

No. 771,114.

PATENTED SEPT. 27, 1904.

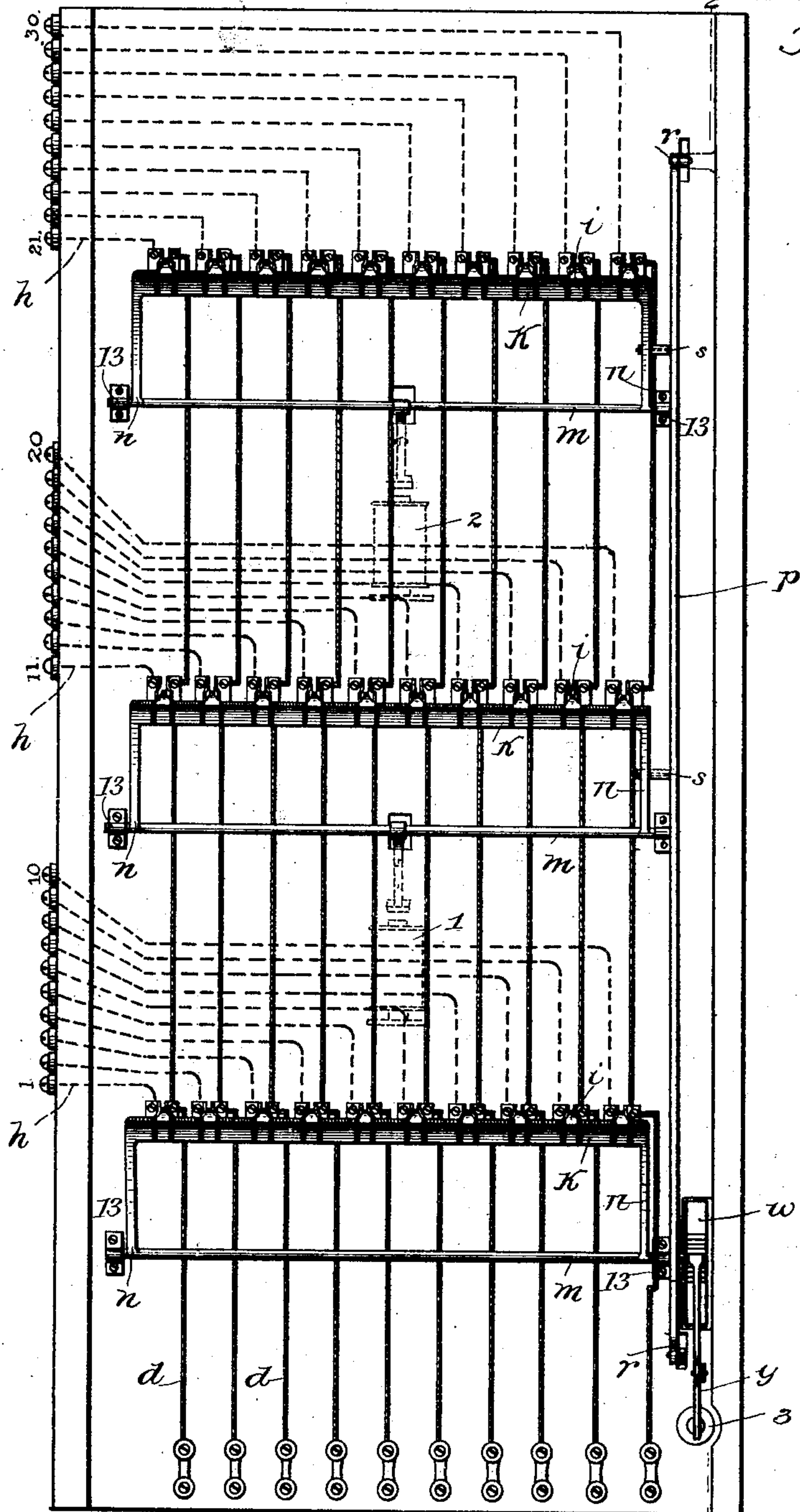
A. K. ANDRIANO & H. HERBSTRIIT.

SWITCHING MECHANISM FOR INTERCOMMUNICATING TELEPHONE LINES.

APPLICATION FILED JAN. 14, 1901. RENEWED APR. 7, 1902.

NO MODEL.

23 SHEETS—SHEET 1.



Witnesses

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3 SHEETS—SHEET 2.

