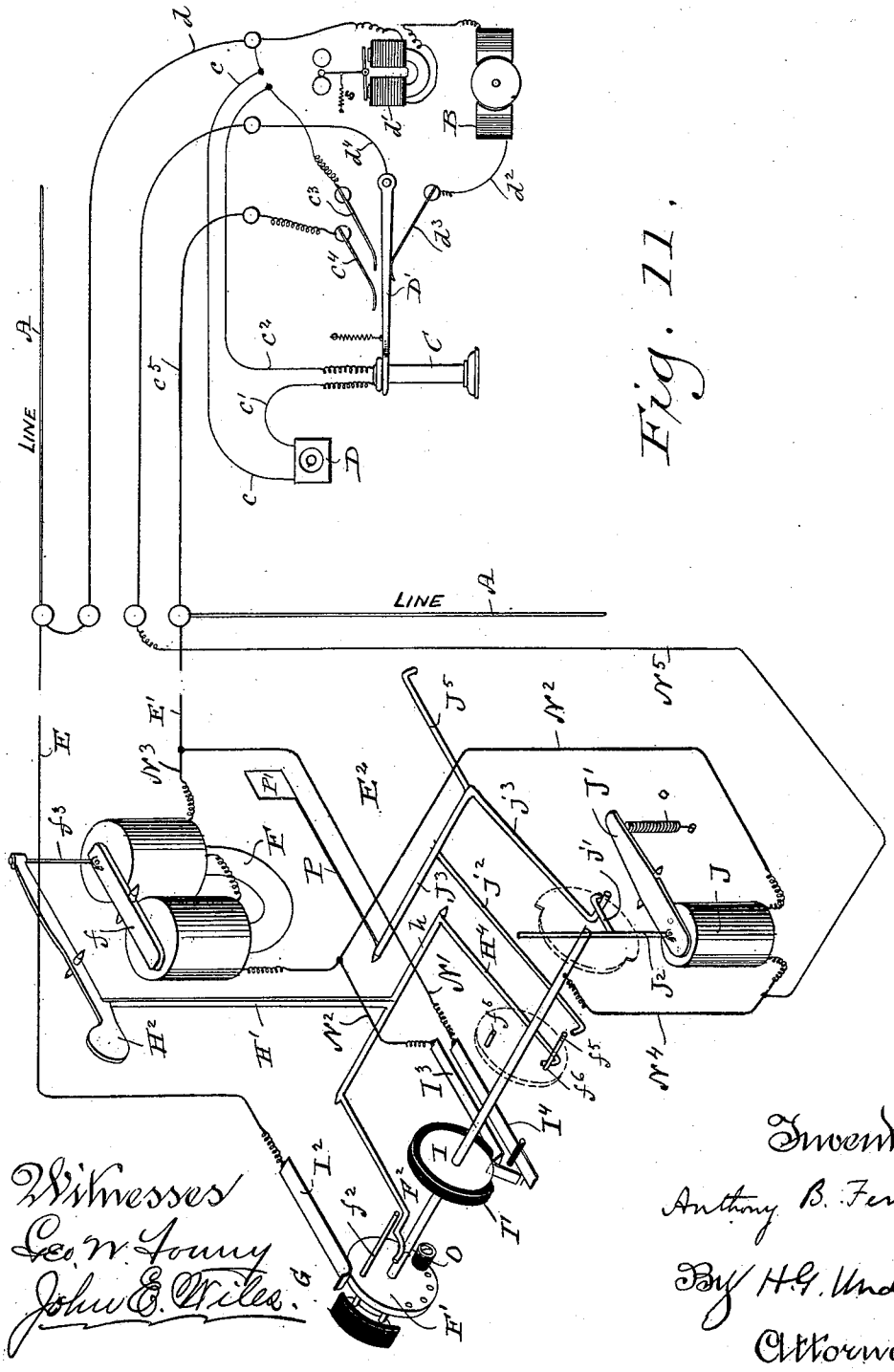

Fig. 11.

