(No Model.) 2 Sheets—Sheet 1.

H. C. STRONG.

COMBINED TELEGRAPHIC RELAY AND TELEPHONE.

No. 312,670. Patented Feb. 24, 1885.

Fig. 1.

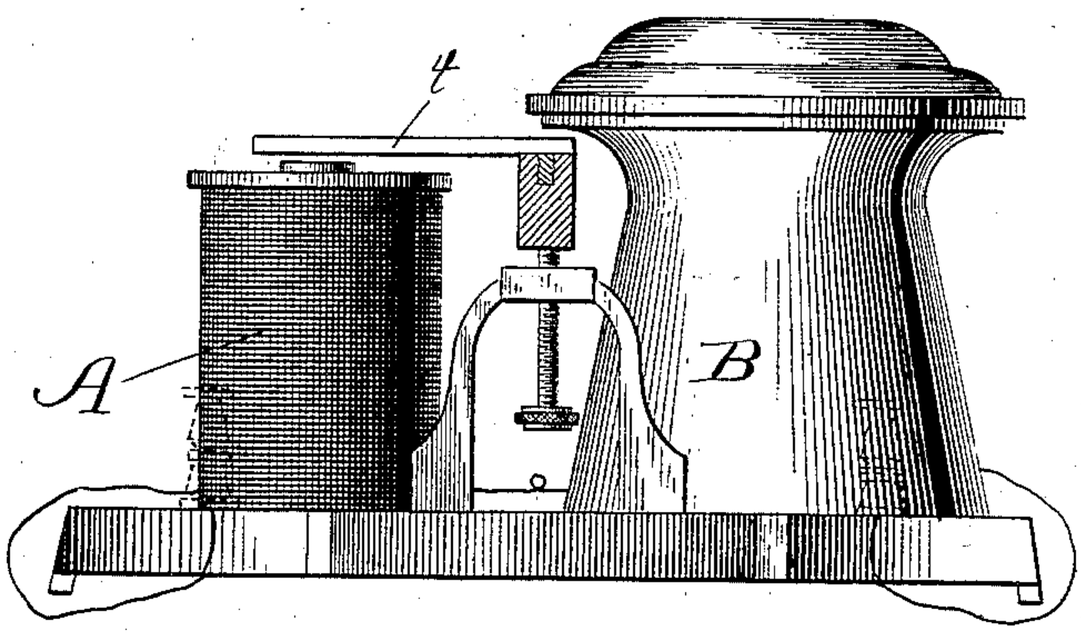
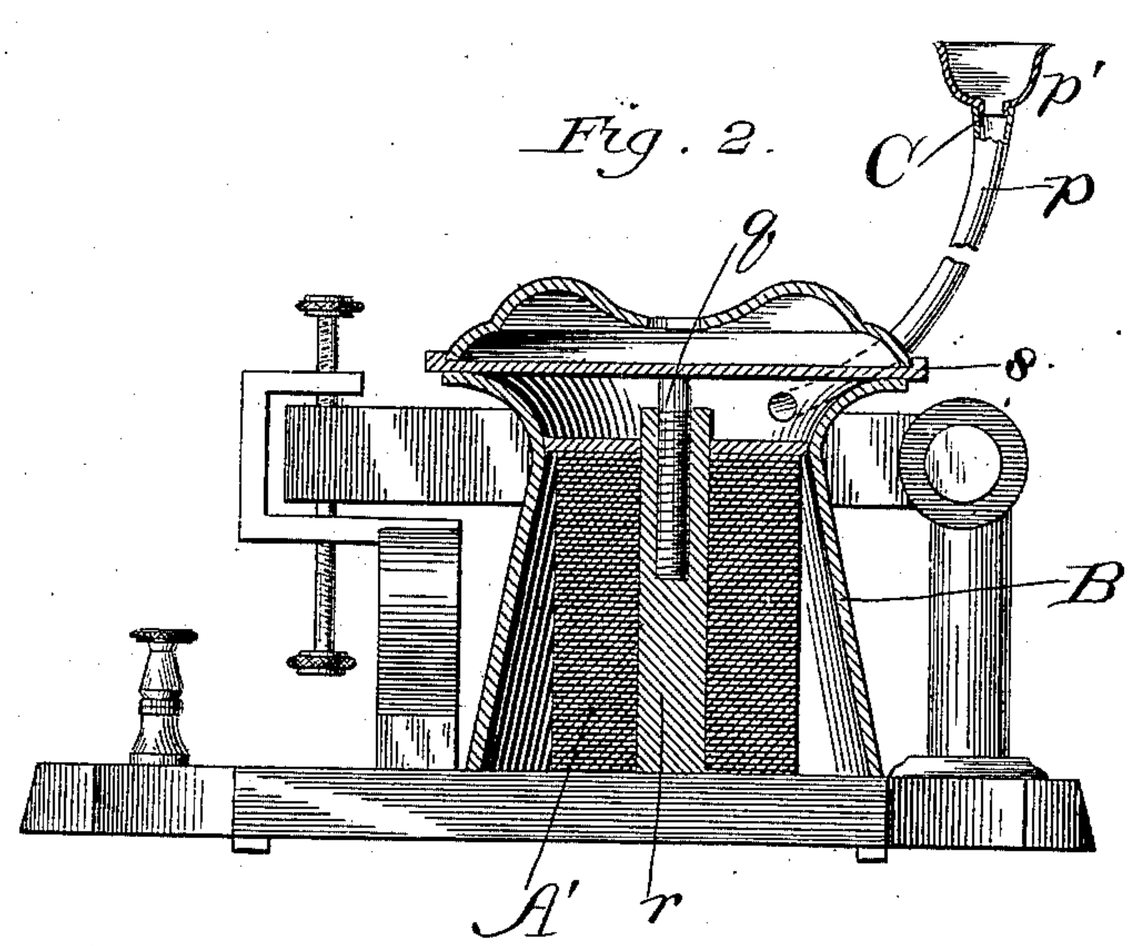