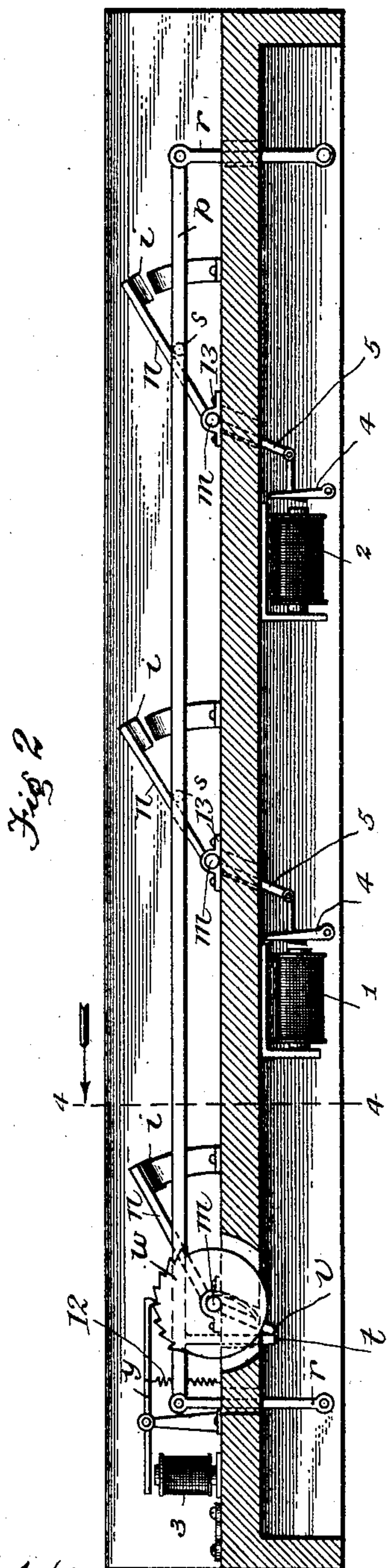


Fig. 2

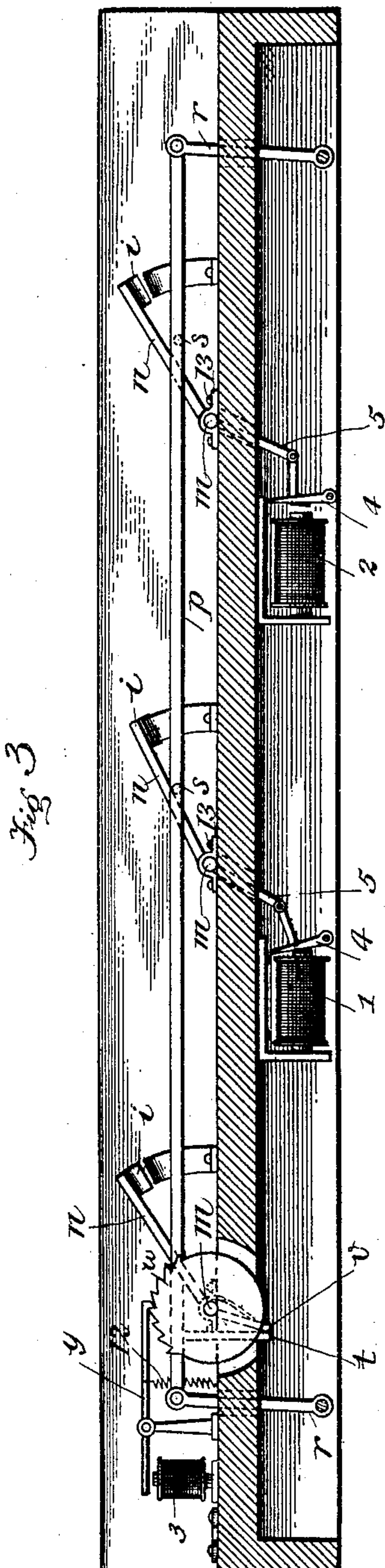


