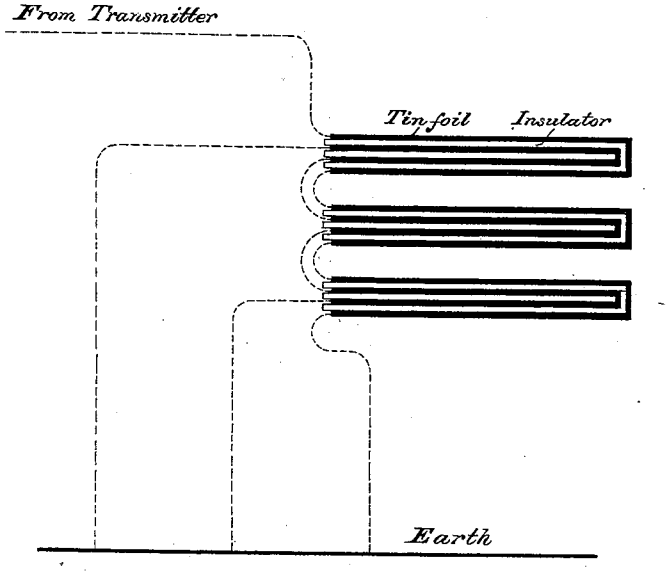
J. MUIRHEAD, Jr.

Condensing Resistance for Electric Telegraphs.

No. 208,665. **Patented Oct. 1, 1878.**



WITNESSES

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JOHN MUIRHEAD, JR., OF WESTMINSTER, ENGLAND.

IMPROVEMENT IN CONDENSING RESISTANCE FOR ELECTRIC TELEGRAPHS.

Specification forming part of Letters Patent No. **208,665**, dated October 1, 1878; application filed May 15, 1878.

To all whom it may concern:

Be it known that I, JOHN MUIRHEAD, Jr., of 29 Regent street, Westminster, England, have invented new and useful Improvements in Electric Telegraphs, and in apparatus connected therewith, which improvements are fully set forth in the following specification.

This invention has for its object to construct an accumulator having also power of conduction, which is adjusted to the requirements. Such an accumulator can be constructed combining both the conductive resistance and capacity required to imitate exactly a real line, and, so constructed, is specially adapted for use in duplex-working systems, and may be called an "artificial line." The artificial line may be constructed with two strips of tin-foil, (or other thin metallic sheet,) laid one over the other, and separated by an insulating material. Each end of one of the strips of metal foil is connected with connecting-clamps on the instrument, and is arranged in one continuous line to the length required, so that the resistance of the entire length of thin metal comes into play. The other strip of metal foil is furnished with earth-connections. The conducting-strips are made of proper dimensions to give the desired resistance and amount of surface; or, instead of employing two strips, a single strip which will give the requisite resistance and capacity may be arranged, as above described, on one side only of the dielectric, while on the other side a continuous metallic sheet, equal in superficies to the whole of the area of the dielectric over which the tin-foil strip is spread, may be used in connection with the earth instead of a second strip. The two strips, with the non-conductor between them, are folded into a convenient shape.

The way in which this instrument is used in duplex telegraphy is as follows: The current established by each contact made by the signaling-key is caused to divide into two parts. One part is passed through the actual cable, and affects the indicator at the receiving end, and the other part is caused to pass through the accumulator by the continuous strip of thin metal attached, as before mentioned, to the connecting-clamps, and so this portion of the current passes to earth. The other strip (or strips) of thin metal has also an earth connection or connections.

The signaling-currents passing into the cable and into the accumulator, which is made to imitate the cable, neutralize each other as to their effect on the indicator at the transmitting-station.

The resistance of the thin metal used in the accumulator is ascertained by experiment, and the conducting-sheet of the accumulator is so proportioned as to make its resistance to the passage of a current the same as that of a given length of the real cable, while its surface is of such dimensions that, with the insulating material employed, its capacity to receive a charge may also be the same as that of the same length of actual cable.

It is obvious that two or more of these accumulators may be coupled in continuous circuit, so as to obtain their combined effects in augmenting both resistance and capacity; or they may be coupled side by side or in multiple circuit, so as to obtain their combined effects in augmenting capacity, while the resistance is decreased in the ratio of the number employed.

When the instrument is in use one end of the artificial line or balancing apparatus may be connected with the transmitter and the other to earth, while the sheets of tin-foil have a direct earth-connection. This is the arrangement I prefer when the cable has a direct connection with the transmitter and with the receiving-instrument; or if, as is now very usual, condensers are interposed at both ends between the cable and the instruments, we make similar arrangements in respect to the artificial or balancing line. When the cable is worked on other systems the connections will be varied to suit the particular system in use, as will be well understood by electricians, the object being in all cases to assimilate as closely as possible the conditions under which the actual and the imitation cable are worked.

If I desire to make an artificial line or balancing apparatus to work with an existing telegraph-cable of which the resistance and capacity are known, I can so construct one unit as to represent both in resistance and capacity a given length of cable, and then it is only

necessary to couple up these units in continuous circuit to correspond to the entire length of the cable; but in other cases it is convenient to make the units with comparatively high resistance as compared with the capacity, and then by arranging the units in parallel circuit a balancing arrangement or artificial line can be readily arranged corresponding approximately to any cable likely to be met with in practice, the resistance being dependent on the dimensions and arrangement of the plumbago paper and the capacity or power of condensation or extent of surface of the tin-foil which faces it.

These instruments are not only useful in duplex telegraphy, but also for other purposes, such as the experimental working of telegraphic transmitting and receiving instruments.

Having thus described the nature of the said invention and the manner of performing the same, I would have it understood that I claim—

1. The accumulator, having also power of conduction or artificial line, as a new manufacture.

2. The combination of the accumulator, having also power of conduction or artificial line, with an electric telegraph cable or line, for the purpose of duplex working.

3. The construction of the accumulator, having also power of conduction or artificial line, by combining the following parts: first, the conducting strip or strips of metal foil by which the current passes through the instrument; second, the metal foil, having an earth-connection, through which it charges and discharges itself; third, the separating-sheets of dielectric or insulating material.

London, 17th December, 1877.

J. MUIRHEAD, JR.

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