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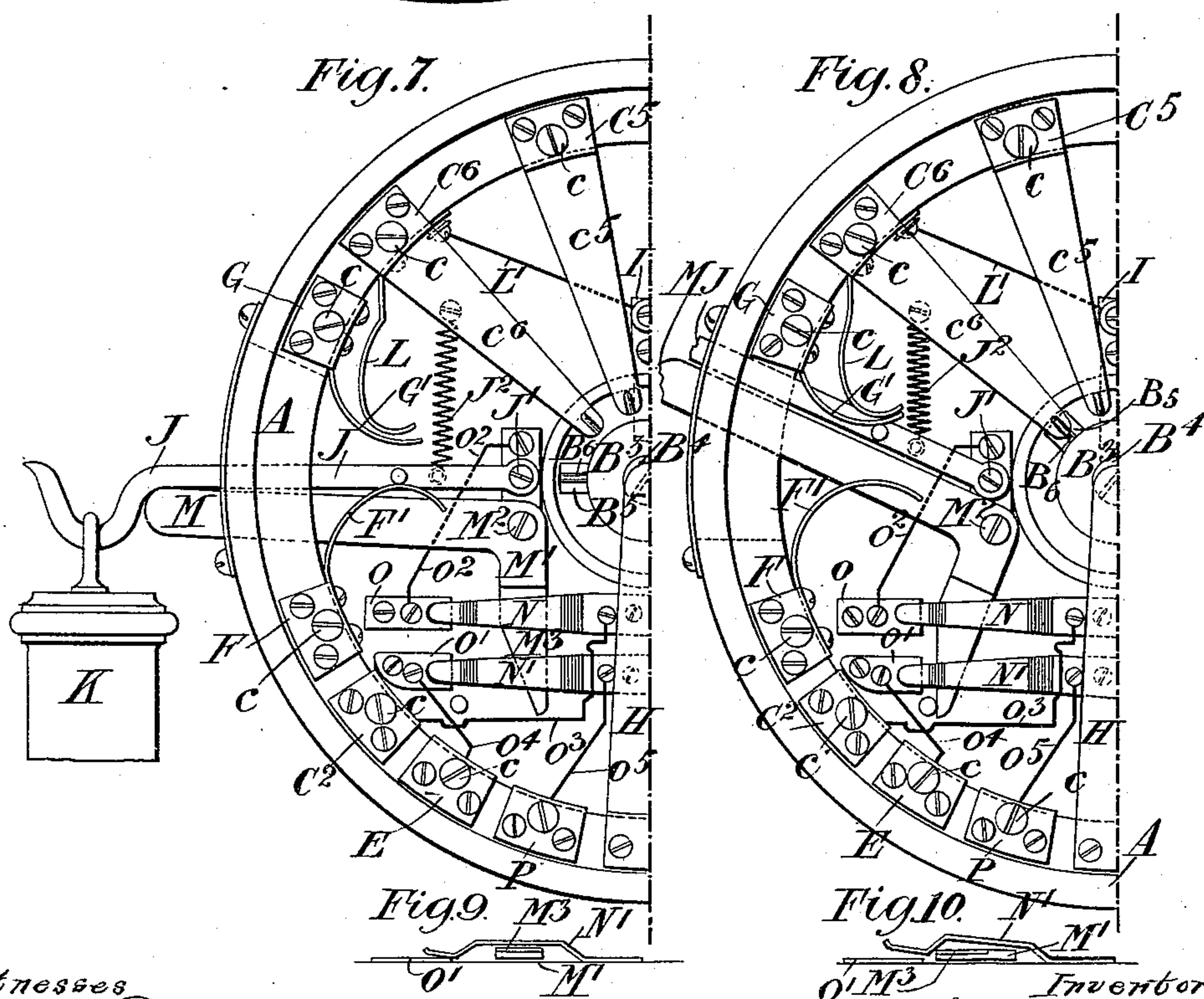
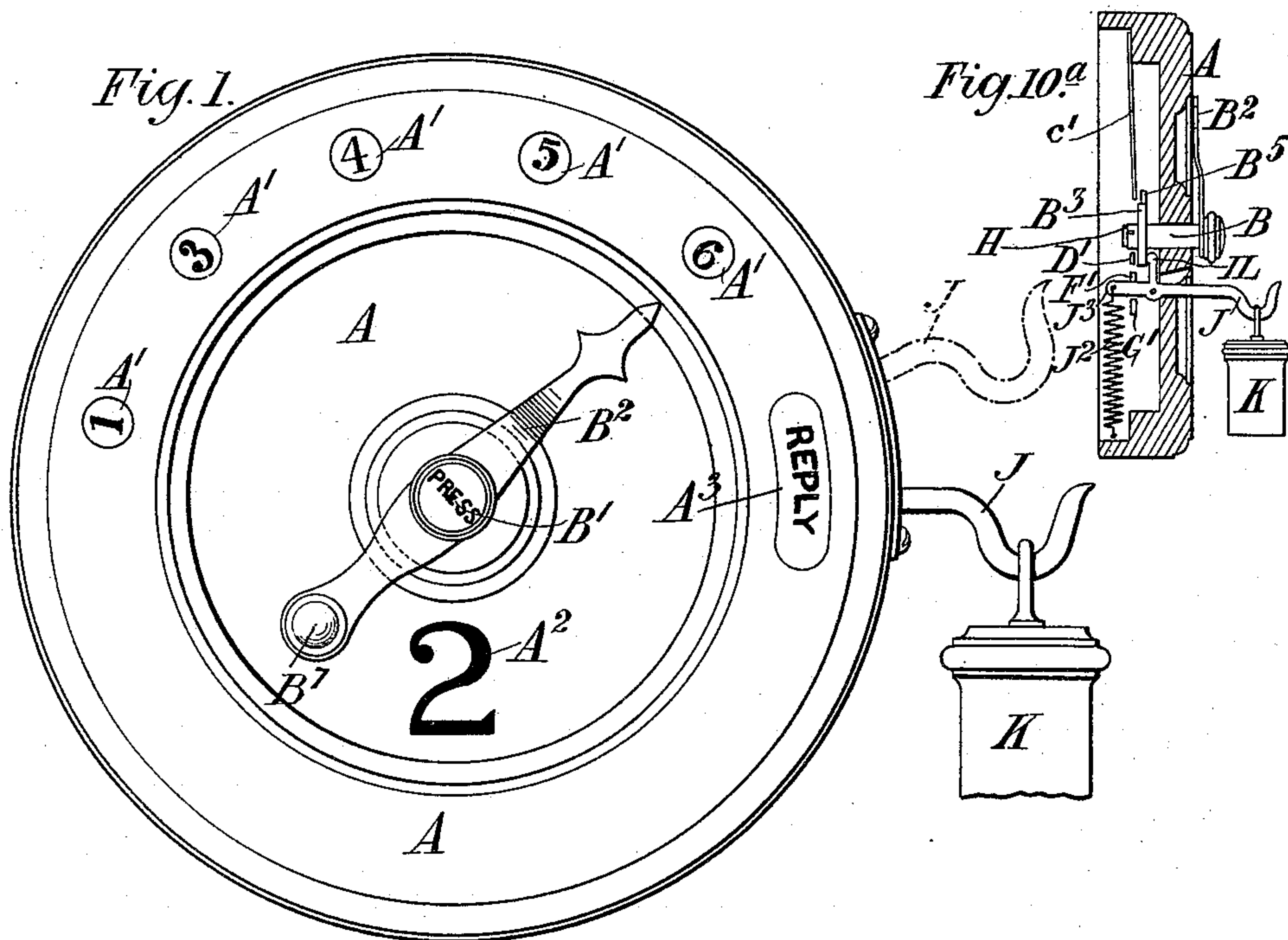
4 Sheets—Sheet 1.

