I. KITSEE.

QUADRUPLEX TELEGRAPHY.

APPLICATION FILED AUG. 10, 1910.

987,630.

Patented Mar. 21, 1911.

2 SHEETS—SHEET 1.

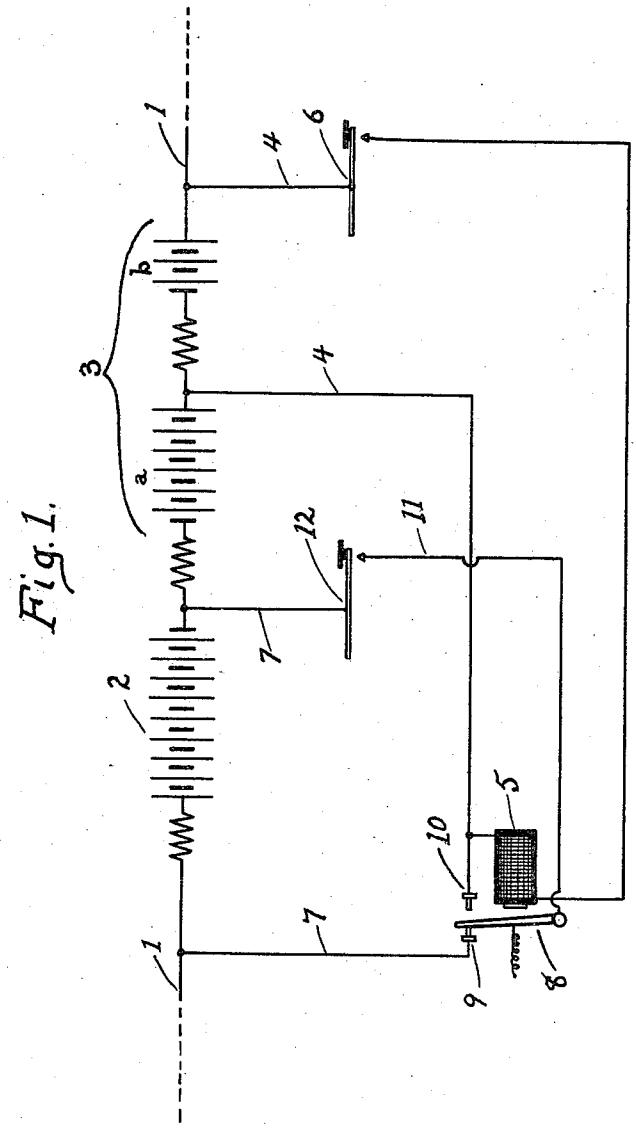

Fig. 1.

Inventor

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2 SHEETS—SHEET 2.

