W. M. BRUCE, Jr.

SELECTIVE SYSTEM FOR PARTY LINE TELEPHONES.

APPLICATION FILED JUNE 9, 1905.

994,500. Patented June 6, 1911.

2 SHEETS—SHEET 1.

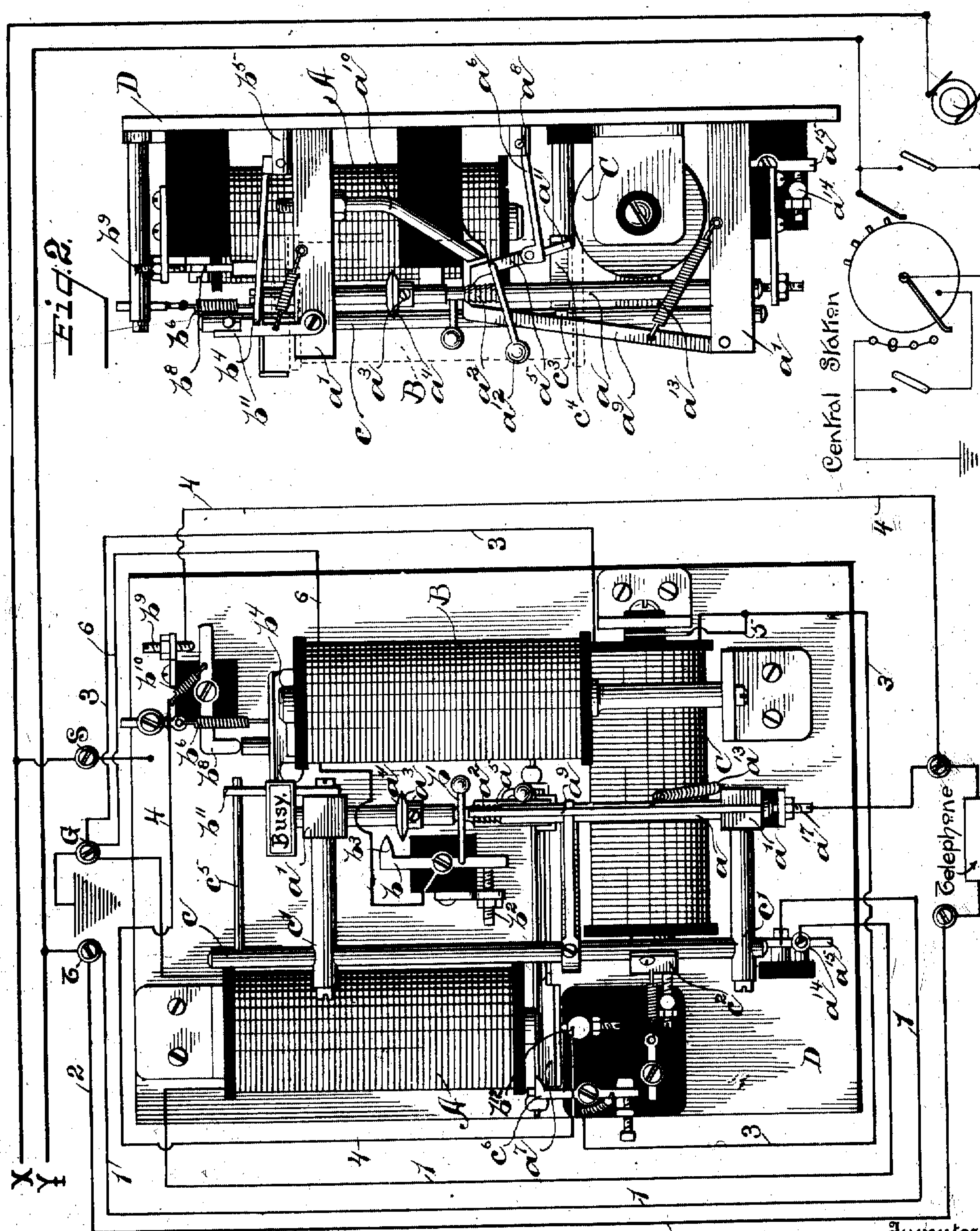

Fig. 1.

Witnesses

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2 SHEETS—SHEET 2.

