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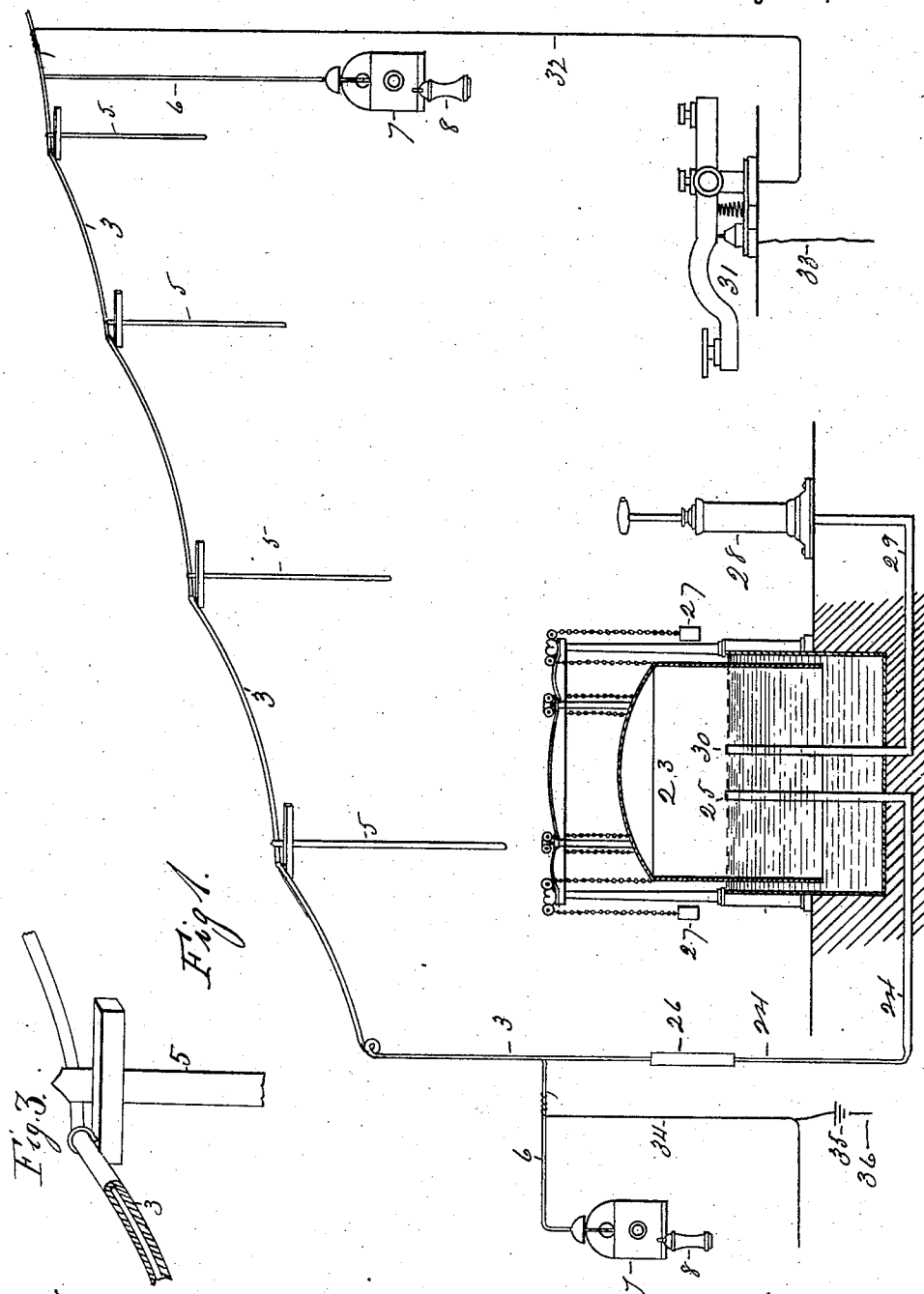
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J. P. HURLEY & G. F. PERKINS.

PNEUMATIC TELEPHONE.

No. 366,319.

Patented July 12, 1887.



Witnesses.  
H. F. Kelton  
J. Bullard

Inventors.  
John P. Hurley  
George F. Perkins  
By Chapman & Atty

(No Model.)

