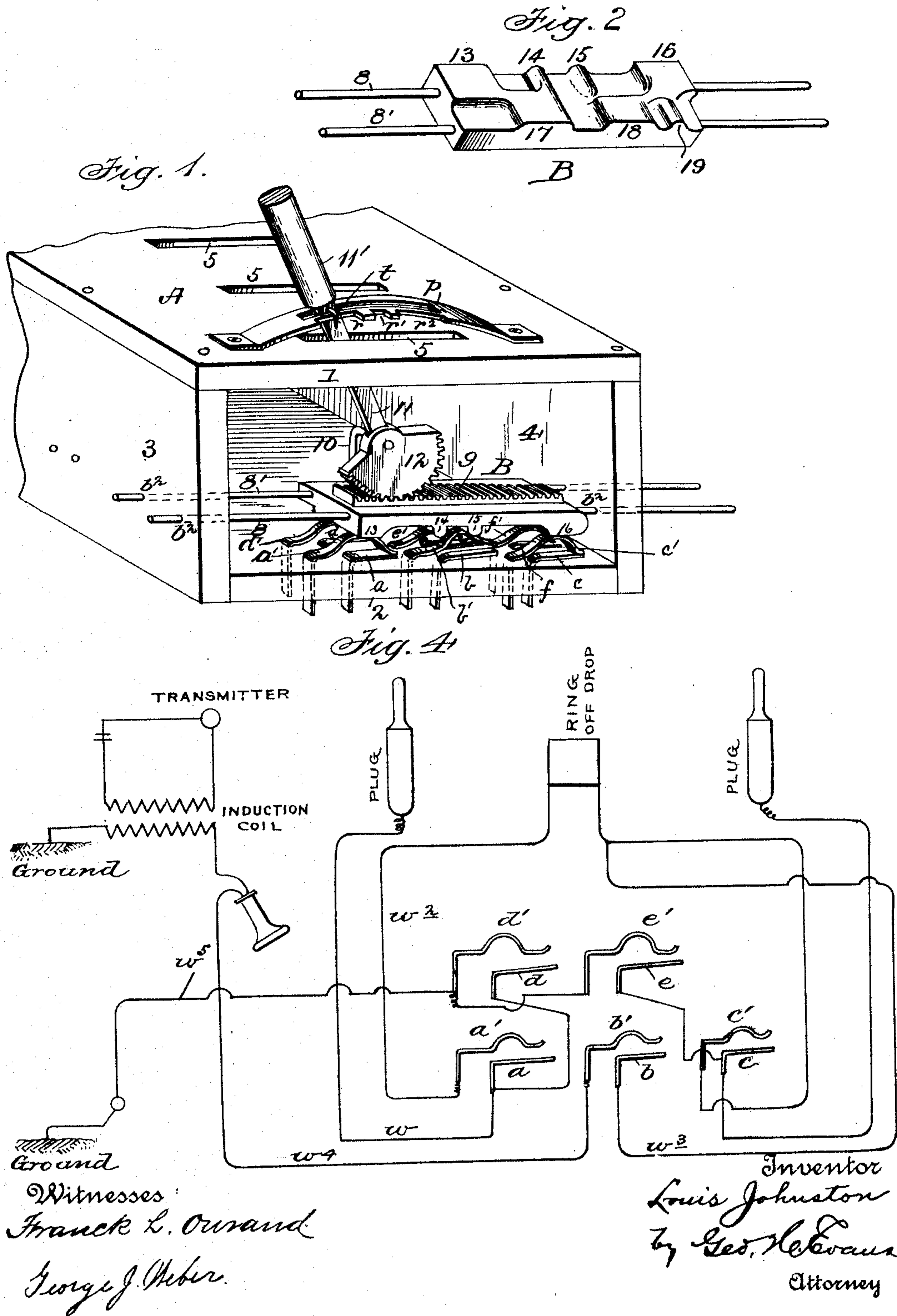


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OPERATOR'S SWITCH FOR TELEPHONE EXCHANGES.

No. 585,915.

Patented July 6, 1897.



