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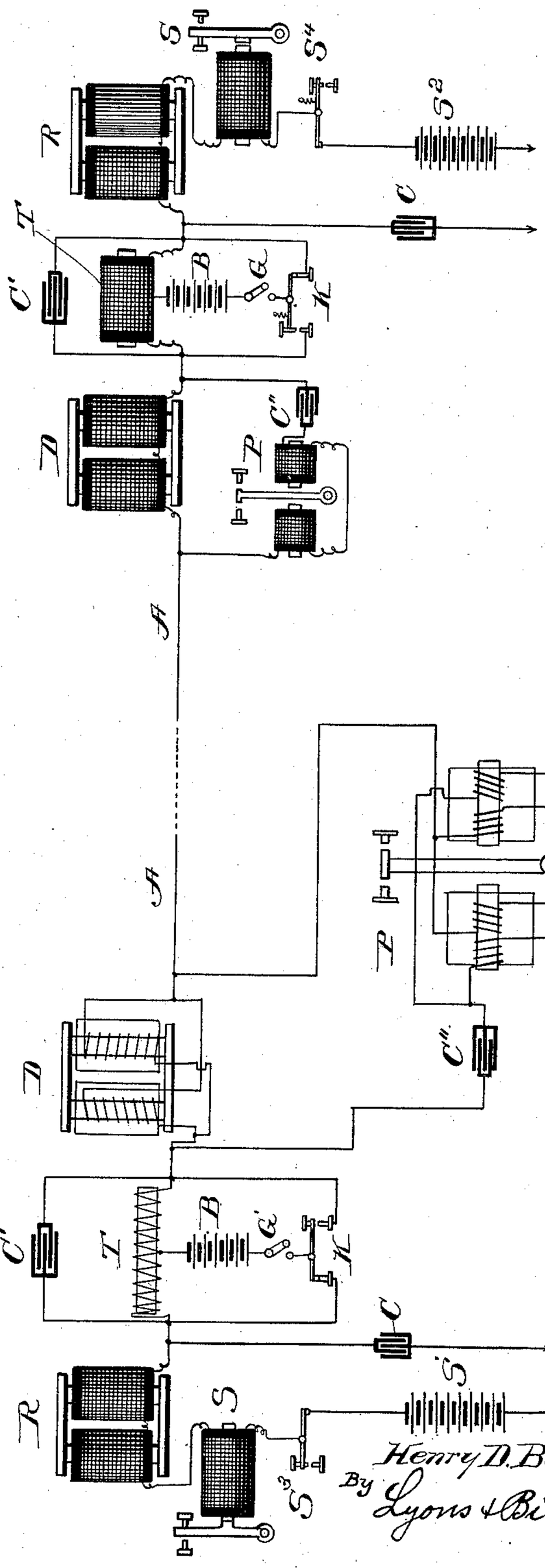
H. D. BARTHOLOMEW.

TELEGRAPHY.

(Application filed Oct. 12, 1899.)

(No Model.)



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UNITED STATES PATENT OFFICE.

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TELEGRAPHY.

SPECIFICATION forming part of Letters Patent No. 656,832, dated August 28, 1900.

Application filed October 12, 1899. Serial No. 733,447. (No model.)

To all whom it may concern:

Be it known that I, HENRY D. BARTHOLOMEW, a citizen of the United States, and a resident of Newark, in the county of Licking and State of Ohio, have invented certain new and useful Improvements in Telegraphy, of which the following is a specification.

My invention relates to multiplex telegraphy of the superposed-current type; and the object of my invention is to produce a system which can be employed in connection with any common system of Morse telegraphy, such as now in use.