Fig. 3

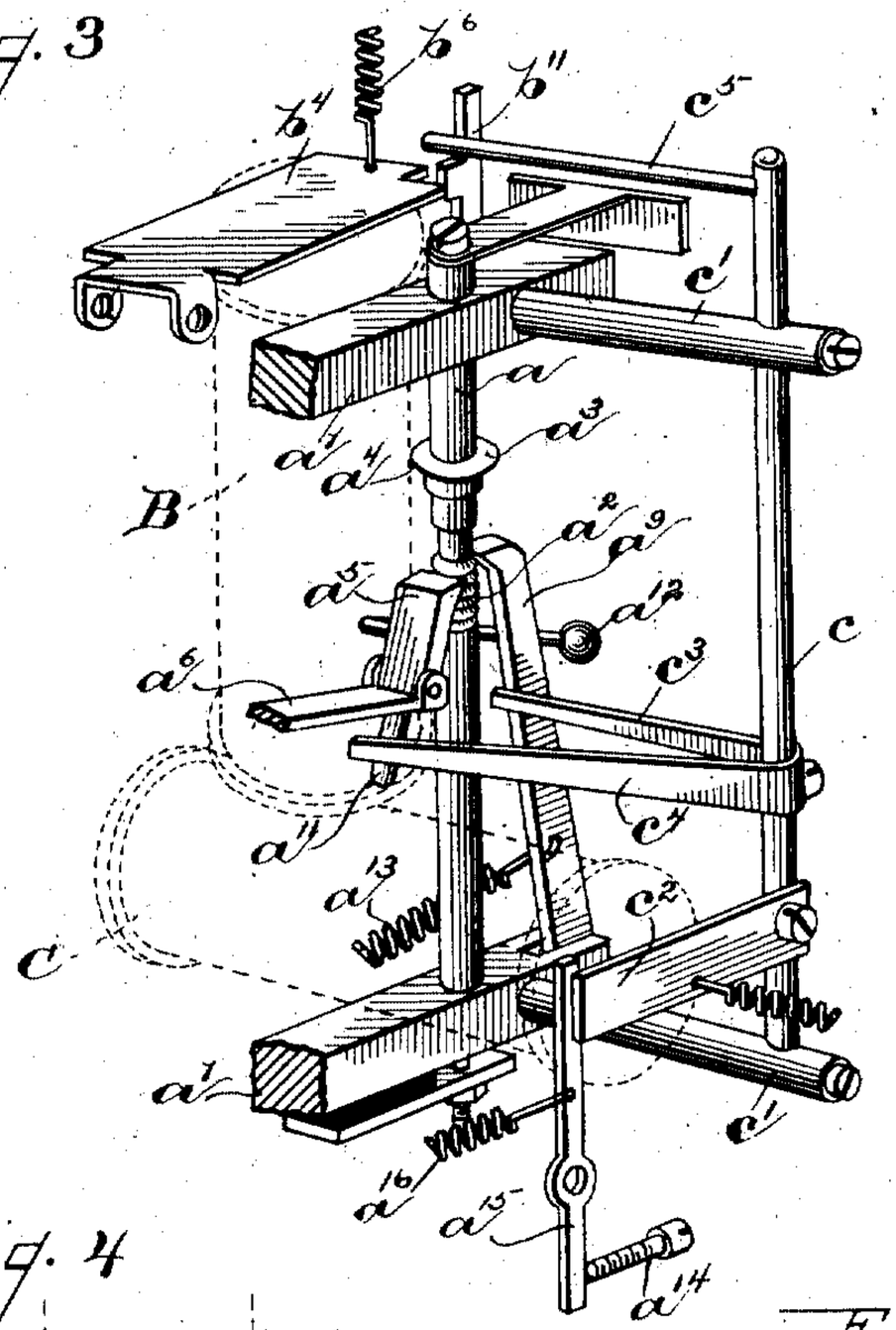


Fig. 4

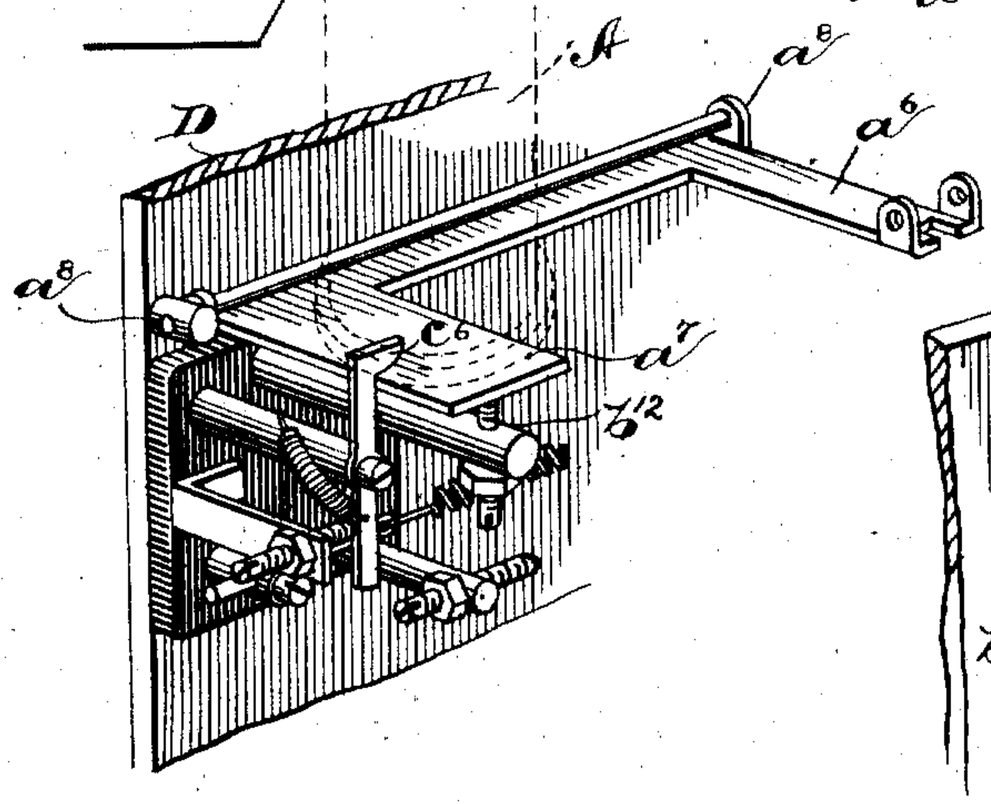
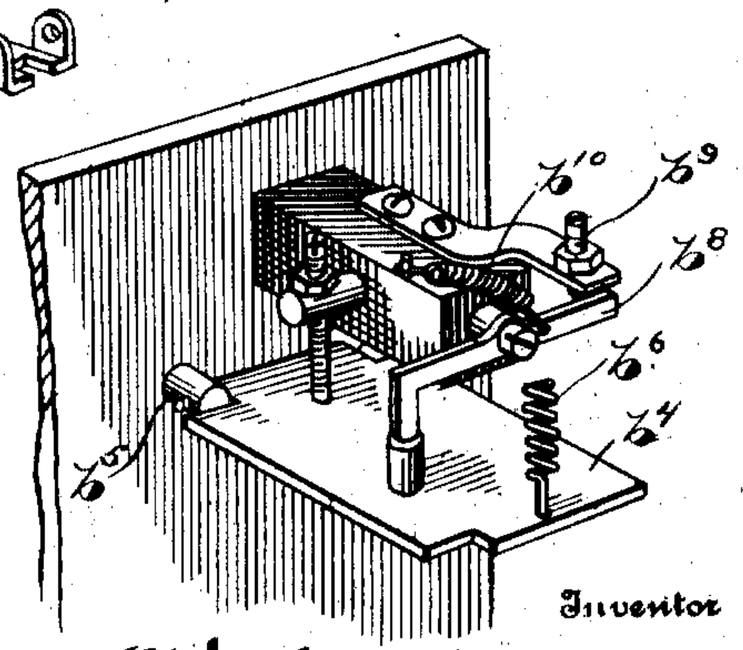


Fig. 5



Witnesses

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UNITED STATES PATENT OFFICE.

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SELECTIVE SYSTEM FOR PARTY-LINE TELEPHONES.

994,500. Specification of Letters Patent. Patented June 6, 1911.

Application filed June 9, 1905. Serial No. 264,366.

To all whom it may concern:

Be it known that I, WILLIAM M. BRUCE, Jr., a citizen of the United States, residing at Springfield, in the county of Clark and State of Ohio, have invented certain new and useful Improvements in Selective Systems for Party-Line Telephones, of which the following is a specification.

My invention relates to improvements in selective apparatus for party telephones.

The object of my invention is to provide a selective apparatus which may be employed with ordinary telephone circuits and instruments now in use, in such a way as to in no wise interfere with the talking circuits; the construction being such that the operator at the central station may select any one or more of the series of instruments on a common line, and automatically disconnect all other instruments of the series.

A further object of the invention showing the parts in normal condition is to provide means whereby upon the operation of the devices in selecting a given station, the other stations will be automatically locked out of the line, and the talking circuit brought into the line at the selected station.