Fig. 2

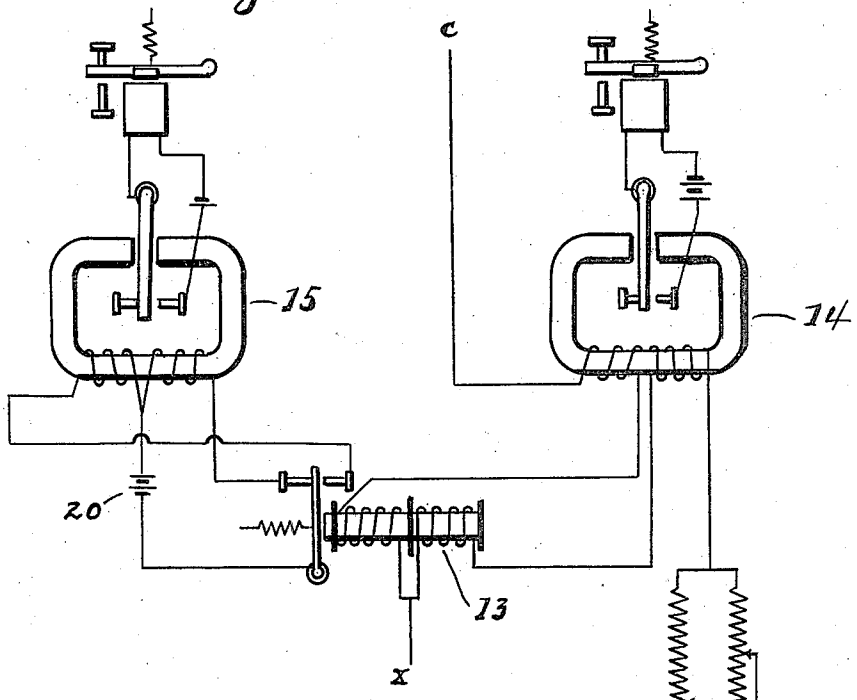
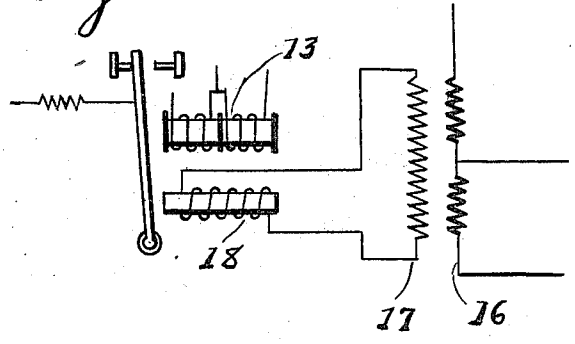


Fig. 3



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QUADRUPLEX TELEGRAPHY.

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To all whom it may concern:

Be it known that I, ISIDOR KITSEE, citizen of the United States, residing at Philadelphia, in the county of Philadelphia and State of Pennsylvania, have invented certain new and useful Improvements in Quadruplex Telegraphy, of which the following is a specification.

My invention relates to an improvement in quadruplex telegraphy. Its object is to produce an efficient and reliable arrangement for such system.

In the drawing, I have illustrated a transmitting and a receiving arrangement. The transmitting arrangement I have supplied with an arbitrary number of cells, knowing that in practice a far greater number is required. In the receiving arrangement I have made use of the differential system, but it is obvious that the bridge system may be substituted therefor.

In the drawing; Figure 1 is a diagrammatic view of the transmitting arrangement; Fig. 2 is a diagrammatic view of the receiving arrangement and Fig. 3 is a diagrammatic view of the neutral relay and means therefor to keep the same in the required position.

In Fig. 1; 1 is the line; 2 and 3 are two sets of batteries oppositely connected as to each other; each set is here shown as to consist of nine cells. The set 3 is divided into the parts *a* and *b;* the part *b* is here shown as to consist of one-third of the whole set; but it is obvious that the relative strength between *a* and *b* may differ in accordance with requirements. The battery set 2 is provided with the shunt 7, 7, including the key 12, armature 8, and contact 9. The division *b* of the set 3 is provided with the shunt 4, 4, including the key 6 and the coil of electro-magnet 5. In the shunt 7, the lower contact of the key is connected through wire 11 with the armature 8.

As is well known to persons versed in the art in quadruplexing a line, the receiving arrangement comprises a neutral relay and a polarized relay; the neutral relay requiring the whole strength of the battery independent of the polarity of same and the polarized relay requiring a lesser electro-motive force but the flow of the current must be in a predetermined direction. In this arrangement, as illustrated, it is supposed that the set 3 is adapted to actuate the neutral relay when only one message is sent and part of the set 2 is required to operate the polar relay.

In Fig. 2; 13 is the neutral relay; 14 the polar relay connected in the line; 15 is a localized differential polar relay connected operatively to the neutral line relay. *x* designates that part of the line which is supposed to be connected to the transmitting arrangement and *c* that part of the line which connects with the far off station. 20 is a battery inserted in the circuit of the localized polar relay.

