C. KINSLEY.

HIGH SPEED TELEGRAPH SYSTEM.

APPLICATION FILED AUG. 30, 1909. RENEWED JUNE 19, 1912.

1,053,042. Patented Feb. 11, 1913.

2 SHEETS—SHEET 1.

Fig. 3.

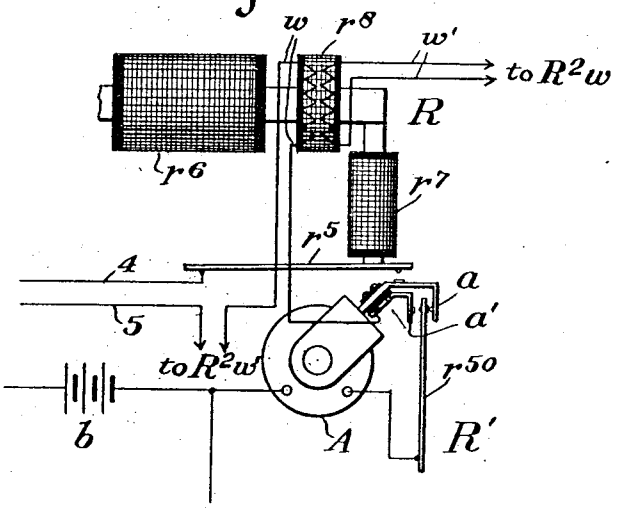
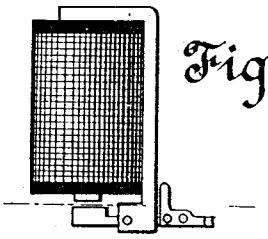


Fig. 4.



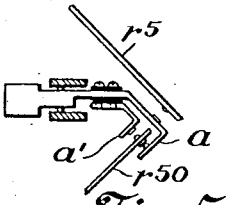
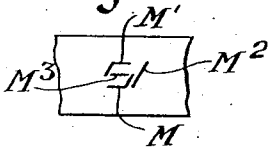


Fig. 5.

Fig. 6.



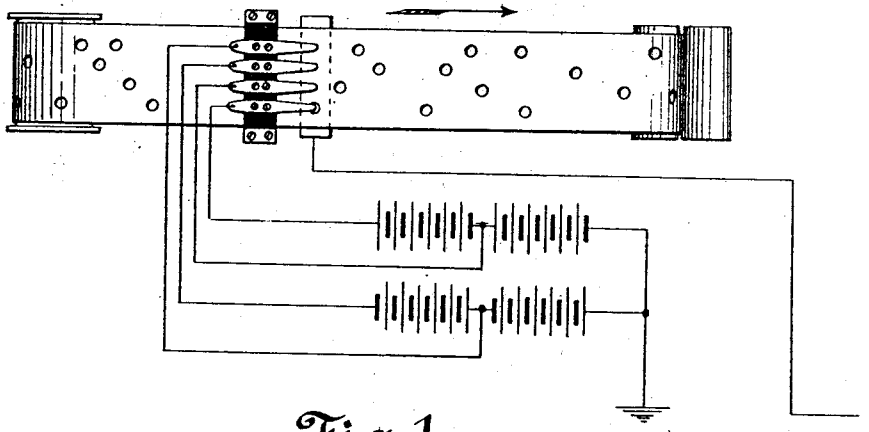


Fig. 1.

Witnesses

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2 SHEETS—SHEET 2.

Fig. 7.

