(No Model.) 4 Sheets—Sheet 1.

W. CHILDS.

TELEPHONE EXCHANGE SYSTEM.

No. 528,590. Patented Nov. 6, 1894.

Fig. 1.

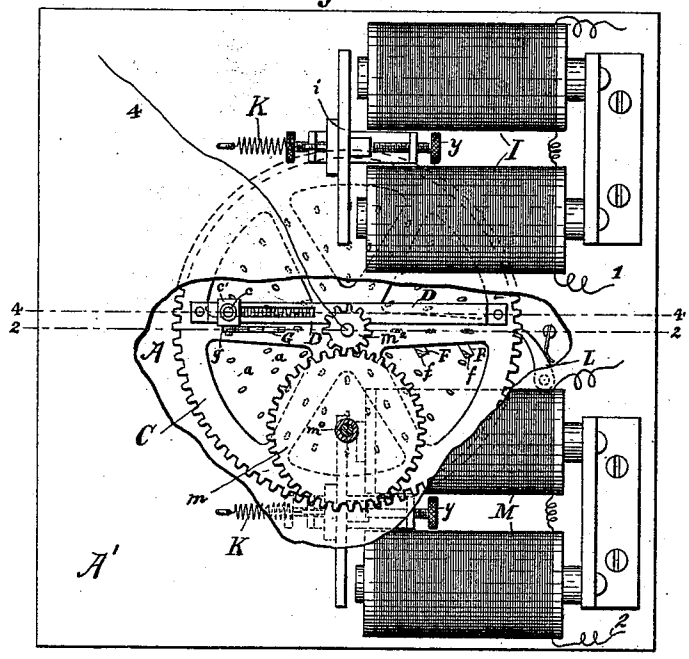


Fig. 2.

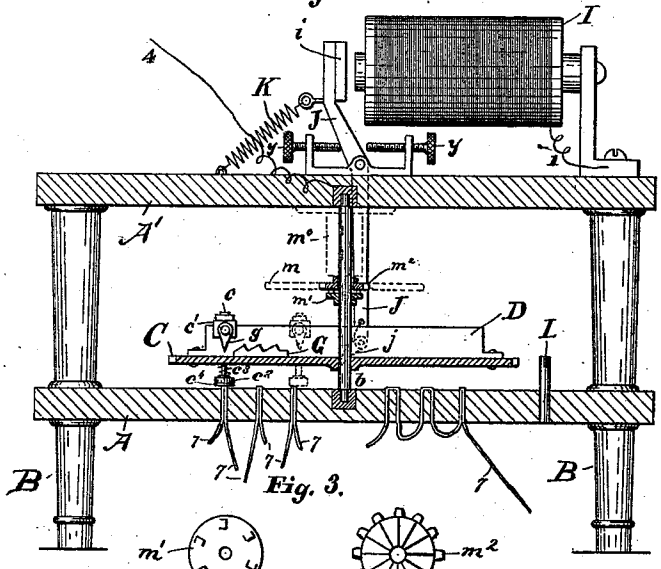


Fig. 3.

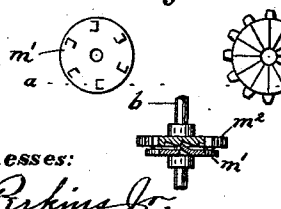


Fig. 4.

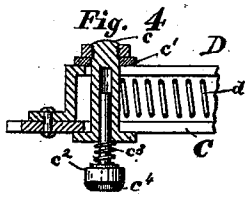


Fig. 5.

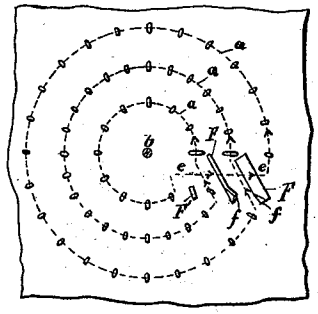


Fig. 6.

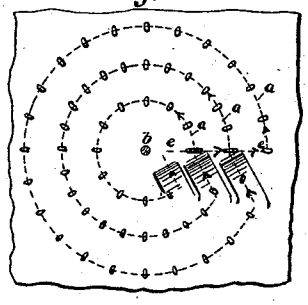


Fig. 7.

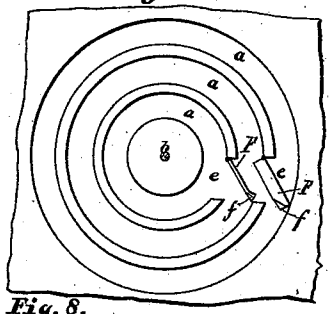
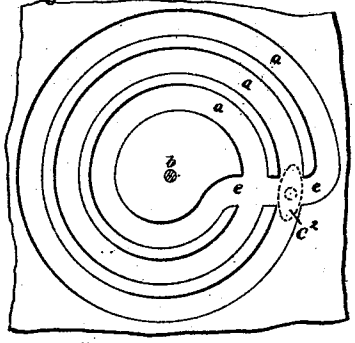


Fig. 8.



Witnesses:

N. W. Perkins Jr.

D. W. Remmers.

Inventor:

Wallace Childs

(No Model.) 4 Sheets—Sheet 2.

W. CHILDS.

TELEPHONE EXCHANGE SYSTEM.

No. 528,590. Patented Nov. 6, 1894.

