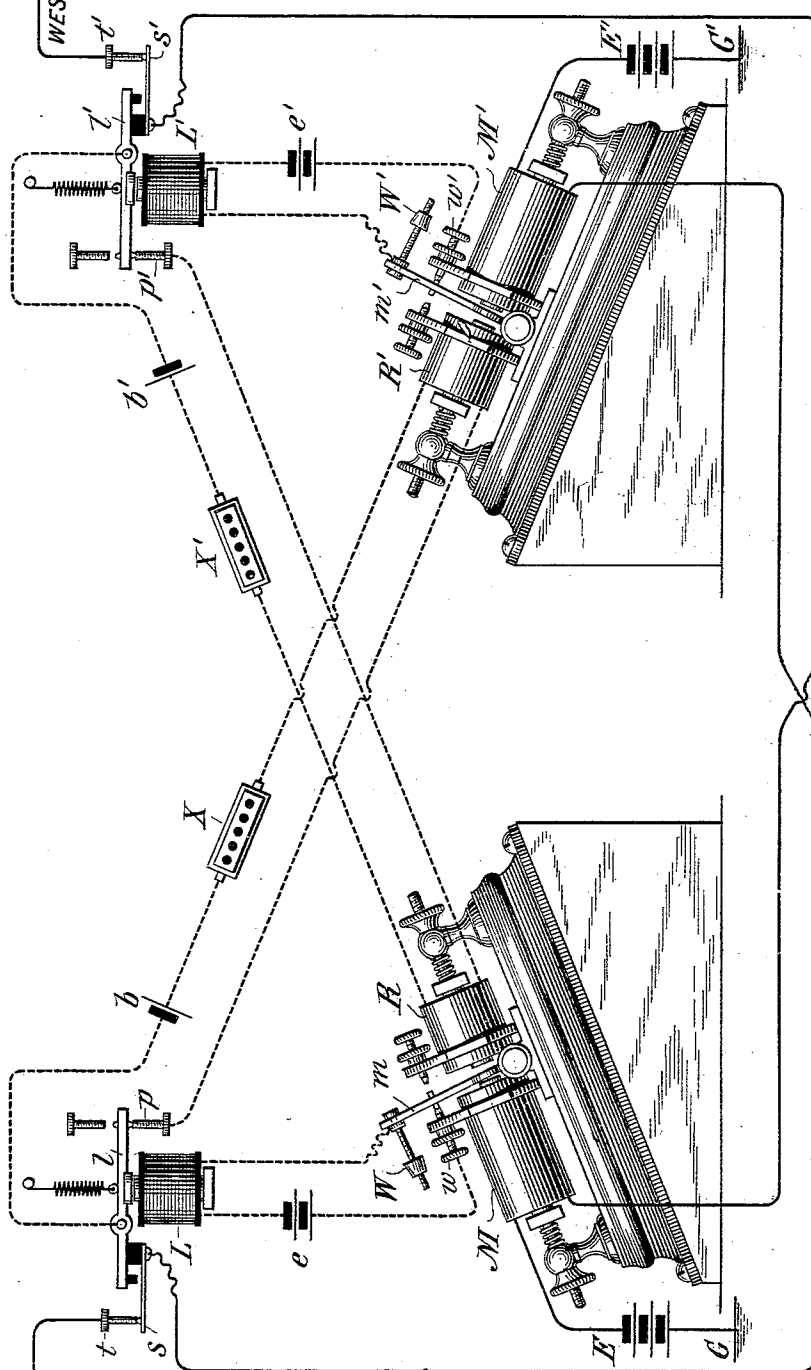


(No Model.)

L. HORTON, Jr.
TELEGRAPHIC REPEATER.

No. 555,165

Patented Feb. 25, 1896.



WITNESSES:

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INVENTOR:

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UNITED STATES PATENT OFFICE.

LEWIS HORTON, JR., OF READING, PENNSYLVANIA.

TELEGRAPHIC REPEATER.

SPECIFICATION forming part of Letters Patent No. 555,165, dated February 25, 1896.

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To all whom it may concern:

Be it known that I, LEWIS HORTON, Jr., a citizen of the United States, residing in Reading, in the county of Berks and State of Pennsylvania, have invented a new and useful Improvement in Telegraphic Repeaters, of which the following is a specification.

My invention relates to that class of apparatus which is employed in telegraphy for automatically reproducing in either one of two otherwise independent circuits signals which are originated in the other circuit by alternately interrupting and restoring the flow of the electric current from a battery or other constant source of energy. Such an organization of apparatus is technically known as a "repeater."

My improvement comprises certain modifications in the construction and mutual relations of the parts of the apparatus heretofore generally employed for this purpose, whereby I am able to dispense with certain parts of the mechanism and yet accomplish the desired end, not only in a more effectual manner, but with less costly and less complicated apparatus. I attain this object by the mechanism illustrated in the accompanying drawing, which is a representation, partly diagrammatic, of a telegraphic repeater embodying my improvement.

I designate the two circuits which are to be coupled together by the repeater, for convenience of explanation, as the "eastern" and "western" circuits, respectively. The relay-magnet of the western circuit is shown at M. This circuit enters at the right of the diagram and is marked "West." By means of its armature-lever *m* this magnet is capable of alternately opening and closing the circuit of a local battery *e* and of thereby actuating a sounder or other reading-instrument the essential parts of which are a local magnet *L* and an armature-lever *l*.

In its general features of structure and operation the apparatus thus far described is substantially the same as that in ordinary use in the telegraphic service. It is duplicated in every particular by the corresponding apparatus pertaining to the eastern cir-

cuit, (marked "East" in the diagram,) which is designated by similar letters of reference, with the addition of the superior reference-numeral 1, as *M'*, *m'*, &c.