Fig. 2.



Witnesses:
Frank J. Blanchard
Chas. J. Heylmann

Inventor:
Henry C. Strong
By Dyrenforth & Dyrenforth,
Attorneys

(No Model.) 2 Sheets—Sheet 2.

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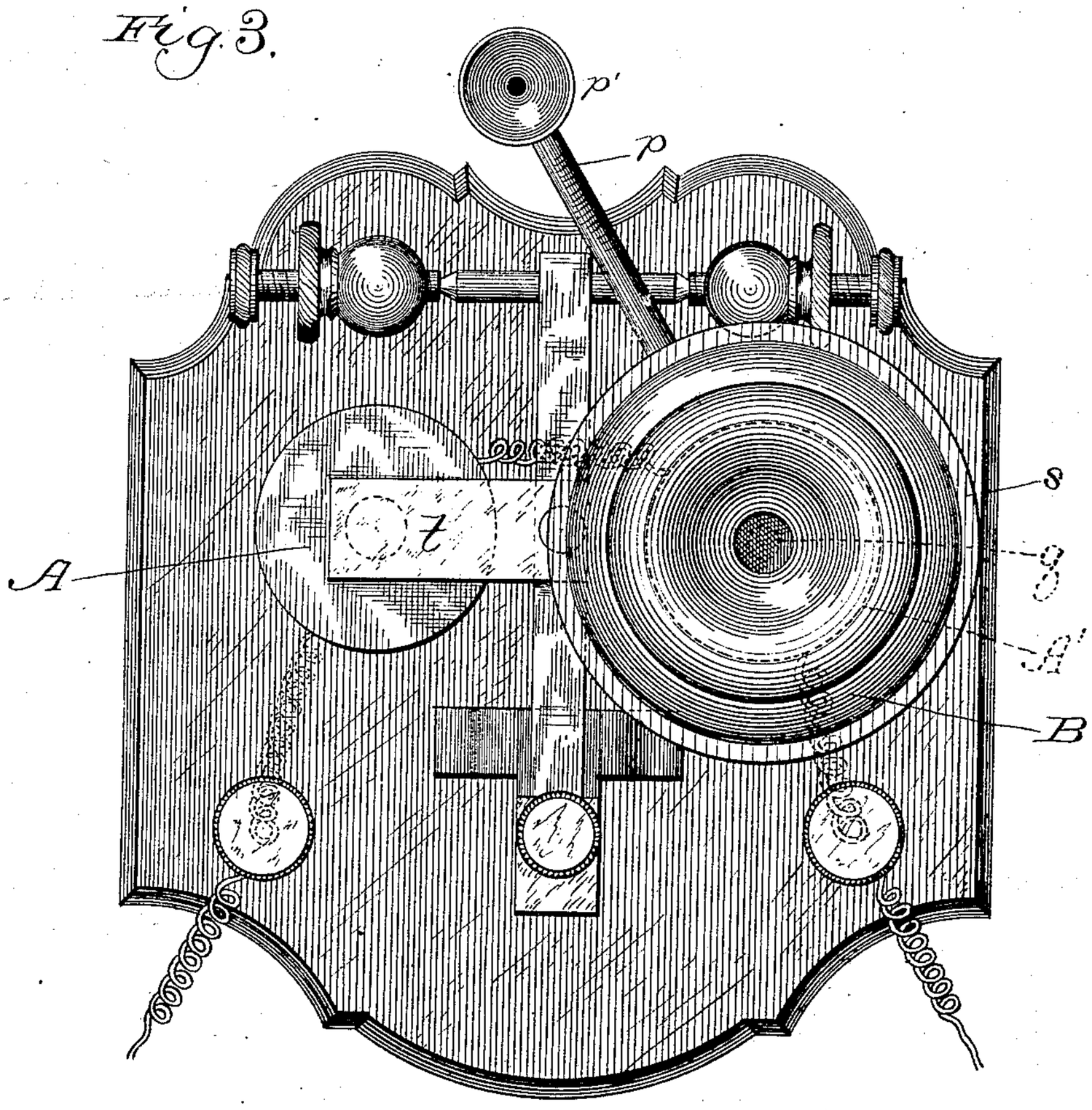
Fig. 3.