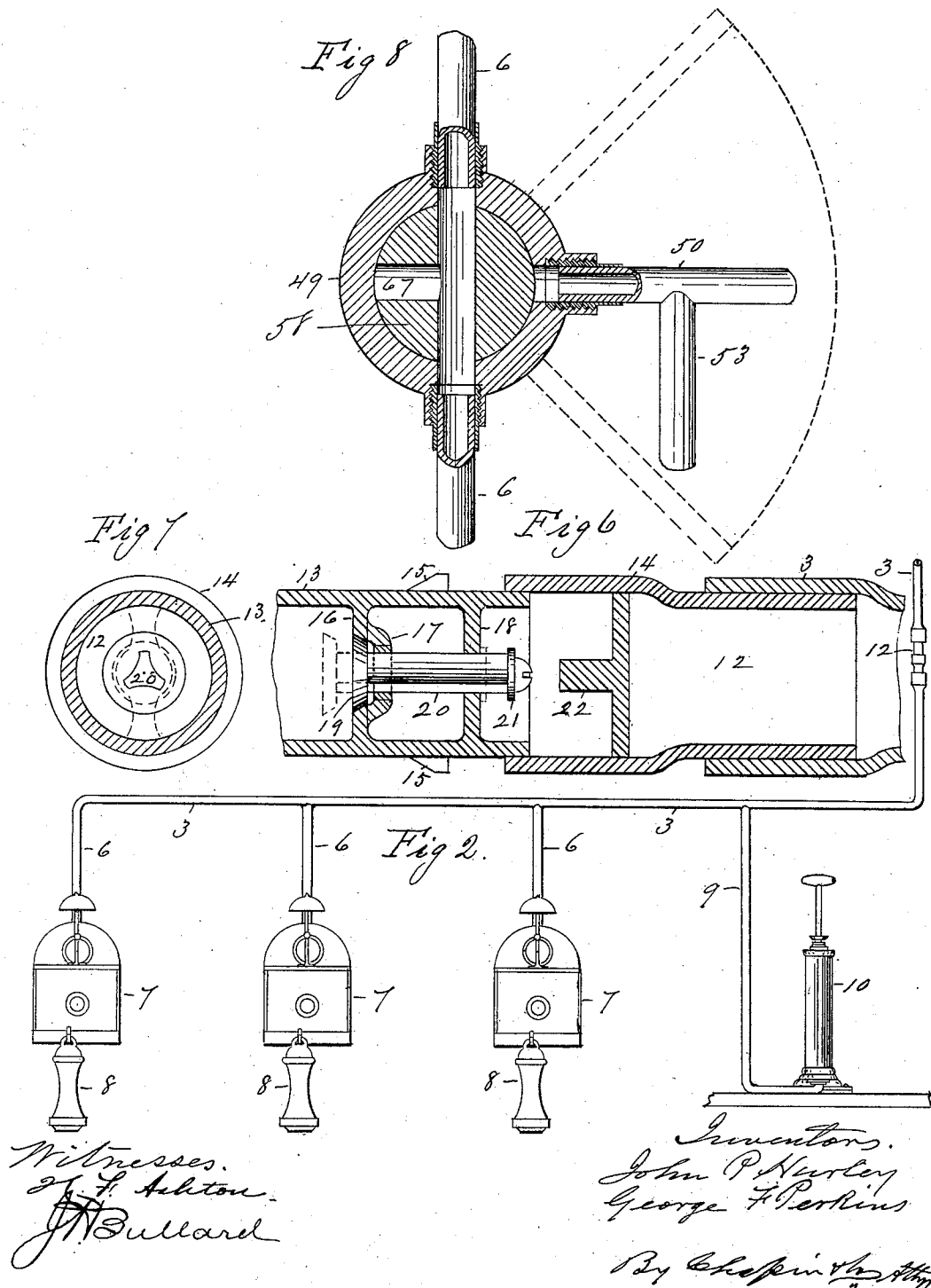
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