The construction and arrangement of telegraph systems operated according to the Morse plan are well understood. In such a system there is a single grounded line-wire with a transmitting apparatus at one end and a receiving apparatus at the other end. Signals are sent by causing the transmitting apparatus to make or break or otherwise change the character of a battery-current of suitable, but generally low, tension. Such system may be a duplex, in which case a message can be transmitted from each end simultaneously, or it may be quadruplex, in which case two messages can be sent from each end simultaneously. My invention adds to such a Morse system, whether simple, duplex, or quadruplex, a transmitting and receiving apparatus operating with high-tension electric currents, and the peculiar arrangement which I employ is such that the high-tension currents in no way interfere with or substantially affect the operation of the Morse apparatus and that the Morse currents in no way interfere with the operation of the high-tension apparatus. We have, then, on the same line-wire two distinct sets of receiving and transmitting apparatuses, one operating according to the old Morse plan, whether simplex or multiplex, the other operating by high-tension currents, and neither system interfering with the other.

The system is well shown in the single figure of the drawing.

The line-wire A, which joins the transmitting and receiving stations, includes a Morse relay S at each end, as well as batteries S' S^2 and Morse keys S^3 S^4, operating in the usual manner, unnecessary here to describe. In order, however, to accentuate the inherent character of the Morse current—that is to say, in order to make the electrical impulse represented by it of a graduated and prolonged character—I insert in the line at each end resistance or retarding coils R, and I also connect the main line at the points indicated with ground-taps containing condensers C. The apparatus and line as thus far described operate like an ordinary Morse system, the only difference being that the Morse impulses are less sudden in character and more prolonged than is usually the case.

I come now to describe my high-tension transmitting and receiving apparatuses, which are connected to the line and which act independently of the Morse apparatus. As will be readily understood, there is both a transmitting and a receiving high-tension apparatus at each end of the line in order that the same line may be used for transmitting and receiving at each end.

The transmitting apparatus comprises a transmitting-coil T in the main line, connected at an intermediate point to one pole of a battery B, the other pole being connected to a key K through a switch G. The front and back contacts of the key are connected to the terminals of the coil T, as indicated, and there is a condenser C′ in shunt about the coil to absorb sparks and to hasten the reversal of the magnetism of the core. The key being supposed to be resting against its back contact, it is clear that a current is passing through one-half of the coil T, strongly magnetizing the same. When, now, the key is depressed and the back contact broken, the circuit through the half-coil just described is broken, and a strong sharp high-tension impulse is sent out upon the line in a given direction. At the same time that this is taking place the front contact of the key is being closed and the battery-current is being sent through the other half-coil. The electromotive force thus induced in the other half-coil on the make will be small compared to the electromotive force of the induced current generated by the break before referred to. It will, however, be in the same direction, as can be readily seen by considering the direction of the battery-current in each half of the coil and remembering the well-known laws of induced currents. It follows, then, that both the breaking of the back contact and the

making of the front contact, caused by depressing the key K, coöperate to send to the line a high-tension impulse in a given direction. This high-tension impulse finds a ground at each end of the line through the condensers C. On the other hand, when the operator raises the key K, and thereby breaks the front contact and makes the back contact, it is clear that another high-tension impulse will go out upon the line, which will be in a direction opposite to that just referred to, which was caused by depressing the key. The result is that the depression of the key sends a high-tension impulse out upon the line in one direction, and the elevation of the key sends a high-tension impulse out upon the line in the opposite direction. The apparatus which I use to receive these high-tension impulses is the polarized relay P, which has its coils in parallel to make it respond more quickly. It will be clear that upon the depression of the key K the current of given direction, which is thereby sent out over the line, will throw the armature of the relay against one of its stops, which we may call the "front" stop. It is also plain that the elevation of the key K, sending a high-tension current of opposite direction on the line, and thereby polarizing the relay P in the opposite sense, will throw the armature of this relay against the opposite stop, which we may call the "back" stop. In other words, the key K and the polarized relay P act exactly as do a common Morse key and a common Morse relay. Each motion of the key-lever down and up corresponds to a motion of the armature-lever back and forth. One of the great advantages of my system is that the high-tension signals received on the polarized relay may be sent and read in exactly the manner of common Morse systems.

In order that the Morse signals may not affect the polarized relay, I place this relay in shunt of the main line, which shunt includes a condenser C''. As will be readily understood, only a small portion of the slow Morse impulses will pass through the condenser C''. At the same time it will be necessary to deflect the high-tension impulses from the main line through the polarized relay P, and for this purpose I employ a diverting-coil D of high electrical impedance. The coils of this diverting-coil may be wound in parallel to reduce their resistance to Morse currents.