Witnesses:
Chas. E. Gaylord.
Mason Bros.

Inventor:
Henry C. Strong
By Dyrenforth & Dyrenforth.
Attorneys.

UNITED STATES PATENT OFFICE.

HENRY C. STRONG, OF CHICAGO, ILLINOIS, ASSIGNOR OF ELEVEN-FIFTEENTHS TO DAVID A. STRONG AND HENRY P. CALDWELL, BOTH OF SAME PLACE.

COMBINED TELEGRAPHIC RELAY AND TELEPHONE.

SPECIFICATION forming part of Letters Patent No. 312,670, dated February 24, 1885.

Application filed March 19, 1884. (No model.)

To all whom it may concern:

Be it known that I, HENRY C. STRONG, a citizen of the United States, residing at Chicago, in the county of Cook and State of Illinois, have invented a certain new and Improved Combined Telegraphic Relay and Telephone; and I hereby declare the following to be a full, clear, and exact description of the same.

It is the object of my invention to render it possible to receive and transmit communications by electricity over lines of great length without the use of repeaters at intervening stations, and even when the line shall be broken and the ends of the broken section or sections grounded, and without the employment of a return-circuit other than that afforded by the earth.

The mechanism I employ to produce the aforementioned object comprises an ordinary telegraphic signal-instrument connected with the line-wire, having one half of its armature removed and the other half operated in the usual way by the portion of the electro-magnet over which it lies, and having the remaining portion of the electro-magnet provided with a permanent magnet affixed to its core, and with a cup and diaphragm to constitute it a telephone.

The advantages afforded by my invention are principally those of permitting a message to be received or transmitted when the line over which it shall pass is broken and the broken ends grounded, or when the battery-current shall have become too weak to operate the armature of the telegraphic instrument, though, as hereinafter explained, it may always be used for receiving and transmitting telegraphic signals and articulate sounds.

The telephone portion of my device is provided to enable telegraphic signals constituting a message to be heard at the receiving end of the line when the battery-current used for the transmission shall have become from any cause too weak to operate the armature of the receiving-instrument. The weak current which lacks the power to operate the half-armature of the receiving-instrument intensifies the permanent magnet inserted into the core of one spool of the electro-magnet of the receiving-instrument, and causes the transmitted signals to be re-enforced or rendered audible, but whether owing to the attracting and repelling effect of the end of the permanent magnet upon the diaphragm, or, in other words, to pushing the diaphragm upward on one part of its surface and pulling it downward on another, or to the noise produced by the disturbing effect upon the molecules of the permanent magnet when intensified by the electric current, is not known to me; but it is certain that signals sent from a distant station and reaching the receiving-instrument with the current in a condition too weak to operate it may be heard very plainly on applying the ear to the telephone portion of the receiving-instrument.