A further object of the invention is to provide means whereby the various instruments in the series will be automatically synchronized by the mere operation of the central device in selecting one or more stations.

A further object is to simplify the construction as well as the means and mode of operation of said devices, and at the same time render them more efficient and less likely to get out of repair.

A further object of the invention is to provide an instrument, which shall be wholly automatic and adapted to be operated from a central energy.

A further object of the invention is to provide an instrument which may be used in connection with a central exchange, which may be either of the central energy or of the local battery type; the construction being such that the selector may be operated over the usual telephone line in harmony with the exchange apparatus circuits and instruments now in common use.

With the above objects and other incidental objects in view, the invention consists of the means, mechanism, construction and mode of operation hereinafter described and set forth in the claims.

In the drawings, Figure 1 is a front elevation of a device embodying my invention. Fig. 2 is a side view of the same with the selector magnet shown in dotted lines. Fig. 3 is a detail view in perspective of the step-up mechanism and the releasing mechanism therefor. Figs. 4 and 5 are detail and perspective views of the circuit making and breaking devices hereinafter more fully described.

In carrying out my invention I preferably employ as a basis of the operation, three electro-magnets which may be termed the step-up magnet, the selector magnet and the releasing or clearing out magnet. These magnets and their coöperating parts, together with the electric circuits, perform the different functions indicated by their respective names, that is to say, the step-up magnet is adapted, by a series of impulses, to operate a step-up device which may be given any number of steps, depending upon the number of instruments on the line. The second, or selector, magnet is adapted at certain predetermined intervals, determined by the central station apparatus, to be operated to form electrical connection with the local telephone or talking instruments at the station selected. The third, clearing-out or releasing, magnet is adapted by an electrical impulse from the central station to release the mechanism before operated, and return the parts to normal. The three magnets referred to are shown in the drawings at A, B and C, A being the step-up magnet, B the selector magnet and C the releasing or clearing out magnet.

A description of the mechanical features is as follows: The magnets, A, B, and C may be arranged in any desired form, but preferably in the manner shown in Fig. 1, all the parts being supported on a suitable base-plate or frame D, with the step-up magnet, A, upon one side, selector magnet B near the other side and parallel with the magnet A, and the releasing magnet below a line transverse to the other two magnets.

The step-up device consists preferably of a rod, *a*, extending longitudinally through the center of the apparatus, and preferably arranged vertically so that it may

be moved upwardly by the electrical impulse in the step-up magnet, and adapted, when released, to drop by gravity. This rod, a, is preferably mounted at or near each end in bearings, a^1—a^1, the rod itself being a perfectly plain straight rod, except for a series of notches which are turned or otherwise formed therein, as shown at a^2. The rod is preferably round. These notches form the different steps, there being as many notches as there are stations to be placed upon the line and one or more in addition. There is mounted on this rod, a, a contacting device, a^3, preferably in the form of a collar with a projecting flange beveled on its outer edges, as shown at a^4, and mounted adjustably on the rod, a. The contacting devices, a^3, on these step-up rods in the different instruments, are adjusted to correspond to the different steps in the rod, so that if all the rods of all the instruments were placed side by side these contacting devices would be separated one from another at distances corresponding to the steps, a^2, in the rods.

