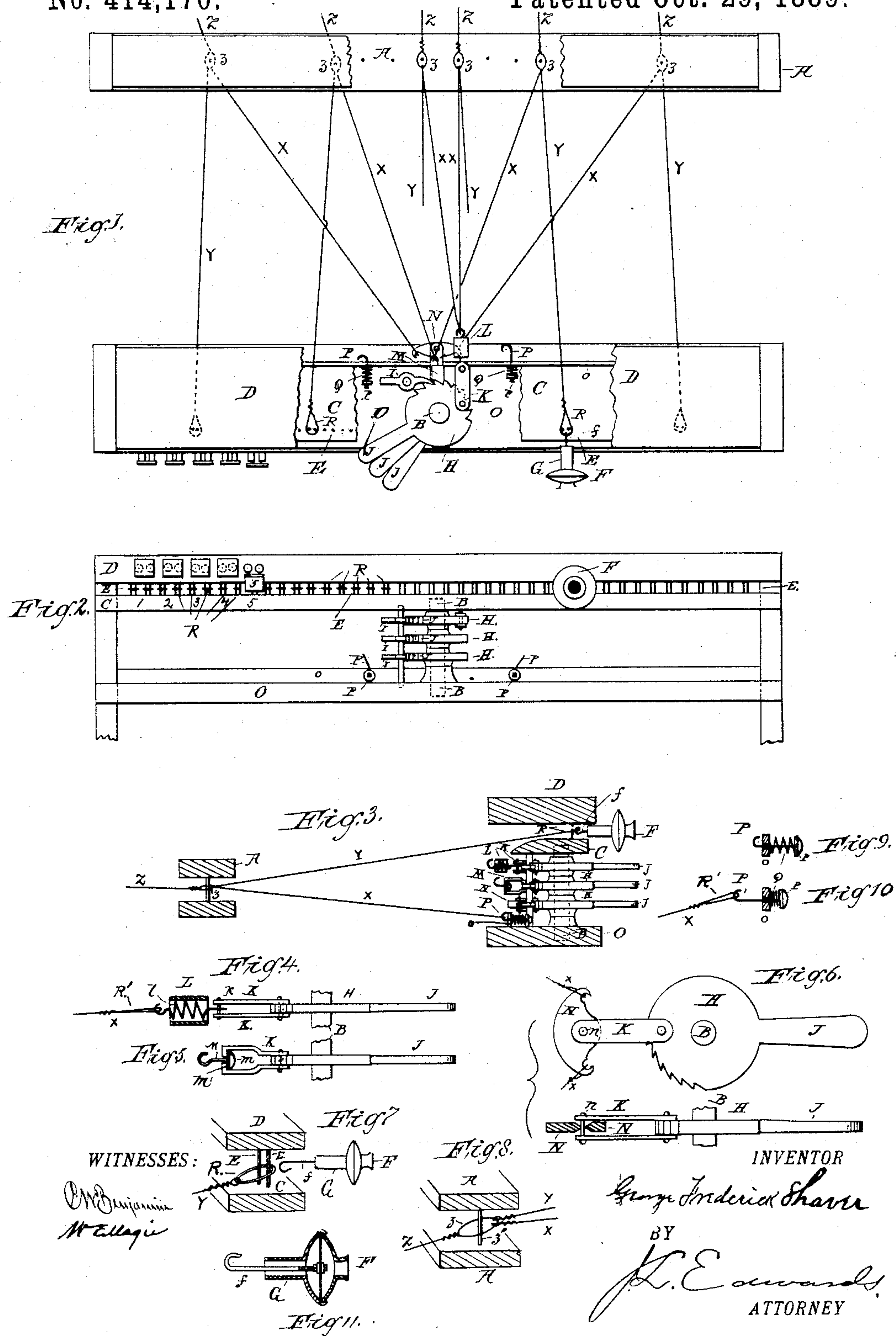


(No Model.)

G. F. SHAVER.  
MECHANICAL TELEPHONE EXCHANGE.

No. 414,170.

Patented Oct. 29, 1889.





# UNITED STATES PATENT OFFICE.

GEORGE FREDERICK SHAVER, OF NEW YORK, N. Y., ASSIGNOR TO THE  
SHAVER CORPORATION, OF SAME PLACE.