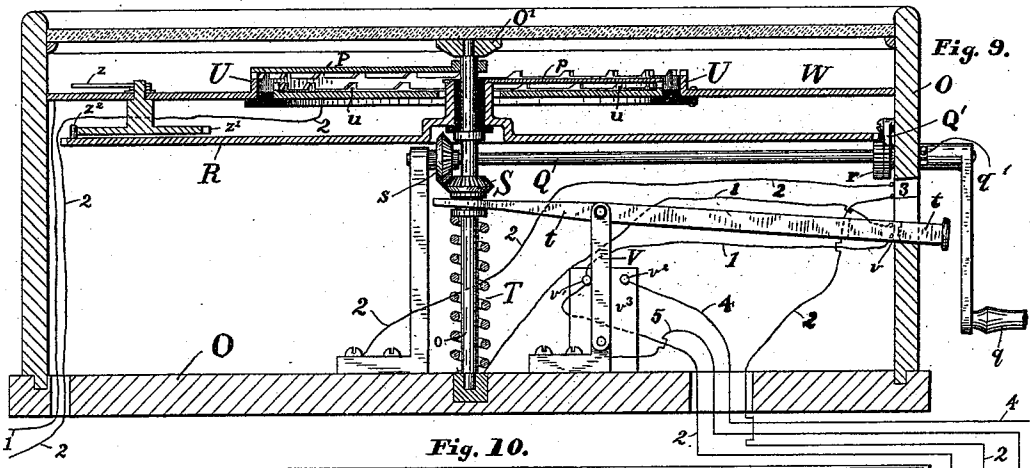
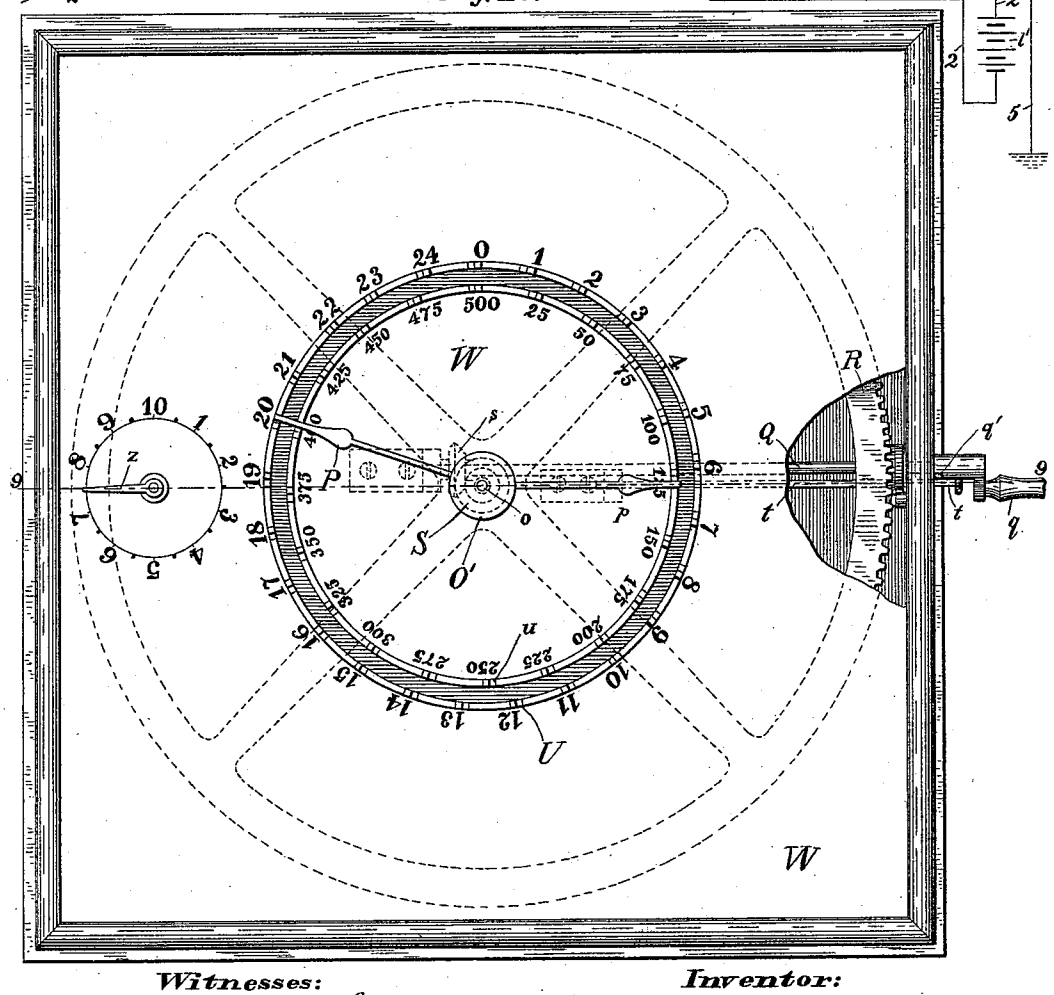


Fig. 9.

Fig. 10.



Witnesses:
N. W. Perkins Jr.
J. W. Remmers.

Inventor:
Wallace Childs

(No Model.) 4 Sheets—Sheet 3.

W. CHILDS.

TELEPHONE EXCHANGE SYSTEM.

No. 528,590. Patented Nov. 6, 1894.

Fig. 11.