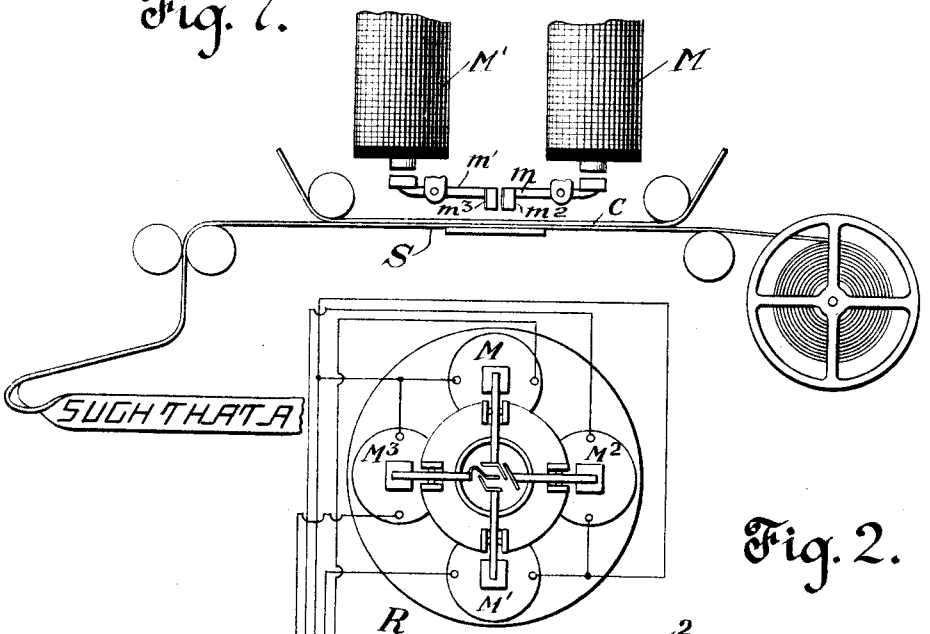
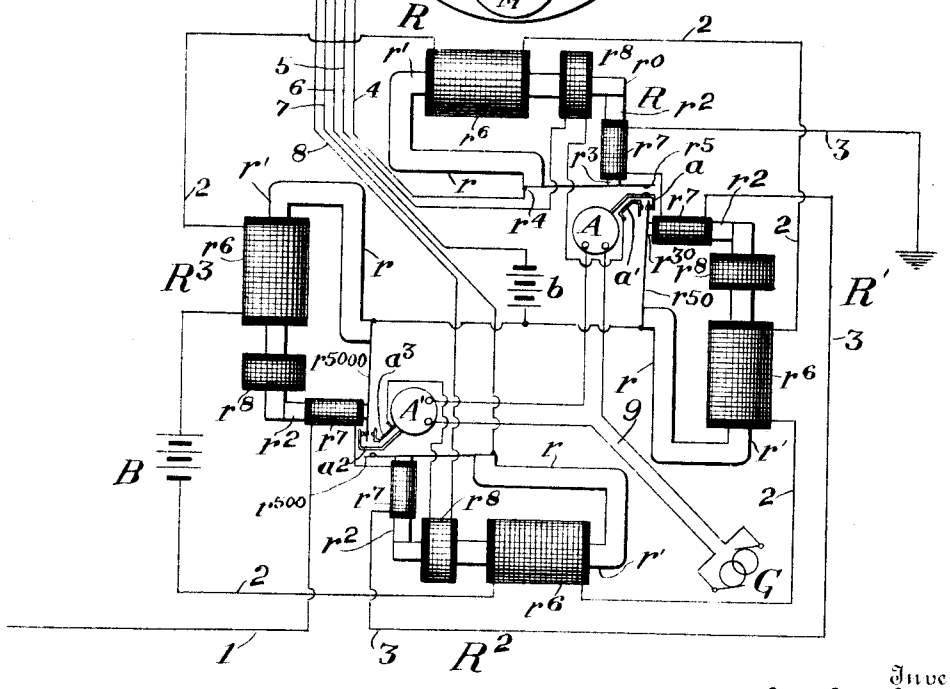


Fig. 2.



Witnesses

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HIGH-SPEED TELEGRAPH SYSTEM.

1,053,042. Specification of Letters Patent. Patented Feb. 11, 1913.

Application filed August 30, 1909, Serial No. 515,318. Renewed June 19, 1912. Serial No. 704,682.

To all whom it may concern:

Be it known that I, CARL KINSLEY, a citizen of the United States, residing at Chicago, in the county of Cook and State of Illinois, have invented certain new and useful Improvements in High-Speed Telegraph Systems, of which the following is a specification, reference being had therein to the accompanying drawing.