To operate the step-up rod, I employ a pivoted pawl, a^5, pivoted to the end of an arm, a^6, formed on an extension of the armature a^7 of the step-up magnet. This armature, a^7, is pivoted as shown at a^8—a^8 to suitable bearings or supports on the main supporting plate D, and is so arranged that when the armature is attracted by the energized magnet A, the pawl a^5 will engage in the notches or steps, a^2, thus moving the rod one step. A retaining latch or holding pawl, a^9, is adapted to hold the rod in the moved position until the same is released. Adjacent to the pawl, a^5 is a stationary projection, a^{10}, against which the operating pawl is adapted to contact as it is moved by the armature of the step-up magnet, the contacting surfaces of the respective parts being wedge-shape, so that the pawl on the limit of its operating stroke, will not only be positively stopped, but will be wedged into the notch and held in this position so long as the magnet is energized, whether this be by an alternating current or direct current, all vibration of the operating arm being prevented. Adjacent to the step-up rod, a, and adapted at a predetermined movement of the step-up rod to contact with the flange, a^4, on said rod, is a swinging contacting device, b, which is electrically connected with the selector magnet, B, in a manner hereinafter more fully described. This contact, b, is preferably an L shaped lever pivoted near its center and provided with a weighted arm, b^1, which normally holds it against an adjustable stop, b^2, the contacting portion, b^3, of said arm being preferably beveled to correspond with the bevel of the flange, a^4, so that the contacting surfaces are adapted to pass each other with but slight friction, and at the same time form while in contact one with the other an electrical connection. Supported parallel to the step-up rod, a, is a rod or shaft, c, journaled at or near its respective ends in bearings or supports, c^1, which extend laterally from the bearing supports, a^1, for the step-up rod. This rod or shaft forms a pivotal support for an armature, c^2, of the releasing magnet C, and also carries thereon two projecting arms, c^3 and c^4, one of which, c^3, contacts with the holding pawl, a^9, and the other, c^4, with an extension a^{11} of the operating pawl, a^5, so that when the rod, c, is turned by the forward movement of the releasing armature, c^2, both the operating and the holding pawls, a^5 and a^9, will be withdrawn from contact with the notches in the rod, a, and permit the same to return to normal position. The operating pawl, a^5, is preferably provided with a weight, a^{12}, so that it is held by gravity in contact with the rod, a, and the notches therein, while the holding pawl, a^9, is provided with a spring a^{13} which holds it in contact with the rod. It will be seen from the description thus far, that at each electrical impulse passing through the step-up magnet, A, its armature will be vibrated, which will cause the step-up rod, a, to move one step, so long as the current is passing through said armature, the operating pawl will be held in engagement with the step-up rod. When the armature is de-magnetized, the step-up armature and operating pawl will drop back to normal position, and the step-up rod will be held in advanced position by the holding pawl, a^9. If in this position, or any position of the step-up rod, the releasing magnet, C, should be energized, the movement of the release armature would disengage both the operating pawl and the holding pawl from the rod, and permit it to return to normal position through the operation of the shaft, c, and the projecting arms, c^3 and c^4.

The selector magnet, B, is also provided with a hinged or pivoted armature, b^4, hinged to suitable projections, b^5, on the plate, D, as shown at Fig. 2. (See also Fig. 5.) This armature, b^4, is normally retracted by a spring, b^6, and contacts with an L shaped circuit closer, b^8, which is adapted, when released, to establish an electrical connection with the contact point, b^9. The circuit closer, b^8, is moved to its contacting position, by a spring, b^{10}, which is also preferably adapted to form the electrical connection with said switch lever. In the normal position of the selector armature, b^4, the circuit closer, b^8, is held out of electrical contact with the point, b^9; when said armature is operated, however, an electrical connection is established through the switch, b^8 and contact point, b^9.

Adjacent to the free end of the armature, b^4, is a spring-catch, b^{11}, which, when the armature is moved by the magnet, engages with the said armature and holds it in inward position. A projecting arm, c^5, on the oscillating rod or shaft, c, is adapted to contact with the end of this spring-catch, b^{11}, and operate the same when the release magnet is operated, thus permitting the armature to return to its normal position.

Adjacent to the armature, c^2, of the release magnet, C, is a circuit breaking device, consisting of a contacting point, a^{14} and a pivoted switch lever, a^{15}, which is also in the nature of an armature, being adapted to be attracted to the core of the release magnet when the same is energized, and to be retracted by a spring, a^{16}. This auxiliary armature or circuit breaker lies at the side of the core of the release magnet, while the armature proper c^2 of said magnet, is located at the end of said core.

The main line entering the station is represented by X Y, in Fig. 1. The respective sides of this line are connected to two binding posts, marked T and S, a third binding-post, marked G, being connected to ground. The sides of the line marked T and S correspond to what is technically known as the tip and sleeve of the plug, used on the switchboard at the central station to establish connection between different lines or with the talking instruments of the central operator.

From the binding post, T, an electric connection is established, through circuit 1, switch lever a^{15}, and contact, a^{14}, step-up magnet A, thence to G, or ground. A connection is also established from T through circuit 2 to the ordinary subscriber's telephone outfit to a contact point, a^{17}, which in the normal position of the step-up rod, a, is in electrical contact with said rod, the circuit passing from said rod and its supports to the main supporting plate, D, through said plate to the opposite or sleeve side, S, of the main line. This circuit establishes the usual connection between the subscriber and central when the instruments are in normal position. A third connection is established from G by circuit 3 through the release or cut-out magnet, C, to ground. This circuit includes a switch or circuit-breaker, c^6, which is adapted, at each oscillation of the step-up armature, a^7, to establish an electrical connection through the main supporting plate, D, and the said armature, by contacting with said circuit breaker, c^6. This circuit or connection through the release or cut-out magnet, c, to ground is traced as follows: from G by a line 3 through the release magnet, c, to circuit breaker c^6, which circuit breaker is insulated from the plate, d, but which is adapted to make electrical contact with the armature, a^7, which is in electrical contact with the base plate, D, and thus with terminal or binding post, S, the circuit being traced by line 3 through the magnet, c, the circuit breaker c^6, armature a^7, plate D, and terminal S. Another electrical connection is established from T through circuit 4 through the subscriber's telephone outfit to S, the circuit being established from the contact b^{12} and the step-up armature a^7 through the main frame or plate, D, as heretofore described. Another electrical connection is established from T through line 1 to switch a^{15}, and from said switch when the same is operated by the releasing magnet, C, through the core of said magnet and line 5, thence through said release magnet, C, and line 3 to ground. Another electrical connection is established from the switch, b, through the selector magnet, B, by circuit 6 to ground.

