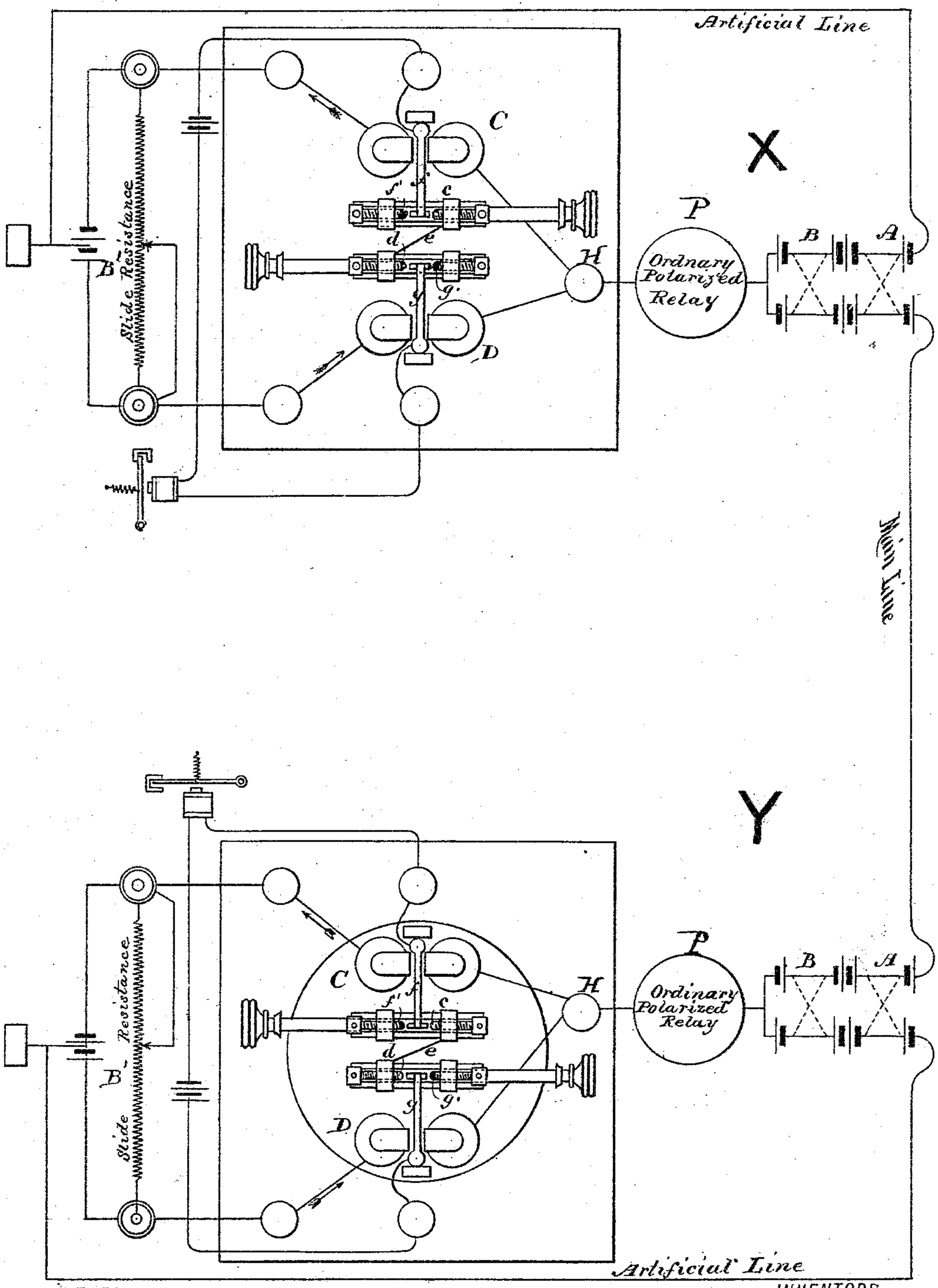
(No Model.)

A. MUIRHEAD & G. K. WINTER.

QUADRUPLEX TELEGRAPH.

No. 281,118. Patented July 10, 1883.



WITNESSES

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UNITED STATES PATENT OFFICE.

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QUADRUPLEX TELEGRAPH.

SPECIFICATION forming part of Letters Patent No. 281,118, dated July 10, 1883.

Application filed March 11, 1882. (No model.)

To all whom it may concern:

Be it known that we, ALEXANDER MUIRHEAD and GEORGE KIFER WINTER, subjects of the Queen of Great Britain and Ireland, and residents in London, England, have invented certain new and useful Improvements in Quadruplex Telegraphy, of which the following is a specification.