T. B. SLOPER.

ELECTRIC TELEPHONIC SWITCH AND SYSTEM.

No. 488,666.

Patented Dec. 27, 1892.



Witnesses

J. M. Fowler Jr
Thomas Durant

Inventor

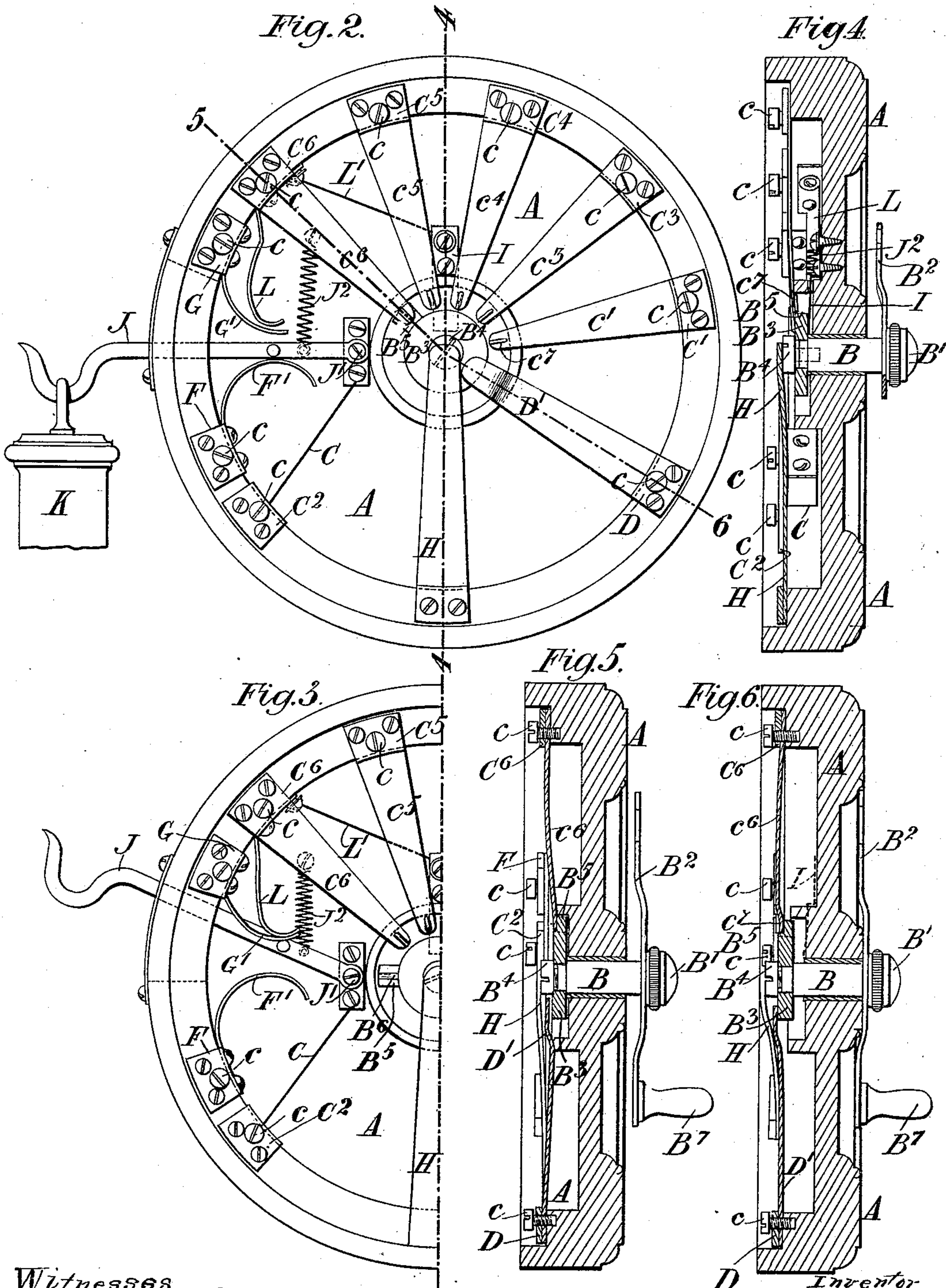
Thomas B. Sloper
By Church & Shumard.
His Attorneys.

