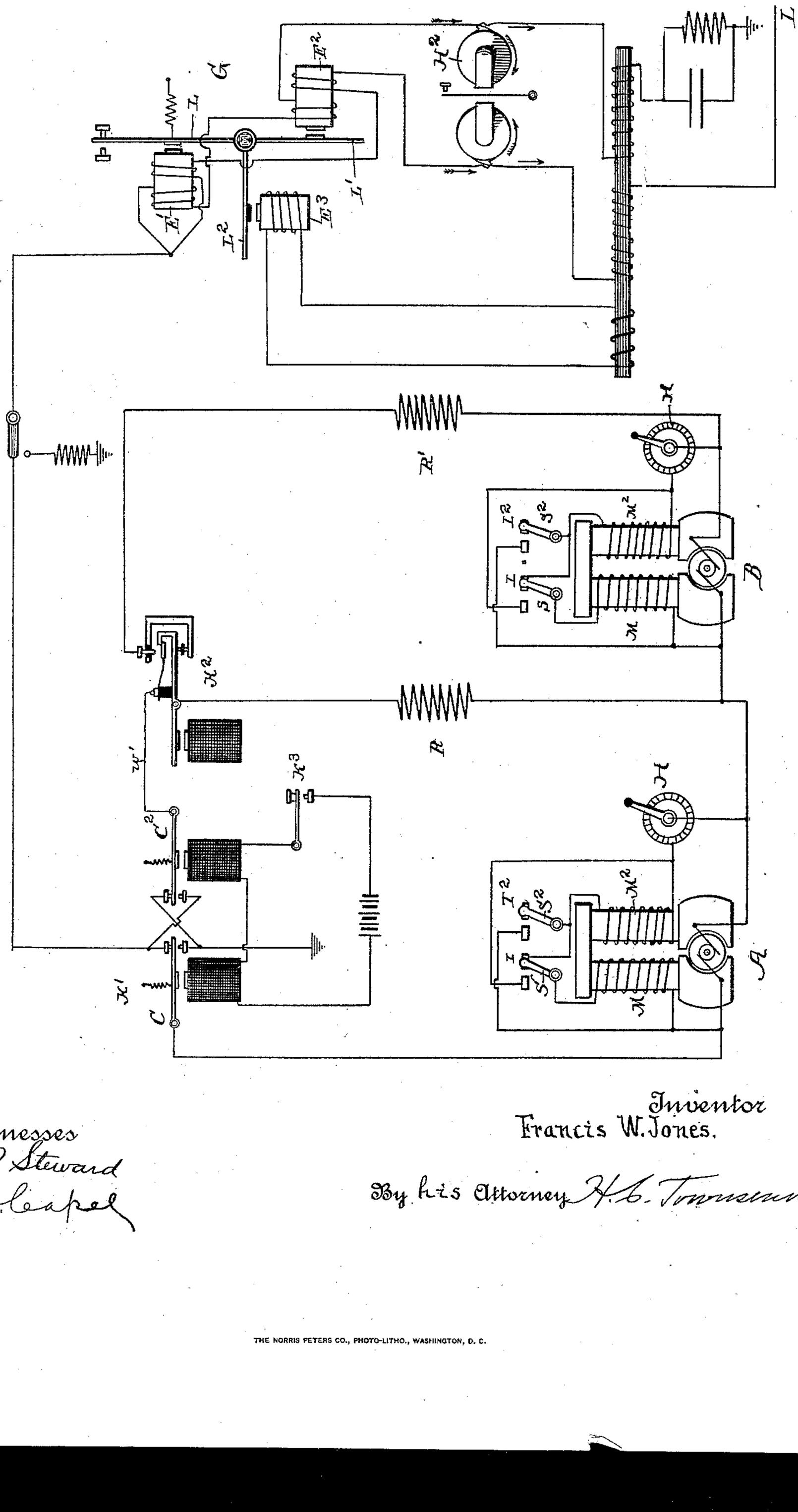
(No Model.)

F. W. JONES.

QUADRUPLEX TELEGRAPHY.

No. 426,591. Patented Apr. 29, 1890.



Witnesses
Ira R. Steward
Thos. H. Capel

Inventor
Francis W. Jones.

By his Attorney H. B. Townsend

UNITED STATES PATENT OFFICE.

FRANCIS W. JONES, OF NEW YORK, N. Y.

QUADRUPLEX TELEGRAPHY.

SPECIFICATION forming part of Letters Patent No. 426,591, dated April 29, 1890.

Application filed January 3, 1889. Serial No. 295,333. (No model.)

To all whom it may concern:

Be it known that I, FRANCIS W. JONES, a citizen of the United States, and a resident of New York, in the county of New York and State of New York, have invented a certain new and useful Quadruplex Telegraphy, of which the following is a specification.