The respective relay-magnets of my apparatus differ from those ordinarily in use in that a constant force is applied to the armature, tending to maintain it in position to keep the local circuit closed whether the relay-magnet is energized or not, and also in that the opening movement of the armature-lever is produced by means of the positive attractive force of an independent retracting-electromagnet instead of the recoil of a strained spring. By placing the armature-lever in a properly-inclined position and suitably weighting it I utilize the force of gravity for the purpose first named above, as will be understood by reference to the drawing, in which *W* and *W'* are adjustable weights, capable of being placed at different distances from the fulcrum of said inclined armature-levers *m* and *m'*.

The alternate magnetization and demagnetization of the retracting-magnets *R* and *R'* is effected by auxiliary local circuits under control of circuit-breaking contacts upon the levers of the respective opposite sounders, as hereinafter more particularly explained.

The mode of operation of the apparatus will be understood from the following explanation: The circuit of the incoming line marked "East" may be traced through contact-point *t*, contact-spring *s*, relay-magnet *M'*, and main battery *E'* to the earth at *G'*. In like manner that of the line marked "West" passes through *t'*, *s'* and *M* to *G*. Normally a constant current passes through both lines. Both local circuits are consequently closed, and so also are the auxiliary local circuits which actuate the respective retracting-magnets *R* and *R'*. The retracting-magnets *R* and *R'* must be adjusted to correspond with the normal strength of the currents in the main circuits by moving their poles toward or away from the respective relay-armatures *m* and *m'* until the opposing attractive forces are exactly equal to each other, after which the armatures *m* and *m'* will be

held against their respective closing contacts w and w' solely by the force of gravity acting upon the weights W and W' .

The relay-magnets and their corresponding retracting-magnets are so arranged that their similar poles face each other upon opposite sides of the common armature.

In order to repeat a telegraphic signal, say, from the eastern into the western circuit, it is only necessary that the operator at any point on the eastern line shall be able to break the circuit of that line, and that this shall have the effect of also breaking the circuit of the western line, and that, conversely, when such operator restores the circuit of the eastern line the circuit of the western line shall also be restored. It is also of great importance that the interval of time elapsing between the occurrence of the breaks and closures of the eastern line and the corresponding breaks and closures of the western line shall be as short as practicable. The manner in which this result is effected will now be explained.

The interruption of the current in the eastern main circuit demagnetizes the relay-magnet M' , permitting the attraction of the retracting-magnet R' to instantly overcome the resistance of the weight W' and break the primary local circuit at contact w' . This operation is almost instantly followed by the breaking of the auxiliary local circuit of the opposite retracting-magnet R at p' , and this again by the breaking of the western main circuit at $s' t'$. The determination of the precise interval of time elapsing between the two last-named operations is a very important point in the adjustment of the apparatus and is effected by means of the movable contacts t and t' . By so adjusting these contacts as to secure a brief but determinate and invariable interval of time between the releasing action of the respective magnets M' and R' , I am enabled to dispense with all devices for short-circuiting the retracting-magnet, and thus not only to materially simplify the apparatus but to avoid much unnecessary consumption of material in the local batteries.

In conjunction with the last-mentioned device I make use of a very short core-magnet to effect the retraction, so as to reduce the necessary time interval as much as possible, and, hence, before the relay-magnet—as, for example, M —has begun to lose its magnetism, its opposing retracting-magnet has become wholly inert, so that the action of gravity upon the weight W comes into play to keep the primary local circuit as well as its auxiliary dependent local circuit unbroken. Hence the opposite retracting-magnet R' cannot act to release its armature m' . Both main circuits

are now open, the eastern at the key of the transmitting-operator and the western between the contact-point t' and the contact-spring s' .

Reversing the above-described operation, the closing of the eastern main circuit first restores the magnetism of the relay-magnet M' , whereupon (the magnetic pull upon the armature-lever m' being again balanced) gravity comes into play to bring the same against its contact-stop w' , whereupon its corresponding sounder closes in orderly succession the western main circuit at $s' t'$ and the auxiliary local circuit of the opposite retracting-magnet R , thus restoring the apparatus to its normal position. This operation is repeated in the same manner during the transmission and repetition of each elementary signal of the conventional telegraphic code. Signals originating upon the western circuit are repeated into the eastern circuit in precisely the same manner by the opposite contacts t and s .

To insure the proper and effective operation of the apparatus, it is necessary that the effective force exerted by the retracting-magnets R and R' should at all times be exactly equal to that of the relay-magnets M and M' , and as the latter necessarily varies according to the condition of the insulation of the main circuit and other circumstances means must be provided for altering the former as required. This may be conveniently effected by the adjustable rheostats X and X' interposed in the respective auxiliary local circuits.

I claim as my invention—

The combination in an automatic repeating apparatus of two main circuits entering a single station, two relays, one in each line at said station, a local circuit containing an electromagnetic, spring-contact, transmitting-instrument operated by said relays, respectively; an electromagnetic retractor for the armature of each relay, and an extra local circuit for each retractor, the extra local circuit of one relay-retractor, say the first, including the down contact-stop and movable or armature contact operated by the automatic transmitter controlled by the second relay, whereby a break in the second circuit, due to the operation of the first relay, occurs after a break in the retracting-circuit of the second relay, and vice versa, substantially as described.

Signed by me this 9th day of September, A. D. 1895.

LEWIS HORTON, JR.

Witnesses:

AMBROSE S. MILLER,
HOWARD P. WANNER.