(No Model.) 3 Sheets—Sheet 1.

L. A. BERTHON.

MULTIPLE COMMUTATOR APPARATUS FOR TELEPHONE SYSTEMS.

No. 506,658. Patented Oct. 17, 1893.

Fig. 1

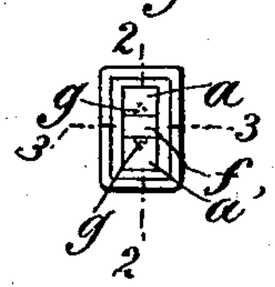

Fig. 2

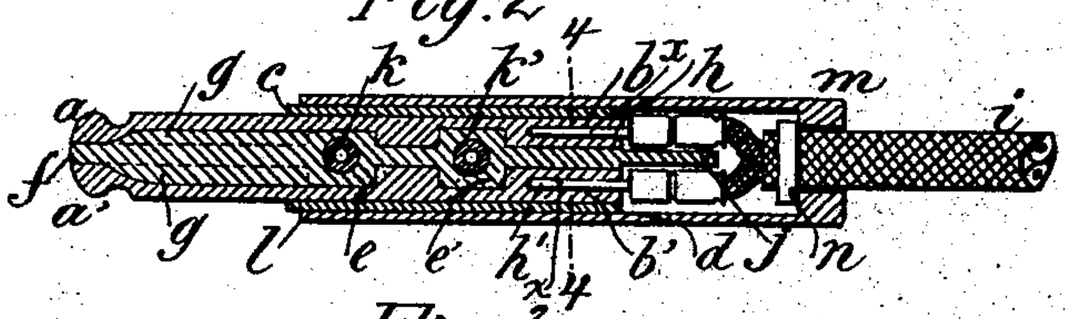

Fig. 4

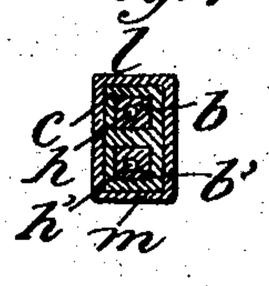

Fig. 3

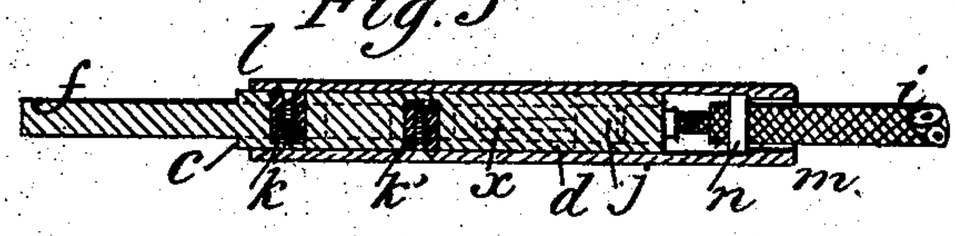

Fig. 5

Fig. 6