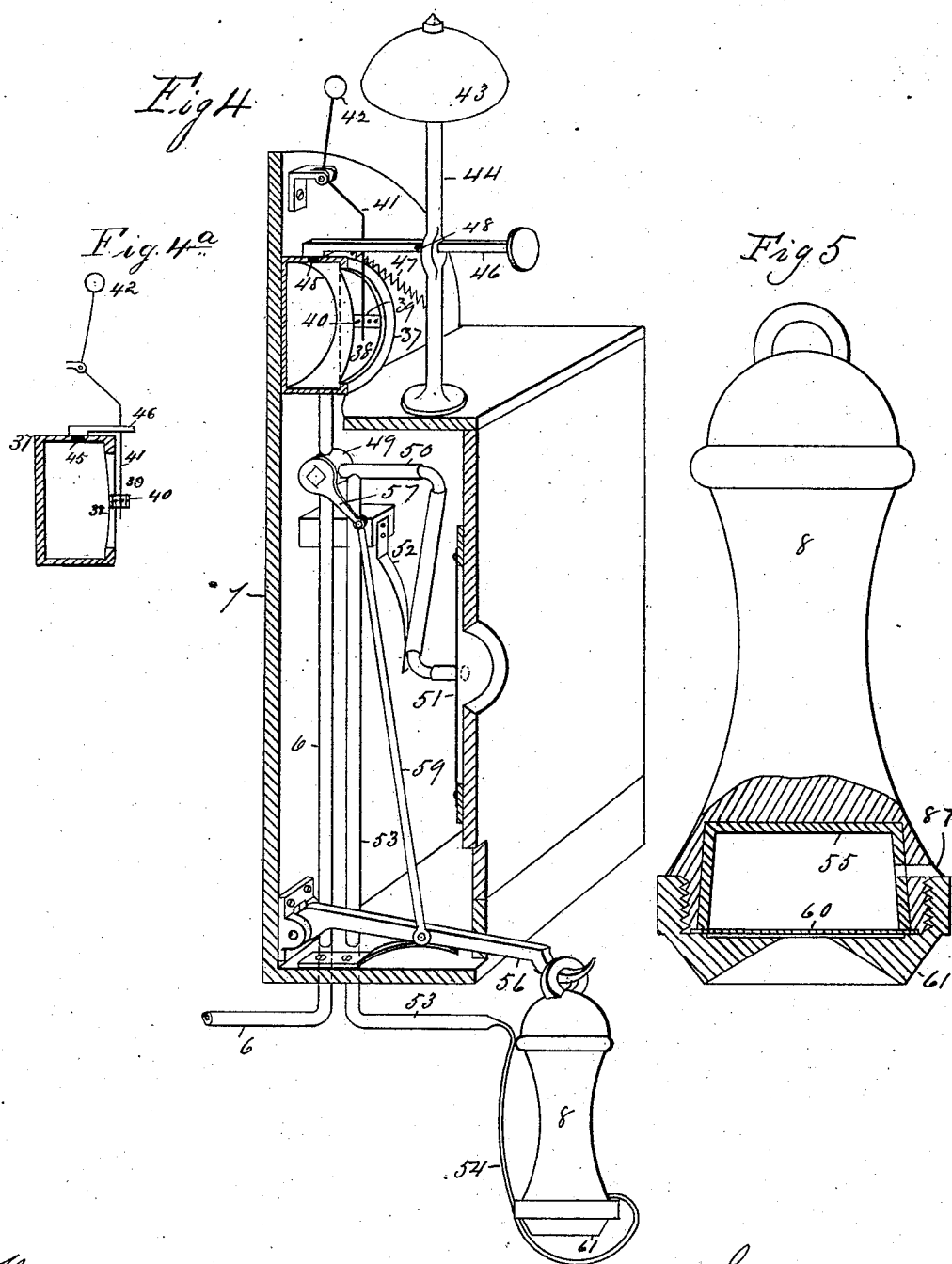
4 Sheets—Sheet 3.