Fig. 3

Fig. 5

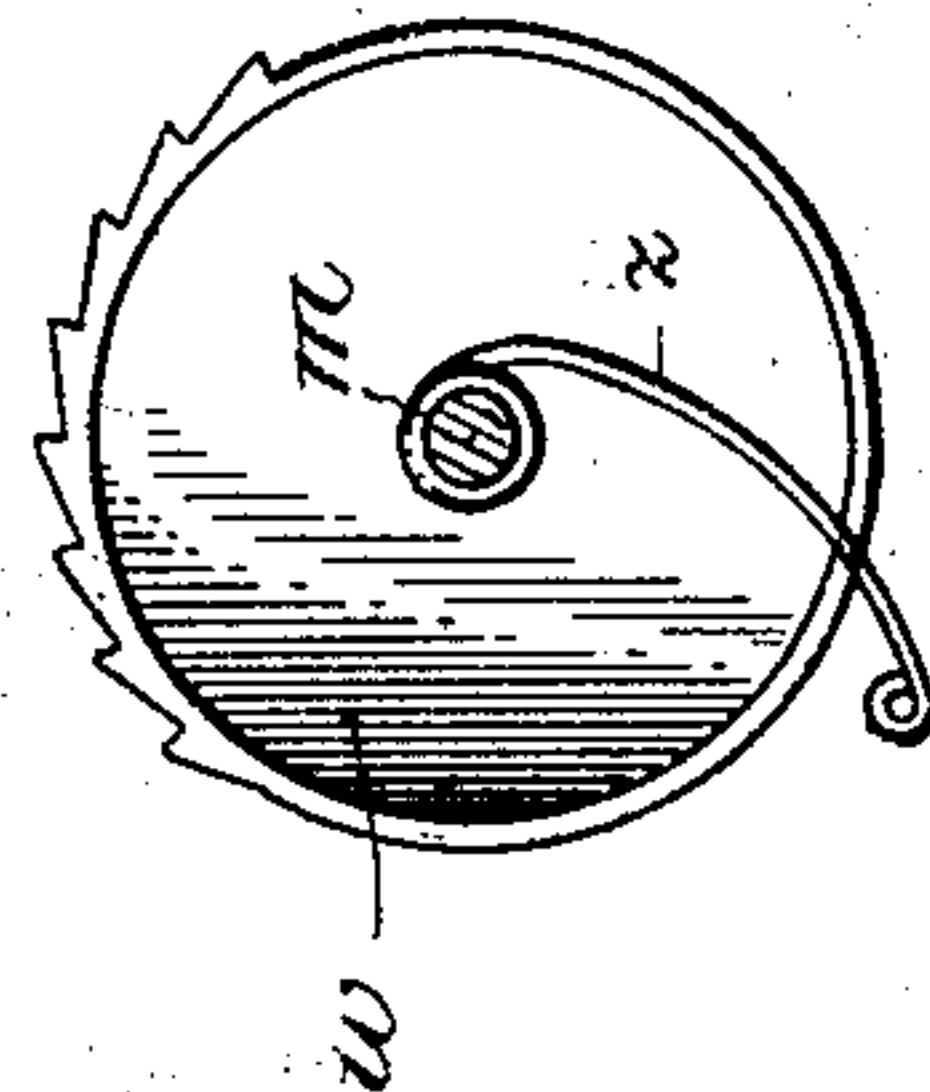
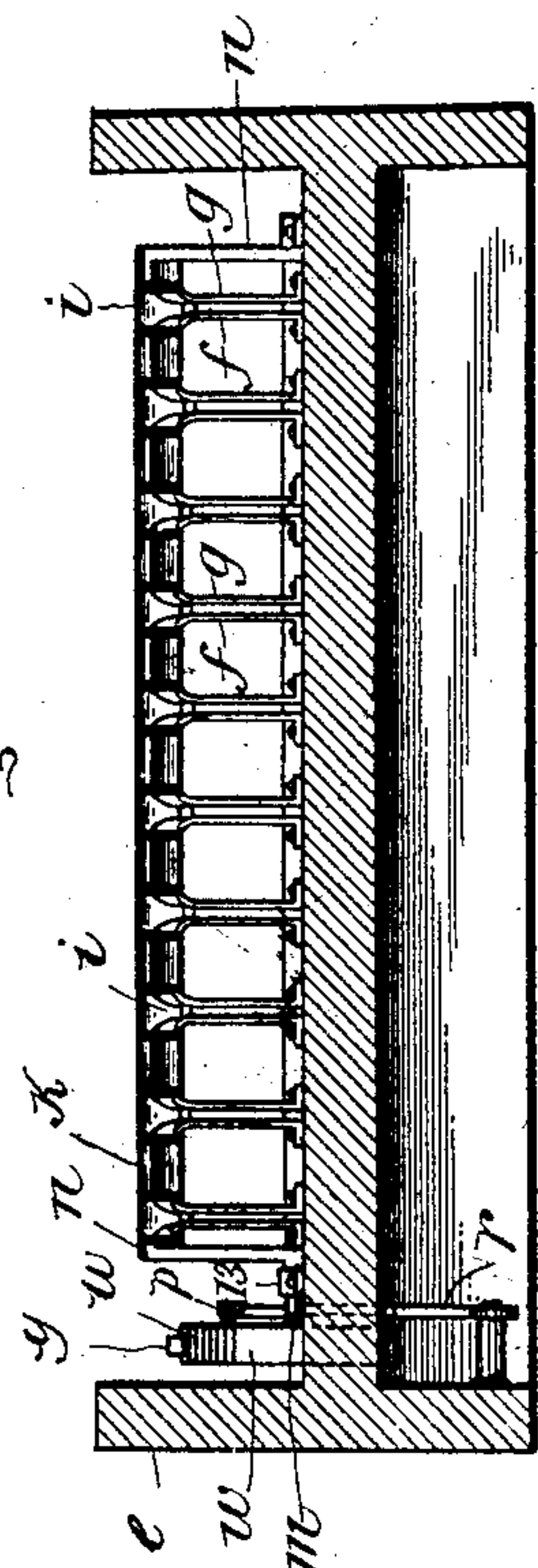