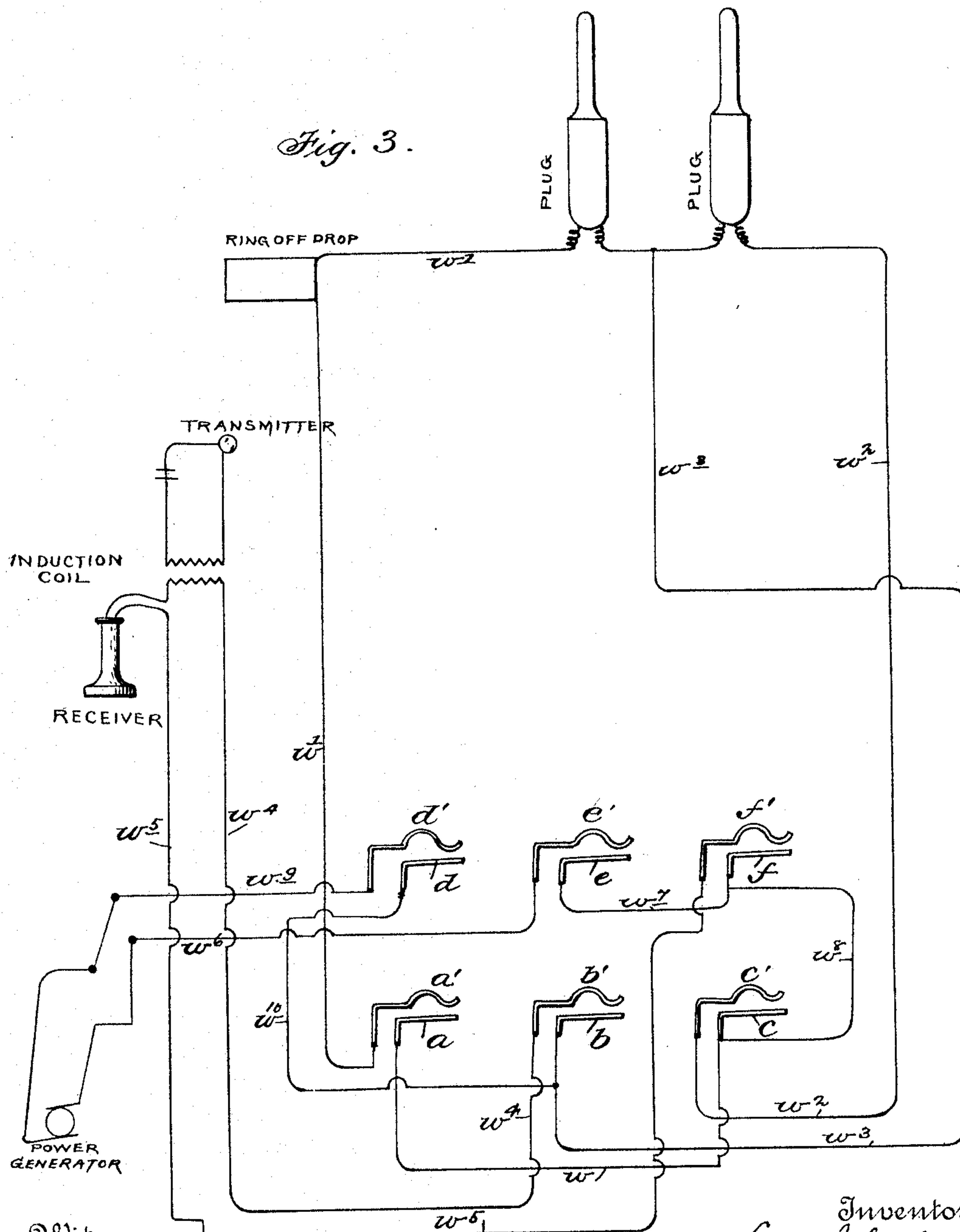
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Fig. 3.



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# UNITED STATES PATENT OFFICE.

LOUIS JOHNSTON, OF LA CROSSE, WISCONSIN, ASSIGNOR OF THREE-FOURTHS  
TO WILLIAM W. CARGILL, FRANK P. HIXON, AND GEORGE H. GORDON,  
OF SAME PLACE.

## OPERATOR'S SWITCH FOR TELEPHONE-EXCHANGES.

SPECIFICATION forming part of Letters Patent No. 585,915, dated July 6, 1897.

Application filed March 13, 1897. Serial No. 627,307. (No model.)

*To all whom it may concern:*

Be it known that I, LOUIS JOHNSTON, a citizen of the United States of America, residing at La Crosse, in the county of La Crosse, in the State of Wisconsin, have invented certain new and useful Improvements in Electric - Telephone - Circuit - Changing Attachments for Central Stations, of which the following is a specification.

The invention relates, primarily, to the cam mechanism by which the circuit connection and disconnection of a telephone with and from different lines may be effected.