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Witnesses
J. M. Fowler Jr
Thomas Durant

Inventor
Thomas B. Sloper
By *Chas. H. Hines*
His Attorneys.

(No Model.)

4 Sheets—Sheet 3.

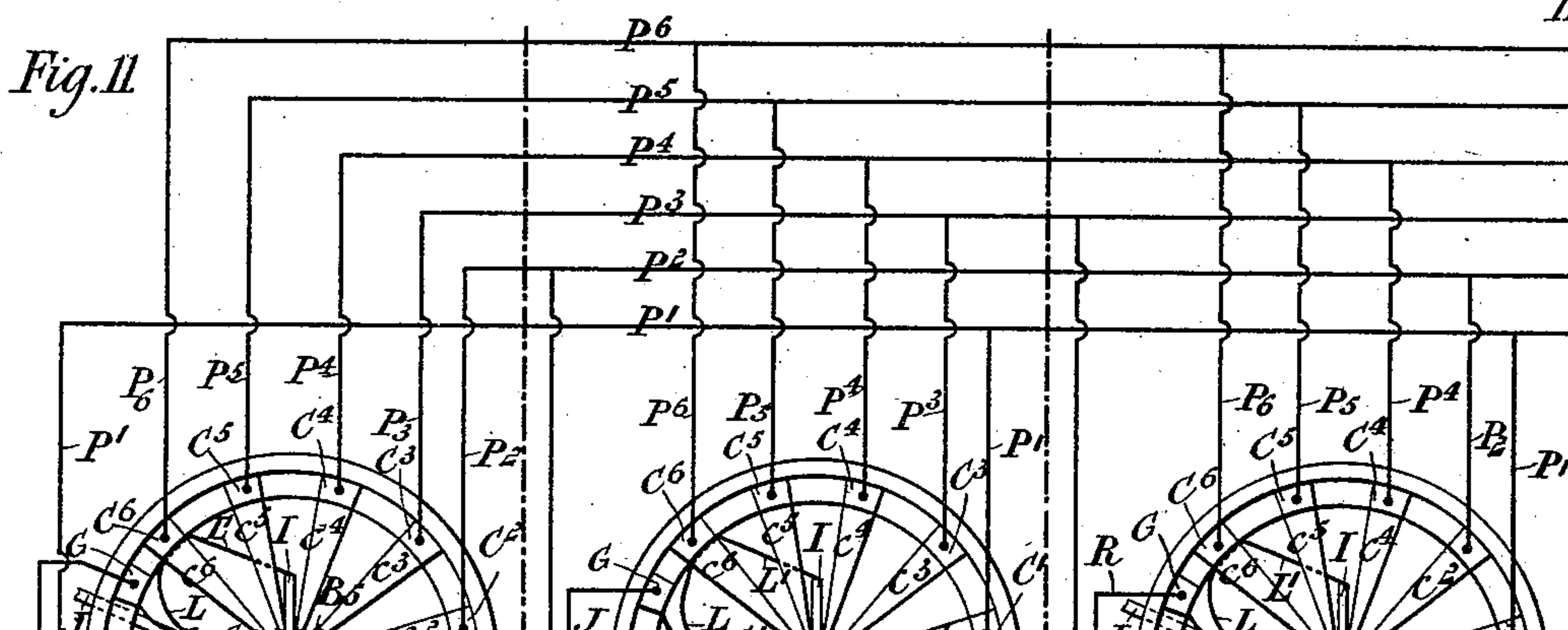
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