In Fig. 3; 16 is the primary of an inductorium adapted to be connected in the line; 17 the secondary thereof and 18 an auxiliary coil in operative relation to the neutral line relay 13.

I have here illustrated only one receiving arrangement, as it is obvious that the far-off receiving arrangement is only a duplicate of the home receiving arrangement. It is also obvious that the home receiving arrangement will remain silent to the impulses transmitted from the home station because, as is illustrated, the coils of the receiving devices are differentially wound and connected respectively to the real and artificial line.

The operation of the transmitting arrangement, as illustrated in Fig. 1, is as follows:—Normally, when both keys are at rest, the batteries of the set 2 neutralize the batteries of the set 3 and no current is flowing over the line. When the operator of key 12 desires to transmit messages to be received by the neutral relay, he depresses his key (designated by the numeral 12). Through this depression, the shunt circuit 7 around battery set 2 is closed; therefore, the whole force of the battery set 3 including the divisions *a* and *b* is made available and the impulse flowing from this set will actuate the neutral relay at the far-off station, but the polar relay will not be affected, because it requires a force of opposite direction to send the armature from the stop where it normally rests to the opposite stop. When the operator of key 6 desires to send impulses, adapted to actuate the polar relay, he depresses his key (designated by the numeral 6), whereby the division *b* of the battery set 3 is short circuited. Through the short circuiting of part of the set 3, the set 2 over-balances the free part of 3, and, therefore, a current will flow over the line from the set 2 of a strength equal to the

number of cells minus the cells of the division *a* of set 3. This current is of sufficient strength to actuate the polar relay, but of a strength insufficient to actuate the neutral relay. It has to be taken here into consideration that the shunt 4 manipulated by the key 6 includes also, as said above, the coil of electro-magnet 5. When, therefore, the shunt is closed through the depression of the key, the electro-magnet 5 is energized and the armature 8 is drawn away from its normal resting point 9 and toward and in contact with the point 10. As long as the key 12 is open, this movement of the armature will not result in any change of the flow of the current over the line. It is now supposed that after the key 6 is closed, the operator at 12 closes his key. Through the closing of 6, the division *b* of set 3 is short circuited and as now the armature 8 rests on point 10, the closing of the key 12 short circuits the division *a* of set 3. The whole force of the set 2 is now available and an impulse will travel over the line of an electro-motive force equal to the whole strength of this set 2. The result at the receiving station will be a two-folded one. The polar relay will answer because the current is of the required direction and the neutral relay will answer because the current is of the required strength. It is now supposed that the operator at 12 depresses first his key and, as said above, through the depression of this key alone, the whole set 2 is short circuited and, therefore, the whole set 3 available. When, now, during the time of the depression of the key 12, the operator at 6 depresses his key, he short circuits the division *b* of set 3 but he also energizes electro-magnet 5 forcing the armature 8 away from the stop 9 thereby opening the shunt around 2 and as the armature is forced against 10, closing the shunt around division *a*. But during the time that this armature travels from 9 to 10, the force of the impulse traveling varies greatly and a period is reached where the line is at zero. During this period, the action of the neutral relay is often very eccentric and the vibration of the armature often actuates the receiving sounder in a manner, so as to make the signals unreadable. It is true that the transmitting arrangement, as illustrated in Fig. 1, greatly reduces such period and greatly reduces the irregular behavior of the neutral relay, yet occasion may arise where even this improved system of transmission does not entirely obviate slight irregularities and for this reason I have recourse to arrangements at the receiving end, as illustrated in Figs. 2 and 3.