The object of the invention is to change the respective telephonic circuits through the medium of a single circuit-changing cam which controls all of the contacts which may be interposed in said circuits.

The invention will be first described, and then specifically pointed out in the claims.

In the devices now used in the art for the purposes to which the invention is adapted a material difficulty or objection to be overcome is that the material used in their construction is attended with so much friction that after the cams have been in use for a short time they become worn out and the intended contacts are imperfectly made and "cut-outs" thus caused. It is one of the objects of the present invention to overcome this deficiency, and this is in a large measure accomplished by the improved constructions of my circuit-changing cam.

The invention is fully and clearly illustrated in the accompanying drawings, where—

Figure 1 is a perspective view of my improved circuit-changing cam mechanism detached from the circuit connections. Fig. 2 is an inverted plan view of the circuit-changing cam. Fig. 3 is a diagrammatic view of the invention interposed in a circuit using a generator having two lines or complete metallic circuit. Fig. 4 is a diagrammatic view of the invention as applied to a grounded circuit.

It will be premised that in the drawings in Fig. 1 but a single circuit-changing cam with its connections is shown, but the casing or supporting-box is shown as being adapted to

receive a number of the devices which, being duplicates of each other, the invention will be readily understood, so as to be operatively applied by the description of a single apparatus and its associated mechanism and circuits.

Referring to the drawings, A designates a box or casing made of hard rubber or other suitable non-conducting material and consisting of top and bottom plates 1 2, connected and supported by side pieces or plates 3 4, the casing being of such size and dimensions as to adapt it to take and support any requisite number of circuit-changing mechanisms. The casing is preferably made with open ends. In the top or cover 1 of the casing are formed the desired number of transversely-arranged slots 5, constituting guide-slots in which the arm or shank of the cam-operator lever moves.

B designates a circuit-changing cam made of suitable non-conducting material and of such length and breadth as to operatively contact or press upon the contact-springs of the respective circuits to be made and broken through the instrumentality of the depressions and elevations formed in and on its under face. On the under surface of this circuit-changing cam are formed a plurality of cam ribs or lugs 13 14 15 16 17 18 19 and of course having intermediate corresponding depressions, substantially as seen in Fig. 2 of the drawings, the purpose being that the cam ribs or lugs shall serve as contact means to effect the contact of the circuit-contacts springs and that when the circuit-changing cam is shifted to make and break other circuits the springs shall have room to move upward and out of contact into the recesses or depressions and break the circuits, as hereinafter will be more fully specified. The circuit-changing cam B is supported on rods 8 8', which slide in suitable bearings  $b^2$ , formed in the sides of the casing, so that the circuit-changing cam may be shifted or reciprocated across the casing and into and out of contact with the desired contact-springs.

On the upper face of the circuit-changing cam is formed or secured a rack-gear 9 of such length as to move it the required distance



endwise in either direction. In the casing is secured a suitable hanger 10, in which is fulcrumed a lever 11, the bar or handle of which projects through a guide-slot in the cover of the casing and may be provided with a hand-piece 11' for the grasp.

On the lower end of the switch-lever is formed or secured a segmental gear 12, which engages with the rack-gear 9 on the circuit-changing cam to move it into and out of contact with the contact-springs of the circuits to be made and broken. Each lever passes through or alongside of a curved locking-plate *p*, provided with suitable recesses *r r' r''*, engaged by a spring-tongue *t*, carried by the lever, whereby the lever and cam will be held in each one of the three positions to which they may be moved to make and break the respective circuits.

It will be perceived that by shifting the lever the circuit-changing cam is moved transversely across the casing and into and out of contact with the springs, making and breaking the required circuits.

In the bottom of the casing are secured a number of contact springs or pieces *a, b, c, d, e, and f*, having one arm overlying the floor of the casing and having the other arm depending and projecting through the floor, substantially as shown, and connected, respectively, to a circuit-wire forming one of the circuits. In a similar manner contact-springs *a', b', c', d', e', and f'* are provided, which overlie the first-mentioned series *a to f*, inclusive, and having one arm extended through the floor of the casing and the circuit-wire of the other limb or line of the respective circuits connected thereto. The contact-arms of the upper series of contact-springs are preferably curved upward, as shown, so that the cam-lugs on the circuit-changing cam will bear on the arch of the curves and press the free ends of the springs, which normally stand free from the lower contact springs or pieces, down into contact therewith to complete or make the desired circuits.

It will readily be perceived that any form may be given the upper series of springs which will adapt them to be pressed down by the cam-lugs on the circuit-changing cam.