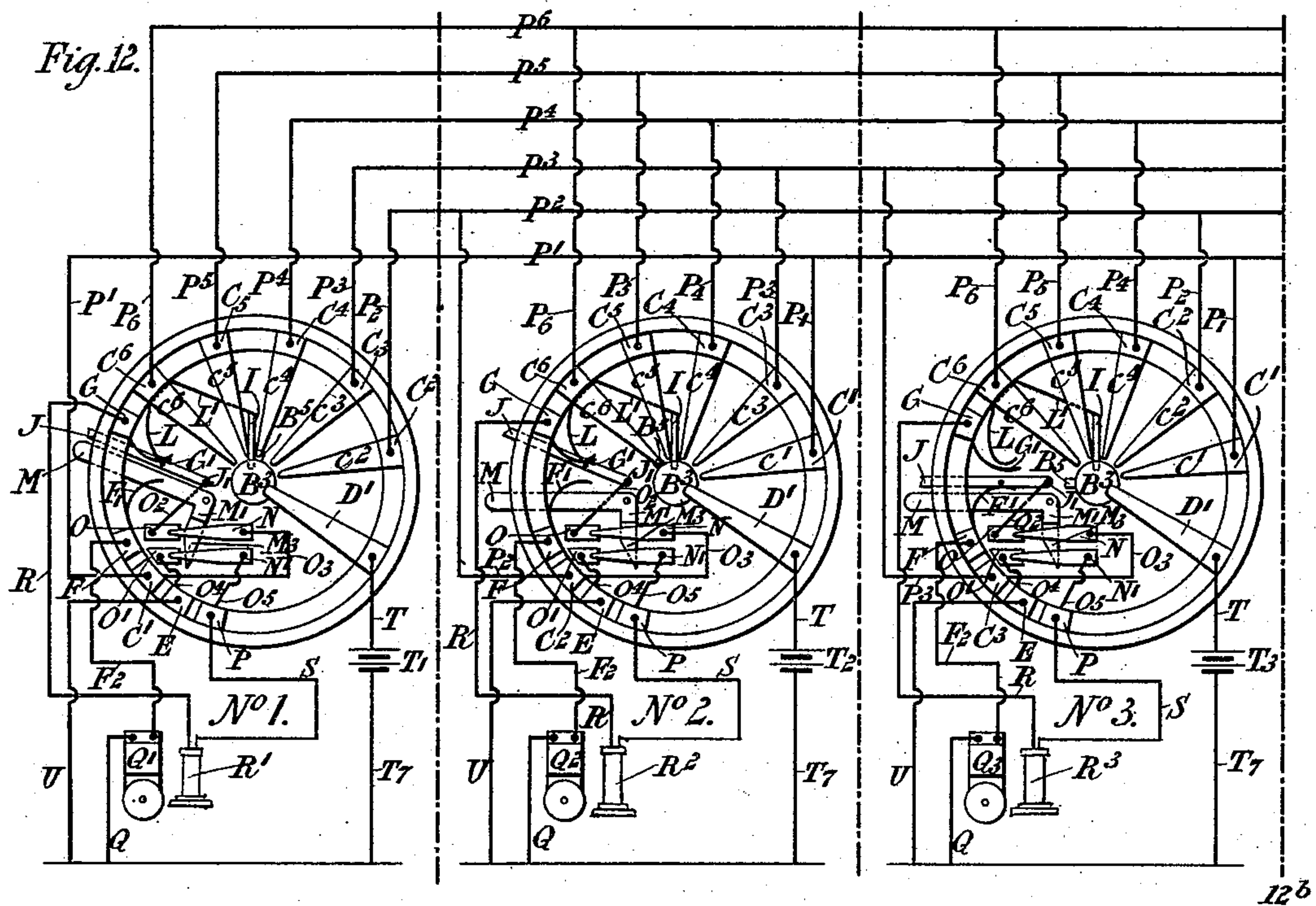
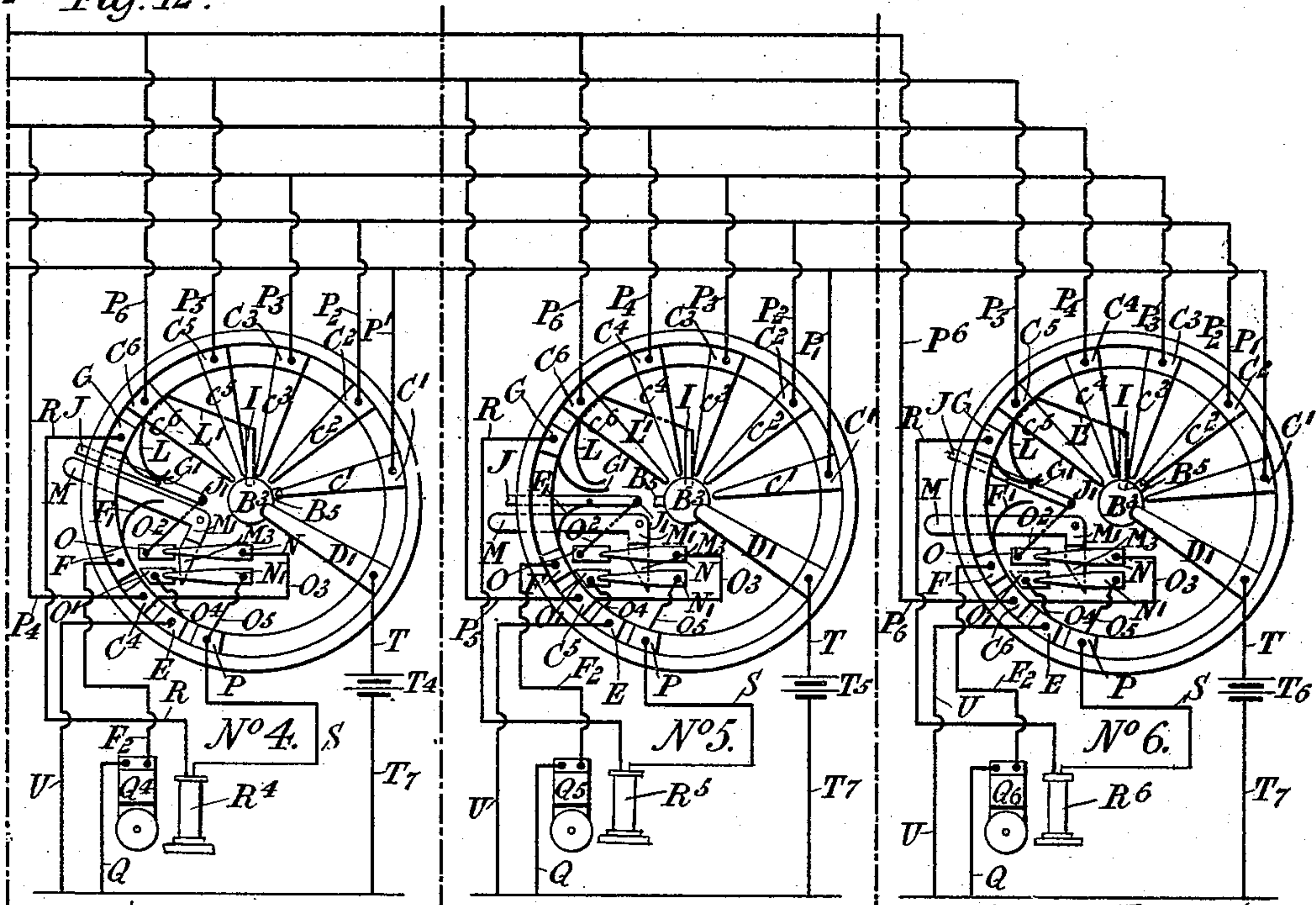


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*Fig. 12^a*

Witnesses

J. M. Fowler Jr.
Thomas Durant

Inventor

Thomas B. Sloper.
 By *Chas. & Chas.*
His Attorneys.