J. P. HURLEY & G. F. PERKINS.

PNEUMATIC TELEPHONE.

No. 366,319.

Patented July 12, 1887.



Witnesses.  
H. P. Allston  
J. Bullard

Inventors.  
John P. Hurley  
George F. Perkins  
By Chapman & Co., Attys.

(No Model.)

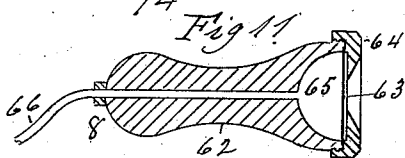
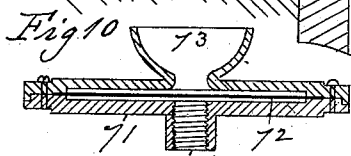
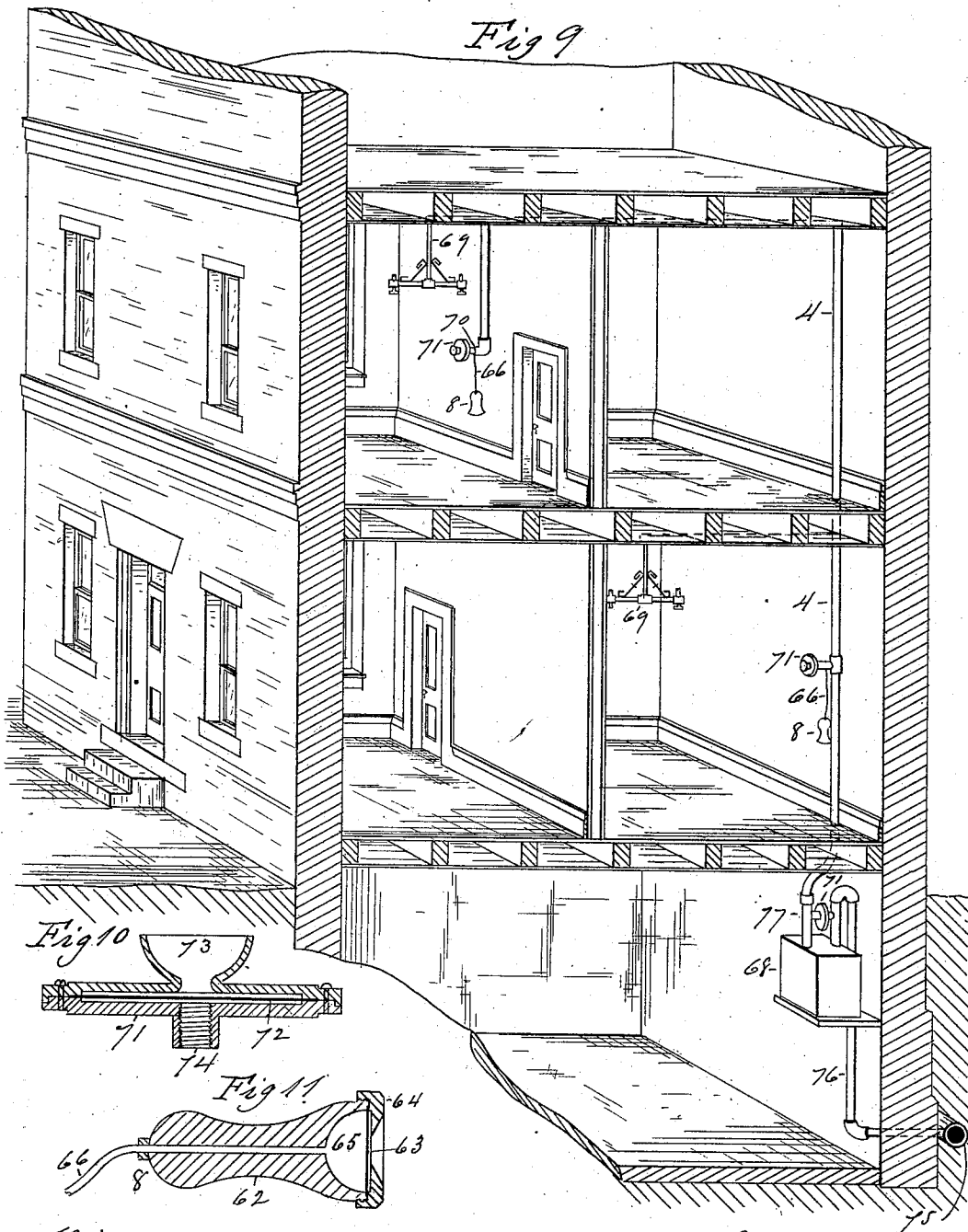
4 Sheets—Sheet 4.

J. P. HURLEY & G. F. PERKINS.

PNEUMATIC TELEPHONE.

No. 366,319.

Patented July 12, 1887.



Witnesses.  
J. L. Ashton.  
J. Bullard.

Inventors.  
John P. Hurley  
George F. Perkins

By Chapman & Allen

# UNITED STATES PATENT OFFICE.

JOHN P. HURLEY AND GEORGE F. PERKINS, OF HOLYOKE, MASSACHUSETTS.

## PNEUMATIC TELEPHONE.

SPECIFICATION forming part of Letters Patent No. 366,319, dated July 12, 1887.

Application filed September 8, 1886. Serial No. 213,152. (No model.)

*To all whom it may concern:*

Be it known that we, JOHN P. HURLEY and GEORGE F. PERKINS, citizens of the United States, residing at Holyoke, in the county of Hampden and State of Massachusetts, have invented new and useful Improvements in Pneumatic Telephones, of which the following is a specification.

This invention relates to improvements in telephone systems; and the invention consists in the peculiar construction and arrangement of the speech transmitting and receiving devices and elements, and of signaling devices connected therewith, all as hereinafter fully described, and set forth in the claims.

In the drawings forming part of this specification, Figures 1 and 2 illustrate in elevation a telephone system embodying our invention, Fig. 1 showing, as hereinafter fully set forth, the connection with said telephone system of means for transmitting signals other than by telephonic means. Fig. 3 is an enlarged detail part of said system, hereinafter described. Fig. 4 is a perspective view, partly in section, of speech transmitting and receiving devices adapted to said system. Fig. 4<sup>a</sup> is a sectional detail of the signal-actuating box and connections, hereinafter referred to. Fig. 5 is an enlarged side elevation, partly in section, of the receiver. Figs. 6 and 7 are respectively a longitudinal and a transverse sectional view, much enlarged, of a coupling for connecting the line of said system. Fig. 8 illustrates, partly in section, detail parts of the speech-transmitting device shown in Fig. 4. Fig. 9 is a perspective view of a portion of a building, partly in section, illustrating one manner of applying our improvements thereto. Fig. 10 is a transverse sectional view of a transmitting and receiving diaphragm and case. Fig. 11 is a longitudinal section of another form of transmitter and receiver, hereinafter fully described.

The improvements in telephone systems herein shown and described belong to the class of telephones which embody devices and elements for the transmission of articulate speech longer or shorter distances by means of a tube containing air or a similar element, having attached thereto two or more diaphragms capable of vibratory action resulting from speech

in proximity thereto, said diaphragms being attached to said tube in such manner that the outer sides thereof are each exposed to the effect of air-waves produced by speech or other sounds, and their inner sides are exposed to and act, and are caused to act, vibratorily against and by the said contents of the said diaphragm-connecting tube, thereby causing words spoken or sounds produced opposite one of said diaphragms to be correctly reproduced in an audible tone at or by said second diaphragm.