My invention relates to high speed telegraph systems and has for its object the production of a system of this class in which only a single line wire will be necessary.

In attaining my object I make use of a series of printing elements, preferably four in number, each of which is adapted to impress on a record surface a characteristic fragment or element common to a number of letters of the alphabet. By operating these printing elements in various combinations, either in conjunction or in sequence, I cause the several letters of the alphabet to be formed. Each element is controlled by an electromagnet in a local circuit supplied with current from a local source; and these local circuits are controlled by relays of peculiar construction, the leading characteristic of which is the attenuation of their armatures which are held in such a way as to have a very high natural period. This type of armature, employed either in a relay or on a printing magnet, is disclosed in my prior application filed August 12, 1903, Serial No. 169,228, and Patent No. 1,018,115, dated February 20, 1912. My present invention is in the nature of an improvement over the inventions disclosed in the said applications.

In the present case I employ two instruments which I may term compound relays, of the aforesaid type, their armatures working in conjunction and in combination with each other to affect the several printing elements. Each relay has an energizing coil or winding, an actuating coil, and a neutralizing coil. The energizing coils are all connected in a local circuit in series with a suitable source of current; the actuating coils are all in series to line; and the neutralizing coils are in series in the respective local circuits containing the printing magnets for purposes to be presently described. Each double relay has also what I may term an electromagnetic agitator for the anvil of its armatures, which are apt to stick thereto. The agitator magnets may be continuously actuated and the anvils continuously moved by means of alternating current separately applied, or by current impulses in the local circuits of the printing magnets.

In operation, I employ current of two strengths, or large and small potential differences, and of plus and minus polarity. Two of the relays respond to positive currents, and two to negative currents; and I differentiate between the relays and their associated printing magnets of each pair, by winding the relays to respond to different current strengths. One relay of each pair responds to currents of small value, but both respond to currents of large value. The armatures are so connected and related to each other that when the second relay of a pair is energized, it not only closes its own local circuit, but simultaneously opens the local circuit of its associated or small current relay.

My invention is illustrated in the accompanying drawings in which—

Figure 1 is a diagram showing the conventional elements at a transmitting station, which may be of any suitable type to produce plus and minus impulses at two different potentials, and all at high frequency. Fig. 2 is a similar diagram showing a receiving station embodying the present invention. Fig. 3 is a fragmentary diagram showing a modified arrangement of the relays. Figs. 4 and 5 show details of the agitators. Fig. 6 shows the impressions produced by the several printing elements. Fig. 7 is a side view of two of the printing elements with the other two removed.

Referring to the drawings, in Fig. 1 I have shown the conventional type of transmitter comprising a perforated tape, with coöperating means for sending impulses of opposite polarity and two different strengths, or in other words, of impressing electromotive forces upon the line at different potentials and opposite polarities. As this transmitting apparatus forms no part of the present invention, it will not be described in detail and I will remark in passing that it may be replaced by any suitable type other than the one indicated. For different types of transmitters I refer to my prior applications hereinbefore identified.

Referring to Fig. 2, 1 indicates the line wire extending from the transmitting to the receiving station. At the latter I provide a group of relays designated by the

letters R, R′, R² and R³ respectively. Each of these relays has a core designated generically by r^0, and as to its several limbs by r, r' and r^2, these limbs being returned at right angles to each other so as to bring the pole piece r^3 in proximity to a straight line extending from the end of and parallel to the limb r. Secured upon this limb at r^4 is a spring strip constituting an armature r^5. This armature is attenuated and of small mass so that it will have a high natural period, and is made of magnetic material so that it may carry the magnetic flux across the gap between the two pole pieces r^3 and r^4. The entire core r^0 is maintained magnetized to a predetermined density and with a predetermined polarity by the coil r^6, which is connected in a local circuit 2 in series with similar coils upon the other relays, and with a suitable source of current B. Upon the limbs r^2, and contiguous to the pole piece r^3 is an actuating winding r^7. These windings on all the relays are also connected in series with each other, in the wire 3 leading from the line 1 to ground. All the line impulses therefore pass through all of these actuating windings in series and by properly proportioning the windings, as well as by making them direct or reverse, according to the direction of the energizing windings r^6, they are made effectively responsive to different current strengths and polarities. Thus, by using the expedient of controlling each of two local circuits by a single relay, responsive to large current only, and two other local circuits each controlled by two relays, one responding to small current for closing and the other to large current for opening, I may selectively control any one of four printing magnets.