UNITED STATES PATENT OFFICE.

THOMAS BEAVAN SLOPER, OF DEVIZES, ENGLAND.

ELECTRIC TELEPHONIC SWITCH AND SYSTEM.

SPECIFICATION forming part of Letters Patent No. 488,666, dated December 27, 1892.

Application filed May 18, 1892. Serial No. 433,473. (No model.)

To all whom it may concern:

Be it known that I, THOMAS BEAVAN SLOPER, a subject of the Queen of England, residing at Devizes, in England, have invented certain new and useful Improvements in Electric Telephonic Switches and Systems, of which the following is a specification.

This invention relates to electric telephonic switches and the system known as the inter-communication system, of working them, the arrangement being such that any two lines of the whole system, which may include any desired number of instruments may be connected directly with each other without an intermediate station and if desired the talking effected through the wires of the instruments of both stations.

The invention will be best understood by reference to the accompanying drawings in which

Figures 1 and 2 are respectively a front and back elevation of one form of the switch adjusted as when ready for ringing-up No. 6 station. Fig. 3 is one half of a back elevation showing the switch as when it has received a call and is being talked through. Fig. 4 is a section taken on line 4—4 of Fig. 2. Figs. 5 and 6 are sections taken on line 5—6 of Fig. 2, Fig. 5 showing the switch as when adjusted for ringing-up No. 6 station, and Fig. 6 as when such ringing-up is in operation. Figs. 7 and 8 are similar half-back elevations of a switch constructed on the same principle as that shown in Figs. 1 to 6 but in addition provided with a switch or bridge for cutting off the earth or return wire altogether from the two communicating stations and connecting them in such a manner that the currents between the two stations pass by one wire and return by the other thus isolating the two instruments being conversed through from all the others of the series, Fig. 7 representing the switch in its normal position and Fig. 8 as when it has been rung-up and adjusted for private conversation with station No. 6 by the person at the called-up station. Figs. 9 and 10 are views showing the two different positions of the additional switch or bridge for forming the "secret circuit". Fig. 10^a is a section drawn to a smaller scale than Figs. 1 to 10 showing the switch arranged with the hook arm in the form of a three-armed lever.

Figs. 11 and 11^a are diagrams showing an installation of six stations provided with the switch shown in Figs. 1 to 6 and Figs. 12 and 12^a are similar diagrams showing an installation of six stations provided with the switch shown in Figs. 7 to 10.

Like letters and figures indicate like parts throughout the drawings.

Throughout this specification and in the accompanying drawings each of the switches is described and illustrated as adapted for an installation of six instruments but it will readily be understood from the following description that by increasing or decreasing the number of contacts the switch may be constructed for an installation of a larger or smaller number of instruments.

Referring to Figs. 1 to 6, A is a preferably circular block or plate of wood, vulcanite or other suitable material recessed at its back to receive the various contact devices and perforated and preferably metal-bushed at its center to admit of the spindle B being moved longitudinally and rotarily therein. On the outer end of the spindle B are secured a head or press-button B¹ an index or pointer B² and a crank handle B⁷ which may be formed in part with the pointer B² and on the outer face of the block A are depicted numbers A¹ or other denominating symbols corresponding to the several stations in the installation less that of the instrument itself which may advantageously be more boldly depicted as at A². The pointer B² may be turned by the handle B⁷ to any of the numbers A¹ as also to a plate bearing the word "Reply" or other symbol A³ Fig. 1 to which it should though not compulsorily be directed when the instrument is not in use.

C¹ C² C³ C⁴ C⁵ and C⁶ are six contact plates to five of which are fitted contact springs each for convenience marked with a corresponding small letter such as c¹ c² &c. and all when hereinafter collectively mentioned being referred to as the contact springs c¹ &c.; the index numerals of these large and small reference letters in this description serve also to identify the various contacts with the different instruments of the installation. Each of the six contact plates C¹ C² C³ C⁴ C⁵ and C⁶ as also the contact plates D F and G are provided with binding screws c for connecting

the various conductors to them as hereinafter explained.

B^3 is a metal disk secured by a screw B^4 on a squared or equivalently shaped part of the spindle B and which is provided with an arm or projection B^5 adapted to make electrical contact with the inner ends of the springs c' or c^2 &c.; the arm or projection B^5 instead of being formed in part with the disk B^3 may be integral with the spindle B.

H is a spring which bears upon the head of screw B^4 so as to tend always to press the spindle B outward and the disk B^3 against the contact I as shown in Fig. 4 and returns said parts to said respective positions after having been pressed inward as shown in Fig. 6 by a person ringing-up another station and in which inner position the contact between B^3 and I is broken. The spring H does not act as an electrical conductor; if desired a helical spring encircling the spindle B may be substituted for the spring H.

J is the hook arm upon the outer or hooked end of which as ordinarily the receiver K is hung as shown in Figs. 1 and 2 and which is pivoted at J' and which a spring J^2 attached thereto always tends to draw to the position shown in Fig. 3.

F' is a contact spring upon which the arm J bears when held down by the weight of the receiver K, and G' and L are two other contact springs the latter of which is connected by wire L' with the contact I and both of which are normally, that is, when the arm J is in its lowered position, out of contact with each other and with the hook arm J as shown in Fig. 2 but which, when the receiver K is removed and the spring J^2 allowed to raise the arm J, are pressed into electrical contact both with each other and with the arm J as shown in Fig. 3.

The contact plate C^2 is electrically connected by a wire C and through the pivot J' with the hook arm J, and the contact plate D which as hereinafter explained is connected to the local battery is provided with a metal blade D' which as shown in Fig. 5 is out of contact with the disk B^3 when said disk is pressed forward by the spring H but with which the disk B^3 makes electrical contact when it is pushed back by the operator for calling-up a distant station.