The respective pairs of contacts are arranged in two parallel longitudinally-alined series, and the under surface of the cam has its projections and depressions in two series at opposite sides of a central longitudinal line, so that the cam will overlie and operate all of the upper contacts of a single mechanism, as set forth in the description of the respective circuits.

In Fig. 3 of the drawings the invention is shown in diagrammatic illustration as in operative association with a dynamo-generator system of circuits, and reference being thereto had it will be seen that when the circuit-changing cam is in primary or normal position, being that as shown in Fig. 1 of the drawings, the cam-lugs 13 16 on the circuit-

changer cam are in engagement with contacts *a a'* and *c c'*, which are pressed in contact, thus closing and completing the plug-and-cord circuits used when persons on these line connections are conversing, through wire *w* from *a* to *c* and from *a'* through wire *w'*, through plugs by wire *w''*, to contact *c'*.

To make the circuit required for the operator's talking-circuit, the circuit-changing cam is shifted a step to the left, so as to bring cam-lugs 13, 15, 16, and 19 on the springs to close contacts *a a', b b', c c', and f f'*, a circuit being thus made through *a a' w' w''* to *c c'*, wire *w'''* to *b b'*, from *b'* by wire *w''* to transmitter *T*, thence by wire *w'''* to contacts *f f'*, and by wire *w'* to *c c'*.

When the operator shifts the circuit-changing cam to make the first "ringing-circuit," it is moved another step to the left to bring cam-lug 16 to close *c c'*, lug 18 to close *e e'*, and lug 17 to close *d d'*. A circuit is then established from the generator *G* by wire *w''*, through *e' e*, wires *w'' w'''* to *c*, the other side of the circuit being from the generator *G* by wire *w''*, through *d' d*, wire *w'''* to wire *w'''*, and then by wire *w''* to *c'*.

When it is required to move the circuit-changing cam to establish the second ringing-circuit, it is moved a third step to the left to bring cam-lugs 14, 17, and 18 to close contacts *a a', d d', and e'*, making a circuit from generator *G*, through *w'' e e' w'' w''' w* to *a*, and from generator by wire *w''*, through contacts *d' d w''' w''' w'* to *a*, thus completing the circuit.

The invention is equally well adapted to a grounded circuit, as is illustrated in Fig. 4 of the drawings. It will be observed that in this demonstration the contacts *f f'* and their connections have been omitted because their service has been substituted by the "ground" at the transmitter. When the circuit-changing cam is at normal position in this arrangement, the cam-lugs 13 and 16 are carried over the contacts *a a'* and *c c'*, closing them, and the line is by *a* through wire *w* to plug, from plug to plug by ground, from plug to wire *w'* to *c*, and from *c'* to *a'* by wire *w''* through ring-off drop. When the operator connects up the talking-circuit in this instance, he moves the circuit-changing cam from normal position to bring cam-lugs 13, 14, and 16 to close contacts *a a', b b', and c c'*, making a circuit from *a* by *w* to plug *I*, from *c* by wire *w'* to plug, from *a'* to *c'* by *w''*, and through *b b'* by *w''' w'''* through transmitter to ground.

When the first ringing or call circuit is made, the operator moves the circuit-changing cam to bring cam-lugs 16 17 18 to close contacts *c c', d d', and e e'*. We then have circuit from generator by wire *w'''* to contacts *e' e*, thence by *w'''* to contacts *c c'*, and by wires *w''* and *w'* to plug and ring-off drop to ground.

When the operator shifts the circuit-changing cam to the third position, being the second ringing position, the cam-lugs 13 and 17 are moved on the contacts *a a'* and *d d'* to



close them, and the circuit is made from generator by wire  $w^5$ , through  $d$   $d'$  to  $a$ , then to  $w$ , to plug, and from  $a'$  by  $w^2$  to ring-off drop and ground.

5 It is readily understood that such of the upper series of contact-springs remaining unused in any of the circuits described lift by their resiliency into the depressions in the face of the circuit-changing cam, and while  
10 in this position for the time being form no part of the circuits in use.

The operation has been specifically stated in the description respecting the manipulation of the circuit-changing cam and in the  
15 statements relative to making and breaking the required circuits, and it will readily be perceived from these sources that the connection to the line of a called subscriber is made, as usual, by inserting the proper plug  
20 in the line to be connected therewith.