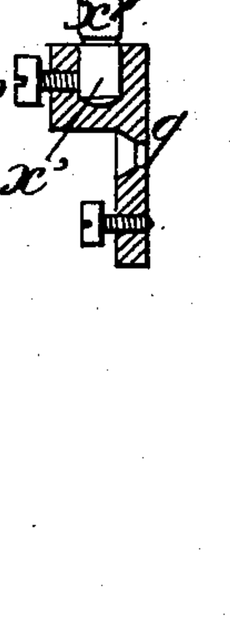

Fig. 7

Fig. 8

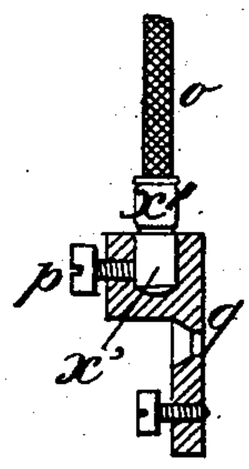

Fig. 9

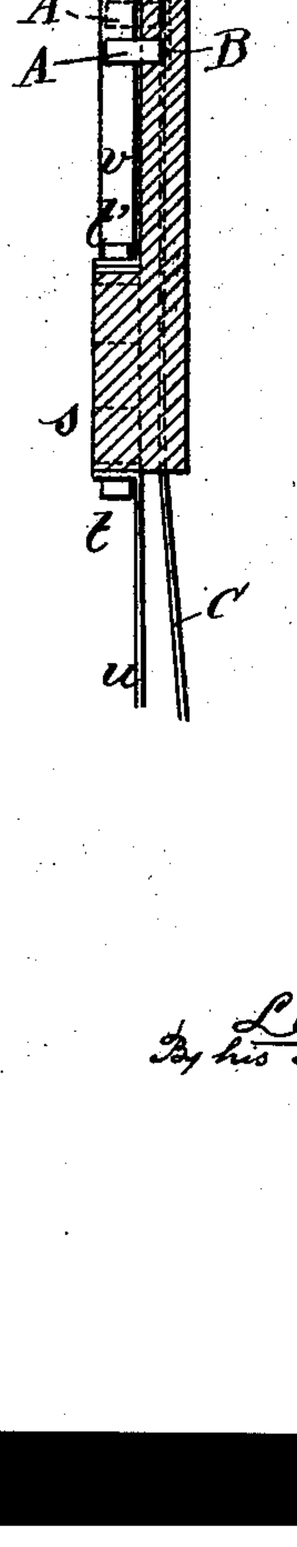

Fig. 10

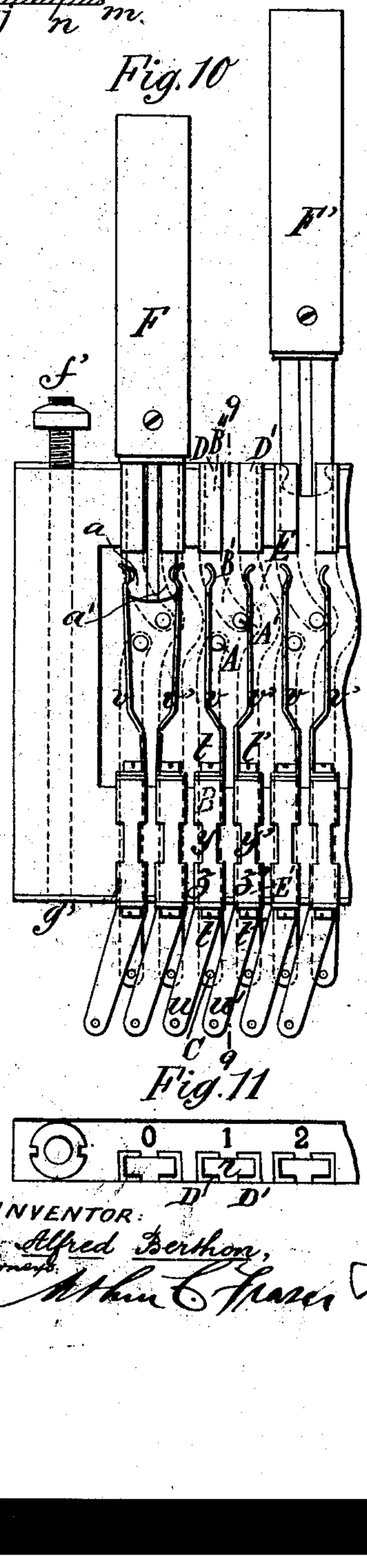

Fig. 11

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(No Model.)

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MULTIPLE COMMUTATOR APPARATUS FOR TELEPHONE SYSTEMS.