The inner end of each of the contact springs c' &c. is preferably provided with a rib or projection c^7 as shown clearly in Figs. 5 and 6 and the arm B^5 is also provided with a groove B^6 for receiving this projection c^7 so that it may readily be felt by the resistance to further rotation when the arm B^5 is in proper contact with any required contact spring but other equivalent means may be provided for this purpose.

The switch shown in Figs. 7 to 10 differs from that before described only in addition of the isolating switch or bridge now to be described and in some of the electrical con-

nections which are altered to suit this addition.

In Figs. 7 and 8 $M M'$ represent a bell-crank lever pivoted at M^2 and is constructed preferably of insulating material such as vulcanite and to the arm M' of which is secured a metal plate M^3 . The arm M like the hook arm J projects through a slot in the block A to the outside of said block and is so arranged that after the receiver K has been removed from off J and the lever arm M has been raised by hand from the position shown in Fig. 7 to that shown in Fig. 8 the said lever arm M will be moved to its original position (Fig. 7) whenever the receiver K is again hung on arm J. $N N'$ are two contact springs the free ends of which are normally in contact with two plates O O' respectively. The contact springs $N N'$ as shown clearly in Figs. 9 and 10 are bent so as to allow the metal-plate-carrying-lever arm M' to work beneath them and while in the position shown in Figs. 7 and 9 to be out of contact with them and allow them to rest in contact with the plates O O', and so that when the lever $M M'$ is moved to the position shown in Fig. 8 the arm M' will raise the springs $N N'$ out of contact with plates O O' and make electrical contact between them through the plate M^3 which at that time bears against the underside of both of the springs. In this arrangement the pivot J' of arm J instead of being directly connected to the plate C^2 as in the former example is indirectly connected to it by wire O^2 leading from J' to O, contact spring N, and conductor O^3 leading from N to C^2 the circuit through these conductors being broken as soon as the spring N is raised off plate O. The plate O' is connected with a plate E by wire O^4 and the contact spring N' is connected by a wire O^5 with a plate P which like the other similar plates before described is provided with a binding screw c.

In Fig. 10^a the hook arm upon which the telephone receiver K may be hung is pivoted in the plate A so as to project out through the front of it and is in the form of a three-armed lever, the arm J having the hook formed upon it, the arm J^3 being caused by the spring J^2 to make contact with the contact plate or spring G' connected with the telephone appertaining to the instrument in question, or, when the weight of the telephone receiver K upon the hook overcomes the spring J^2 the arm J^3 as shown in Fig. 10^a, makes contact with the contact plate or spring F' connected with the bell appertaining to the same instrument. The third arm I L (referred to by these two letters because it fulfills the functions of the before described contacts I and L) is adapted to move the disk B^3 longitudinally upon its axis so that its contact projection B^5 will be in the proper plane to make contact with any one of the contact plates c' &c. of the respective line wires of the system, when the receiver K is off the hook. By means of the same arm I L or of the spring H similar

to that before described and shown in Figs. 2 to 8 when the telephone receiver K is upon the hook, the disk B³ is so moved that its contact projection B⁵ is clear of all the other contact plates or springs c' &c. but so soon as the weight of the receiver K is removed the disk B³ moves forward projecting the arm B⁵ into the plane of the plates or springs c'. In addition to the radial contact plates or springs c' &c. there is also provided the metal blade D' with which as in the before described examples, the disk B³ can be brought into contact when pushed in for the purpose; this contact is in direct connection with the battery appertaining to the station and through it the battery current can be carried to any of the wires of the system in order to ring the bell at a distant station.

Referring now to Fig. 11, which diagrammatically represents an installation of six telephone stations numbered from 1 to 6 and each provided with a switch similar to that shown in Figs. 1 to 6, it will be seen that all the contact springs c' except at No. 1 station where such spring is not necessary are connected together by conductor P' and that this conductor is connected through plate C' and wire C with hook-arm pivot J' of said No. 1 station and constitutes the home line of said No. 1 station. Similarly all the contact springs c² except at No. 2 station where it is not necessary are connected together by conductor P² constituting the home line of station No. 2, and which is connected through plate C² with pivot J' as shown clearly in Figs. 1 and 2 which represents this No. 2 switch. All the contact springs c³ except at No. 3 station where one is not necessary are connected together by conductor P³ constituting the home line of station No. 3, and which is connected through plate C³ with pivot J' of No. 3 station, and so on throughout the series of switches. Each of the contact plates F is connected by a wire F² with one terminal of the coils of a call bell Q', Q², Q³, Q⁴ Q⁵ or Q⁶ the other terminal being connected by a wire Q to earth said wires constituting the bell line of each station. Each of the plates G is connected by a wire R to one terminal of the appropriate telephone R', R², R³, R⁴, R⁵ or R⁶ the other terminal of which is connected through wire S to earth constituting the telephone line of each station. Each of the blades D' is connected by a wire T to one pole of a local battery T' T² T³ T⁴ T⁵ or T⁶ the other pole of which is connected to earth by a wire T⁷.