Fig. 4



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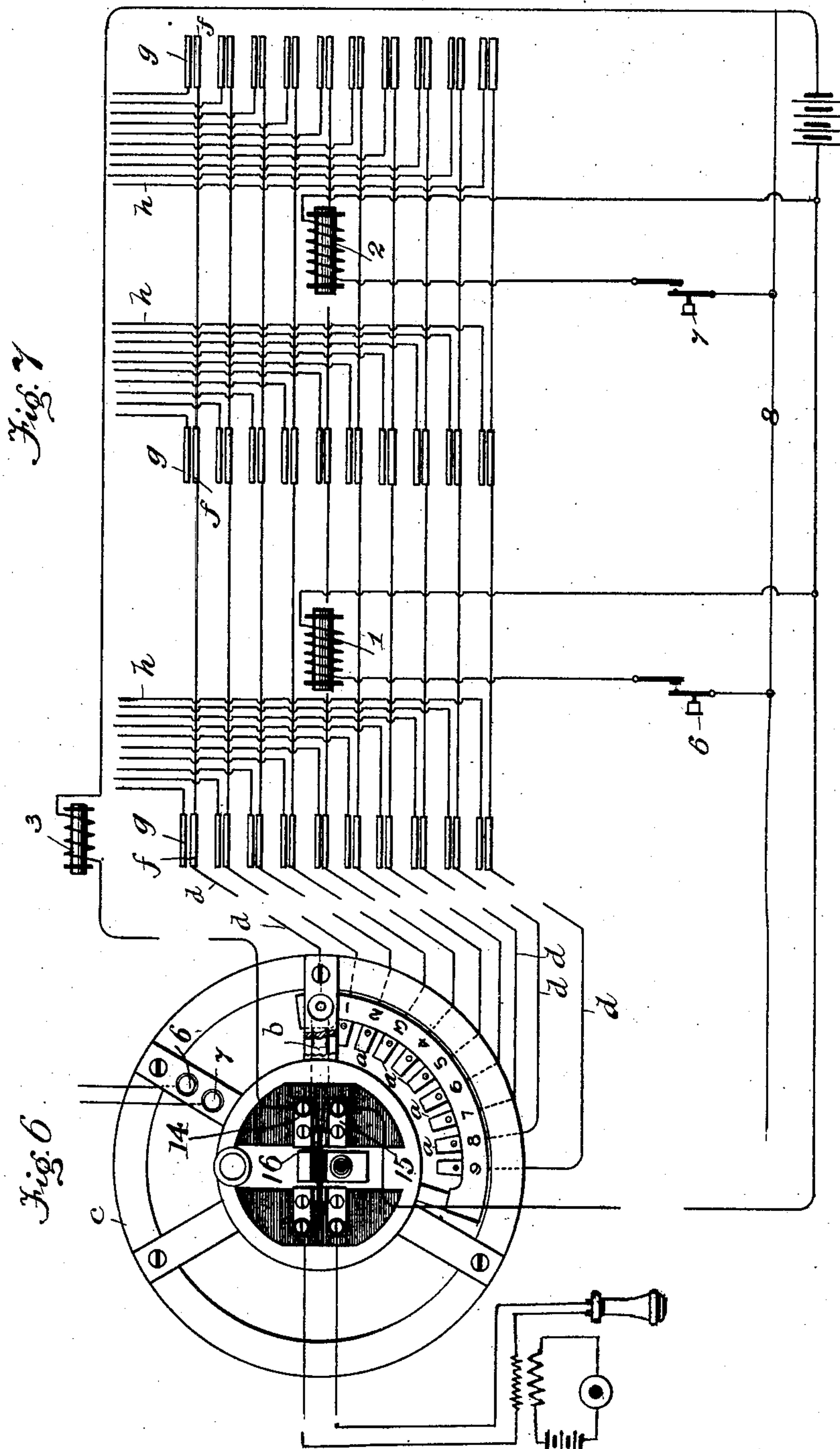
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3 SHEETS—SHEET 2.



Witnesses

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UNITED STATES PATENT OFFICE.

ALBERT K. ANDRIANO AND HERMANN HERBSTTRITT, OF SAN FRANCISCO, CALIFORNIA, ASSIGNORS, BY MESNE ASSIGNMENTS, TO DIRECT-LINE GENERAL TELEPHONE COMPANY, OF SAN FRANCISCO, CALIFORNIA, A CORPORATION.

SWITCHING MECHANISM FOR INTERCOMMUNICATING TELEPHONE-LINES.

SPECIFICATION forming part of Letters Patent No. 771,114, dated September 27, 1904.

Application filed January 14, 1901. Renewed April 7, 1902. Serial No. 101,612. (No model.)

To all whom it may concern:

Be it known that we, ALBERT K. ANDRIANO, a citizen of the United States, and HERMANN HERBSTTRITT, a subject of the Emperor of Germany, residing in the city and county of San Francisco and State of California, have invented new and useful Improvements in Switching Mechanism for Interconnecting Telephone-Lines, of which the following is a specification.

This invention relates to that class or description of switching device for telephone systems which is intended to give direct connection between one station and another instead of through a central station, the object being to enable one station to connect directly with and call up another station without requiring to make the switch through a central office or station.