In carrying out our invention we provide a tubular line-connection, as 3 and 4, constructed of any suitable material capable of retaining air, gas, or an aeriform fluid. Thus said tube line may be made from rubber, wood, or metal, according to the conditions of construction and use thereof; but generally the metal tube is preferable, on account of greater durability and being less subject to damage by accident or otherwise; and, furthermore, the use of the metallic tube for the aforesaid telephonic system permits of its utilization also for telegraphic and signaling purposes, as hereinafter set forth. The said tube line 3 is shown in Fig. 1 as hung on ordinary telegraphic poles, 5; but such arrangement thereof, when it is used solely for said telephoning purposes or for signaling by means of the elements employed in said telephone service, is not essential, but said tube line may be run in any other convenient manner between points of telephone communication regardless of insulation, for the reason that in no form whatever is electricity or electro-magnetism employed in the operation of the within-described telephoning system or devices in the transmission of articulate speech.

Fig. 2 illustrates a portion of a tubular line, 3, having, like that in Fig. 1, several branches, 6, of like or similar tubular construction to said main line, communicating with the latter, which connect the main line with receiving and signaling boxes 7, the latter having attached thereto the receiving-instruments 8, the latter being adapted, also, under certain conditions, as hereinafter described, to be used as transmitters.

In Fig. 2 is shown connected to the line 3 by a branch, 9, an air-pump, 10, of ordinary

construction, for the purpose of supplying to said line an aeriform fluid, whereby said line is kept simply filled with the latter, or more or less internal air-pressure is maintained therein. If more convenient, however, a slight vacuum, more or less, may be maintained within said tube line and its connections, instead of a pressure, as heretofore described, as the below-described transmitting devices connected with said line operate substantially in the same manner in connection with pressure or vacuum in the line, and said pump 10 may be employed for producing either condition. A coupling, 12, for the purposes of uniting conveniently, temporarily, or otherwise, the ends of said tubular line, is illustrated in enlarged views in Figs. 6 and 7, and is shown between separate ends of the line 3 in Fig. 2. Said coupling consists of two shells of tubular form, 13 and 14, preferably of metallic construction, shell 14 being adapted to slide onto the end of shell 13 against suitable stops, 15, as shown in Fig. 6. The shell 13 is provided with a diaphragm, 16, having a valve-seat therein and a valve-stem support, 17, on one side thereof, and a second transverse support, 18, through which the spindle of the valve 19 extends, as shown in said figure. Said spindle 20 is of puppet-valve form, as shown in Fig. 7, and near its end is placed a stop-washer, 21.

The operation of said coupling is as follows: One end of the line being connected with the part 13 of the coupling, the pressure, if any there be, in the line will act against the end of the valve 19, driving the latter against its seat and preventing any escape of the aeriform contents of the line. When another part of the line is connected with that to which said part 13 is attached by the part 14 of the coupling, the latter-named part is placed on the end of the part 13 and pushed to position against the stops 15, thereby carrying the end of the stud 22 against the end of the valve-stem 20, and thereby sliding the valve endwise away from its seat, as shown in dotted lines in Fig. 6, and opening a passage through the parts of the coupling, whereby the separate parts of the line united by the latter are put in communication with each other.

In Fig. 1 is illustrated the preferable means for maintaining within the tubular line 3 any required degree of supply of air or aeriform fluid by means of an ordinary gas-holder, 23, which is supported by weights and chains in the ordinary manner in a suitable water-tank, as there shown. The said tubular line 3 is connected with the gas or air holder 23 by means of a pipe, 24, which is connected with an ordinary stand-pipe, 25, which communicates with the interior of said holder, said pipe 24, if of metal, being connected with the line 3 by an intermediate pipe or sleeve, 26, which is made of any material that is a non-conductor of electricity, when said main line is employed for electric signaling or telegraphic purposes,

as hereinafter described, in addition to its above-referred-to use for the transmission of speech telephonically. When, however, the tubular line 3, be it constructed of metal or other material, is employed only for telephonic use by the above-referred-to means, the tubular connection between the line 3 and said stand-pipe 25 may be of the same material as the main line. By means of the counterbalancing-weights 27, attached by chains to the holder 23, such degree of constant air-pressure may be maintained within the holder and the line 3 connected therewith as may be desirable, and said pressure may be in practice only slight, varying from such a degree as would be barely indicated upon an ordinary siphon-gage to a few inches (more or less) measured by said gage-indication. When it is found requisite or desirable to replenish the holder 23 with air, any suitable pump, as 28, may be employed for that purpose, the latter being connected by the pipe 29 with an inlet stand-pipe, 30, leading into said holder. In practice the said holder may be arranged in any suitable tank in the room of a building, or in the cellar thereof, in convenient proximity with any part of the line 3, and be connected therewith in any suitable manner.