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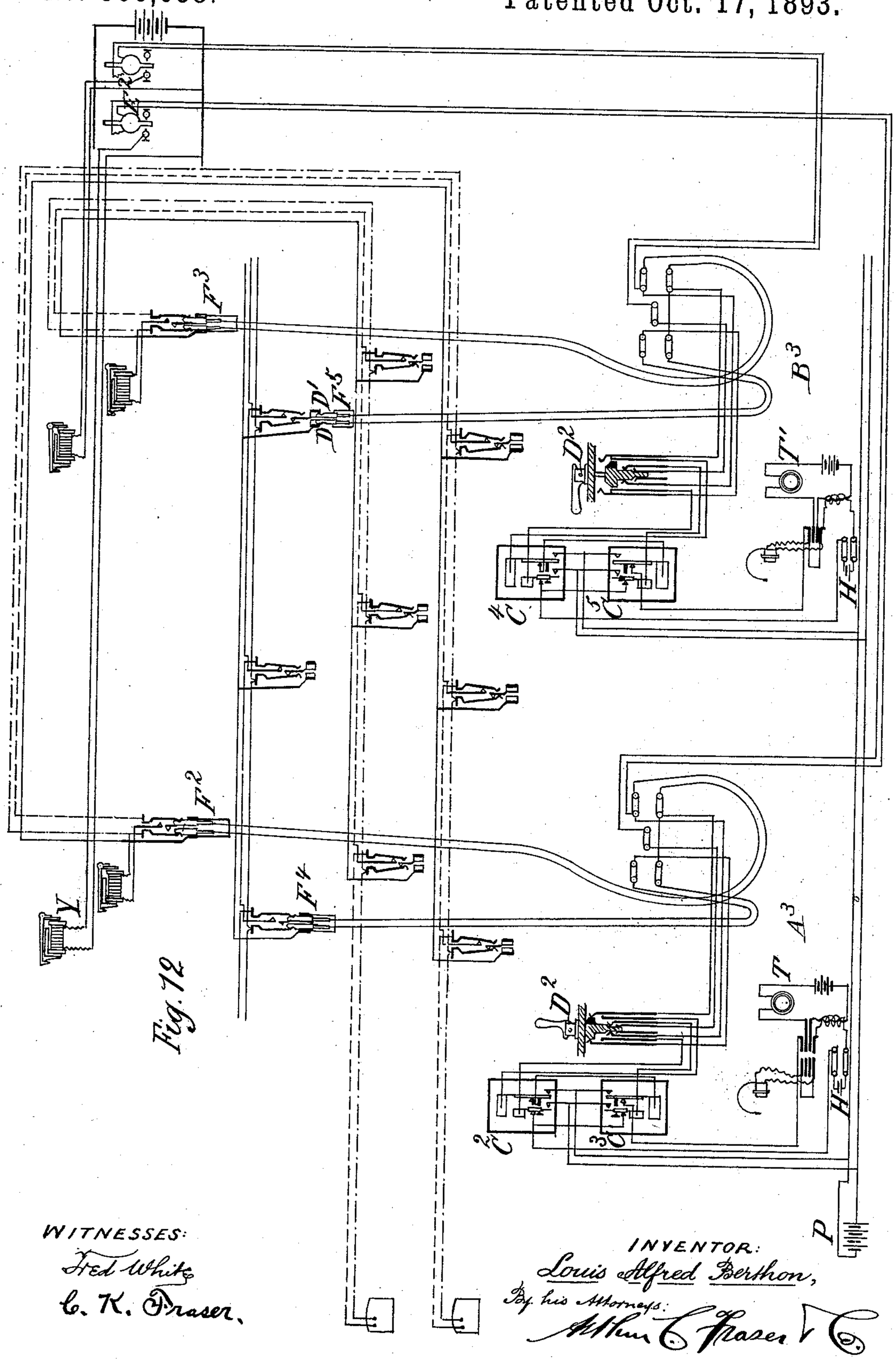

Fig. 12

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L. A. BERTHON.

MULTIPLE COMMUTATOR APPARATUS FOR TELEPHONE SYSTEMS.

No. 506,658. Patented Oct. 17, 1893.