To insure that the Morse currents which have leaked through the condenser C'' shall not affect the polarized relay, I make the cores of this relay of steel, which is tempered to the proper degree of softness. Even very soft steel will answer. I have discovered that such a polarized relay is quick to respond to the sudden impulses of the high-tension currents and that the polarity of the cores remains as determined by the polarity of the last high-tension impulse passing therethrough. On the other hand, I have found that the slower Morse impulses are not sufficient to operate such a relay. In addition to this the magnetism remaining in the cores is sufficient to retain the armature in a given position, thus making its action similar in all respects to a Morse relay.

From all this it will be seen that the high-tension impulses resulting from a single depression and elevation of the key K passing over the line and being diverted by the coils D into the polarized relays P will operate the armatures of these relays back and forth once for each movement of the key, so that Morse operators at these instruments may send and take off the signals in the usual way. On the other hand, the Morse currents which have been sent out from the batteries S' S^2 and which operate the Morse relays S in the usual way will have their impulses so graduated and prolonged by the retarding-coils R as to pass readily through the diverting or impedance coils D; but such Morse currents will not pass through the condensers C'' in quantity sufficient to operate the polarized relays P by reason of their peculiar construction above pointed out.

What I claim is—

1. In a superposed-current telegraph, a transmitting-coil in the line for sending alternating impulses out on the line, a pair of key-contacts connected therewith, a key, and a battery connected to the coil and key, substantially as described.

2. In a superposed-current telegraph, a transmitting-coil, key-contacts connected to terminals of the coil, a key and a battery having its poles connected to an intermediate point of the coil and to the key respectively, substantially as described.

3. In a superposed-current telegraph, a transmitting-coil in the main line having its terminals connected to front and back key-contacts, a key coöperating with the contacts and a battery having its poles connected to the key and to an intermediate point of the coil respectively, whereby operation of the key in one direction sends an impulse of a given polarity to line, and operation of the key in the opposite direction sends an impulse of the opposite polarity to line, substantially as described.

4. In a superposed-current telegraph, the combination of a main line, a diverting-coil therein, and a condenser and polarized receiving-relay having steel cores in shunt of the diverting-coil, substantially as described.

5. In a superposed-current telegraph, the combination of a main line, Morse transmitting and receiving apparatus therein, a transmitter for putting high-tension alternating currents upon the line and a polarized receiving-relay having steel cores, said relay being irresponsive to the Morse currents but responsive to the high-tension alternating currents, substantially as described.

6. A superposed-current telegraph comprising the combination of Morse transmit-

ting and receiving apparatus, a retarding-coil in the line and condensers in ground-taps of the line for prolonging the Morse current, a transmitting-coil connected to the front and back contacts of a key-lever which in turn is connected through a battery to an intermediate point of the coil, and a polarized receiving-relay and condenser in shunt of a diverting-coil in the line, substantially as described.

7. In a superposed-current telegraph, the combination of a main line, Morse transmitting and receiving apparatus therein, a transmitter for putting high-tension alternating currents upon the line, and a condenser and polarized receiving-relay having steel cores in shunt of the line, said relay being thus irresponsive to the Morse currents but responsive to the high-tension alternating currents, substantially as described.

8. A polarized relay having an armature positively moved in each of two directions by the magnetisms engendered by opposite polarities of current, said relay having steel cores to make it responsive to high-tension alternating currents but irresponsive to unidirectional low-tension currents, substantially as described.

9. A polarized relay having an armature positively moved in each of two directions by the magnetisms engendered by opposite polarities of current, said relay having steel cores wound with pairs of coils in parallel with each other, whereby it responds to high-tension alternating currents but does not respond to unidirectional low-tension currents, substantially as described.

In testimony whereof I have signed my name to this specification in the presence of two subscribing witnesses.

HENRY D. BARTHOLOMEW.

Witnesses:

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CHARLES A. ANDERSON.