In Fig. 1 are shown means for utilizing the tubular telephonic line 3 when the latter is made of metal, or, for instance, hollow wire, for the transmission of electric signals or for telegraphic purposes, and said means consist of an ordinary Morse instrument, 31, connected with the line 3 by an electric conductor, 32, and having a ground-line, 33, also attached thereto. At the opposite end of said line through a branch, 6, connected with the latter, is attached a second electric conductor, 34, to which may be attached a second Morse instrument or other similar device for the transmission of electric signals, a battery, 35, being connected to said conductor 34, as shown, and having a ground-connection, 36. The said receiving and signaling box 7, whose construction is illustrated in detail in Fig. 4, consists of a suitable case, substantially as shown, made of wood or other suitable material, with which a tubular branch from the main line 3 is connected. A box, 37, is attached to said case, having a flexible diaphragm or head, 38, secured thereon by its borders, which constitutes one side of said box, and to the outer side of said diaphragm is secured a projecting bar, 39, having pins projecting from its side, between which the end of a bell-hammer lever, 41, hangs, said hammer 42 being pivotally attached to said case near to the signal-bell 43, the latter being supported on a suitable stand, 44, on said case, as shown. The said box 37 is provided with an air-hole, 45, through one side thereof, and a rod, 46, passing through the bell-stand 44 has a push-button on its outer end, as shown, and a valve-like projection on its under side near its opposite end covers said

air-hole. A spring, 47, connected between the rod 46 and the bell-stand 44, serves to hold said valve closely over said air-hole and to retract the rod 46 when pushed by applying force against said button, a pin, 48, through the rod 46 serving to stop the rearward movement of the latter when said air-hole is covered, as shown in Fig. 4. The tubular branch 6 enters said box 7, as shown, and has a two-way cock, 49, therein, the end of said branch 6 terminating at and communicating with the interior of the box 37. A branch pipe, 50, leads off from the side of said cock 49, in which are two elbows or bends, as shown, and the end thereof terminates opposite the center of a diaphragm, 51, against which it is held by a spring, 52. To secure a close connection between the end of the said branch 50 and the diaphragm 51, the extreme end thereof is preferably of elastic tube—such as that made from rubber or similar substance—which permits of a close contact, sufficiently so to prevent the escape of air from said tube, if need be. The diaphragm 51 consists of the ordinary thin metallic or other suitable plate, capable of vibratory movements, as aforesaid, and is secured by its borders on the inner side of the front of the box 7 behind an opening through the latter, as shown, toward which opening the voice of a person using the telephone is directed, in order that the diaphragm may be acted upon thereby in the manner above referred to. A branch tube, 53, leads off from the branch 50 through the bottom of the box 7, and thereto is attached by a suitable flexible tube, 54, a receiving-instrument, 8, the latter being provided with a ring on one end to adapt it to be hung on the end of a lever, 56, the latter being pivoted by its opposite end to the inner side of the box 7. A spring, as shown, under said lever 56 throws it upward when it is relieved of the weight of said receiver 8. A lever, 57, is attached to the squared end of the plug 58 of said two-way cock, the end of which lever is connected with said lever 56 by the rod 59. The receiving-instrument 8, an enlarged view of which, partly in section, is shown in Fig. 5, is constructed with a body having a socket in one end of it, in which is placed a box, 55, made preferably of metal, having its side toward the end of the receiver open, and across which is secured a diaphragm, 60, a perforated mouth-piece, 61, being screwed on the end of the receiver against the borders of said diaphragm, thereby securing it against the open side of said box in such position that it is capable of vibration caused by the action of the voice thereon through the intermediary of said aeriform fluid in the line 3 and the branches connecting the latter with said instrument, the action of said aeriform fluid on the diaphragm 60 being induced by the vibratory action of another diaphragm connected with said line, against which speech is directed. The said diaphragm 60 is of substantially the same material as that of the

above-referred-to diaphragm 51. The said flexible tube 54 is connected with the opening 87, which leads to the interior of the box 55 in said receiver.

Although the instrument 8 is referred to as a receiving-instrument, it is so designated with the transmitting-box 7 in order to distinguish it from the latter; but it is, in fact, capable of the transmission of speech when connected with the line 3, and so operates when the diaphragm 60 has speech directed against it in the manner that the diaphragm 51 is used. Fig. 11 illustrates in section, but in a slightly-modified construction, a simpler form of said combined receiver and transmitter, in which 62 is the body of the instrument, made of wood, hard rubber, or other suitable material; 63, the diaphragm, and 64 the mouth-piece, adapted to be screwed onto the end of said body, and securing said diaphragm against the end of the latter and covering a chamber, 65, which is connected by a passage through the body, and by a tube, 66, with the line 3, or any of the branches thereof.