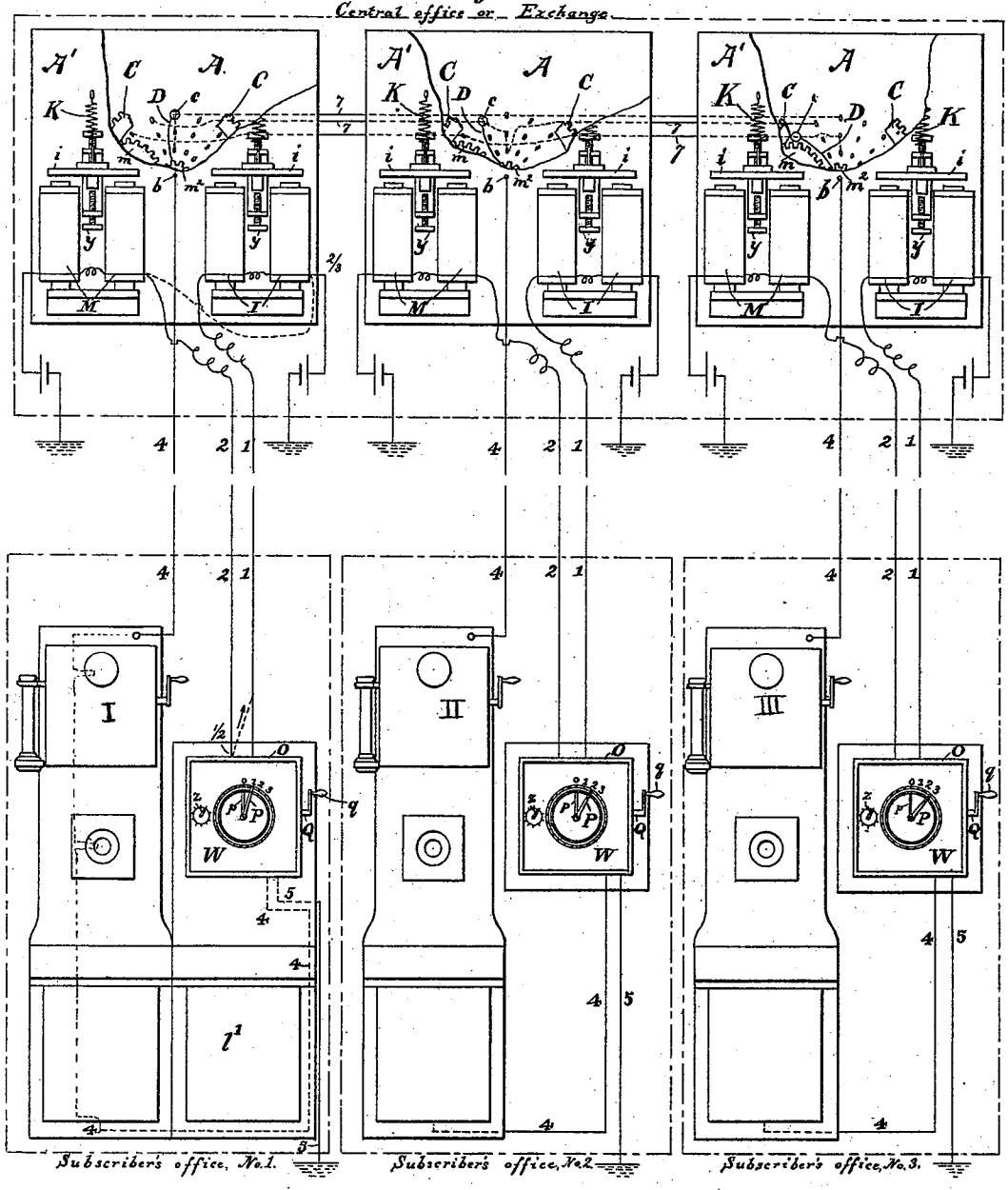
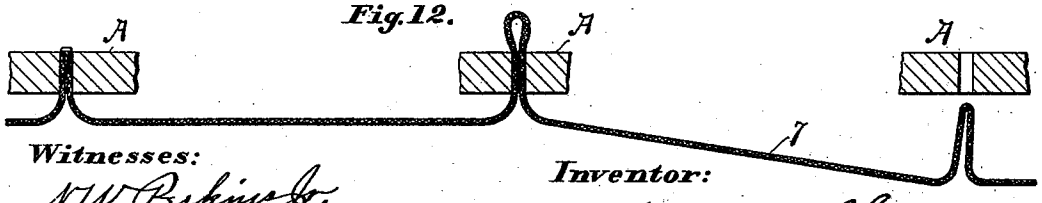


Fig. 12.



Witnesses:
N. W. Perkins Jr.
T. W. Remmers.

Inventor:
Wallace Childs

(No Model.) 4 Sheets—Sheet 4.

W. CHILDS.

TELEPHONE EXCHANGE SYSTEM.

No. 528,590. Patented Nov. 6, 1894.