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UNITED STATES PATENT OFFICE.

ANTHONY B. FERDINAND, OF OSHKOSH, WISCONSIN.

TELEPHONE SYSTEM.

SPECIFICATION forming part of Letters Patent No. 471,352, dated March 22, 1892.

Application filed June 29, 1891. Serial No. 397,868. (No model.)

To all whom it may concern:

Be it known that I, ANTHONY B. FERDINAND, a citizen of the United States, and a resident of Oshkosh, in the county of Winnebago, and in the State of Wisconsin, have invented certain new and useful Improvements in Telephone or Analogous Electric Systems; and I do hereby declare that the following is a full, clear, and exact description thereof.

My invention relates to improvements in telephone signal devices; and it consists in the matters hereinafter described, and pointed out in the appended claims.

The objects of my invention are, first, to provide means whereby after one subscriber has called the central office it is rendered impossible for any other subscriber to place his telephone in circuit with the one which is using the line, while at the same time the operator at the central office is enabled to call any subscriber at will; second, to provide means for automatically adjusting all the telephones after a suitable lapse of time into a position which will permit any subscriber to call up the central office at will, and, third, to provide means whereby a plurality of telephones may be arranged upon one line instead of necessitating the use of a separate line for each telephone, while at the same time absolute secrecy is insured to the party using the line at any one time.

In the accompanying drawings, illustrating my invention, Figure 1 is a front elevation of a signaling device constructed in accordance with my invention. Fig. 2 is a sectional view of the same on line 2 2 of Fig. 6. Fig. 3 is a rear elevation of the same. Fig. 4 is a side elevation, partly in section, of a portion of the apparatus shown in Figs. 1, 2, and 3. Fig. 5 is a detail view of one of the parts. Fig. 6 is a top plan view of my improved signaling device. Figs. 7, 8, 9, and 10 are detail views of different portions of the mechanism. Fig. 11 is a diagrammatic view illustrating my improved signaling device as adapted for use in connection with an ordinary telephone-instrument.

In said drawings, A indicates the main line, upon which two or more sets of telephone-instruments are located.

B is the ordinary magneto-instrument; C, the ordinary hand-telephone; D, the transmitter, and D′ the pivoted lever or switch upon which said hand-telephone is suspended when the telephone is not in use.

d is a wire leading from the main line to the magneto and upon which the usual call-bell or other signal *d′* is located, and d^2 a wire leading from the magneto to a contact brush or spring d^3, which normally engages with the switch D′.

d^4 is a wire leading from the switch D′ and connected with the signaling device.

A wire *c* leads from the line *d* to the transmitter D, and a wire *c′* connects the transmitter with the hand-telephone, a wire c^2 leading from the latter to a contact-spring c^3, arranged to engage with the switch D′ when the hand-telephone is removed. A second contact-spring c^4 is connected by a wire c^5 with the main line, as shown in Fig. 11.

Two wires E and E′ connect a signaling device E^2 with the main line A A. The signaling device E^2 comprises a motor, suitable means for setting said motor in operation, and suitable contact-pieces and insulating-segments for shifting the circuit at successive movements of said motor, as will be hereinafter more fully described.

As shown more particularly in Figs. 1 to 10, inclusive, the signaling device comprises a magnet F, provided with a swinging armature *f*, which carries an arm *f′*, adapted for engagement with a projecting pin f^2 upon a revoluble disk or wheel F′, which is actuated by the motor. The disk F′ is mounted upon a shaft F^2, which is driven by the motor. An insulating-section G is movably engaged with the outer surface of the disk F′ in any suitable manner, so as to permit of a movement of said insulating-section toward or away from said disk—as, for instance, as shown in Fig. 4 of the drawings more particularly—in which said insulating-section has a sliding engagement with spindles or pins *g g*, which extend outwardly from the disk F′. A rock-arm G′ is pivoted to the frame of the signaling mechanism, as at g^2, and engages at one end with the outer surface of the insulation G and having its other end located in the path of a push-rod H, by means of which said rock-arm may be rocked about its pivotal connection with the frame. An arm H′ is pivoted to the frame of the signaling mechanism, as at *h*, and is ar-