The present improvements have for their object to provide a switching device of greater capacity embracing a much greater number of stations than has heretofore been practicable by reason of the multiplicity of lines and connections required in previous constructions to furnish every station with means for selecting and making a direct connection with any desired station in the system without loss of time or the employment of complicated mechanism. In these improvements each station or telephone in the system is provided with the usual switching means, composed of a plurality of stationary line-contacts and a movable switch point or contact through which the local circuit of one station is connectible with that of another station; but instead of bringing all the lines directly into a switch and employing a separate contact for every line, as heretofore, I connect each telephone in the system with all the other telephones through a local switchboard on which circuit-closing contacts equal in number to the incoming lines are disposed in several groups, each of which preferably contains the same number of contacts, and then connect the movable contact of the switch at the telephone with the contacts on this switch-

board through the stationary contacts of the switch at the telephone. The stationary contacts last mentioned correspond in number with the contacts in the groups on the switchboard, and they are arranged to form the terminals at the telephone-switch for all the contacts in the several groups, according to their numerical order in the group—that is to say, one spring of the first circuit-closing contact in each group is connected with the first stationary contact in the local or telephone switch, one spring of the second circuit-closer in each group with the second contact in the local switch, and so on for the remaining contacts—every stationary contact in the local switch being connected in this manner to one side of that circuit-closer on the board which corresponds in numerical order in the several groups with the number or position of the stationary contact in the switch. To the other side of each circuit-closing contact is permanently connected an incoming telephone-line. In this manner every telephone is connected in open circuit at the switchboard with the local switch, and consequently by closing the line at the circuit-closing springs in any selected group all the telephones belonging to that group will be electrically connected with all the stationary contacts in the local switch. It only remains then to connect the local circuit of the station with that one of the stationary contacts which forms the terminal at the switch of the required line. By this means the number of wires and connections and the number of switching-contacts are reduced to a minimum at each telephone instrument, and provision is made for handling a greater number of stations through the switching device than has heretofore been practicable. The nature of these improvements and the manner in which I proceed to produce, apply, and carry out the same are explained at length in the following description, in which reference is had to the accompanying drawings, forming part thereof.

Figure 1 of the drawings is a plan or front view of a switchboard containing switch-points

and connections for connecting one telephone or station with thirty other stations in one system and showing the position of the parts when the switch is set to give connection between one telephone and any other telephone from No. 1 to No. 11 in the same system. Fig. 2 is a longitudinal sectional view through 22, Fig. 1. Fig. 3 is a similar sectional view showing the movable switch-points on the board set to connect the telephone with any one of the stations in the second group containing the contacts for the stations from No. 11 to No. 21. Fig. 4 is a transverse section at 44, Fig. 2. Fig. 5 is a detail of the throw-off spring and locking-dog, on an enlarged scale. Fig. 6 is a top view of the stationary contacts of the local switch at the telephone and the wires connecting those contacts with the line-wires through the mechanism on the switchboard. Fig. 7 is a diagram of the circuits leading out from the switch to the lines through the local switch and the local battery and circuit-closers of the switching device.

The switch illustrated in these drawings provides connection for thirty telephones in one system. In it there are ten stationary contacts a at the telephone-stand c and a movable switch point or contact composed of a switch-arm b , swinging on a pivot in an arc over the contacts. These are arranged in the usual manner for connecting the primary circuit of the telephone to any one of the lines that terminate at the stationary contacts. This part of the switching mechanism is the same in its general construction and arrangement as those already in use and no detailed description is necessary to a clear understanding of these improvements by persons skilled in the art. In connection with this local switching means every station is provided with a switchboard e , containing a set of contact-springs $f g$ for each individual telephone of the system. The incoming line-wire h carried from each telephone to the board is connected to one spring, g , through a binding-post in the usual manner, and to the other spring, f , one of the contacts a at the local switch is connected by a wire d . These terminals $f g$ at the switchboard are divided into several groups, each containing as many terminals as there are contacts a in the local switch at the telephone, and those terminals are disposed at equal distances apart and on parallel lines lengthwise of the switchboard, so as to the more conveniently connect with the same contact a all the line-terminals that occupy the same relative position in the several groups.

A system containing thirty stations is herein illustrated for the purpose of explaining the application and operation of our invention; but it should be understood that we do not limit our invention to the exact form or construction of mechanism or apparatus or the number of stations herein described, because it will readily be seen that by adding

one or more groups of circuit-closing springs $f g$ with the necessary circuit-closers and connections or by increasing the number of terminals in each group and correspondingly increasing the number of stationary contacts in the local switch the system is capable of being expanded to handle a greater number of stations. In the present construction the thirty lines are divided on the switchboard into three groups of ten contact-springs each, and each of the contacts a in the local switch is connected by a wire d with one spring f in the contact-springs of each group occupying the same relative position in its group as the contact a occupies in the local switch. Each of these contacts a thus forms the terminal at the telephone of a contact f in each separate group, and one contact in the set a constitutes, therefore, a switch-contact to three different lines, any one of which is connected electrically with the stationary contact in the local switch by closing the circuit between the two springs f and g of the required line. The contacts last mentioned are properly numbered to agree with the contacts a at the telephone, so that those in the first group form the line-terminals of the first ten stations, those in the second group consist of the second ten stations or those numbered from 11 to 20, inclusive, while the third group contains the remaining number of stations.