Fig. 13

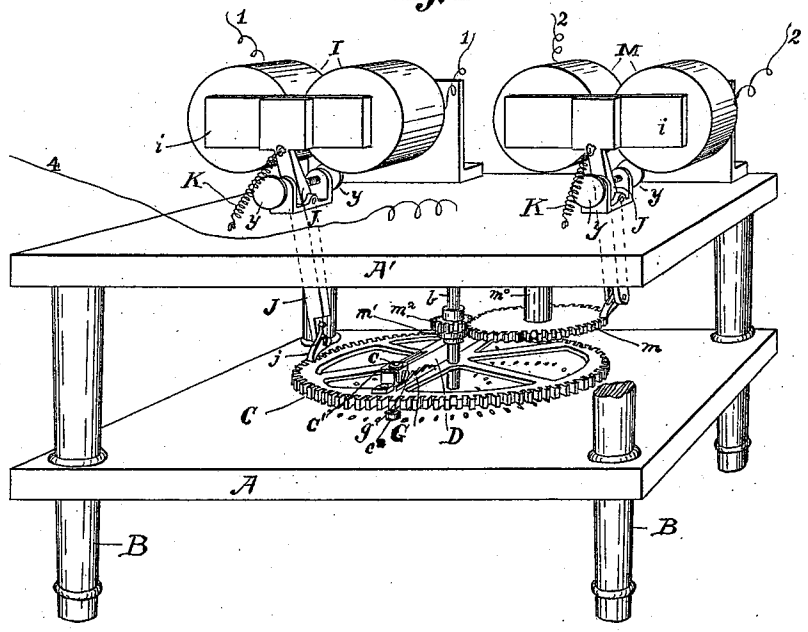
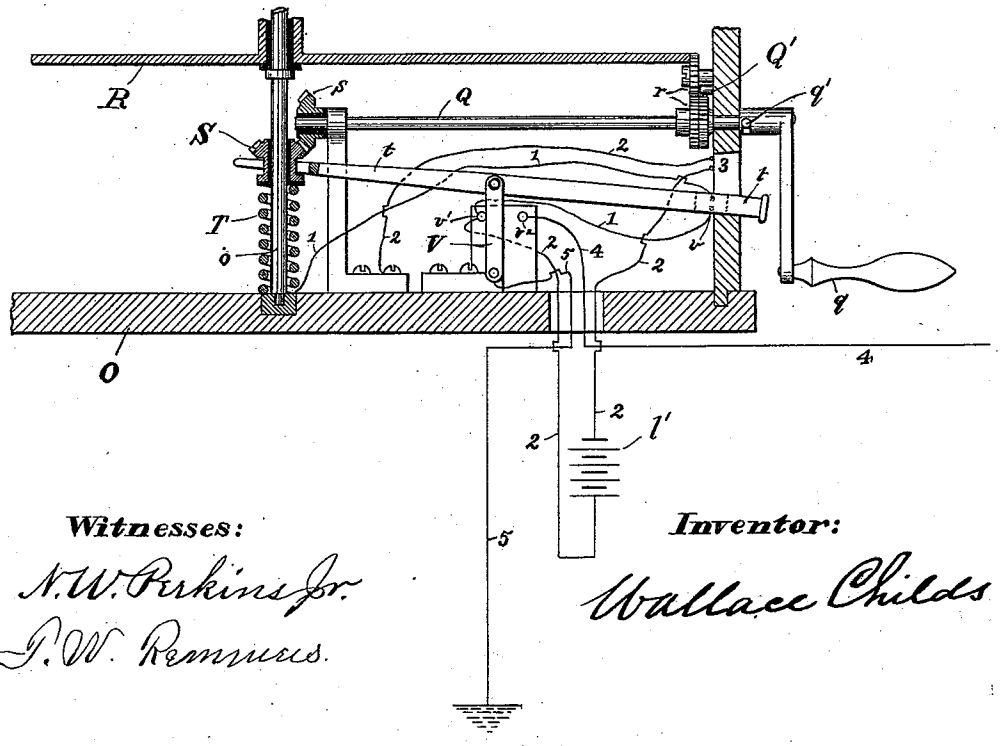


Fig. 14.



Witnesses:

N. W. Perkins Jr.

J. W. Remmers.

Inventor:

Wallace Childs

UNITED STATES PATENT OFFICE.

WALLACE CHILDS, OF FORT SMITH, ARKANSAS.

TELEPHONE-EXCHANGE SYSTEM.

SPECIFICATION forming part of Letters Patent No. 528,590, dated November 6, 1894.

Original application filed May 27, 1890, Serial No. 353,325. Divided and this application filed May 12, 1891. Serial No. 392,455.

(No model.)

To all whom it may concern:

Be it known that I, WALLACE CHILDS, of the city of Fort Smith, county of Sebastian, State of Arkansas, have invented certain new and useful Improvements in Systems of Telegraphic or Telephonic Exchanges, of which the following is a specification.

My present invention is shown in part in an application by me, Serial No. 353,325, filed May 27, 1890; but such features specified in said application and shown herein are designed to be divisional with said application.

My invention relates to telegraphic, or telephonic exchange systems in which the subscriber's circuits are all connected with a common "central office," where connection is made between the subscribers' circuits over which telegraphic, or telephonic communication is desired to be had, by the subscribers thereto; and the object of my invention is to provide improved switching means for automatically making connections between the subscribers' telegraph, or telephones and disconnecting the same without the services of operators or attendants at said central office.

This object I attain by the mechanism illustrated in the accompanying drawings, in which—

Figure 1, is a plan or top view of a switching instrument containing my invention and adapted to be used in such systems. Fig. 2, is a central longitudinal section on the line 2—2 of Fig. 1. Fig. 3, is an enlarged side elevation of a part of Fig. 2, with a part in cross section on line *a*—*a* and also several of the gear wheels thereat, the use of which will be shown hereinafter. Fig. 4, is a fragment of a cross section on line 4—4 of Fig. 1, showing the traveling switch, means for permitting it to move transversely to the switch-path and the detail-construction of said traveling switch. Fig. 5 is a plan view of the bottom plate on which the switch-path is arranged, showing the circuit wires and the deflecting flanges arranged thereon. Figs. 6, 7, and 8 show preferable forms in which the switch-path may be arranged on said bottom plate. Fig. 9 is a transverse vertical section on the line 9—9 of Fig. 10 of a switch-operating-instrument containing my invention which is designed to be placed in the subscribers' office and to be electrically connected with the switching instrument of his line at the central office, for operating the traveling switch of the latter. Fig. 10 is a plan view of said switch-operating-instrument showing the dials thereon and the hands thereof. Fig. 11 is a diagrammatic view of three switching-instruments and three switch-operating-instruments connected together in a system of the class mentioned, and three telephones of ordinary construction to be connected together as shown hereinafter. Fig. 12 shows three fragments in cross section of the bottom plates of three switching instruments in the central office and also a wire connecting the same in a manner contemplated in this system and for a purpose hereinafter shown. Fig. 13 is a perspective view of my switching instrument. Fig. 14 is a fragmental cross-section of my switch-operating instrument, showing how the gearing should be arranged to operate the crank reversely to that shown in Fig. 9—also showing the insulation about the gears S *s*.