In Letters Patent of the United States No. 227,039, granted to us April 27, 1880, we show a system of quadruplex telegraphy operating upon the following principle, viz: that with a series of four currents, while the local circuit of one receiving-instrument is completed when the current strength has a value on one side of the middle of the series and is broken when the current has a value on the other side, the other receiving-instrument or relay completes the circuit while the current has a value corresponding with either of the two intermediate numbers of the series, and breaks the local circuit when the current strength corresponds with either of the extreme numbers. Thus, with a series of currents, +4, +2, 0, —2, the ordinary polarized relay, which we employ in this as in the patent above referred to, is adjusted so as to complete its local circuit whenever the current changes from plus to minus or zero—that is, with the series of currents given to 0 or —2, and break it whenever the current is plus, while the tension or "biplex" relay, as we term it, which responds to changes in strength of current only, is adjusted to make its local circuit when the current is +2 or 0, and break it when the current is +4 or —2. In our prior patent above mentioned the bias of the tongues of the tension or biplex relay against their contact-points, by which bias the relay is made to respond to given changes in strength regardless of polarity, was simultaneously adjusted or increased and decreased by the simultaneous movement of the contact-points themselves.

Our present invention relates to a method of causing the bias of a tension or biplex relay by means of a battery so connected as to send a current locally through the coils of the relay, but not into the line. The strength of this current, and consequently the amount of bias or tension of the relay tongues to be overcome by the main-line current, we adjust by means of a shunt of adjustable resistance, placed in such a position with reference to the other apparatus that while it regulates the amount of the current flowing through the relay-coils from the local battery it does not alter the currents received from the distant stations. We accomplish this in the present instance by working the tongues of the relay by independent coils and joining them up as shown in the drawing.

The accompanying drawing illustrates diagrammatically the organization at two stations connected by a main line.

Two stations, X Y, are shown, organized as in our former patent—that is, there is a true or main line connecting the two stations, and at each station there is an artificial line or compensating-circuit, a split battery interposed between the main and artificial lines, relays or receiving-instruments interposed between the battery and the earth, and reversing-keys A and B, of the usual construction—such, for instance, as those shown in detail in our prior patent above mentioned. The key B separates the battery into two portions, and when depressed serves to reverse that portion only of the battery between it and the earth, and thus changes the strength of current sent to line. The key A, when depressed, reverses the current acting on the distant station, whatever may be the position of the key B and the consequent strength of the battery. The operation of such an organization with a polarized relay and a tension or biplex relay, is fully set forth in the patent mentioned, and will be clear to those skilled in the art.

We will now specifically describe the organization herein shown.

The slide-resistance, by means of which the current from the battery B may be accurately adjusted, as is well understood, forms a shunt on the battery, and may be in the form of a Wheatstone rheostat, ranging up to twenty or thirty ohms resistance. The middle of the battery B′ is joined to earth, and the line-currents, entering the coils of the tension-relay at H, divide equally between the opposite coils C and D, and, uniting again at the center of the battery B′, pass thence to earth. Let us suppose the current from the local biasing-battery B′ to be so adjusted as to have a strength of 1 in the coils C and D, and let the direction of this current be that shown by the ar-

rows, the coils being so joined that this current will cause both relay-tongues to make contact with their contact-points *c* and *d* when there is no current on the main line. Then, as regards the main-line current, which divides at H and one-half passes through the coils C and one-half through the coils D, the local current will be +1 in the coils C C—that is, will be in the direction of the main-line current and will re-enforce it, and —1 in the coils D D, that is, it will oppose or neutralize the main-line current. Let us further suppose the incoming currents from the distant station to be as follows: when both keys are at rest, +4; when B is depressed and A at rest, +2; when B and A are both depressed, 0; when B is at rest and A depressed, —2. The tongue *f* of the tension or biplex relay must be so adjusted that in a state of rest—that is, when no current is passing through its coils—it will go against its insulated stop *f'*, and the tongue *g* must be so adjusted that its position of rest is against its contact-point *d*. Then with a current from the local battery B' in the direction of the arrow, having a strength of 1 in the coils C and D, and no current from the main line, the tongues *f* and *g* will go against their respective contact-points *c d*, and complete the local-sounder circuit through the wire *e*. Now, a current of plus sign in the coils C will maintain the tongue *f* against its contact-point, while 0 will let it fall against its stop; and a current of plus sign, sufficient to overcome the local, passing from the point H to earth through the coils D, will cause the tongue *g* to make contact with its insulated stop *g'*, and a current of 0 or minus through D will cause it to make contact with its contact-point. Then—