Fig. 14

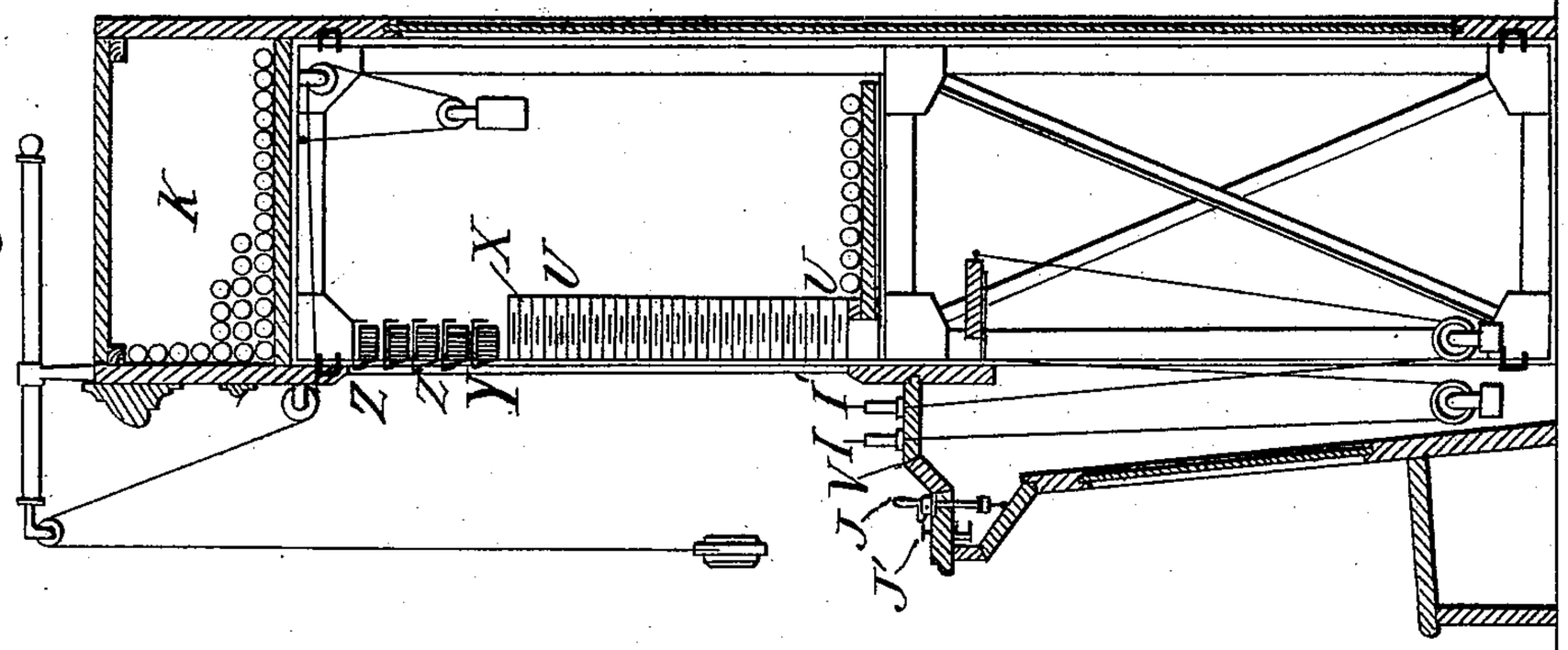
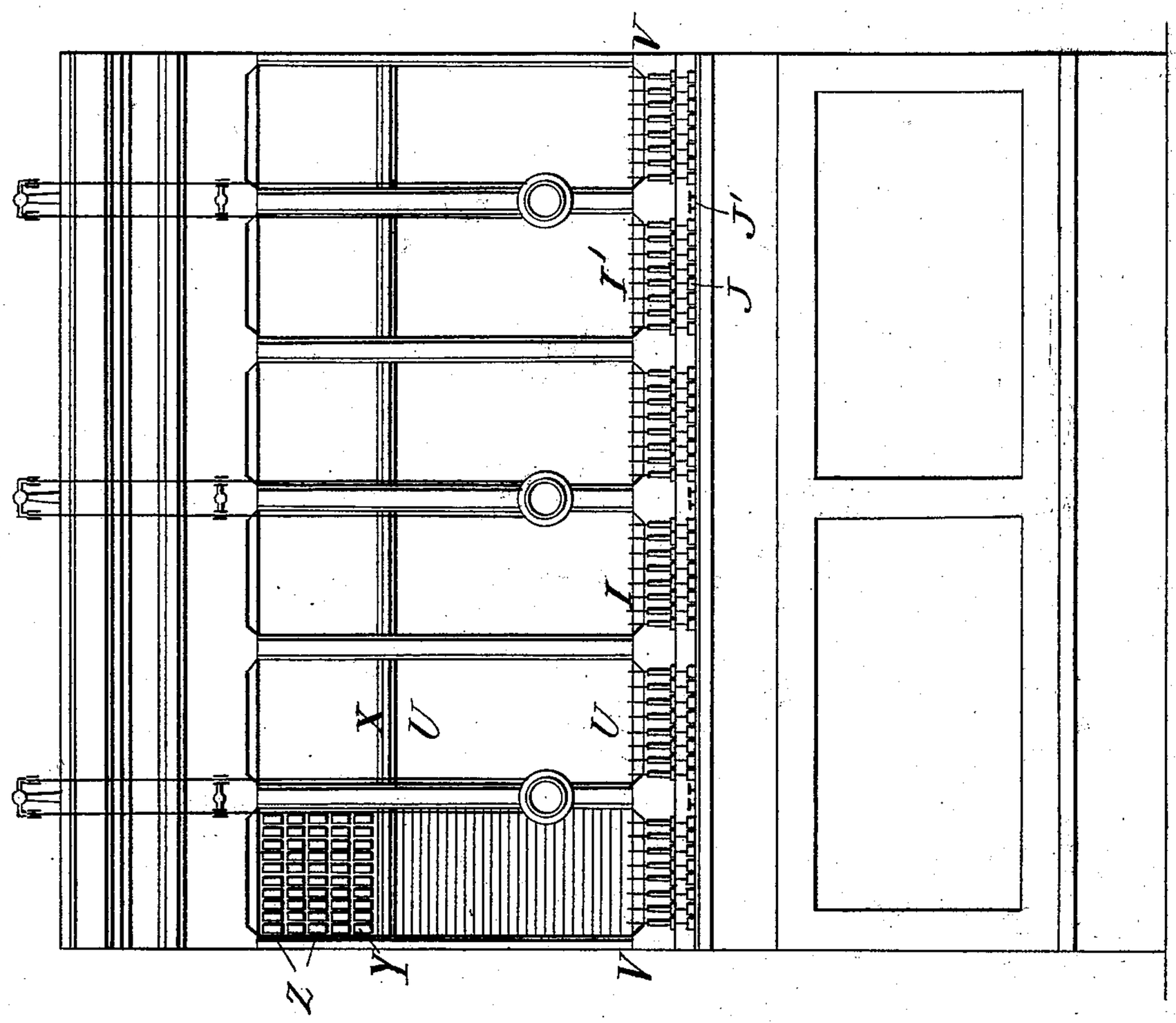