ranged to move at times into the path of the push-rod H to prevent any longitudinal movement of said rod. A detent or pawl H^2 is pivoted upon the frame of the signaling device and is arranged to engage with the end of the arm H′ to hold it out of the line of movement of said push-rod H. One end of the rock-arm G′ is arranged to engage with the detent H^2 when said rock-arm is moved by the push-rod H, so as to raise said detent out of engagement with the arm H′. A rod f^3 is connected at one end with the armature f of the magnet F and at its other end is connected with the end of the detent H^2, as shown at f^4, and is adapted to move said detent into a position to release the arm H′ upon a movement of the armature f of magnet F. A laterally-extending arm H^3 is provided upon the arm H′, said laterally-extending arm being preferably weighted, as shown, so as to cause said arm to drop as soon as arm H′ is freed from its engagement with the detent H^2. A pin g' is provided upon the insulating-section G and is arranged to engage an inclined arm g^3, which projects from the frame, as shown more particularly in Figs. 3 and 4, so that by the rotation of the disk F′, together with the said insulating-section, said pin will be brought into engagement with the inclined arm g^3 and will force said insulating-section farther away from the disk F′. The shaft F^2, upon which the disk F′ is mounted, is provided with a wheel F^3, which is in turn engaged by a pinion F^4 upon a shaft F^5, and the latter shaft carries a wheel F^6, which is driven by the motor and is provided with projecting pins or studs f^5 f^5 upon one side and a similar pin or stud f^6 upon the other side. An arm H^4 is connected with the weighted arm H^3 and is provided with an upturned end h', arranged to move into the path of the pin f^6 when the parts are in the positions shown in the drawings, so as to dog the wheel F^6 and prevent its rotation at such times. The end of the weighted arm H^3 is arranged to move into the path of the pin f^2 upon the release of the arm H′ by the detent H^2, as before described, so that said pin will engage with the end of said arm and raise the same upon a rotation of the disk F′, so as to move the arm H′ again into engagement with the detent H^2. A disk I is located upon the shaft F^2 and is partially surrounded by a covering of insulation I′, and a contact-spring I^2 is arranged to bear upon the periphery of disk F′, while two similar springs I^3 I^4 are arranged adjacent to the periphery of the disk I, as shown more particularly in Figs. 3 and 11 of the drawings.

A magnet J is provided for governing a portion of the operation of the signaling apparatus, said magnet being provided with a swinging armature J′, to which is connected a rod J^2, provided with hooks j and j'. A rock-shaft J^3 is journaled in the frame of the signaling device and is provided with two arms j^2 and j^3, the former arranged to move into and out of the path of the pins f^5 f^5 on the wheel F^6 by successive movements of the rock-shaft J^3 and provided with an upturned end j^4 and the latter arranged to engage with a cam-wheel J^4 upon the shank F^2, the operation of which will presently be described.

A pinion K is loosely mounted upon a continuously-revolving shaft K′ driven by the motor and provided with a disk K^2, which is rigidly secured to said shaft, and a similar disk K^3 is provided upon the hub of pinion K, which is arranged to bear against the face of disk K^2 at times, so as to cause said pinion to rotate. A rock-shaft L is pivoted between brackets l l on the frame, and an arm L′ projects inwardly from said rock-shaft and engages with a cam-wheel L^2, operated by the motor. An arm L^3 projects from the rock-shaft L and is arranged to bear against the outer end of a projection k on the outer end of the hub of the pinion K, so that when the arm L′ is depressed by the cam-wheel L^2 said rock-shaft L will be rotated and the arm L^3 will be pressed inwardly and will be crowded against the projection k, so as to force the disk K^3 against disk K^2 and cause the pinion K to be rotated by the frictional engagement of said disks. A longitudinally-movable bar M is provided with rack-teeth m, arranged to engage with the teeth of the pinion K, so as to cause the movement of said bar by the rotation of said pinion. One end of the bar is provided with an upwardly-projecting arm M′, adjustably secured thereon and adapted to be moved lengthwise of said bar by means of a set-screw m', said upturned arm being located in the path of a projecting stud or pin j^5 on the cam-wheel J^4. The other end of said longitudinally-movable bar is adapted to engage with the end of an arm J^5 on the rock-shaft J^3, as will be hereinafter more fully described.