The operation of the installation shown in Fig. Fig. 11 is as follows:—Supposing the operator at No. 1 station requires to call-up No. 3 station he first turns round the index B² until it points to the number three (A') so as to bring the arm B⁵ into contact with c³ the terminal of the home line of station No. 3 and then presses the button B' so that the disk B³ bears against the blade D'. The current from battery T' now passes through the blade

D' disk B³ and contact spring c³ of No. 1 station along wire P³ to No. 3 station where it passes through plate C³, pivot J', hook-arm J spring F' plate F wire F² to bell Q³ the circuit being completed through wires Q of No. 3 station, earth and T⁷ of No. 1 station. In this manner the bell Q³ will be sounded and all the operator at the called-up station (No. 3) has to do is to take the receiver K off hook-arm J at that station and preferably place the index B² at "Reply" as shown with regard to the arm B⁵ in Fig. 3 when he can talk through the telephone as usual. This operation at No. 3 station by allowing the hook arm J to be raised by its spring J² out of contact with spring F' breaks the circuit through the bell Q³. The operator at No. 1 station by removing the pressure of his hand from the knob B' at that station allows the spindle B to be returned by its spring H to its normal position when the contact with blade D' and consequent circuit through the battery T' will be broken; he then removes his receiver K from the hook arm J at his (the No. 1) station so that by the ascent of the hook arm J out of contact with spring F' the circuit through the bell Q' is broken and the telephone circuit between the two instruments R' and R³ is completed in the following manner:—One terminal of each of the telephones R', R³ is connected to earth by one of the wires S and assuming the current through the switches to pass from station No. 1 to station No. 3 it will leave the telephone R' by way of the appropriate wire R pass to switch of No. 1 station through plate G and the spring contacts G' and L which are then pressed together by hook arm J, contact I disk B³ disk-arm B⁵ contact c³ and leave station No. 1 through the wire P³ which conducts the current to the plate C³ of No. 3 station. The current then passes through wire C to pivot J' and through hook-arm J, contact G' plate G and wire R to the telephone R³. If when the operators at say the No. 1 and No. 3 stations are speaking the arm B⁵ at No. 1 station be in contact with the spring c³ as before described and the arm B⁵ at No. 3 station be in contact with spring c' then the currents will pass between the two instruments partly through the home line wire P' of station No. 1 and partly through the home line wire P³ of station No. 3 returning through earth, the hook arm J of No. 1 instrument being then electrically connected with No. 3 switch and the hook arm J of No. 3 connected with No. 1 switch.

With the last described system and because one terminal of each of the telephones is connected to earth it is possible for the conversation between two stations, say Nos. 1 and 3 as before, to be heard through the instrument of a third station by the operator at that third station say No. 2 turning the arm B⁵ until it makes contact through one of the springs in this example either c' or c³ with one of the wires P' or P³ through which the telephonic currents pass. It is to overcome this that I

devised the system illustrated in Figs. 7, 8, 9, 10 and 12 and which I call the "secret circuit system" and by which any two stations of the series may be completely cut out of communication with the others. In this system as shown in Fig. 12 the bell-circuit is completed and broken in precisely the same way as in the arrangement shown in Fig. 11. None of the telephones R' &c. are however directly connected with earth, the complete metallic circuit being established over the home lines of the respective stations between which the conversation is taking place, the home line of one station being the positive and the home line of the other station the negative wire.

Supposing now that the operators at stations Nos. 1 and 4 desire to employ the "secret circuit system" and they have placed themselves in communication as before described by lifting their respective receivers off the hook arms J and turning the arms B⁵ into contact with the springs c⁴ and c' respectively both of which in this instance must be so adjusted, they each then raise the lever arm M at the respective stations. The telephone currents then pass between the two stations Nos. 1 and 4 as follows, assuming that they first pass from the telephone R' through the wire R. They pass at No. 1 station through plate G and through the spring contacts G' and L which are pressed together by hook arm J, through wire L', contact I disk and disk-arm B³ B⁵, contact c⁴ and leave No. 1 station and pass to No. 4 station by wire P⁴. At this station No. 4 the currents pass through plate C⁴ wire O³ spring N plate M³ spring N' wire O⁵ plate P from which the currents pass to the telephone R⁴ through wire S. The currents then in the reverse manner pass from the telephone R⁴ to telephone R' by way of the following of the No. 4 station connections viz:—plate G, spring contacts G' and L, wire L', contact I disk and disk-arm B³ B⁵ contact c'. The currents then pass from No. 4 station to No. 1 station by the wire P' and at No. 1 station they pass to the telephone R' through the following of the No. 1 station connections viz:—plate C' wire O³ spring N plate M³ spring N' wire O⁵ plate P and wire S. If the lever arms M of any two stations in communication are not raised as last described then the "secret circuit system" is not brought into operation and the conversation carried on between these two stations may as in the arrangement shown in Fig. 11 and after similar adjustment of the contacts be overheard at another station. In Fig. 12 stations Nos. 2 and 6 are shown connected in this manner, without employing the "secret circuit system" with the two stations connected in this manner and the arms B⁵ at each station being respectively in contact with springs c⁶ and c² and assuming the current to flow first from telephone R² through wire R at that station it will take either of two courses at station No. 2 in one of which it will pass through the following connections of said station No. 2 in the order in

which they are named viz:—plate G, contacts G' and L, wire L', contact I disk and disk-arm B³ B⁵ contact c⁶. The current thus leaving station No. 2 will be conducted to station No. 6 through wire P⁶ and will then pass through the following connections of station No. 6 in the order in which they are named viz:—plate C⁶, wire O³, spring N, plate O, wire O², pivot J', hook arm J and contact G', plate G, wire R, telephone R⁶, wire S, plate P, wire O⁵ spring N', plate O', wire O⁴, plate E, wire U to earth, through which the current passes and returns to telephone R² through the following connections of station No. 2 viz:—wire U, plate E, wire O⁴, plate O', contact spring N', wire O⁵, plate P and wire S. The other alternative open to the passage of currents between No. 2 station to No. 6 is first from telephone R² through wire R and through the following of the No. 2 station's connections viz:—plate G, contact G', hook arm J, pivot J', wire O², plate O, contact spring N, wire O³, plate C², wire P² which conducts the currents to contact plate C² at No. 6 station. At this station the currents thus conducted pass through the following of the No. 6 station connections viz:—spring contact c² disk-arm and disk B⁵ B³, contact I, wire L' contacts L and G', plate G, wire R, telephone R⁶, wire S, plate P, wire O⁵, spring contact N', plate O', wire O⁴, plate E and wire U to earth with which the telephone R² is also connected as before explained.