Fig. 13



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UNITED STATES PATENT OFFICE.

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MULTIPLE-COMMUTATOR APPARATUS FOR TELEPHONE SYSTEMS.

SPECIFICATION forming part of Letters Patent No. 506,658, dated October 17, 1893.

Application filed June 15, 1892. Serial No. 436,817. (No model.) Patented in France November 16, 1891, No. 217,476, and in England May 16, 1892, No. 9,282.

To all whom it may concern:

Be it known that I, LOUIS ALFRED BERTHON, a citizen of the Republic of France, residing in Paris, France, have invented certain new and useful Improvements in Multiple-Commutator Apparatus for Telephonic Systems, (which invention has been patented in France, No. 217,476, dated November 16, 1891, and in England, No. 9,282, dated May 16, 1892,) of which the following is a specification.

This invention relates to multiple commutator apparatus for telephonic installations, such for example as the system known as the "Berthon" system of telephonic apparatus.

The invention aims to provide certain improvements in such apparatus, and in the construction and arrangement of the contact plugs and spring jacks for multiple commutators, especially those of the said Berthon system of telephonic apparatus with metallic circuits.

In the accompanying drawings, which illustrate my invention, Figure 1 is an end elevation of my improved contact plug. Fig. 2 is a longitudinal section thereof on the line 2—2 in Fig. 1. Fig. 3 is a longitudinal section thereof cut at right angles to Fig. 2, and on the line 3—3 in Fig. 1. Fig. 4 is a cross-section thereof cut on the line 4—4 in Fig. 2. Fig. 5 is a fragmentary view of one of the conductors adapted for connection to the plug but in incomplete form. Fig. 6 is a similar view thereof in complete form. Fig. 7 is a fragmentary view of the opposite end of a conductor. Fig. 8 is an elevation thereof showing the binding post for this end of the conductor in section. Fig. 9 is a vertical section of a spring jack cut on the line 9—9 in Fig. 11. Fig. 10 is a fragmentary under side plan view of a spring jack. Fig. 11 is a fragmentary end elevation thereof. Fig. 12 is a diagrammatic view showing the circuits and apparatus for two subscribers' lines disposed according to the preferred form of my invention. Fig. 13 is a front view of a commutator showing the complete installation for six thousand circuits; and Fig. 14 is a vertical cross-section thereof.