As illustrated in Fig. 11 of the drawings more particularly, a wire E connects the brush I^3 with the line A, a wire N′ connects the brush I^4 with the line, and a wire N^2 connecting the brush I^3 with the magnets F and J. A wire N^3 also connects magnet F with the line, and another wire N^4 connects the magnet J with the shaft F^2. Upon the disk F′ is provided a projecting pin O, of insulating material, arranged to engage with the contact-spring I^2 and raise the same away from the surface of said disk F′.

The operation of my improved signaling device is as follows: Supposing that six sets of telephone-instruments, all equipped with my improved signaling apparatus, are connected with the central station by a common line-wire, that one, two, three, four, five, and six rings call the respective subscribers upon said line. Now supposing that subscriber No. 3 desires to call the central office. He first presses the push-button upon the outer end of the push-rod H, which causes said rod to engage with the rock-arm G′, thus rotating said arm about the pivotal support g^2 and causing the lower end of said arm to press

the insulating-section G inwardly toward the disk F′, and causing the upper end of said arm G′ to lift the detent H² out of engagement with the upper end of the arm H′. Now as soon as the push-rod H is released it is returned to its normal position by a spring h^2, when the arm H′ is permitted to move into the path of the said push-rod, the weighted arm H³ dropping downwardly and the arm H⁴ dropping down out of engagement with the stud f^6, which frees the wheel F⁶ and permits said wheel to be rotated by the motor until the arm j^3 on the rock-shaft J³ engages with a depression in the periphery of the cam J⁴, when arm J⁵, which is of greater weight than arms j^2 and j^3, will drop, causing arms j^2 and j^3 to rise, the end of the former moving into the path of the studs or pins f^5 f^5 on wheel F⁶, so as to stop said wheel after it has made a partial rotation. By the time that the wheel F⁶ has rotated sufficiently to bring one of the studs f^5 into engagement with said arm the disk F′ will be moved into a position to bring the insulation G beneath the contact-spring I². He now operates the usual magneto B to call the central office, and after thus calling the central removes the hand-telephone C from the switch D′, as in the usual use of telephones. When the hand-telephone is removed, the lever D′ is raised into contact with the springs c^3 and c^4, thus placing the hand-telephone and the transmitter in circuit with the main line. In the position of the parts of my improved signaling device illustrated in Fig. 11 the telephone-instrument is short-circuited, inasmuch as the current is now free to pass through wire E, spring I², disk F′, wires N⁴, N⁵, and d^4 to lever D′, and in case said lever is raised into contact with springs c^3 c^4 will pass through said spring c^4 and wire c^5 and thence out of the line. When the insulating-section G in the signaling device of the subscriber calling the central office has moved beneath the contact-spring I², the circuit through said signaling device becomes broken, and his telephone is no longer short-circuited. When the subscriber calling the central operates the magneto, however, to so call the central, the magneto-current traverses the entire circuit upon which the six telephones are located, passing through the magnet F in the signal-box of each subscriber and causing said magnets to operate the armatures f, so as to pull downwardly upon the rods f^3 and release the detent H² in each of said signal-boxes. This operation permits the arm H′ in each of said signal-boxes to move into the path of the push-rod H, so as to prevent the operation of said push-rod and at the same time frees the wheel F⁶ and permits said wheel to rotate until stopped by the engagement of the arm j^2 with one of the stops f^5. In this position the shaft