To connect any station with another station, all the terminals $f g$ of all the lines in that particular group containing the station to be called are closed by connecting the springs of each pair together, after which the switch-point b of the calling-station is set on the proper contact a in the local switch. This gives connection through the local switchboard e and the local switchboard c between the two stations for ringing up and talking.

The connection between the spring f and the other spring g in each pair is made by a circuit-closing device, the construction and operation of which will be understood from Figs. 1, 2, and 3 of the drawings.

The bar k has a separate circuit-closing insulated spring or blade i for each pair of springs $f g$, and it is connected by arms n to a rock-shaft m , which has rocking movement in bearings 13 on the switchboard e . The necessary movement to throw the bar k toward the stationary circuit-closers $f g$ and press the circuit-closing springs or blades i between those springs is produced by electrically-operated means as distinguished from a hand-operated means, composed of an open electric circuit, including push-buttons 6 7, a local battery 8, and an electromagnet having an armature-lever 4 so connected to the bar k that as often as the battery is thrown upon the magnet by closing the circuit at the push-button the attraction of the armature will move the bar k and set the circuit-closers i on the bar into the row of springs $f g$.

In the present illustration of our invention there are three bars k , carrying the insulated circuit-closers i , one for each set or group of contacts $f g$, and these bars are operated and controlled by independent means. Each of the bars for the second and third group of contacts is controlled by an individual electromagnet and armature, the magnets being in circuit with and controlled by the aforementioned push-buttons. For convenience those push-buttons 6 7 are arranged on the stand c of the local switch or in proximity to the movable contact of that switch, so as to be within reach of the person manipulating the switch.

The contrary movement of the bar k to withdraw the circuit-closers i from the springs $f g$ is effected by a spiral spring z , having one end attached to the rock-shaft m of the first bar k and the other end secured to a fixed point on the board together with a long slide-rod p , having stop-pins s projecting from the side next the arm n of the bars k in front of and in line with the arms of the second and third circuit-closing bars of the three sets. The rod p is mounted on pivoted arms or links r , attached at the lower ends to the base of the switchboard, and it is also operatively connected with the circuit-closing bar k of the first set or group by an arm v , projecting downwardly from the rock-shaft m of the first bar, and a rigid arm t , depending from the rod p , as shown in Figs. 2 and 3.

The first set of circuit-closers i is thrown into the springs $f g$ by the spiral springs z acting on the rock-shaft m that carries the first circuit-closing bar k , while the contrary movement of the bar to open all the contacts in that row is produced by the movement of the slide-rod p in the opposite direction, the last-mentioned rod being drawn forward by the arms of either one of the other cross-bars k , engaging the stop-pin s in the forward movement of the cross-bars as the electromagnet acts on the rock-shaft m through the armature 4 and its connecting-lever 5. When the rod p is thus moved, the arm t , depending therefrom, engages with the arm v , extending from the rock-shaft m of the first group of contacts and operates to rock the shaft sufficiently to disengage the circuit-closers carried by the cross-bar k from the stationary line-contacts, leaving the circuits of the lines of the first group open at the springs $f g$.

In the normal position of the switch when the telephone is not in use it should be understood that the lines terminating at the springs g in the first group remain normally closed on or connected with the stationary contacts a in the local switch, thereby affording ready connection with any one desired of the stations contained in such first group from 1 to 10 simply by setting the movable arm b of the local switch to the desired switch-number.

Thus the circuit-closers i on the bar k of

the first group rest normally in the springs $f g$, while the bars k of the remaining groups of circuit-closers on the switchboard stand out of the spring in those groups. The spiral spring z , before mentioned, is wound up or put in tension by the movement of the first rock-shaft m whenever the circuit-closing bar k of the first group is withdrawn from the springs $f g$, and as this takes place as often as the local switch-contacts are to be connected with the lines that are contained in either the second or the third group on the switchboard the rod p is first drawn forward by the moving circuit-closer engaging the pin s , and the arm t on the rod being pressed against the arm turns the rock-shaft m . This movement of the rock-shaft has the effect to put the spiral spring z in tension to supply the force required to throw the first set of movable circuit-closers into the springs $f g$ of the first group, which is the normal position, as before described, and at the same time it withdraws the previously-set movable circuit-closer from the springs of the second or third group.