In quadruplexing according to the system of today, the neutral relay is connected to a local sounder of the neutral type. I consider such arrangement insufficient for the reason that the slightest tremor of the armature of the neutral would actuate the local instrument. To obviate this effect, I substitute for the "neutral" sounder a "differentially wound polarized" relay. Normally, the armature of the neutral line relay closes one winding of the differentially wound polarized relay with the interposition of a source of current. The armature of the differential polar is thereby forced to its idle stop and will remain there no matter if the armature of the neutral is set in vibration or travels part way between its two stops and it is only the contacting of the armature of the neutral with its opposite stop which results in the moving of the armature of the polar to that stop which closes its circuit and actuates the local sounder. No matter, therefore, how strong the vibration of the neutral armature may be, it will not affect injuriously the working of the sounder from which the message is read. It is obvious that instead of a sounder, other translating devices may be substituted. To increase the efficiency of this arrangement and to hold over the armature of the line-neutral during the zero period of the line, I have recourse to the arrangement as is illustrated in Fig. 3. In the line is placed one coil of an inductorium, here designated by the numeral 16, and the second coil of the inductorium is connected to an electro-magnetic coil, here designated by the numeral 18, in proximity to the armature of the neutral.

It is supposed that at the sending station, the operator at 6 breaks in on the operator of 12. The ceasing of the current flow over the line and, therefore, through the coil 16 will generate a powerful impulse at 17. This impulse will only be momentary, but yet of a sufficient length of time to overbridge—so to speak—the time period when the line is at zero.

Having now described my invention, what I claim as new and desire to secure by Letters Patent is:—

1. In quadruplex telegraphy, a transmitting arrangement comprising two sets of batteries, both sets oppositely connected to each other and normally in the line, transmitting means adapted to short circuit one set of batteries in their entirety, transmitting means adapted to short circuit part of the second set of batteries and means operatively related to both of said transmitting means to short circuit the remaining unshunted part of said second set.

2. In a system of telegraphy, in which a neutral relay and a polarized relay are employed as receivers, a transmitting arrangement comprising two sets of electric generators connected in series as to the line and in opposition as to each other and comprising two transmitting means; one of said

means adapted to make active that set of generators adapted to actuate the neutral relay; the second of said means adapted to make active part of the set of generators adapted to actuate the polarized relay; and means operatively related to both of said transmitting means to make passive the first set of generators and make active the second set of generators in their entirety.

3. In a telegraphic system, a transmitting arrangement comprising two sets of batteries in opposition as to each other and normally in the line, two transmitting keys, means operatively related to one key to make active the battery of one polarity, means for the second key to make active part of the battery of the opposite polarity and means related to both of said keys to make active the whole of the battery of said opposite polarity.

4. In a transmitting arrangement for quadruplex telegraphy, two batteries of opposite polarity inserted in the line, two transmitting means, one of said transmitting means including a shunt circuit and a coil of an electromagnet, the second of said transmitting means including a shunt circuit and the armature and forward stops of said electro-magnet.

5. In a system of telegraphy, in which a neutral and polarized relay are employed as receivers, two sets of batteries connected normally in the line and in opposition as to each other, one shunt circuit normally open for one of said sets and two shunt circuits normally open for the second of said sets, transmitting means to close the shunt of one set of batteries, transmitting means to close the shunt of part of the other set; and means operatively related to both of said transmitting means to open the shunt when closed of the first set and close the second shunt around the second set.

6. A telegraphic quadruplex system comprising two stations for each terminal of the line, each terminal equipped with two sources of current normally in the line and of opposite polarity and means to make active one or the other source as transmitter and each terminal equipped with neutral and polar relays as receivers.

7. A telegraphic quadruplex system comprising for each terminal of the line two sources of current normally in the line and means to make active one or the other of said sources without breaking the line, both sources connected in opposition but in series as to each other and both sources of equal electro-motive force and comprising means to receive different signals independently.

8. A telegraph quadruplex system comprising for each terminal of the line two stations, two sources of current connected normally at each terminal in the line, the two sources of each terminal operatively related to both stations of said terminal, each station equipped with means to make active one or the other of said sources and neutral and polarized receiving devices for each station.

In testimony whereof I affix my signature in presence of two witnesses.

ISIDOR KITSEE.

Witnesses:
MARY C. SMITH,
ALVAH RITTENHOUSE.