My invention relates to quadruplex-telegraph apparatus, and especially to apparatus in which reversals of polarity and changes of tension are employed for sending two messages at the same time over the same wire.

The object of my invention is to permit the employment of dynamo-machines as a substitute for galvanic batteries in those forms of duplex or quadruplex telegraph in which a pole-changer is employed for reversing the connections of the generator with the line-circuit and earth.

My invention consists, further, in a novel pole-changing transmitter.

It has heretofore been proposed to employ dynamo-electric machines for telegraphic purposes. Owing to the low internal resistance of a dynamo-machine a practical difficulty arises when the same is used in connection with a pole-changing transmitter, owing to the fact that at the instant of change of the transmitter there is ordinarily formed a short or local circuit whose resistance, as compared with that of the line for which the dynamo is designed, is so small that arcing of the current at the contacts of the transmitter and irregularity of action in the dynamo are liable to ensue. This is a difficulty which would not ordinarily exist in galvanic batteries since the internal resistance of the batteries arranged in series is ordinarily very large and there is not such a disparity in the total resistance of the circuit for said battery under the condition when it is flowing over line and under the other condition when its current may flow across the contacts of the transmitter on a short or local circuit.

The object of my invention is to permit the use of dynamo-machines of low internal resistance without any disruptive or disturbing effects at the contacts of the pole-changing transmitter; and to this end my invention consists in the combination, with the dynamo and the pole-changing transmitter, of artificial resistances inserted in the local connections between the transmitter and dynamo.

A further object of my invention is to enlarge the range of adjustment of potential of the dynamo when the same is regulated by operating the strength of the magnetic field.

To this end my invention consists, essentially, in the combination, with the two field-magnet coils, of switch devices whereby they may be included either in series or in multiple arc, as desired, in combination with an artificial resistance in the series connection with said coils, as well as in a connection or common return formed when the coils are in multiple arc.

My invention consists, further, in the special combinations of devices and apparatus, which will be more particularly specified in the claims.

Referring to the accompanying drawing, the figure is a diagram of circuits and apparatus embodying my invention at one end of a quadruplex-telegraph line.

A B indicate, respectively, two small dynamo-machines, the armatures of which are connected directly with the transmitting-keys, while the fields of the machines are sustained by current derived from the armature through a circuit independent of the key-connections. The dynamos are so constructed as to give electro-motive force sufficient to yield between one hundredth of one ampère and one ampère upon a quadruplex circuit. This result, with a circuit of the given resistance connected to the machines, may obviously be obtained by proper winding of the armature and by revolving the same at the proper speed.

The dynamo A is always in connection, and has its polarity determined by the pole-changing devices K′, to be presently described, while dynamo B is controlled by means of the tension-key K^2, of any ordinary or usual description, which serves when depressed to throw said dynamo into series with dynamo A, and when released to cut out dynamo B, leaving, however, a circuit for the dynamo A to the pole-changing apparatus K′.

The pole-changing apparatus consists of two levers C C^2, which are the armature-levers for electro-magnets on the local circuit

with the ordinary controlling-key K^3. The levers C C^2 operate together when the key K^3 is depressed. Each lever moves independently of the other between two ordinary contact-stops, as indicated, or between other forms of stops, as desired, the front stop of one lever and the back stop of the other being connected together and to line, while the back stop of the first lever and the front stop of the other lever are connected together and to earth. One of the levers C connects to one pole of the local circuit containing the dynamo and the other lever connects to the opposite pole through the continuity-preserving tension-key K^2. By operating the levers independently of one another, as described, I may use ordinary hard contact-stops adjusted to allow very little play for the levers, a construction which would be impracticable if a single lever were employed vibrating between said stops. The adjustment being close and the local magnets acting with promptness, it will be found that no difficulty exists in causing the levers to change their connections at practically the same instant.

The pole-changing device K′ obviously reverses the polarity of the current flowing onto the line, whether such current be that produced by dynamo A alone or by dynamo A having its tension re-enforced by that of dynamo B. The key K^2 operates in the ordinary manner to cut the dynamo B in and out of circuit to change the tension irrespective of the polarity or condition of the key K′.

The keys K′ K^2 operate in the ordinary and well-known way to send signals independently of one another by changes of tension and reversals of polarity.

In order that electric arcs may not be formed at the points of contact of the apparatus K′ during opening and closing, I interpose the artificial resistance R R′, as indicated in the local circuits. These resistances may be of any character—such, for instance, as the resistance employed in electric-lighting apparatus or other electric arts.