The general plan of my improved switching-instrument embraces a coil or concentric circular route for the purpose of giving great length of path or a series of paths within a small area. In such path or paths are arranged contact points with switch wires for all the subscribers' telegraph or telephone lines of the system, and in connection with such switch-path or paths is provided a traveling switch which is attached to a revolving arm or support carrying said switch along such path or paths, the connection of said switch to its support being such as to permit said switch to move along on the support in a direction transverse to such path or paths and for keeping the switch in lateral adjustment therewith.

The general plan of the switch-operating-instrument embraces two contact plates, each provided with a series of contact points projecting therefrom for making and breaking electrical connections, one of said plates being adapted to a revolving pointer for moving and indicating the movement of the traveling switch at the central office to bring it into connection with the switch-path contact points of the subscribers' lines which are lo-

cated within certain distances of each other; and the other of said plates being adapted to another revolving pointer or hand, which is adapted to be operated as desired in connection with, or independently of the first named pointer, for moving the traveling switch at the central office to bring it into connection with the contact points of the subscribers' lines which are located in the switch-path without the certain distance covered by the first pointer, and indicating the amount of such movement.

Referring to the drawings, A designates the switch-board constructed of non-conductive material preferably a hard rubber plate, and A′ is the top made of any suitable material which is supported by the legs B or in any other convenient manner. The switch-path *a* of the switch-board is arranged in the form of a coil, or concentric circles.

Over the switch-board and supported by a shaft *b* is arranged a wheel C; and upon said wheel, is an arm or slotted case support D, upon which is arranged a traveling switch *c*. The switch is carried around but always in the same general direction of the length of the path *a*, by the rotation of said wheel. The traveling switch is attached to a slide *c′* and is thereby rendered capable of longitudinal movement on the arm D, and it is under the pressure of a spring *d* tending to move it outward. The bottom of said traveling switch is provided with a movable stem and head c^2, the stem of which is preferably provided with a spring c^3 which is attached to the bottom of the body of *c*, and to a metal washer fitting tightly on the stem which impinges on the head c^2 and tends to press said head out of the socket of *c* as shown in Figs. 2 and 4. Over the bottom of the head c^2 a washer c^4 of non-conductive substance preferably of hard rubber, is fitted like a collar, which is designed to prevent said head c^2 from presenting a greater contact surface to the circuit wire 7, than the extended electrode point of said head c^2 which projects through in the center of said collar as shown in cross section at the bottom of c^2 in Fig. 4, but said collar c^4, may be omitted and not impair the working of the traveling switch. The stem head c^2 moves against guide flanges F in or alongside of the path or paths *a* which are adapted to deflect the head c^2 and thereby compress the spring *d* by moving the slide *c* inward, as the arm moves around against said flange. Said flanges may be either movable or stationary, or both. If movable they are preferably hinged to the plate A so as not to go back beyond a perpendicular and are provided with a slightly turned up corner *f* against which the head c^2 of the traveling switch strikes and turns up said flanges temporarily as the switch passes that point and is deflected by said flanges in its revolutions; the flanges when up operating as guides for said switch from one circle or coil to that of another circle or coil of the path *a*.

To the arm D is attached at the side a ratchet G, with pawl *g* on the sliding piece *c′*, which engage together and hold the traveling switch against the spring *d* until said switch is on the inner coil or circle and passed the last flange at F′, and is directly in line with the return route *e*—*e* of said switch, when said pawl is carried past the inner end of the ratchet and will drop down into a vertical position and slide back over the teeth of the ratchet when the switch passes out over the way *e*—*e* and over the flanges which are normally down thereat or hinged so as not to obstruct the outward passage of said switch, until the pawl is carried outward beyond the end of the ratchet bar G, as shown in Fig. 2, so that the inward compression of the spring *d* caused by the rotation of the arm D, against the flanges F when released will again bring the pawl into working position on the ratchet.

In Fig. 5, F′ shows the deflecting flange stationary and attached to plate A.

In Fig. 6 the path *a* is depressed in the plate A, at the way *e*—*e* which leaves the flanges separating said depressed portions of the path *a*, stationary and standing in same relative position as shown in Fig. 5.

In Fig. 7 is shown the path *a* depressed in the plate A, continued its full length and the part of the flange F at the way *e*—*e* made movable to turn up or down while other parts of said flange are continued in concentric circular rims or stationary flanges.

In Fig. 8 is shown the path *a* depressed as in Fig. 7, and the deflecting flanges or guides stationary and continued around the path *a* in a series of standing rims; also the stem head c^2 is shown oblong as I do not limit my invention to the form shown in Fig. 2.

If the style of switch-board be preferable as shown in Figs. 7 and 8 the ratchet bar G, the pawl *g* and sliding piece *c′* may be omitted as they then are not essential to the operation of the switching-instrument.

It is obvious that the plate A, may be of the style shown in any one of the views Figs. 5, 6, 7, and 8 and the construction of all of the other parts of the switching-instrument be substantially as shown, or that switching-instruments in a system may use any one of said styles exclusively or interchangeably as illustrated in said figures.