## MECHANICAL-TELEPHONE EXCHANGE.

SPECIFICATION forming part of Letters Patent No. 414,170, dated October 29, 1889.

Application filed March 11, 1889. Serial No. 302,936. (No model.)

*To all whom it may concern:*

Be it known that I, GEORGE FREDERICK SHAVER, a citizen of the United States, and a resident of New York city, in the county of New York and State of New York, have invented certain new and useful Improvements in Mechanical-Telephone Exchanges, of which the following is a specification.

The object of my invention is to provide a means for connecting mechanical-telephone lines through a central station or exchange in such a manner as to enable any subscriber or patron having a line connected with a central office to communicate with any other subscriber similarly connected by means of apparatus hereinafter described, whereby the loss of power and distinctness of articulation due to imperfect means of connecting the several wires or either of them, as heretofore experienced, is obviated. The means whereby this end is attained is shown in the accompanying drawings, in which—

Figure 1 represents a plan view of the apparatus; Fig. 2, an elevation taken from the front side of the apparatus. Fig. 3 shows a side view of the connecting mechanism and the arrangement of the line-terminals. Figs. 4, 5, and 6 show detail views of the different forms of vibrators used in connecting lines at the central office. Fig. 7 shows a detail of a main-line terminal and its support, also the manner of connecting the central-office operator's telephone. Fig. 8 represents the method of supporting a line-wire at the point of junction with the supporting-frame of the line-terminal. Figs. 9 and 10 show the manner of supporting the inner ends of the auxiliary line-terminals X X. Fig. 11 shows a hand-telephone for use at the central office.

Referring to the drawings, A represents a supporting-frame for the entering lines.

B represents a shaft which serves to support the connecting mechanism, and is mounted between the upper and lower parts of the frame C and O.

C and O represent a frame-work which supports the entire switching apparatus and terminals.

D represents an electric-annunciator frame carrying annunciator-drops, to which line-

wires are connected in the usual manner for calling purposes.

E E represent the supports for the inner ends of the main-line terminals, the ends of the said terminals being formed into loops R, made preferably of stiff wire, which inclose the supports E E, which are made of two vertical wires placed a short distance apart and parallel with each other and extending between the parts of the frame C and D. Two wires are used to support each terminal loop of the main-line wires Y Z, in order to facilitate the engagement of the said main-line terminal wires with the hand-telephone F, which is provided with a connecting-bar *f*, terminating in a hook at one end, the other end being rigidly attached to the diaphragm.

H H H represent a series of ratchet-wheels mounted upon the shaft B, and are provided with pawls I I I, which engage with the ratchet-wheels and serve to hold them in any desired position. The ratchet-wheels H H H are provided with handles J J J, for the purpose of turning the ratchets around the shaft B in the operation of setting tension upon connected terminals. The ratchet-wheels H H H are perforated to receive a bolt, which secures upon each of the ratchets yoke-pieces K K, which support the various vibrators L M N. The vibrator L is a spiral spring covered with a sleeve of rubber *l'*, which acts as a damper for eliminating the resonance of the spring *l*, and said spring terminating at either end in a hook, one end being supported by a small bolt *k*, which passes through the ends of the yokes K K, and the other end being adapted to engage with the looped ends of the auxiliary-line terminals X X. The vibrator M is composed of a bar terminating at one end in a button-shaped head *m* and at the other end in a hook, which is adapted to engage with the terminal loops of the auxiliary-line terminals X X, as above described. The head of the vibrator M rests upon a rubber cushion *m'*, resting within the yoke K, Fig. 5. The vibrator N is a plate or bar terminating at either end in a hook, also adapted to engage with the loops at the ends of the auxiliary-line terminals X X, and is perforated at its center, the perforation being



countersunk at each end, thus forming a knife-edge which rests against a bolt *n*, which passes through the said perforation from the upper to the lower parts of the yoke K, Fig. 6. The vibrator N is capable of a rocking or oscillating motion upon its supporting-bolt *n*, and in use adjusts itself to the auxiliary connecting terminal wires X X, even should they be of slightly different lengths. The vibrator L, I find best adapted for connecting parallel wires, the vibrator M for acute angles, and the vibrator N for connecting wires entering the frame A at obtuse angles with each other. At the point of junction of the entering line-wires Y Z with the supporting-frame A the line-wire is formed into a short loop *z*, which surrounds a vertical flexible supporting-wire *z'*, Fig. 8, and which serves as a sliding support for the line-wires Y Z and prevents the said line-wires Y Z from coming into contact with each other. At the inner ends of the loops *z* the auxiliary-line terminals X X are attached to the main wires Y Z, the sole utility of the said auxiliary-line terminals being to afford convenient means for connecting the main-line wires together.