The operation of the devices thus described is as follows:—Means are provided at the central office for sending a series of impulses over one side of the line which connects with T. These impulses are transmitted through circuit 1 to the step-up magnet, A, to ground. At each impulse, the armature of said step-up magnet is attracted and moves the step-up rod one step. At each movement of the step-up armature a connection is established through circuit 3 above described to the binding-post S and to the other side of the line, but as no current is flowing through this line at that time no effect is produced on the release magnet, C. The rod, therefore, continues to be stepped up until it reaches the limit of its movement, all the rods in all the instruments being simultaneously moved. As the contact, a^4, on the rod passes the switch lever, b^3, a circuit is established from binding-post S through said rod, and through the selector magnet B and circuit 6 to ground. If, therefore, while these parts are in contact an impulse should be sent over the opposite side of the line to binding post, S, a connection would be established from that side of the line through the selector magnet to ground, which would energize said magnet and establish a connection by the circuit closer b^8, from T to S through circuits 2 and 4. This circuit would be broken, however, at the contact b^{12}, upon each movement of the step-up armature. When the armature was in its normal position and the step-up rod had reached the limit of its stroke, that instrument which had received an impulse from the side X of the line at the time the contact flange a^4 was in connection with the switch, b^3, would have its subscriber's telephone outfit bridged across the line, all others being disconnected therefrom, by the breaking of the circuit which would take place on the first step of the rod which separates said rod from the contact a^{17}. The rod carries at the top a "Busy" sign which is

adapted to be displayed through an opening in the casing which surrounds the instrument, and as the rods operate simultaneously in all of the instruments, all said signs will be displayed at the same time. The parts remain in this position until the selected subscriber is disconnected. It will be seen that while in this condition any number of impulses may be passed from T or the T side of the line through the step-up magnet, which would attract the step-up armature without any further result than breaking the contact at b^{12}. If, however, an impulse should be sent over both sides of the line from ground at the central station, the step-up armature would be attracted and establish a connection through the release or clearing-out magnet, C, which in turn would operate the circuit breaker, a^{15}, disconnect the step-up magnet, permit the step-up armature to be released, establish a connection through the circuit-breaker, a^{15}, and the core of the release magnet from ground to the opposite side of the line, which would operate the release armature, the rod or shaft e, release the step-up rod and the selector magnet, and permit all the parts to return to their normal position.

Inasmuch as the selected subscriber's telephone outfit is bridged across the line, if an impulse was sent over one side of the line, only, to ground, for the purpose of releasing, the current would be divided between the ground connection and through the other circuit offered through the subscriber's talking outfit to the main line provided the battery at central station was grounded as is usual a sufficient current might not be secured to affect the release until the subscriber should hang up his telephone, and thus cut this instrument out of circuit. By the arrangement described, however, of sending the clearing-out impulse in the same direction from ground at central to both sides of the line to ground at the subscriber's station, the bridging of the talking instruments across the main line will not prevent the operator from, at any time, releasing the line, and thus obtaining possession of the line for other subscribers in the case that one subscriber should attempt to retain the line, or should leave his receiver off the hook.

The circuits which I have described here are those which are especially adapted for use with central energy system. By the arrangement shown, an operator at the central station has complete control over the local instruments.