F² in each of the six signal-boxes on the line will have rotated so as to bring the insulation I′ on each of the disks I into engagement with the spring l^3, thus pressing said springs downwardly into engagement with the springs I⁴, thus placing the brush I², disk F′, shaft F², wire N⁴, magnet J, wire N², brushes I³ and I⁴, and wire N′ in circuit. It will be observed in this connection that the push-button being operated in but one signal-box of the six, the insulating-sections G G in the other five signal-boxes are not brought beneath the springs I², so that said springs continue to bear upon the peripheries of the disks F′, respectively. Now after the party calling has called for any other subscriber connected with the exchange, whether said latter subscriber is provided with my improved signaling apparatus or not, the operator at the central office is free to call said subscriber and to place him in communication with the party calling. Now supposing that the party calling desires to talk to subscriber No. 5 upon his own or a similar line, the operator at the central office sends five successive impulses over the line upon which said subscriber's telephone is located. These impulses successively energize the magnet J and cause the armature J′ thereof to depress the rod J². When an impulse is sent through the magnet J and the rod J² is operated, as above described, the hook j' will be drawn down so as to engage the end of the arm j^3, thereby operating to rock the rock-shaft J³ and depress the arm j^2, so as to free the wheel F⁶ and permit said wheel to perform a part of a rotation, the armature J′ being returned to its initial position by means of a spring o, so as to raise said rod J² and release the arm j^3 and permit the arm j^2 to again move into the path of the studs f^5. This operation is repeated each time that an impulse is sent over the line, so that the motor is released and permitted to move the shaft F² with disks F′ and I and the cam J⁴ one step for each impulse. The pins O O are arranged upon the respective disks F′ F′, so that when said disks have been rotated one step the disk in box No. 1 will have moved sufficiently to bring its pin O under the spring I², and when the disks have moved two, three, four, five, or six steps the pin O in the box whose number corresponds with the number of steps which said disks have moved will be brought under the spring I² and the circuit through this signal-box broken at this point, while the disks in the boxes of a lesser number will have moved beyond the point where the circuit is broken and the circuit re-established, the disks in the boxes of a higher number than the number of steps which said wheels are advanced having not yet reached the position necessary to break the circuit. In this condition, therefore, all the telephones upon the line, except the one from which the central is called and the one called by the central, remain short-circuited and the push-buttons of the entire number of signal-boxes on the line remain locked, so that it is impossible for any other subscriber to either call the central to in any way interrupt the con-

versation between the two connected telephones or to overhear such conversation, it being obvious that only the signal-boxes in which the circuit is broken are cut out of circuit with the main line, so as to cause the current to pass through the telephones connected with said signal-boxes, respectively.

In order to indicate to all the subscribers when the line is in use, any suitable indicator is provided—as, for instance, as shown in Figs. 1 and 3 of the drawings. An arm P is secured to the rock-arm H′ and is provided with a card at its outer end bearing the word "Busy" or any other desired characters to indicate that the line is in use, said arm being arranged to rise as the arm H′ is released by the detent H^2, so as to display the card P′ at each of the signal-boxes on the line.