The wheel C may be operated by electro-mechanism of any ordinary construction. Said mechanism consists in the present instance of an electro-magnet I, armature *i* and lever J, the latter being pivoted to the frame and carrying a spring pawl *j* which rides on the teeth at the periphery of said wheel, in such manner as to propel said wheel by means of electrical pulsations of said electro-magnet. A spring K operates to retract the lever and pawl in the usual manner. A pawl L is arranged to hold said wheel from moving backward. The mechanism as thus applied at the periphery of said wheel is adapted to move the same forward according as the

stroke of the lever is regulated by the set screws *y*—*y*, one tooth or more at each pulsation of the electro-magnet I. Similar operating mechanism is also provided, located at M to be applied to the shaft *b* through wheel *m*, said gear wheel working in a bracket attached to the under side of the top A′ shown by dotted lines at m^0 in Fig. 2, and worked by a lever and pawl similar to lever and pawl J, *j*, connected with the electro-magnets at M, and adapted to operate the said gear wheel *m* and work it in a like manner and for a like purpose that the wheel C is worked, as shown in perspective view in Fig. 13. Fitted loosely on the shaft *b* is a smaller gear wheel m^2 with slanting radial grooves on its face, and adapted when it is revolved, to engage with the spurs of the wheel *m′* which is rigidly attached to said shaft *b*, or said wheel m^2 may engage as desired with said shaft direct in any suitable manner. Fig. 3 shows the face sides of m^2 and *m′* and their relation to each other on the shaft *b* on a line *a*—*a* in said figure. The shaft *b* when rotated by the wheel C turns in m^2 but does not communicate any motion thereto, or engage the spurs of *m′* with said wheel m^2. The gear wheels *m* and m^2 engage when operated and are of such construction that each electrical pulsation of the electro-magnets M will cause the wheel C to move through the same distance as would twenty five pulsations of the electro-magnets at I, operating on said wheel C at its periphery. The gearing may be arranged in same manner but in proper proportions and operate as fifty or one hundred to one. In the present instance it is as stated twenty five to one. By means of the mechanism described at electro-magnets I, the wheel C is operated for moving the switch *c* through short distances as within twenty five points, and by means of the mechanism at M, through longer distances as more than twenty five points and the switch *c* is made to travel more rapidly than in the first instance.

The switching-instruments of the system are connected together in a central office shown in Fig. 11, by as many switch wires or circuits as there are switching-instruments in the system. Said wires are designated by the figure 7, one wire being adapted to each instrument, and it starts from the switch-path thereof, having one or more contact points exposed thereat to a traveling switch *c* as shown on the right side of the switch-board in Fig. 2. Thence it runs to and connects with all the switch-boards of the switching-instruments of the system leaving exposed a contact point in each switch-board in the path of each traveling switch in the manner as shown on the left side in Fig. 2. A view of a manner of securing said wire 7 is shown in Fig. 12. Said wire is passed through an opening in the switch-board A, leaving a loop, which may receive a wedge or suitable piece, and the wire then drawn taut when it will be secure in the opening, and leave a piece projecting. The covering or insulation thereat of said wire should be removed, so as to make a contact for the traveling switch.

It will be observed that one single wire connects all the switch-boards together and may be used by all, but to facilitate exchanges between subscribers a single wire is assigned to the especial use of each switching-instrument.

The object of having more than one contact point on the same wire in some one of the switching-instruments, preferably the one from which it starts, is that more than one place in the switch-path *a* may be had by each subscriber where he may normally rest his traveling switch and be in position for "call" without moving his said switch over the entire route as would be the case were he compelled to move said switch around the pathway to the initial point of starting.

The mechanism of the switch-operating-instrument in the subscribers' office for producing the electrical pulsations in the switching-instrument at the central office is illustrated in Figs. 9 and 10, in which O designates the box or frame. O′ is a cap bearing for the shaft *o*, said shaft being journaled in said frame, and provided with two hands or electrode pointers P, *p*. Q is a shaft provided with a crank *q* for operating the same. A pawl and ratchet wheel Q′ are provided to prevent turning said shaft backward. The shaft Q is geared with shaft *o* and a large wheel R (placed loosely on the shaft *o*), to which the pointer *p* is connected, by a small wheel *r* on shaft Q; and also pinions S, *s*. The pinion S slides on the shaft *o* but will not turn thereon as the shaft may be flattened on one side and the pinion S correspondingly made to fit it, or arranged in any suitable manner for this purpose, and is held normally against the pinion *s* by a spring T. The pinion *s* should be insulated where it is fitted to its shaft Q, as should all other conductors where contact is not desired.

The shaft Q may normally rotate reversely by reversing the pawl on the ratchet at Q′, but in order that the hands or pointers will not reverse too by so doing, an extra wheel is required which should be suitably mounted to gear with the wheels *r* R and between the same, to preserve the normal direction of rotation of said wheel R, and thus the hands *p* and, *z* and the wheel S attached to the end of the shaft Q, said shaft first being shortened and its bracket bearing placed on the opposite side of S and of the shaft *o*, and S geared with *s* thereat; thus preserving the normal rotation of said shaft *o* and its pointer P.

The operation of the crank *q* communicates movement to the pointers P, *p*; said pointers moving at different rates of speed for a purpose hereinafter explained. A lever *t* is provided whereby the pinion S may be thrown and held out of gear with the shaft Q for the purpose of keeping the pointer P which is attached to the shaft *o*, at rest while the pointer *p* is in operation. Said lever is also used for

another purpose hereinafter explained. Said pointer P operates in connection with a serrated conductive dial U which is in circuit with the wire 1 which connects with the electro-magnet I of the switching-instrument in the central office for operating the lever J in the manner before described; and said pointer *p* operates in connection with another serrated conductive dial *u* which is in circuit with wire 2 which connects with the electro-magnet at M of said switching-instrument in the central office for operating the lever which works the gears at *m* in the manner before described.

The circuit formed by the wire 1 is normally closed at *v* and the circuit formed by the wire 2 is normally open at 3 and the operation of the crank *q* breaks and closes the circuit 1 by means of the pointer P coming in contact with the serrated points on U thereby producing electrical pulsations in the electro-magnet I, but produces no effect in the mechanism at M by reason of the break at 3 in the circuit as stated.