Referring to the accompanying drawings, I will now describe the preferred form of my invention as applied to the "Berthon" system of telephonic apparatus with metallic circuits.

The contact plug, best shown in Figs. 1, 2, 3 and 4, is constructed of two pieces of brass or other metal *a b*, *a′ b′*, embedded for a long portion of their length in a block *c d* of insulating material, preferably that known as "ivorine," the metal pieces being formed with notches or projections *e e′* forming abrupt shoulders into contact with which the ivorine penetrates so as to be effectually secured thereto. Outside the block *c d*, the two pieces of metal *a b*, *a′ b′*, are separated from each other by a thickness *f* of ivorine, which is held in grooves *g* in the metal pieces. See Figs. 1 and 2. The inner ends of the metal pieces have longitudinal holes *h h′* respectively bored in them into which pass the metal rods *x* that are secured to the ends of the wires of the flexible conducting cable *i*. For preventing all contact between the two rods *x*, the insulating block *c d* is extended rearwardly as a partition *j* between them. In the insulating block *c d* are also embedded two screw-nuts *k k′* into which are screwed the screws that secure the sheath *l m* of ivorine that incloses completely the said parts. The closed rear end *m* of the sheath is formed with a hole through which passes the flexible conductor *i*. A small ring *n* of copper or other material is clamped onto the woven covering of the conductor *i* within the rear end of the sheathing and constitutes a collar for preventing the conductor from being drawn out of the sheath. The block of ivorine is molded in a divided steel mold the interior of which has the exact configuration of the block to be produced. This mold is heated to the required degree, the above mentioned pieces of metal which are to be embedded in the block, namely, *a b*, *a′ b′*, and *k k′* are first introduced into the mold, and the remaining spaces are then filled with ivorine, and the whole is then subjected to spring pressure in the mold. After cooling the formed mass is removed.

The flexible conducting cable *i* contains two

conductors, each of which is formed of a coiled brass wire n', see Fig. 5, the end of the coil being screwed onto a threaded copper rod x, and then covered by a winding of metal thread for diminishing the resistance of the joint, and this is then covered by a silk or cotton winding or braiding o, and over this is fixed a thin metal tube c', see Fig. 6, which covers both the collars d' of the metal rod x and the under side of the windings or braidings to which it is secured by indentations e'' e''. Fig. 6 shows the end of the conducting cable, the metal rods of which are secured in the holes of the block as before described, and the other end of the cable is shown in Figs. 7 and 8. This end has a metal covering x' which is constructed in electrical contact with and constitutes part of the electric conductor passing through the cable, being joined to the covering and the conductor by indentations e'' e''. This metal covering x' is secured by a set-screw p in the socket of a contact piece or binding post g. See Fig. 8. The flexible conductor thus formed offers a weak resistance but is of considerable mechanical strength on account of the double winding or braiding covering each conductor of the cable, and the further winding or braiding which unites the two conductors in one cable.

The spring jacks U are combined in rows of twenty upon an ivorine bar, lettered s s' in Figs. 9, 10 and 11. They also consist of metal pieces embedded in the insulating material at the time of molding the latter. I will describe in the first instance the arrangement of a single spring jack. Three are shown in Figs. 10 and 11.

Two blocks of brass y z and y' z' notched along say half their length, are embedded in an ivorine slab s s' and serve for holding by means of screws t t' the copper blades u u', to which are soldered the conducting wires, while the springs v v' are secured likewise by screws t t' to the other ends of the blocks y z, y' z'. The latter bear against their respective stops A A', with which they are in contact when at rest. The stops are each formed of a small silver stud riveted each to a respective communicating plate embedded in the thickness of ivorine s s', and lettered B. B'. The stop A is riveted to the communicating plate B, which is arranged to receive a wire at its part lettered C, and the stop A' is riveted to the communicating plate B', which is soldered at B'' to a piece of brass D of a trough-shaped cross-section. Facing the latter is another piece D' of the same shape soldered to a communicating plate E, shown in dotted lines in Fig. 10, to which is soldered a wire at E'. The three plates B, B' and E being embedded in the ivorine s, are thus formed in one piece therewith, as are consequently also the pieces A, A' and D D' to which they are riveted or soldered. At each end of the bar s s' is also embedded a bolt f' g' for fastening the bar to the framing of the commutator.