I prefer to place an artificial resistance in the connection both to the front and back contacts of the key K^2, so that whatever the condition of said key there may always be a resistance on the local circuit at the time of change of position of the levers C C^2. In the particular location shown the resistances also have the function of preventing injury to the contacts of the key K^2 as said key moves from one position to the other, since in this operation the dynamo B cannot flow on short circuit, owing to the presence of the artificial resistances.

The dynamos may be of any desired construction. Their field-magnets (indicated at M M^2) are in the usual derived circuit. The coils of said magnets are ordinarily in circuit in series with one another through a switch-lever S, and such series connection includes also an adjustable or variable-resistance regulator H of any desired character.

I I^2 indicate two switch-contacts, with one of which—to wit, I—switch S may close contact to make a multiple-arc connection for the coil M, that is independent of the connection of coil M^2. Contact I^2 has a connection, as shown, independent of the coil M, and switch-lever S^2 connects with coil M^2, as indicated, so that when said latter switch closes the circuit the coil M^2 will be in multiple arc with coil M. The common return of the multiple-arc connections indicated includes also the adjustable resistance H. In the position of the switch-levers that is shown the coils are in series with one another and the connection of the machine may be adjusted by means of the regulator H, the capacity of adjustment being with this arrangement of the devices evidently determined by the extent to which the regulator H can reduce the resistance in the derived circuit containing the said field-magnets. If a further range of adjustment is desired, it is not necessary to change the switch-levers S S^2 to throw the field-magnet coils M M^2 into multiple with one another, thereby greatly reducing the resistance in the derived circuit. By manipulating the regulator H under this condition a range of adjustment is obtained beyond that possible under the former condition.

G indicates the neutral receiving apparatus adapted to respond to the action of the tension-changing key at the opposite end of the line-wire.

H^2 indicates the usual polarized relay, responsive to changes of polarity. These receiving-instruments are wound differentially, as well understood in the art, with two sets of coils—one in the line-circuit and the other in the artificial circuit connected to earth.

The instrument G is provided with a relay-lever having three arms L L′ L^2.

Each of the magnets E′ E^2 is a short-core neutral magnet, and is similar to the electro-magnet heretofore employed in what is known as a "No. 2 relay" of a quadruplex-telegraph set. The magnets E′ E^2 pull on the lever, as indicated, in the same direction, thus augmenting the magnetic effect of arriving currents, such magnets being each wound in the usual way, differentially, with coils in the line and artificial circuits. The cores and coils being in separate convolutions do not increase the time of reversals beyond that incurred with only one of them in circuit. The armatures for said magnets are mounted, respectively, on the arms L L′. The third arm L^2 connects the armature for the magnet E^3, which is also a neutral magnet, and which is connected with the secondary of an induction-coil designed to generate currents after the manner described in my prior patent, No. 360,528, dated April 5, 1887. The primary of said coil is wound differentially, like the coils on the magnets E′ E^2, and the secondary on the reversal of the arriving current from the distant station is the seat of a local current, which, flowing through the magnet E^3, tends

to hold the lever up against its front contact-stop when the magnets E′ E² are acting upon the same. For this purpose the magnet E³ acts on the arm L² in a direction to assist the pull of the magnets E′ E², and therefore, when the latter lose their power at the instant of reversal of the line-current, serves to bridge over the period of reversal and prevent mutilation of the signal.

What I claim as my invention is—

1. In a quadruplex or diplex system of telegraphy, the combination, with the dynamo-electric generators A B, arranged to reverse polarities, of resistances R, placed in the tap-wire, and R′ in the long end, the pole-changing non-continuity-preserving transmitter K′, and single transmitter K², substantially as shown, for the purpose set forth.

2. In a quadruplex or diplex system of telegraphy, the combination of reversible dynamo-electric generators A B, with resistances R R′, and pole-changing non-continuity-preserving transmitter K′, substantially as shown, for the purpose set forth.

3. In a quadruplex or diplex system of telegraphy, the combination of reversible dynamo-electric generators A B and resistances R R′, with a pole-changing non-continuity-preserving transmitter K′, and a single transmitter K², substantially as shown, and for the purpose set forth.

4. In a quadruplex or diplex system of telegraphy, the combination of reversible dynamo-electric generators A B, resistances R R′, and a pole-changing non-continuity-preserving transmitter K′, with a single transmitter K² and receiving-instruments, substantially as shown, and for the purpose set forth.

5. In a quadruplex or diplex system of telegraphy, the combination of reversible dynamo-electric generators A B, resistances R R′, double switches S′ S², the regulator H, and the transmitter K′ with K², receiving-instruments, earth, and line, substantially as shown, and for the purpose set forth.

Signed at New York, in the county of New York and State of New York, this 16th day of November, A. D. 1888.

FRANCIS W. JONES.

Witnesses:
WM. H. CAPEL,
HUGO KOELKER.