When the motor is first released in each of the signal-boxes on the line, the cam-wheel J^4 in each of said boxes is rotated so as to cause its pin j^5 to engage the arm M′ on the bar M and to move said bar longitudinally, so as to carry its opposite end away from the extremity of the arm J^5. By the time the pin j^5 passes out of engagement with said arm M′ the cam-wheel L^2 will be rotated sufficiently to cause the arm L′ on the rock-shaft L to ride out of engagement with the depression in the periphery of said cam-wheel in which it has previously rested and into engagement with the circular portion of its periphery, thus crowding said arm L′ downwardly and rocking the shaft L, so as to crowd the arm L^3 against the projection k on the hub of pinion K and press the disk K^3 against disk K^2, thus causing pinion K to rotate, as before described, to give a longitudinal movement to the bar M. The operation of the motor gradually moves said bar lengthwise until it comes into engagement with the end of arm J^5 and raises said arm so as to depress arm j^2 and release the wheel F^6, thus permitting the motor to again operate the moving parts of the signaling mechanism until the pin f^2 on disk F′ comes into engagement with the end of arm H^3 and moves arm H′ into engagement with the detent H^2, in which condition the motor will be held from movement by the engagement of the end h' of arm H^4 with the stop f^6 on wheel F^6. This movement of the parts is effected in each of the signal-boxes simultaneously, the arm H′ in each of said boxes being thereby moved out of the path of push-rod H, so as to place each of said signal-boxes in condition to call the central in the manner before described.

By means of the adjusting-screw m' the arm M′ may be adjusted lengthwise of the bar M, so that the movement of said bar first described will be greater or less in extent, according to the direction in which said arm is adjusted, thus requiring a correspondingly greater or less time for the motor to move said bar into a position to engage with the end of the arm J to free the wheel F, and thus enabling the apparatus to be adjusted so as to restore the instrument to its normal condition at the end of any predetermined time.

As illustrated more particularly in Figs. 1 and 10 of the drawings, the hook j at the upper end of rod J^2 is arranged to move into the path of a pin R, which extends from the shaft R′ of the governor, which limits the speed of the motor, so that when the rod J^2 is depressed, as before described, to release arm j^2 said hook j will act as a stop to prevent too great a movement of the motor and will hold the same from movement until the rod J^2 is again released and arm j^2 is again moved into the path of the pins f^5 f^5. After a subscriber has finished using his telephone he may signal the central office in the usual manner, and the operator at the central may send a sufficient number of impulses over the line to cause all the motors to move the parts of the apparatus into a position to cause the cam-wheel J^4 in each signal-box to depress the lever j^2 and release the motor, thus permitting the parts to be moved thereby until the arm H^4 is moved into engagement with the stop f^6 on the wheel F^6, as before described, which movement places all the signal-boxes on the line in a condition to enable any one of said subscribers to call the central.

The magneto-currents which operate the call-bells and release the detents in the several signal-boxes are insufficient to operate the armature J′ of the magnet J against the resistance of the spring o, so that said currents operate the call-bells and the armatures of the magnets F F without disturbing the other parts of the mechanism. On the other hand, the impulses of current which are sent through the magnet J are of a sufficient strength to overcome the resistance of said spring o, said impulses, however, being of a constant current.

The coils F F in each of the signal-boxes being arranged in the form of polarized coils are easily operated by a light current of an alternating character, while a constant current will operate to hold the armature f in one position, it being constantly attracted at one end by said magnet, and the connections are so arranged that the impulses of the constant current intended to operate the armature of magnet J will traverse the magnet F in such a direction as to hold armature f of the magnet F immovably in the position shown in Fig. 3 of the drawings. This insures the proper operation of the detent H^2 and prevents an accidental displacement of the same in case more impulses are sent from the central along the line than are necessary to restore the several signaling devices to their normal conditions.

In order to prevent the impulses of the stronger current sent from the central over the line to operate the magnets J J from operating the call-bells at the several stations, a spring s is connected with the armature or arm of bell-hammer at each of the call-bells d',

which serves to always return said armature to a given position, and the impulses of said stronger current are caused to pass through the bell-magnet in such a direction as to operate to hold said armature immovably in said position in the same manner as before described with reference to the magnets F F.

Any desired form of motor for moving the signaling mechanism into the various positions described may be employed, that shown in the drawings being an ordinary clock-movement, to which the necessary parts have been added.

I would have it understood that I do not desire to limit myself to the combination of parts shown and described, as the construction and the arrangements of the various parts of my improved apparatus may be variously modified without departure from my original invention, and any device in which means is provided for enabling one subscriber upon a line including several telephones to call the central office and at the same time to cut off all communication between the other telephones on said line and the central office and in connection therewith and means for automatically restoring said instruments to their normal condition, so as to enable any one of said subscribers to call the central office, I would regard as coming within the scope of my said invention.