In order to prevent the auxiliary connecting-wires X X X from touching each other when not in use, they are provided with terminal loops of stiff wire R', similar in construction to the loops R of the main-line terminals, and are attached to a frame *o* by means of a pin P, which passes loosely through the frame *o* and terminates at one end in a hook and at the other in a button *p*. A retracting spiral spring Q is mounted upon the pin P at a point between the frame *o* and the button *p* and normally draws the hook P inwardly in the position shown in Fig. 9. When it is desired to mount the terminal loop of an auxiliary-line terminal X upon the hook P, the button *p* is first pushed outward, thus forcing the hook P out toward the frame A, and the loop of the auxiliary wire X may then be placed over the hook P, when the device remains in the position shown in Fig. 10. To enable the central-office attendant to communicate with subscribers, a hand-telephone is provided, (shown at F, Fig. 11,) and consists of two saucer-shaped disks of wood apertured at the center and supporting a diaphragm between them fastened to the outer edge of the disks. A small bar *f* is rigidly attached to the center of the said diaphragm by means of nuts adjusted upon the bar at either side of the diaphragm and terminates at its outer end in a hook, which when in use engages with the loop R of the main-line terminals Y Y. A hollow cylinder G extends backward from the rear of the hand-telephone, and serves as a handle by which it is held in position when connected with a line-terminal.

When a subscriber desires to communicate with another subscriber, the operation is as follows: The subscriber first rings a magneto call-bell, which is attached to his line in the usual manner, the effect of which being to

cause an annunciator mounted at D, Fig. 2, to fall, thus exposing a number representing his line. The central-office attendant then connects the hand-telephone F with the main-line terminal loop of the subscriber's wire by placing the hook *f* within the loop R at the end of the main-line terminal, and transfers the tension of the same to the telephone by pulling the telephone F toward him, and is then enabled to communicate with the subscriber. If the subscriber desires to communicate with another subscriber, the attendant rings a bell attached to the line of the subscriber wanted in the usual manner, and then proceeds to connect the lines of the two subscribers by removing the auxiliary-line terminals X X, attached to the main-line wires Z Z, from the rack or frame *o*, and attaching their terminal loops to vibrator L, M, or N, according to the angle made by the subscribers' lines entering the frame A. After attaching the auxiliary-line terminals to the vibrator the lever J of the ratchet H, supporting the vibrator, is moved around, thus drawing the vibrator toward the shaft B and imparting tension to the auxiliary-line terminals X X, in which position it is retained by the pawl I. The action of drawing the auxiliary terminals toward the shaft B not only imparts tension to the auxiliary-line terminals, but slacks the main-line terminals of the connected subscriber's line, so that in effect the connected line-wires Z Z and the auxiliary-line terminals X X, now under tension with the vibrator, constitute a complete tension-circuit from one subscriber to the other, and they are then enabled to converse with each other with the same facility as though talking over a single line connecting their respective telephones. After the subscribers have finished using the lines the pawl I of the ratchet H is released, and the handle J is returned to its original position, thus allowing the vibrator to move away from the shaft B, thus slacking the auxiliary-line terminals X X and restoring the tension of the main-line terminals Y Y, when the auxiliary terminal loops may be disengaged from the vibrator and returned to their original positions upon the frame *o*. By increasing the number of the ratchets and vibrators L M N it will be seen that as many connections may be made at the same time as there are ratchets and vibrators, and as the ratchets are mounted upon the shaft B at different altitudes and adjusted to revolve in different planes, it follows that there is no interference or crossing of the line-terminals when connected.

It may be seen that any suitable device—such as a cam or set of pulleys—may be used to draw the vibrators toward the shaft B; so I do not limit myself to the ratchets H as a means for setting the tension upon connected line-terminals, but prefer the device shown, which I find can be operated with great facility.