What I claim is—

1. In an electric-circuit-changing mechanism, the combination with a non-conducting cam having a series of recesses in its working  
25 face and teeth or projections between said recesses, of a series of pairs of contacts arranged one in advance of the other in a plane parallel with the said working face; one member of every pair at the same side  
30 of the series normally tending to spring away from its opposed mating member and toward the said working face of the cam, whereby as the cam is moved predetermined distances certain of said contacts will spring into the  
35 cam-recesses and certain others will be moved into contact with their mates to make and break the determined circuits, substantially as described.

2. The combination with the circuit-changing  
40 cam herein described, composed of a non-conducting body formed with cam-lugs and depressions on its under face, supporting rods projecting from the ends of the body, a rack-gear on its upper face and a lever having  
45 a segmental gear meshing with said rack, of a series of pairs of contacts all controlled by said projections and depressions on the cam.

3. The combination with a reciprocating  
50 circuit-changing cam having projections and depressions on its under face, of a series of pairs of contact-springs arranged in longitudinal series under the cam; whereby when the cam is moved longitudinally a predetermined  
55 distance certain of the upper springs will be depressed by the cam-projections into contact with the lower mating contact springs or pieces and the upper springs of certain pairs of contacts will spring upwardly into  
60 the cam-recesses out of contact with their mating contact springs or pieces.

4. The combination with a reciprocating circuit-changing cam provided on its under  
65 side at opposite sides of its longitudinal center with alternately-arranged projections and depressions, of two longitudinally-alined series of pairs of contact-springs under said

cam and in the path of its two sets of projections and depressions.

5. In an electric-telephone-circuit-changing  
70 mechanism, the combination with the talking, call, and reply circuits having a series of pairs of contacts arranged side by side in the same plane, one member of each pair at the same side of the series tending normally  
75 to spring away from its mate, of a non-conducting cam having its working face overlying said series of contacts and formed therein with parallel series of recesses and intervening teeth or projections; whereby as the cam  
80 is moved predetermined distances certain of the contacts will spring away from their mates into the recesses while others will be moved by the cam teeth or projections into contact with their mates to break and make deter-  
85 mined circuits, substantially as described.

6. In an electric-telephone-circuit-changing mechanism, the combination of a system of telephonic circuits having spring-contacts  
90 interposed therein, one set or series of said contacts consisting of arched springs, a reciprocating circuit-changing cam formed with lugs and intermediate depressions on its under face, whereby any one of the determined  
95 circuits may be made and broken, and a lever to shift the circuit-changing cam.

7. In an electric-telephone-circuit-changing mechanism, the combination with the lower contact-pieces  $a, b, c, d, e, f$ , having connection respectively to wires forming one side  
100 of the circuit, and the upper contact-springs  $a', b', c', d', e',$  and  $f'$ , having connection respectively to wires forming the other side of the circuit, and tending normally to spring away from their mating lower springs of a  
105 longitudinally-reciprocating circuit-changing cam B made of a suitable non-conducting material, formed with lugs on its under face to normally hold the talking-circuit through contacts  $a a', c c',$  by depressing springs  $a',$   
110  $c',$  and lugs and depressions also on its lower face to open and close other circuits in the operative series by depressing certain of the upper springs and allowing others of such  
115 springs to move up into said depressions.

8. In combination with the contact-pieces  
120  $a b c d e f$ , the contact-springs  $a' b' c' d' e' f'$ , and circuits connecting the same in series, of a circuit-changing cam composed of a suitable non-conducting material formed with lugs and depressions on its under face disposed to bear on and release the contact-springs and make and break determined circuits, and having a rack-gear on its upper  
125 face, sliding supports or bearings to sustain the circuit-changing cam, and a suitably-fulcrumed lever formed with a segmental gear to engage the rack on the circuit-changing cam to reciprocate it.

9. In electric-telephone-switch circuits, the  
130 circuit-changing cam herein described, comprising a non-conducting casing A, contact-pieces  $a b c d e f$ , in the floor of the casing and having connection respectively to one



side of the circuits, arched contact-springs  $a'$ ,  
 $b' c' d' e' f'$  in the floor of the casing arranged  
to contact with their free ends the said con-  
tact-pieces and having circuit-wires con-  
5 nected thereto, a circuit-changing cam B  
formed with a plurality of lugs and depres-  
sions on its under face, and a rack-gear on  
its upper face, sliding rods arranged in bear-  
ings in the sides of the casing whereon the  
10 circuit-changing cam is supported to move

transversely across the casing, a lever ful-  
crumed in the casing and formed with a seg-  
mental gear on its lower end to engage the  
rack on the circuit-changing cam and oper-  
ate the same.

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