The successful operation of my invention requires the use of a high-tension current upon the line, to which the connection of the battery is made in the manner shown and described in Letters Patent of the United States, No. 192,856, granted to S. J. M. Baer, July 10, 1877, and shown in the drawings of Letters Patent of the United States No. 75,886, to Lancelot H. Everett, March 24, 1868, and shown and described in an application filed by me March 15, 1877, for a patent for an improvement in railway telegraphing and telephoning, and also shown, described, and claimed in Letters Patent No. 235,658, granted to me December 21, 1880. I accomplish the object above stated by means of the mechanism hereinafter described and claimed, and shown in the drawings, in which—

Figure 1 is a front elevation of a relay-instrument having an armature for one spool of the electro-magnet, while the other is inclosed by a telephone-cup; Fig. 2, a vertical section through the telephone portion of the device, showing a diaphragm, a screw-threaded permanent magnet adjusted within the core of the electro-magnet, and a flexible tube having one end inserted underneath the diaphragm; and Fig. 3 a plan view of my improved device.

A and A′ are the spools of the electro-magnet of a relay-instrument, the spool A only being provided with an armature, *t*.

B is a telephone-cup having an ordinary diaphragm, *s*, properly adjusted, the cup in-

casing the spool A′ of the electro-magnet, into the core *r* of which a permanent magnet, *q*, is screwed, and thereby adjustable to impinge against the under surface of the diaphragm when the current shall be very weak.

To illustrate the operation of my device, suppose, as one instance, that a current transmitting a telegraphic message from New York to Chicago becomes too weak after a part of the message shall have been received to continue to attract the armature *t* of the receiving-instrument to the electro-magnet. The operator at the receiving-station on applying his ear to the telephone portion B will plainly hear the remainder of the message, and words spoken by him into the telephone portion B will be transmitted to and heard by the operator at the New York station, provided with a similar device.

To illustrate by another instance, suppose that during the transmissin of a message the line-wire is severed, the broken ends falling upon the ground. The effect upon the armature *t* of the receiving-instrument will be to cause it to cling to the core of the electro-magnet A, indicating the mishap to the operator at the receiving-station, who, to catch the remainder of the message, will apply his ear to the telephone portion B. He may also converse with the operator at the transmitting-station through the telephone portion B.

The adjunct C, comprising a flexible tube, *p*, inserted at one end into the cup B underneath the diaphragm *s*, and provided with a cup, *p′*, at the opposite end, affords a very useful device in connection with the telephone-instrument, since by applying the ear to the cup *p′* signals produced by a weakened current through the action of the magnet *q* are much more plainly audible than to the ear applied to the mouth of the cup B. This result seems to be due to the position of the end of the tube *p* between the diaphragm *s* and end of the magnet *q*, which would indicate that the sound is not produced by the bending of the diaphragm under the influence of the permanent magnet, but by the disturbing effect of the current upon the molecules of the magnet *q*.

The device above described presents the peculiar advantage of availability on lines of great length equal to the present telegraphing circuits without interfering with the telegraph system now in general use, though there may be instruments used in the duplex and quadruplex systems of telegraphy in connection with which my device cannot be operated, in which case, where it is desired to converse through the telephone the duplex or quadruplex may be switched out, but the same battery-current will be used to transmit and receive the telephone communication.

I am aware that it is not new to use a telephone in connection with a receiving-instrument for the purpose of hearing telegraphic signals, such application of a telephone-instrument having been made heretofore, but for a different purpose from mine, and operating upon an entirely different principle.

I am also aware that it is not new to use a flexible tube connected at one end with the telephone and arranged to render the opposite end suitable for application to the ear for the purpose of concentrating the sound upon the latter; but I believe it to be new to apply the end of the tube to the telephone in the manner set forth in the foregoing description, whereby the desirable results stated are attained.

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

1. A telegraphic signal-instrument having one pole of its electro-magnet connected up in a battery-circuit, and provided with an armature to constitute a signal-receiver, and having the other pole provided with a permanent magnet adjusted to its core, and with a diaphragm and cup to constitute a telephone receiver and transmitter, substantially as described.

2. A combined telegraph-instrument and telephone comprising the electro-magnet A A′, armature *t*, diaphragm *s*, permanent magnet *q*, adjustable within the core *r* so as to lie firmly against the under side of the diaphragm *s*, and cup B, the whole being constructed and arranged to operate substantially as and for the purpose set forth.

HENRY C. STRONG.

In presence of—
C. C. LINTHICUM,
DOUGLAS DYRENFORTH.