I am aware that other means of connecting mechanical-telephone lines have been used, notably a piece of wire mounted upon a hanger and terminating in hooks which are attached to the terminals of the lines connected, and means for imparting tension to the piece of connected wire, thus practically extending one line by means of the piece of wire to the other line connected; but I find such devices to be very slow and awkward in use, and that a great loss of power of the vibrations transmitted from one line to another is experienced by such means, whereas by the means herein set forth no such loss occurs, there being no extension of the line-wires connected; but in lieu thereof I use simple devices for transmitting or rather transferring vibrations from one line to another through a vibrator.

I am also aware that line-wires terminating upon radial bars placed across and parallel to the rear side of the diaphragm of a mechanical telephone and arranged to transmit vibrations from one line to another by sliding the line-terminals inwardly toward the center of the diaphragm have been used; but in this device only one set of connections can be made at one time and imperfect articulation only is secured.

I have also heretofore used branch wires leading from the main-line wires entering a central-exchange switching apparatus, (shown in a former patent issued to me;) but in that arrangement the branch wires were used simply as a means for enabling the central-office attendant to communicate through them to the main lines of the subscribers, the connecting of subscribers' lines being effected by an auxiliary wire fitted with hooks and arranged to engage with the ends of the main-line terminals; but in this apparatus the main-line terminals remain undisturbed, and the auxiliary-line terminals X X are used to connect the main lines with each other, the latter arrangement affording very superior means and results, both as to ease and rapidity of manipulation and increased power and better articulation.

What I claim as new, and desire to secure by Letters Patent, is—

1. A movable vibrator L, for connecting mechanical-telephone lines, consisting of a spring *l*, terminating in a hook at either end and provided with a damper *l'*, in combination with a tension-setting device and a series of mechanical-telephone line-terminals, whereby parallel lines may be connected together through the vibrator for intercommunication without loss of power or distinctness of articulation, substantially as herein set forth.

2. In a mechanical-telephone exchange apparatus, a vibrator L, consisting of a spring,

a vibrator M, consisting of a bar hooked at one end and provided with a button-shaped head resting upon an elastic cushion, and a vibrator N, consisting of a bar terminating in hooks and perforated at its center to receive a supporting-bolt *n*, a supporting-shaft B, common to all the vibrators, tension-setting devices H I J K, and a series of mechanical-telephone lines and auxiliary-line terminals, substantially as herein set forth.

3. A device for connecting mechanical-telephone lines together for intercommunication through a central office or exchange, consisting of auxiliary terminal wires X X, one end of each being permanently attached to the main-line wires at a point distant from the ends thereof and the other end being movable, in combination with the said main-line wires and a vibrator and tension-setting device, whereby communication may be established between any pair of main lines by attaching their respective auxiliary terminal wires to a vibrator and imparting tension to the same, substantially as herein set forth.

4. In an apparatus for connecting mechanical-telephone lines, a tension-setting device consisting of a ratchet H, pawl I, and yoke K, and lever J, mounted upon a shaft B, in combination with a series of mechanical-telephone lines, and a vibrator adapted to engage with and transmit vibrations from one connected line to another, substantially as herein set forth.

5. In a mechanical-telephone exchange apparatus, an adjustable support for the entering wires, consisting of a loop *z*, interposed in and forming a part of the said wires, in combination with a supporting-wire *z'*, passing through the said loop, whereby the said line-wire may be free to move upon its support during the action of setting tension upon connected wires, substantially as set forth.

6. In a mechanical-telephone exchange, a support for auxiliary-line terminals, consisting of a frame or rack *o*, having a series of pins P mounted thereon and passing loosely through said frame, the said pins terminating at one end in a hook and at the other end in a flattened head *p*, in combination with a retracting-spring Q, interposed between the head *p* and rack *o*, whereby the said auxiliary-line terminals are kept taut by the action of the spring and crossing of the line-terminal wires is prevented, substantially as herein set forth and described.

Signed at New York city, in the county of New York and State of New York, this 8th day of March, A. D. 1889.

GEORGE FREDERICK SHAVER.

Witnesses:

WM. E. MAGIE,

H. D. OGDEN.