The spiral spring z is held in tension and prevented from acting on the rock-shaft through the medium of a toothed segment or disk w , fast on the rock-shaft, a locking-lever y , having a hooked end, engaging the toothed rim of the disk, with which it is held in contact by a coiled spring 12, as represented in Figs. 2 and 3. The lever y is fulcrumed in a fixed support on the switchboard, and its outer end extends beyond the fulcrum in working relation to the pole of an electromagnet 3. The magnet is in open circuit with the local battery 8 through a circuit-closer composed of contacts 14 15 and a movable stop 16 on the switch-stand. The magnet when energized acts to release the spiral spring z . The operation of the switching mechanism as thus constructed and connected will be as follows:

If the line of the station to be rung up be found in the first group of circuit-closers, the calling-telephone is immediately connected with it by setting the movable contact b of the local switch on the proper one of the stationary contact a , because those local switch-contacts are already connected with the spring-terminals g in the first group on the board by virtue of the movable circuit-closers i being already in operative position. On the other hand, if the required connection is to be made with a station found in the second or the third group on the switchboard the proper push-button 6 or 7 at the local switch is pressed to energize the magnet 1 or the magnet 2, according to the particular circuit-closer to be brought into action, and as the armature 4 is attracted by the magnet the rock-shaft m is turned and the circuit-closers are set into the springs $f g$ of the selected group. As the pin s on the rod p is engaged by the arm connecting the bar k to the rock-shaft the rod p is drawn forward, thereby bringing the arm t

against the arm v of the first rock-shaft m and throwing the first set of movable circuit-closers out of the springs $f g$ of the first group. By that movement also the spiral spring z is put in tension and is held by the toothed disk and pawl until the time of release after the conversation over the connected line is ended. The magnet 3 then is energized to release the spring z , whereupon the circuit-closer k on the first rock-shaft is thrown into the group of springs $f g$ beneath it, and at the same time the movable circuit-closers controlling the contacts in the remaining groups are withdrawn by the rod p , acting as already described.

It will be observed that the incoming lines at each station are divided into two sets of groups. Those of the first set have been described, and all the contacts of each group are arranged to be closed simultaneously. The other sets are formed by the contacts that are united by the conductors d . Thus the first in series of each group of stationary line-contacts are arranged in a set or group connected with the first stationary contact of the local switch c , the second in series of each group of stationary line-contacts are formed into another set connected with the second stationary contact of the switch c , and so on.

The circuit that is connected with the movable arm of the local switch may be termed the "principal" circuit, as it includes the source of electric energy that by means of the switching mechanism shown and described may be connected with any of the metallic circuits. We have shown the invention applied to a switching mechanism of an interconnecting telephone system, for which it is well adapted. It is apparent, however, that its principle may be applied to switching mechanisms for other electrical systems. In the present system, as already stated, the circuit including the source of energy is the local telephone-circuit, while the circuits that are connected therewith include translating devices through which said power or energy operates, such devices in the present system being the distant telephone instruments.

Having thus fully described our invention, what we claim as new therein, and desire to secure by Letters Patent, is—

1. In a telephone system in combination, a plurality of stations each provided with a local switch having a plurality of stationary line-contacts and a movable contact adapted to connect the talking-circuit thereof with a selected one of the line-contacts, and circuit-closing devices in groups, each group containing as many contacts as there are stationary contacts in the local switch, all the circuit-closers comprising the groups being connectible with the contacts in the local switch in numerical sequence, and means for selecting and operating the circuit-closing devices of any selected group.

2. In a telephone system, a plurality of stations each having a local switching device composed of stationary line-contacts and a movable contact through the medium of which the circuit of the station is connectible with a selected one of the stationary line-contacts, in combination with line-terminals comprising a plurality of circuit-closing devices divided into separate groups, each group containing as many lines as there are stationary contacts in the local switching device, and means for closing the circuits between all the stationary contacts in the local switch and the contacts contained in any selected one of the groups of circuit-closers, and means for breaking the connection of said stationary contacts with the lines in all the remaining groups.

3. In a telephone system, a plurality of stations each having a switching device containing terminals for all the lines of the stations composing the system, said line-terminals being arranged in groups, each containing an equal number of lines; a local switch to each station comprising a movable contact and a plurality of contacts corresponding in number and numerical sequence with the line-contacts contained in a group; means connecting the stationary contacts of the local switch in numerical order with the contacts contained in all the groups; and movable circuit-closing devices adapted to close the circuits between the stationary contacts of the local switch and the line-terminals contained in a selected group; and means operating the said circuit-closing devices to make or break the line-circuits.

4. In an interconnecting switch for telephone systems the combination, with incoming line-terminals arranged in separate groups, each group containing an equal number of lines; of stationary switch-contacts corresponding in number with the terminals comprising each group, said contacts being normally in electrical connection with the line-terminals in one group in numerical sequence and disconnected from the line-terminals in the remaining groups, a movable switch-contact adapted to connect the station with a selected stationary contact, and electrically-operated means for disconnecting all the stationary contacts from the line-terminals of one group and connecting them with the line-terminals of another group.