First. When both keys are at rest at the distant station and the current received from the line is +4, as is obvious from the arrangement of batteries illustrated—that is, is +4 at the point H and divides equally, so as to give +2 in each branch of the circuit at that point—the resultant current in the coils C C is the current of +1 from the battery B' and the current of +2 from the point H, giving a sum of current of +3; and that in the coils D D is the current of +2 from the point H opposed by the current of —1 from the battery B', leaving a current of +1, having a direction from H to earth. The direction of the positive current in the coils D being thus reversed, of course the tongue *g* is drawn over against its insulated stop *g'*. Therefore, when both keys are at rest at the distant station and the line-current is +4 the tongue *g* is against its insulated stud, and as it is necessary for both tongues to be against their contact-points, in order that the local circuit of this relay should be completed through the wire *e*, the local circuit of the relay is now broken, notwithstanding that the tongue *f* is held against its contact-point by the current +3 in the coils C C. The ordinary polarized relay is placed in the undivided portion of the circuit, and consequently the current through its coils is +4. It is adjusted, as is well understood, to work when the current falls below +2, so that it completes its local circuit only when the received current is either *nil* or —2.

Secondly. Let key B now be pressed at the distant station, the line-current becomes +2. This current divides at H, as before, and the resultant current in the coils C C is reduced to +2, and that in the coils D D to 0, because in the latter coils the two opposite currents neutralize each other. The tongue *f* remains in contact with its contact-point, and the tongue *g*, which is so adjusted as above mentioned, falls to its place of rest against its contact-point; hence the local circuit of this relay is completed, and the sounder S worked by it answers to the depression of key B; but as the current in the relay P is +2, this relay does not complete its local circuit.

Thirdly. Let key B be kept depressed and key A also be depressed, the current received from the line becomes 0, and both the tongues *f* and *g* are held against their contact-points by the local current from the battery B', as before mentioned, so that the relay still answers to the depression of key B, and as there is no current in the polarized relay P, this relay now works and responds to the depression of key A.

Fourthly. Let key A be kept depressed, but let key B rise so that only key A is depressed, the current from the line becomes —2, and the relay P still works in answer to the depression of key A; but as the resultant current in the coils C C becomes 0, the tongue *f*, in response to its adjustment, goes to its position of rest against its insulated stud *f'* and breaks the local circuit of this relay. Thus the polarized relay responds to the reversal of the battery at the distant station by the depressing of key A, while the biplex or tension relay responds to the changes in strength caused by the depressing of key B; and, as will be understood by those skilled in such matters, the keys at both stations—that is, all four keys—may be operated simultaneously, and each relay will respond to its respective key.

It is evident that the adaptation of this system to other series of currents is merely a question of the adjustment of the batteries and of the relay-tongues.

The right to hereafter file other applications for any subjects-matter illustrated or referred to in this patent or the application therefor, and not claimed, is reserved; and no claim is herein made to the general organization of an apparatus for transmission of messages; but it is our purpose to limit this patent to the broad feature of biasing the relay by means of a local-battery circuit.

The subject-matter herein claimed is shown as embodied in an organization having special reference to the Letters Patent hereinbefore referred to; but obviously, as above mentioned, the series of currents may be varied and the invention may be used in organizations or systems of different characters.

We claim as our invention—

1. The combination, substantially as set forth, of a biplex or tension relay and a local-battery circuit in which the coils of the relay are placed, the parts being so adjusted that the requisite bias of the relay is produced by the local current, so that the relay will only close its circuit when given strengths of currents are received over the main line.

2. The combination, substantially as set forth, of the relay-tongues, their contact-points and insulated stops, independent electro-magnets for operating each tongue, a local-battery circuit in which the coils of the relay-magnets are placed, and which produces the requisite bias of the relay-tongues, and an adjustable slide-resistance which shunts the battery in said local circuit, for the purpose described.

3. The combination, substantially as set forth, of a biplex or tension relay, a local circuit containing a battery, in which the coils of the relay are placed, and which produces its tension or bias, a main line, and the split or branch sections of the main line, in which the opposite coils of the relay are placed, so that the currents received from the main line are in the direction of the local biasing-current in one set of coils of the relay and opposed to the local current in the other coils, a sounder, and its local circuit, which is made and broken by the relay when currents of given strength are received from the line.

In testimony whereof we have herein subscribed our names this 7th day of February, 1881.

ALEX. MUIRHEAD.
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Witnesses:
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