The manner of the operation of the transmitter 7 and the receiver 8, Fig. 4, when said devices are used in connection with the tubular line 3 for transmitting and receiving speech-sounds, is as follows: The position in which the lever 56 is held in said figure by the weight of the receiver 8, which is hung thereon, is one which brings the plug 58 of the cock 49 to the position shown in Fig. 8—that is to say, bringing the air-passage which extends quite through said plug in a line with the tube 6, which leads directly to the box 37, thereby permitting the said air-pressure in the line 3 to be communicated to the interior of said box, thereby distending the diaphragm 38 thereon, as shown by the curved line in said figure, the dotted line thereon indicating the position of the diaphragm when the pressure of the line 3 is not exerted on the said box. To operate the signal-bell of other like boxes on the line, calling the latter by their numbers, the push-rod 46 is pushed endwise, carrying its valve-shaped end off from the air-hole 45, as many times as said number 3, for instance, may require, thereby letting the air escape from the box and permitting the diaphragm to retract each time that the pressure is taken off, sufficient time between each movement of the rod 46 being allowed to permit the diaphragm to be distended. The said projection 39, attached to the diaphragm, having pins therein, as above described, by which it engages with the arm 41 of the hammer 42, moves with said diaphragm, and thereby operates the hammer against the bell 43, causing the latter to be struck as many times as the push-rod 46 is operated, thereby calling the desired party on the line. As soon as the called party responds by any proper preconcerted signal the receiver 8 is lifted from the lever 46 and applied to the ear in the usual way, permitting said lever to swing upward

by the action of the spring thereunder, and swinging the plug of the cock 49 from the position shown in Fig. 8 to one in which the long passage through said plug is brought into  
 5 juxtaposition with the opening through the barrel of the cock which leads to the branch pipe 50 and the short passage 67 in said plug opposite the end of the branch 6, whereby  
 10 communication between the latter and the line 3 is opened directly with the rear side of the diaphragm 51, against which the end of the branch 50 is held, as aforesaid. The parts are now in position for the transmission of articu-  
 15 late speech and the reception of the same, as above described, after which the instrument 8 is hung on the lever 56, restoring the said operating parts to the position shown in Fig. 4.

The above-described tubular line 3, with its  
 20 branches, transmitting and receiving instruments, and means for supplying said line with aeriform fluid, constitutes one manner of carrying out our invention; but we have discovered that substantially the same results are ob-  
 25 tained and by substantially the same means, but undersomewhat different conditions, by attaching transmitting-instruments, or both transmit-  
 30 ting and receiving instruments, to the ordinary gas-pipes of a building, as illustrated in Fig. 9, in which are shown several rooms in a building with which the ordinary gas-pipe, 4, is con-  
 35 nected, leading from a meter in the basement (indicated by the number 68) up through said rooms, and connected with the ordinary chan-  
 40 deliers, 69, by branches of said pipe extending between the floors of said building, as indicated by dotted lines in said figure. At different points on said pipe outlets 70 are ar-  
 45 ranged in the same manner as for attaching gas-brackets thereto, and to said outlets are attached diaphragm-boxes 71, constructed as  
 50 illustrated in section in Fig. 10. Said boxes 71 consist of two disks of metal or other suitable material, inclosing between them a dia-  
 55 phragm, 72, of substantially the same material as that in said box 7, and secured, as shown, by its borders between said disks, whereby it is free to vibrate, as above described. One of  
 60 said disks is provided with a mouth-piece, 73, and the second disk, or rear one, is provided with a screwed socket, 74, whereby said box is attached to the said outlet on the gas-pipe 4. Two persons in said house—one in the upper  
 65 and one in the lower room thereof—wishing to speak with each other by means of said diaphragm-boxes and the connecting-pipe 4, the latter containing the usual gas-supply for illuminating purposes, may speak into the  
 70 mouth-piece 73 in either of said rooms, while the other listens at said mouth-piece in the other room; but for greater convenience in the use of said pipe and boxes as a means for tele-  
 75 phonic communication a receiving-instrument 8 is attached by a flexible tube 66 to each of said outlets 70, whereby the receiver  
 80 8 may be held to the ear while speaking into