The brass pieces D D' facing each other form between them a rectangular opening r, see Fig. 11, into which is inserted the plug F.

In Fig. 10, one plug F is shown entirely inserted into the spring jack, its extremity after having separated the two springs v v' thereof, being held in position by the pressure of the latter in the notched sides of the former. In this position the contact is interrupted between each of the springs and its stop. Fig. 10 also shows another plug, lettered F', partially introduced into the entrance r of the spring jack. In this position, which is that for the test trial of the telephonic circuit, the two wires of the plug are in communication with the pieces D D' of the spring jack.

The diagram of the communications for the two subscribers' lines, lettered A^3 and B^3, is shown in Fig. 12. The two wires of each line are connected with the springs v v' of the spring jack, and the test wire to the piece D' of Fig. 10. Two telephone apparatuses are shown at T and T', Fig. 12, with a calling key C^2 or C^3 arranged for sending the current of the battery P through the plug F^2 or F^3, and a calling key C^4 or C^5 arranged for sending the current through the plug F^4 or F^5. A commutator with lever D^2 when in the raised position, puts the two plugs F^2 F^4 in communication with the relay E^2, which actuates in a local circuit the signal Y for the termination of speech. When the lever D^2 is turned down, the relay E^2 is short-circuited, and the telephone apparatus T is in communication. A battery H consisting of one element is placed in the circuit of each telephone T T' for the test of the lines. When the line is free, the trial wire is insulated and consequently the pieces D D' are also insulated, and if the plug F^3 be put in contact with these pieces, the telephone T' will not give any sound because the circuit of the battery H is open. If the line is occupied, the trial wire will be put in communication by the plug with one of the wires of the line, that is to say, there is a communication between the pieces D D' in all the other spring jacks of the same line. The contact with the plug F^5 will then cause a sound in the telephone T'.

The reduced size of the above described spring jacks allows of the construction of commutators of great capacity, which can be served by the telephone attendant when seated.

Figs. 13 and 14 show the complete installation of a commutator for six thousand circuits. In these figures the call signals of the subscribers are at the upper part at Z, and just below these the signals for the end of speech Y; then come the local spring jacks at X, and the general spring jacks at U. The table V carries the plugs F F', the lever commutators D^2 corresponding to those lettered D^2 in Fig. 12, and the calling keys C^2. The return cables of the call signals are placed at K. The last call signal is placed at 1.86 meters above the ground line, this being a height

that can readily be reached by an operator seated on a high seat.

What I claim is the following-defined novel features or improvements, substantially as hereinbefore set forth, namely:

1. In contact plugs for the spring jacks of telephone apparatus, the two metallic conducting pieces, as *a b*, *a' b'*, in combination with an insulating material carrying the same and molded thereto, as *c d*, said metallic pieces being constructed with projections or shoulders against which said insulating material is molded, whereby their displacement is prevented and they are insulated from one another.

2. In flexible conducting cables for telephonic apparatus, the terminal rod, as *x*, adapted to make electrical contact with the plug, the coiled conducting wire, as *n'*, connected to said rod *x*, the winding of metallic wire over the joint between said conductor and rod, the textile braiding, as *o*, over said conductor, and the metallic tubular clamp, consisting of a thin metal tube, as *c'*, placed over the joint between said rod *x* and said coiled wire *n'*, and indented against them substantially as and for the purpose set forth.

3. In spring jacks for telephonic apparatus, the combination of metallic conducting blocks, as *y z*, *y' z'*, the springs, as *v v'*, secured to said blocks, the stops, as A A', for said springs, the conducting metallic plates, as B B', to which said stops are respectively electrically connected, the pieces, as D D', for receiving and holding the plugs, the conducting plate, as E, and the bar of insulating material, as *s s'*, adapted to receive and hold the said recited parts and insulate them from each other, substantially as and for the purpose set forth.

In witness whereof I have hereunto signed my name in the presence of two subscribing witnesses.

LOUIS ALFRED BERTHON.

Witnesses:
JULES ARMENGAUD,
ROBT. M. HOOPER.