Inasmuch as in the normal position of the selector instrument, each subscriber can get directly on the line by removing his telephone hook in the usual way, it might happen, in the event that a subscriber's receiver was down at the time his call was made, that sufficient current might be diverted through this path to prevent the step-up magnet from working satisfactorily, but, inasmuch as but a slight amount of energy is sufficient to start the step-up armature, this talking circuit would be immediately broken at the contact b^{12}, thus diverting the entire current through the step-up magnet and operating the step-up rod which immediately disconnects the subscriber at the contact a^{17}. The circuit breaking device, a^{15}, operated by the release magnet also, as soon as the release magnet is energized, breaks the circuit through the step-up magnet, and allo[illegible] the step-up mechanism to return to its normal position to permit the release of the parts which otherwise could not take place if the step-up magnet was energized, and the armature held attracted to said magnet. The use of the circuit breaking device to establish a new circuit through the core of the release magnet also insures a circuit through said release magnet, which can be utilized as long as necessary to insure the release of all the parts.

I have referred to the fact that more steps are employed in the step-up rod than there are stations, generally one extra step suffices. This is to insure that the contacting flange, a^4, shall pass the switch, b^3, no matter what station is selected, the interval of contact only being utilized for operating the selector magnet, and establishing the talking circuit for the subscriber selected. Any number of steps, however, may be employed more than are required for the number of stations. Suppose an instrument should be constructed for ten subscribers, eleven steps would, ordinarily, be employed. This instrument could be used for any number of subscribers less than ten and they could be made to operate on every step or every alternate step, as desired, it being only necessary that there are as many steps as there are subscribers, and at least one more, employed.

As before noted, the springs which operate the switches for making the contact, such as b^4, c^6, etc., are used to establish an electrical connection with said switch, and thus furnish an electrical connection which is positive and independent of the pivotal connections with the frame or supporting parts.

As the releasing of the step-up device by means of the clearing-out magnet, is entirely independent of the operation of the step-up device, each operation of the step-up device will tend to synchronize the movement of all the step-up devices in the event one should be displaced. For instance, if one of the step-up rods should be moved one or two notches in advance accidentally or otherwise before the calling operation is performed, this particular rod would not operate correctly on the first call if that particular instrument should happen to be called. It would, however, reach the limit of its

movement before the other devices, at which point it would be arrested until all the other devices had been brought in synchrony therewith; all of the devices would then be released synchronously and would fall together so that on the next operation they would be in proper step. No accidental displacement of the rod, therefore, in one instrument would affect more than the first operation, so that if the operator should fail to get the proper subscriber on the first operation, by reason of some displacement of the step-up rod, it is only necessary to repeat the operation and the instrument would simply be released by the operation of the operator's release key and the operation of calling repeated, the next operation bringing them automatically into step or in synchrony.

Having thus described my invention, I claim:—

1. The combination with a subscriber's telephone outfit, bridged to cross a main telephone line by a circuit having two branches, one of which is normally closed and the other is normally open, a step-up magnet located in a branch extending from one side of said line to ground, a circuit breaker operated by said magnet to close and open one branch of said subscriber's circuit at each impulse of the said step-up device, a selector magnet adapted to close the normally open branch of said subscriber's circuit when the step-up device is moved to a pre-determined position, the movement of said step-up device being adapted to open the normally closed branch at the first movement thereof, substantially as specified.

2. In a selective instrument, a step-up magnet, a selector magnet, a release magnet, the step-up magnet being located in a normally grounded circuit connected to one side of the telephone line, and the release and selector magnets being located in normally open grounded circuits from the other side of the line, a circuit closing device adapted to be operated by said step-up magnet at each electrical impulse to close the circuit through said release magnet, and a circuit closing device adapted to be operated at a pre-determined number of impulses of said step-up magnet to close the circuit through said selector magnet, and a subscribers' telephone outfit bridged across said main telephone line, the circuit for said subscriber's outfit having two branches, one normally closed and the other normally open, the normally closed branch being adapted to be opened at the first movement of the step-up magnet, and the normally opened branch being adapted to be closed by the operation of the selector magnet, substantially as and for the purpose specified.

3. In combination with a subscriber's telephone outfit bridged across a main line, a step-up magnet in a grounded circuit from one side of said line and a release magnet adapted to be brought into a grounded circuit from the opposite side of said main line, a switch operated by said release magnet to break the circuit through said step-up magnet, and establish a circuit through said release magnet from the opposite side of said line, substantially as specified.

4. The combination with a step-up rod having a series of steps and a holding pawl engaging in said steps to hold it in any desired position, a step-up magnet and its armature carrying a pawl adapted at each impulse to move said rod one step, a selector magnet having an armature, a circuit closing device operated thereby, and a catch for holding said armature in its advanced position but operated by said magnet, a circuit closing device for said selector magnet operated by a predetermined movement of said step-up rod, a release magnet and its armature adapted to break the circuit through said step-up magnet and to operate said holding pawl and catch, and permit the parts to return to normal position, substantially as specified.