the mouth-piece 73. By means of the said transmitting or receiving device connected with the gas-pipe of a building a distinct  
 85 transmission of articulate speech through a longer or shorter distance is had. In Fig. 9, 75 indicates the gas-main of the street near which said house is located, and 76 the serv-  
 90 ice-pipe leading from said main to the meter 68. Between said service-pipe 76, leading to the meter, and a pipe, 77, leading from the meter and connected to said gas-pipe 4, is at-  
 95 tached one of said diaphragm-boxes 71, but provided with a screwed socket, 74, on each disk to adapt it for such connection, the pur-  
 100 pose of which is to provide means for telephonic communication through said pipe 4 down to the tube 77, thence across above the meter to the pipe 76, and through the latter  
 105 to the street-main 75, and thence to other houses or places which may be connected with said street-main by means of the here-  
 110 inbefore-described transmitting-instruments, which are attached to places of communication in the manner illustrated in Fig. 9. The  
 115 aforesaid cross-connection between the tube 77 and the pipe 76, embracing therein the diaphragm-box 71, is made for the purpose of obtaining a suitable communication be-  
 120 tween said house and the street-main 75 without disturbing the ordinary condition and action of the gas-meter 68. The interposition  
 125 of the diaphragm 72 in the aeriform line of communication between said house and gas-main does not interfere with the proper re-  
 130 sponsive action of a diaphragm connected beyond the cross connection above the meter, since the action of the diaphragm in the latter connection and the one communicated with be-  
 135 yond it would be substantially simultaneous. When the aforesaid tubular line 3 is of metal and is extended in a proper insulated manner on the posts 5, or otherwise, other means of  
 140 signaling between the several stations on said line may be adopted than those above de-  
 145 scribed, and shown in Fig. 4, for it is obvious that said line, with its branches 6, having connected thereto, as described, the diaphragm-  
 150 box 71 or the instrument 8, may be used, as set forth, for the transmission of speech and for  
 155 signaling otherwise than by means of the devices shown in Fig. 4. Resort may be had to the use, if desired, of the electric connections with line 3 shown in Fig. 1, to which may be  
 160 attached any suitable signaling-instrument, whereby any station on the line may be called.

What we claim as our invention is—

1. Means for transmitting articulate speech between distant points, consisting of a tubular  
 165 connecting-line containing an aeriform fluid under pressure, several stations connected with  
 170 said line, each provided with a speech transmitting and receiving diaphragm, substantially as described, the latter having the inner  
 175 surface thereof wholly or in part exposed to and in communication with the aforesaid aeriform contents of said connecting-line, and sig-

nal devices connected with the latter, consisting of an air-box having a hole therein for the escape of air connected with said line, and having an elastic diaphragm attached thereto subject to air-pressure in said box, a movable valve-rod having a valve thereon, whereby said air-hole is opened and shut, a bell, a hammer pivoted near the latter, having a lever thereon extending by the side of said elastic diaphragm, and a projecting bar attached to the latter, with which said bell-hammer lever engages, combined and operating substantially as set forth.

2. An instrument for communicating articulate speech to a tubular connecting-line, substantially as described, containing an aeriform fluid, consisting of a suitable box having a vibratory diaphragm attached thereto, a tubular connection with said line terminating at the rear side of said diaphragm, and a spring holding the open end of said tubular connection against the diaphragm, substantially as set forth.

3. An instrument for communicating articulate speech to and receiving the same from a tubular connecting-line, substantially as described, containing an aeriform fluid, and for signaling over said line, consisting of a suitable box, 7, having a vibratory transmitting-diaphragm attached thereto, a bell-operating box, 37, having an elastic diaphragm thereon, a tubular connection, 6, with said line communicating with the interior of said box 37, having a branch, 50, leading therefrom, the end of which terminates at the rear side of said transmitting-diaphragm, a two-way cock, 49, located in said tubular connection 6, with which cock said branch 50 is connected, having a lever, 57, attached to the plug thereof, a vibratory lever, 56, pivoted in the said box 7, connected with said lever 57 by a suitable rod, aspring to swing lever 56 upward, a tubular con-

nection, 53, communicating with said branch 50, and a receiving-instrument, 8, attached by a flexible tube to said connection 53, having a ring thereon whereby it is suspended on said lever 56, combined and operating substantially as set forth.

4. A pipe or tube inclosing a gaseous fluid, a switch-valve therein, a weight which closes said valve in one direction, but opens it in the direction of a signal apparatus, and a spring which closes the valve to the signal and opens it to permit communication through the tube to a receiving-diaphragm, the specified parts and their essential connections being combined and arranged substantially as described.

5. The combination, with a tubular telephonic line having an inclosed gaseous fluid, and transmitting and receiving instruments connected therewith, substantially as described, of a coupling connecting parts of said tube, said coupling consisting of two shells, 13 and 14, of tubular form, one shell having a closing valve therein and the other shell having a spindle, by which said valve is opened when the shells are pressed together in coupling, all substantially as described.

6. The combination, with the gas-pipes and meter of a gas system, of a telephonic transmitter and receiver of the character described, connected to said pipes at opposite sides of the meter, and a tube, 77, connected to the pipes on each side of the meter, said tube being closed by a flexible diaphragm to prevent the passage of gas, while permitting vibration, substantially as described.

JOHN P. HURLEY.  
GEORGE F. PERKINS.

Witnesses:

JONES S. DAVIS,  
E. W. CHAPIN.