rod D is sleeved, into which is inserted the upper portion of the ratchet-rod D′. This sleeve construction between the rods D and D′ allows the ratchet-rod D′ to have a longitudinal motion only, thereby keeping the ratchet-teeth *d* continuously toward its attendant pawl.

The ratchet-rod D′ is provided outside of the cylinder A and conveniently below it with a series of ratchet-teeth *d*, by means of which the rods D and D′ are moved longitudinally. The wheels E and E′, through the hub of which the rod D extends with a feather-and-groove connection R, (see Fiv. VI,) so as to cause the rotation of the rod D and at the same time admit of its longitudinal sliding movement therein, are provided on their peripheries with a series of ratchet-teeth *e* and *e′*, by which the rod D is rotated, and with it the circuit-closer C and C′.

G H I represent levers having pawls *g h i* pivoted in their ends in position to engage the ratchet-teeth, with which they are respectively in contact. Each lever has a vibratory movement and is oscillated by the alternate energizing and de-energizing of their respective magnets, thereby imparting motion to its adjacent ratchet-teeth and consequently the circuit-closing needle C′. At each pulsation of the push-button at the sub-station made at the will of the operator causes, through the channels thus described, the circuit-closing needle C′ to move from row to row and from wire to wire in the row. When only three levers are used, the dog T (see Figs. I and II) would be necessary. Its use is obvious.

The magnets K K K are located in suitable positions that when energized by the manipulation of certain keys at the sub-station, operate their respective levers. A set of magnets K′ K′ K′ K′ are also located in suitable positions, that when energized their respective levers P serve to release the pawls from their engagement with the ratchet-teeth and allow the circuit-closing needle C C′ to assume the initial position by the aid of gravity and the spring S. At each sub-station there is a set of keys marked, respectively, G′, H′, I′, and P′. Each key is connected by wire with its respective lettered magnet at the central office, and when pressed an electrical circuit is established, it being understood that both ends of the wire are grounded or connected with a return-tap, it also being understood that a battery is used to generate the electricity and may be located at the sub-station between the keys and the ground. The line-wire N extends from the telephone to and within the central office, there connected by the circuit-closing connective wire W to the circuit-closing needle C, and also by connective B to the inside of each cylinder.

Each perforation *a* of the cylinder A is numbered with respect to an initial or starting point on the cylinder—for example, in rows numbered 1 2 3 4, &c.—from the lower end of the cylinders upwardly, and by places in each row—as, for example, 1 2 3 4 &c.—to the right or left of a given vertical row, so that, supposing there were one hundred perforations in each of the rows, No. 310 would be in the third row from the bottom, ten spaces to the right or left of the vertical initial line.

Each connective wire B and phonic line-wire N, Figs. II and III, with which the connections are attached, is also numbered to correspond with the number of the perforations *a*, through which the terminals extend.

The person wishing to place his transmitter and earphone in connection with those of another, he will do so by successively pressing or depressing the keys, which cause the circuit-closer C C′ to move. For example, if telephone 288 wishes to place himself in connection with telephone 315 he will do so by pressing the key marked G′ three times, then the key marked H′ once, and then the key marked I′ five times. His circuit-closer C C′ is then in contact with wire-terminal No. 315. In Fig. II sub-station No. 288 is represented as being in connection with sub-station No. 315. This is known by the positions of the circuit-closer C of cylinder No. 288, the course of the electrical current being indicated by arrows. Had its circuit-closer C been turned to the next wire indicated in the drawings, 288 would be in connection with 11. The person at telephone 315 will take down his earphone. The two are then able to converse with each other. When conversation is ended, the person calling up hangs up his earphone, depresses key marked P′, which causes the magnets K′ to be energized, attracting the armatures, thereby withdrawing the several pawls from their engagement with the ratchet-teeth and allow the circuit-closer C C′ to fall and return to its initial point.

If a person has called up the wrong number, he will push the key marked P′ and start over again.

The size of the cylinder A will depend solely upon the number of wires required in the system and the distance apart which it may be found most expedient to place them; and it is also evident that various slight changes might be resorted to in the mechanical construction of the several parts which I have described without materially departing from the spirit and scope of my invention, and hence I do not wish to be limited strictly thereto.

Having thus fully described my invention, what I claim as new, and desire to secure by Letters Patent, is—

1. In a system of telephone, telegraph, or other electrical exchange, the combination, with a series of wires leading to different stations in the system and having their ends insulated and held in curved rows, of a contact-needle supported at the axis of the rows, mechanism for moving the needle from row