5. The combination with a vertically moving rod having a series of steps, an operating pawl and a holding pawl, means for reciprocating said holding pawl, an oscillating release shaft adjacent to said rod, an arm on said shaft engaging each of said pawls, and a release magnet and its armature adapted to oscillate said shaft, substantially as specified.

6. The combination with a gravity-rod, an operating pawl and a holding pawl, a release shaft having projections to engage said pawls, a selector device having a holding catch, a release magnet, and an armature for said magnet connected to said release shaft and a projection on said release shaft to operate said catch, substantially as specified.

7. The combination with the step-up rod of an operating pawl, a holding pawl therefor, a circuit closer operated independent of said step-up rod and means for preventing the opening of said circuit closer when in closed position, a release magnet and its armature, and means for simultaneously operating said pawls and releasing said circuit closer by the operations of said magnet, substantially as specified.

8. In a selective signal instrument, a step-up device consisting of a plain cylindrical rod having a series of notches therein, a reciprocating pawl for successively engaging said notches to operate said rod in one direction, an adjustable flange on said rod, and a pivoted contacting device adapted to contact with said flange in passing, and means independent of the rod-moving device for releasing the same and permitting

it to fall by gravity, substantially as specified.

9. The combination with a series of telephone stations on a single line, of a series of selective instruments, each having a step-up device consisting of a plain, straight rod with a series of notches, an adjustable flange on said rod adapted in its movement to contact with a pivoted contacting device, means for synchronously operating said rods, an electrical circuit, including a selector magnet, at each station adapted to be energized through said step-up rod by said flange in passing said contacting device, and a clearing-out magnet for releasing said rod and also said selector device, substantially as specified.

10. In a selective instrument, a step-up mechanism embodying a vertically arranged loosely supported cylindrical rod having a series of circumferential notches therein, a reciprocating pawl for successively engaging said notches to operate said rod in an upward direction, a circular collar or flange mounted adjustably on said rod and a yieldingly contacting device adapted to contact said flange by the movement of said rod, a signal device attached to said rod and adapted to move therewith, means for concealing said signal except when at a predetermined position in the movement of said rod and means independent of the rod moving device for releasing the rod and permitting it to fall by gravity.

11. The combination with a series of telephone stations on a single line, a series of selective instruments each having a step-up device consisting of a plain straight rod having a series of notches, an adjustable flange on said rod adapted in its movement to contact with a circuit closer, means for synchronously operating said rods and holding them in their advanced positions, a selector magnet at each station adapted by a predetermined movement of said step-up rod to be brought into circuit by the flange on said rod contacting said circuit closer, and a release magnet at each station and means for synchronously operating said release magnets to release said rods and said selective devices, substantially as specified.

12. In a selective instrument, a step-up magnet, a selector magnet and a clearing-out magnet, a step-up device consisting of a plain straight cylindrical rod with a series of notches, and a step-up pawl engaging said notches operated by said step-up magnet, a circuit breaker also operated by said step-up magnet at each movement of its armature, means on said rod for closing a circuit through said selector magnet when said rod reaches a predetermined position, a circuit closer operated by said selector magnet and means for holding the same in its closed position, and a releasing magnet operated independently of said selector and said step-up magnets for releasing said rod and also releasing the circuit closer operated by said selector magnet, substantially as specified.

13. In a selective instrument, a step-up magnet and a selector magnet, a step-up rod arranged between and parallel with said magnets, a release magnet at right angles to said rod, a pawl operated by said step-up magnet to engage and operate said step-up rod, and a holding pawl also adapted to engage and hold said rod, a catch for the armature of said selector magnet, a shaft journaled in proximity to and parallel with said step-up rod connected to the armature of said release magnet so as to be oscillated thereby, and connections from said shaft to the step-up and holding pawls and the selector magnet catch, as and for the purpose specified.

14. In a selective instrument, a step-up device consisting of a plain cylindrical rod having an adjustable flange, a pivoted contacting device adjacent thereto adapted to contact with said flange, a step-up magnet and a selector magnet adjacent to and parallel with said rod and a release magnet at right angles to said rod, means connected with said release magnet to release said rod when said magnet is energized and permit said rod to fall by gravity and also to release the armature of said selector magnet, as and for the purpose specified.

In testimony whereof, I have hereunto set my hand this 6th day of June A. D., 1905.

WILLIAM M. BRUCE, Jr.

Witnesses:

Chas. I. Welch,

Clara Gallagher.