The before described apparatus instead of being constructed with an adjustable arm B⁵ for making contact with the distant line termini which however is the preferred arrangement, may be provided with an adjustable plug for this purpose, and in other respects the invention may be modified without departing from the spirit of the invention; for example, if desired the contacts F' G' and L and the hook arm J may be mounted on a block or frame independent of the block A upon which are mounted the switch contacts c' &c. and parts co-operating therewith.

For the sake of facilitating the understanding of the invention no mention is herein previously made to the use of microphones in conjunction with the before described apparatus, when such however are used an extra contact as usual is required for closing the circuit when the receiver is off the hook. In cases where no microphone is used one battery may if desired be arranged to ring all the bells in the system.

I claim—

1. A telephonic system embodying home, telephone and bell lines switches controlling the communicating home and telephone lines but not the bell line, telephone hooks and contacts moved by said hooks controlling the home line, the telephone line and bell line said contacts being so arranged relative to the hook that when the hook is depressed, the bell circuit is established and the circuits of the home line and telephone are broken and when

elevated said circuits are established, substantially as described, whereby the necessity of setting the switch after a conversation is avoided.

2. In a telephonic installation or intercommunication system in which each station has a direct line to each other station and may be placed in communication with any of the other stations without an intermediary the combination with a switch board at each station of a contact permanently connected with the telephone a movable hook arm and another contact which may be connected through the switch with any of the distant lines both of the contacts being out of contact with each other and with the home line when the receiver is on the hook arm and both of which when the receiver is moved from the hook arm make contact with each other and with the line wire substantially as described.

3. In a telephonic installation the combination in the same switch board and with the movable hook arm thereof of a contact permanently connected with the telephone and another contact which may be connected through the switch with any of the distant lines connected to it both of the contacts being out of contact with each other and with the home line when the receiver is on the hook arm and both of which when the receiver is removed from the hook arm make contact with each other and with the line wire substantially as described.

4. In an intercommunication telephonic system the combination with a hook arm such as J connected with the line-wire of a contact such as L connected to the switch used for connecting with different lines and another contact such as G' connected to the telephone so arranged that both contacts are out of contact with the hook J and with each other when the receiver is on its hook and both when the receiver is removed from the hook arm make contact with each other and with the hook arm J substantially as described.

5. In a telephonic installation the combination with a disk or central spindle having an arm and surrounded by a number of spring contacts constituting the termini of the distant lines and with either of which the arm may make contact, a contact for connecting with the home line and telephone and with which the disk is normally in contact and a battery contact with which the disk is normally out of contact but may be pushed against it substantially as described.

6. In an electrical switch for connecting the home telephone line with either of a number of other lines, the combination with a longitudinally movable spindle B having a projection B³, a series of springs in circuit with the distant lines and in position to be engaged by said projection, of a home line contact in position to establish the circuit when the spindle is in normal position and a battery contact in position to establish the battery circuit when the spindle is moved lon-

gitudinally, whereby the home line is broken and battery sent to the distant line by moving the spindle; substantially as described.

7. In a telephonic installation, the combination with a switch board having a movable hook arm J and rotary and longitudinally movable disk B³ provided with a contact arm B⁵, of a series of spring contacts c', &c., in position to contact with arm B⁵, a spring contact D' for the battery circuit out of contact with said disk when the latter is in normal position and in contact therewith when the disk is moved longitudinally and contact F' completing the bell circuit when the hook lever is depressed, and contacts G' and L completing the line circuits when the hook lever is raised; substantially as described.

8. In a telephone installation, the combination with a switch board or block A having a rotary and longitudinally movable spindle B carrying a disk B³ and arm B⁵ and the series of spring contacts c', &c., of the contact D' controlling the battery circuit and contact I controlling the home circuit and contacting respectively with the disk to complete their circuits when said spindle is at opposite extremes of its longitudinal movement; substantially as described.

9. In a telephonic system the combination with a switch board or block A of a three armed lever, one arm J hooked for the suspension therefrom of the receiver, another arm making contact with the home-bell connection F' and being out of contact with the home telephone when the receiver is on the hook and vice versa and the third arm shifting the contact disk B³ and through it making contact for itself and the disk with the battery substantially as described and illustrated in the accompanying drawings.

10. In an intercommunication system of telephony, the combination with a series of stations each having a home line wire terminating in contacts at each of the other stations a switch at each station for connecting any one of said terminal contacts with the telephone of that station, a ground connection for the telephone of each station, switches in such ground connections and contacts for establishing connection between the telephones of each station and its home line in lieu of the ground connection, whereby a complete metallic circuit may be established between any two stations to the exclusion of the others, substantially as described.

11. In a telephone system, the combination with a series of stations with double line wires between each two stations, a plate O' in each station connected with ground; a plate O in each station, connected with one terminal of the telephone and the terminal of one line wire, a contact N connecting the terminal of the other line wire with the plate O and a contact N' connecting the other terminal of the telephone with plate O', of a contact lever co-operating with the contacts N N' to interrupt their connection with plates O O' and

establish the circuit between the said contacts N, N', whereby the ground connection is broken and the line terminal N brought into connection with the telephone terminal
5 to establish a complete metallic circuit.

12. In a telephonic installation the combination with the movable hook arm of a switch board of two contact plates O O' one electrically connected with the hook arm and the
10 other to earth or return wire two spring contacts N N' one connected to the line wire and

the other to the home telephone and a lever M M' M³ substantially as described and illustrated in the accompanying drawings.

In testimony whereof I have hereto set my
15 hand in the presence of the two subscribing witnesses.

THOMAS BEAVAN SLOPER.

Witnesses:

HARRY B. BRIDGE,

CHARLES E. ROSE.