The lever *t* is bifurcated and engages loosely with S whereby said gears S *s* are thrown in, or out of connection, also operating as a switch for alternately breaking and closing the circuits 1 and 2. For this latter purpose said switch *t* is provided with a contact plate at *v* which is attached to said lever *t* (but insulated therefrom) in any suitable manner. Said plate is adapted alternately to break and close said circuits at 3 and *v* when said lever is vibrated for throwing the gearing S *s* in, and out of connection. The serrated contact points on the dials U *u* are in the proportion of twenty on *u* to twenty five on U in the present instance. Any other proportion may be had by proportioning properly the operating gearing. The dial U is indexed whereby the pulsations produced on the points U may be read by noting the position of the pointer P on said dial which will correspond to the number of pulsations produced in the electro-magnet I, of the switching-instrument and determine the distance, or number of contacts made by the traveling switch *c* with the points 7 in the path *a* of said switching-instrument. The dial *u* is also indexed counting twenty five for each serrated contact point thereon, as each contact thereon by the pointer *p* produces a pulsation in the electro-magnet M at said switching instrument in the central office, equal to twenty five contacts of the pointer P, in moving the traveling switch *c* along the path *a* to connect with the circuit wires 7 according as said wires are spaced in said path *a*. Worked in connection with the pointer *p* is a small hand *z* which is operated by its gear wheel *z'* which engages with a spur z^2 on the wheel R; said spur turning said hand *z* a half a point as registered on its dial at each complete rotation of said wheel R and its pointer *p*. It is obvious then that where the switch-boards of a system are constructed of a size to accommodate twenty five or less subscribers the hands *p* and *z* are superfluous, where over twenty five and not more than five hundred, *z* is superfluous, but when over five hundred and up to ten thousand subscribers the three hands are necessary. If a system of over ten thousand subscribers be needed the wheel *z'* should be proportionately arranged to be struck by said spur z^2 and the index of *z* correspondingly numbered. The plate W is preferably of copper and of two pieces insulated one from the other and joined together by a hard rubber ring or in other convenient manner. The circuits for the switching-instruments, and the switch-operating-instruments are made with batteries and conductors in electrical connection in the usual manner and it is not deemed necessary to describe them in detail in order to a full understanding of my invention.

The telephone, or telegraphic instrument shown in Fig. 11 is of any ordinary construction and forms no part of my invention except as herein shown in connection with my invention, and it is therefore not deemed necessary to describe it more fully.

The circuit connections of the various instruments in the system are shown in Fig. 11 in which 1 designates the circuit for operating the switching-instrument through the instrumentality of the mechanism at electro-magnets I, applied to the periphery of the wheel C; and 2 the circuit for operating the said instrument through the instrumentality of the mechanism at M applied to the periphery of the wheel *m*, as before described, and 4 the telegraph or telephone main line which runs therefrom to the central office and connects with the shaft *b*, thence with the wheel C, arm D, and traveling switch *c* in the path *a* as shown in Fig. 2. The electro-magnets I and M may be connected in one circuit as indicated by the dotted lines in subscriber's circuit No. 1. To do this the part of the wire 2 between the point $\frac{1}{2}$ and the electro-magnet M is omitted and the wire 2 joined at $\frac{1}{2}$ as indicated by the arrow line thereat, and the ground connection severed at $\frac{2}{3}$ at electro-magnet I, and a wire connection made between said magnets as indicated by the dotted line thereat. In such case the electro-magnets I should be of greater electrical resistance than the electro-magnets at M. The battery power should be normally only sufficient to operate the electro-magnet I; and not enough to operate M. Increased battery power is applied when M is to be worked in this circuit by switching in the extra battery shown in line 2 at *l'* through the contact plate *v*. When the circuit 2 is closed at 3 by lifting the lever *t* and bringing its contact plate at *v* to cover the broken ends of said line 2 as shown in Fig. 9, it should be understood that in such case the electro-magnet I will be energized also and worked simultaneously with electro-magnets; M but this does not thereby interfere with the effect desired

as the pawl of lever J would ride on the periphery of its wheel C as lost motion while the lever and pawl of the wheel *m* of the magnet M would be doing work. If two circuits are used the battery *l'* may be omitted.

The circuit for line 2 when operated on but one wire as described would be, starting at ground on wire 5, then lever V, metal stud *v'*, line 2 through battery *l'* to 3, where lever *t* should have been raised to cover the points of the wire 2 thereat and connect them electrically through the contact plate on said lever *t*, thence over wire 2 to bracket of shaft Q to Q, and thence through *r* to R, thence to *u* and plate W, thence over wire 2 to point ½, thence on wire 1 through electro-magnets I, thence over dotted line wire to electro-magnets M, thence through battery thereat to ground. The other circuits are readily traceable and it is not deemed necessary to specify them.

The operation at the subscriber's office is as follows: The pointers of the switch-operating-instruments in each subscriber's office are set on the respective dials to correspond with the position of the traveling switch *c* on the switching-instrument in the central office, and the relative contact points of all the wires 7 being indicated by the position of the hands or pointers on said dials of the plate W, any subscriber desiring connection with any other subscriber of the system will move the pointers P *p* by turning the crank *q* until said pointers indicate the desired number. The movement of said pointers over and in contact with their respective dial points U and *u* causes electrical pulsations of the electro-magnets and moves the traveling switch *c* into connection with any line 7 with which connection is desired in the manner before described; and on whatever wire 7 the traveling switch *c* may rest may now be "rung up" in the usual manner over the main line 4 if the lever *t* shall first be drawn out so as to move a switch V from *v'* where circuits 1 and 2 come together, (said switch is insulated from said lever *t* where it is hinged thereto and it is also hinged to a metal bearing fastened by the side of a wooden block v^3 on the frame O, said metal bearing carrying a ground wire 5 which has connection with said switch V) into contact with the said wire 4 at v^2.

In Fig. 11 of subscriber's office are shown the several positions of the pointers P *p*, and the corresponding position of the traveling switch *c* in the central office.