Having thus described my invention, what I claim as new, and desire to secure by Letters Patent of the United States, is—

1. In a telephone or analogous electric system, the combination, with the main line or circuit and the instruments or stations thereon, of a device located adjacent to each of said instruments or stations and connected with the main line, said device comprising mechanism under the control of a central office and serving at times to prevent the operation of the adjacent instrument, suitable means for enabling the central operator to move said mechanism into a position to permit the operation of said adjacent instrument, and suitable mechanism for automatically restoring said device to its normal position after said movements have been effected, substantially as described.

2. In a telephone or analogous electric system, the combination, with the main line or circuit and the instruments or stations thereon, of a device located adjacent to each of said instruments or stations and connected with the main line, said device comprising mechanism under the control of a central office and serving at times to prevent the operation of the adjacent instrument, suitable means for enabling the central operator to move said mechanism into a position to permit the operation of said adjacent instrument, and suitable mechanism for automatically restoring said device to its nornal position at a predetermined time after such movements have been effected, substantially as described.

3. In a telephone or analogous electric system, the combination, with a main line and a plurality of instruments or stations thereon, of a device located adjacent to each of said instruments or stations and connected with the main line, said device comprising mechanism under the control of the subscriber for placing his own telephone in circuit with the central office and for enabling him to cut off all communication between the remaining telephones and the central office, suitable mechanism under the control of the central operator for placing any desired one of the remaining telephones in condition for operation, and automatically-actuated mechanism for restoring all of said devices to their initial positions independently of said central operator at a predetermined time after said movements have been effected, substantially as described.

4. In a telephone or analogous electric system, the combination, with the main line and instruments or stations thereon, of a device located adjacent to and connected in shunt with each of said instruments or stations and with the main line, said device comprising a switch for cutting out the current therefrom, means for moving said switch by hand, and a motor for restoring said device to its initial position after a predetermined time, substantially as described.

5. In a telephone or analogous electric system, the combination, with the main line and instruments or stations thereon, of a device located adjacent to and connected in shunt with each of said instruments or stations and with the main line, said device comprising a switch for cutting off the current therefrom, means for operating said switch by hand, means for locking said switch-actuated mechanism from movement, and a motor for automatically restoring said device to its initial position after a predetermined time, substantially as described.

6. In a telephone or analogous electric system, the combination, with the main line and a plurality of instruments or stations thereon, of a device located adjacent to and connected in shunt with each of said instruments or stations and with the main line, said device comprising a switch for cutting off the current therefrom, means for operating said switch by hand, means for locking said switch-actuating device from movement, a motor for changing the relative positions of the said parts, a magnet provided with a swinging armature operatively connected with and adapted to release said motor and said locking device, and means connected with said motor for automatically restoring the parts to their initial positions, substantially as described.

7. In a telephone or analogous electric system, the combination, with the main line and a plurality of stations or instruments thereon, of a plurality of signaling-instruments, each located adjacent to one of said stations or instruments and connected in shunt therewith

and with the main line, each of said signaling-instruments comprising a switch for cutting it out of circuit, a push-button or other device for operating said switch by hand, a second switch also adapted to cut said instrument out of circuit, a motor operatively connected with said latter switch, a magnet provided with a swinging armature, means connected with said armature for releasing said motor, means also connected with said armature for locking said push-button or other device, and means operatively connected with the motor for automatically restoring the parts to their initial positions after a predetermined time, substantially as and for the purpose described.

In testimony that I claim the foregoing I have hereunto set my hand, at Milwaukee, in the county of Milwaukee and State of Wisconsin, in the presence of two witnesses.

ANTHONY B. FERDINAND.

Witnesses:
JOHN E. WILES,
N. E. OLIPHANT.