5. A switching device for individual stations in a telephone system comprising a plurality of stationary contacts, a movable contact to which is permanently connected the local or primary circuit of the station, a plurality of line-terminals corresponding in number with the lines of the stations contained in the system, and consisting of circuit-closing springs in pairs arranged in separate groups containing an equal number of lines, each line being connected to one spring of its circuit-closer in the group to which it belongs, the other

spring being connected to that one of the stationary contacts which corresponds in numerical sequence with the line-terminal, a connector to each group adapted to connect the circuit-closing springs of the lines contained in a group, and means for selecting and electrically operating the connector of any one group to close the circuits between the stationary contacts and the lines belonging to that group.

6. The combination, with a local switch comprising stationary contacts and a movable contact; of a switchboard having line-terminals arranged in separate groups, each group containing as many lines as there are contacts in the switch, stationary circuit-closers through which the stationary contacts are connectible in numerical sequence with the lines contained in the said groups, a movable circuit-closer to each group and means for separately operating the movable circuit-closer of any one group.

7. The combination, with a local switch comprising stationary contacts and a movable contact, of a switchboard having line-terminals arranged in separate groups, each group containing as many lines as there are contacts in the switch, stationary circuit-closers through which the stationary contacts are connectible in numerical sequence with the lines contained in the said groups, a movable circuit-closer to each group and electrically-actuated means for separately operating the movable circuit-closer of any one group.

8. The combination, with a local switch comprising stationary contacts and a movable contact; of a switchboard having line-terminals arranged in separate groups, each group containing as many lines as there are contacts in the switch, stationary circuit-closers through which the stationary contacts are connectible in numerical sequence with the lines contained in the said groups, a movable circuit-closer to each group and means for separately operating the movable circuit-closer of any one group, comprising an electromagnet in circuit with a battery, a circuit-closing key, and an armature-lever actuated by the magnet and operating to throw the circuit-closer into operative relation with all the stationary circuit-closers contained in the group, one group of the stationary circuit-closers being normally in connection through its movable circuit-closer with the contacts of the local switch, means connecting the movable circuit-closer of one group with those of all the remaining groups, and means actuated by the movement of any one movable circuit-closer to throw off all the other circuit-closers.

9. In a telephone system a local switching device having a plurality of stationary line-contacts and a single movable contact, a switchboard having a terminal for each of the lines of the system composed of two spring-contacts, said line-terminals being arranged in groups containing each the same number of lines,

switching means for connecting the stationary contacts of the local switching device in numerical order with one set of the line-terminals composing a group on the switchboard, a connector to each group of said terminals including a movable circuit-closer for each set of spring-contacts, means for selecting and setting each circuit-closer in operative relation with the spring-contacts of its group, and means operatively connecting the movable circuit-closer of a selected group with the corresponding circuit-closer of another group, whereby the operation of throwing one movable circuit-closer in working position with relation to the line-terminals in its own group will throw the other circuit-closer out of operative relation.

10. In a telephone system, the combination of a plurality of stations, a local switchboard provided with stationary contacts to which the lines from the stations lead, such line-contacts being arranged in groups, means for simultaneously closing all of the line-contacts of any one group, connections between corresponding line-contacts in the several groups, whereby such connected contacts are arranged in sets, a switch having a series of contacts with which the several sets of connected line-contacts of the different groups are united, a movable switch-arm arranged to make contact with the contacts of the said switch, a local telephone connected with the movable switch-arm, and means for operating the simultaneously-operated contact-closers for each group of line-contacts, substantially as set forth.

11. In a telephone system, the combination of a plurality of stations, a switchboard having a group of open contacts $f g$, the lines from the stations leading to the contacts g , a switch having a set of stationary contacts connected respectively with the contacts f on the switchboard and a movable arm arranged to be brought into contact with the said stationary contacts, means for simultaneously closing all of the contacts $f g$ in the group, and telephone apparatus connected with the movable arm of the switch, substantially as set forth.

12. In a telephone system, the combination of a plurality of stations, a switchboard provided with stationary contacts to which the lines from the stations lead, such contacts being arranged in groups, a switching device having a series of contact-points and a movable arm arranged to be brought into engagement therewith, independent connections between the points of the switching device and the line-contacts of the several groups corresponding in sequence thereto, independent circuit-closing means for each group of line-contacts arranged to simultaneously close all of the line-contacts in its group, means for independently operating the said circuit-closing means, means arranged to prevent more

than one set of circuit-closers from operating at a time, and telephone apparatus connected with the movable arm of the switching device, substantially as set forth.

- 5 13. The combination of a plurality of electric circuits each terminating in a stationary contact, such contacts being disposed in groups, a local switching device having a series of stationary contacts and a movable co-
10 operating contact, movable circuit-closing devices disposed in groups corresponding with the groups of stationary contacts for the circuits, and each arranged to simultaneously close or break all of the contacts of its par-

ticular group, independent conductors by 15 which the stationary contacts of the local switch are connected in numerical sequence with the stationary contacts of all the groups, and means for selecting and operating the circuit-closing devices of any particular 20 group, substantially as set forth.

In testimony that we claim the foregoing we have hereunto set our hands and seals.

ALBERT K. ANDRIANO. [L. s.]

HERMANN HERBSTRIIT. [L. s.]

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