If subscriber No. 1 moves his crank *q* and turns his pointer P to 2 his traveling switch *c* will take the same relative position as is shown in No. 2 and subscriber No. 1 will then be in position to "call or ring up" No. 2 and so with No. 3. If No. 3 should desire to call No. 1 it would be necessary to have the switch *c* of said No. 3 travel the entire route or path *a* until No. 1's wire was reached and said switch *c* rested thereon. In case the party to be connected with is within twenty five points of the line of the party operating the traveling switch *c* the connection will be made by means of the pointer P alone, but if more than twenty five points as say two hundred and fifteen then the pointer *p* is brought into play as follows: First raise the lever *t* to throw the gears S *s* out of connection and close the circuit on the wire 2 at 3 and break it on 1 at *v*. Now turn the crank *q* which will bring the pointer *p* into contact with its dial points *u* and thus bring the electro-magnet M into operation to make two hundred points by eight pulsations of said electro-magnet. The hand *p* will now stand at 200 on its dial. Then reverse the lever *t* when the gears S *s* will resume connection. Now continue to turn the crank *q* until the pointer P indicates 15 on the dial U, which will signify that fifteen pulsations of the electro-magnet I have been made and the switch *c* will be on a wire corresponding to the number 215 as shown by the sum of the hands P *p*. Now pull out the lever *t* which gives the wire 4 at v^2 a ground over switch arm V with wire 5 which connects with said arm when such telegraph or telephone will be in position to "call" subscriber No. 215 unless said No. 215 shall be engaged, in which case, if the operator's first "call" be not answered he will push in the lever *t* and wait a minute or so, then pull out the lever *t* and "call" again and so on till No. 215 is found disengaged. After communication the lever *t* should again be pushed in and the crank *q* turned until his pointers indicate a normal contact with his own wire and then pulled out again and left. The hand P should always point to zero when the pointer *p* is to be operated independently.

It should be explained that the crank *q* is fitted onto the shaft Q with shouldered collar at *q'* which will permit of said crank slightly turning backward without turning the shaft Q, so that crank *q* may be moved back out of the way should it happen to be in line when the lever *t* is pulled out.

It is obvious that in small systems a single coil or circle may accommodate sufficient contact points for the required number of subscribers.

Having now fully described the construction and operation of my invention, I wish to be understood that I do not limit myself to the precise details of construction and arrangement shown and described, but reserve to myself the right to vary therefrom by using the known equivalents for any or all of the described devices, and generally to avail myself of the existing state of electrical science and practice in carrying out my invention within the true spirit and scope thereof.

What I claim is—

1. An automatically operated telegraphic or telephonic exchange switch-board, comprising a series of contact points arranged in

concentric circles, and a relatively moving switch-contact adapted to co-operate with said contact points substantially as described.

2. An automatically operated telegraphic or telephonic exchange switch-board, comprising a series of contact points arranged thereon in concentric circles, a relatively moving switch-contact adapted to co-operate with said contact points, and circuit wire connection from said contact points to like contact points in all like switch-boards of said exchange.

3. An automatically operated telegraphic or telephonic exchange switch board, comprising a series of contact points arranged in concentric circles, a switch-contact adapted to co-operate with said contact points and move centrifugally across said circles for the purpose specified.

4. An automatically operated telegraphic or telephonic exchange switch board, comprising a series of contact points arranged in concentric circles, a rotary switch-arm and contact piece, said contact piece adapted to move lengthwise of said circles of contact points and transversely thereto for the purpose specified.

5. A switch-board comprising a pathway of concentric circles, substantially as shown, in combination with circuit wires extending from said pathway to the like pathways of all the other switch-boards of the system, an electrode switch in line to a subscriber's office to connect with said circuit wires, one or more deflecting flanges, and electrical propelling devices to operate said switch.

6. A switching-instrument comprising a series of concentric circular paths, one or more deflecting flanges, a traveling switch and electrical propelling devices to move said switch substantially as and for the purpose specified.

7. In a telegraphic or telephonic system, a switch-operating-instrument, comprising two electrode hands insulated from each other, a shaft to which one of said hands is rigidly attached, a gear wheel fitting loosely over said shaft carrying the other hand, one of said hands capable of being independently operated, the other only in conjunction therewith, a plate composed of two dials or rings insulated from each other and in open circuit with a central office, means to operate said hands into contact with electrode points on said dials and close said circuit; and a non-electrode hand and dial operative only in conjunction with the hand capable of independent movement to indicate the number of revolutions made by said independent electrode hand substantially as and for the purpose set forth.

8. In a switch-operating-instrument, a compound switch having two connecting arms, gearing capable of being operated by one of said arms, line wires 1 and 2 capable of having their circuits opened or closed by and through the other of said arms; and an electrode switch as V which carries the ground wire 5, and means to operate said switch and move said arms simultaneously substantially as set forth.

9. In a telegraph or telephone instrument of ordinary construction having one end of its main line wire run to a switching instrument, and terminating therein with a revolving electrode switch, the other end of said line run to a switch-operating-instrument, and terminating therein in a stationary insulated point, which is capable of being connected to by a switch carrying a ground wire, and means to move said switch into or out of contact with said line wire whereby said line wire may open or close a circuit with said revolving electrode switch as and for the purpose specified.

10. In a switch-board in a central office or exchange having electrical connection with a subscriber's station, a single wire having one or more contact-points in the switch-path of said switch-board and running to the switch-path of each of all the other like switch-boards and exposing but one contact-point in each of all of said other like switch-boards, an electrode-switch, and electrical propelling devices to move said switch into contact with said one or more contact-points substantially as specified.

WALLACE CHILDS.

Witnesses:
C. D. GREENE, Jr.,
ART. D. GREENE.