In addition to the energizing and actuating relays, I show what I may call neutralizing coils, marked r^8. The large currents due to large potential differences at the transmitting end, are apt to effect the receiving or actuating windings of the two relays R and R², which are wound to respond to small currents—or rather the cores of the relays R and R² will show either too large a residual magnetization or will be demagnetized, depending on the direction of the current. The effect of these neutralizing windings will be described in detail in connection with the statement of operation. It may be said at this point in passing however that Fig. 3 shows how extra spools or neutralizing windings r^8 on the relays R and R² may be so wound and connected as to neutralize, by the local printing current, the abnormal effect produced by large signaling current. If only the extra magnetizing effect is to be considered, then Fig. 2 shows how these coils r^8 need have only one winding. Of course, extra windings might be used on the coils r^7, but an extra spool is considered best to be shown for clearness.

A and A′ represent what I shall term electromagnetic agitators. The two relays R and R′ and the other two R² and R³, are associated in pairs, with one of the agitators for each pair. It is the function of this agitator to move the anvil contacts of the relays to prevent sticking which I have found can be prevented. The details of the agitator are shown more clearly in Figs. 3, 4 and 5, the former showing the same parts as in Fig. 2 but on a larger scale, and the last two showing respectively a side view and a bottom plan view.

As already stated, the relays R—R′ constitute a pair, their armatures working in combination with each other. These armatures are normally attracted and touch the pole pieces r^3 and r^{30}. When the armature r^{50} is up, and the armature r^5 is retracted, then a circuit is completed from the local battery b through r^{50} to anvil a, with which it is in contact, thence to r^5 and so to the wire 4 and its printing magnet. On the other hand, with the armature r^{50} retracted and down, circuit would be from the battery b through r^{50} to the anvil a' and so through neutralizing winding r^8 of R to the wire 5 and its printing magnet. The wire 6 is a common return from all the printing magnets to the battery b as will be pointed out a little later. The relays R and R′ both respond to positive current, coming over the line 1. In each case this current produces its effect through the winding r^7, which is opposed to the winding r^6. This winding r^7 on the relay R is wound and bears such a relation to the winding r^6 for currents of small value as to produce a neutralizing effect; while the winding on relay R′ responds only to currents of large value. The same proportions obtain respectively between the windings on relays R² and R³. Thus, the four printing magnets M, M′, M² and M³ can be selectively affected by impulses over line wire 1 in the following manner: (1) A positive impulse of small value releases armature r^5 and closes wire 4 to magnet M. (2) A positive impulse of large value releases both armatures r^5 and r^{50}. The latter closes circuit from battery b to the anvil a' thence through the coil r^8 to wire 5 and magnet M′; while the former is prevented from closing circuit of wire 4 and magnet M by the fact that the battery feed for this circuit is through the armature r^{50}, which has moved out of contact with the anvil a and into contact with the anvil a'. (3) A negative impulse of small value releases armature r^{500} of relay R² and closes wire 7 to the magnet M². (4) A negative impulse of large value releases both armatures r^{500}

and r^{5000}, the latter connecting battery through windings r^8 and the wire 8 to magnet M^3, and the former partially closing circuit 7 at the anvil a^2, but finding no battery there because the controlling armature r^{5000} is out of contact therewith. It will be noted that in the diagram, the coils r^8 of the relay R′ and R^3 are not connected.

With the arrangement shown in Fig. 2, the agitator magnets A and A′ are fed from an alternating current generator G through the wires 9. Their function is to keep the anvils a and a^2 in motion, so that there will be constant rubbing contact between these anvils and the armatures r^{50} and r^{5000}, which would otherwise be liable to stick. Incidentally this constant movement prevents sticking of the other armatures which however is less liable to occur. Some details of the agitators are shown in Figs. 4 and 5 which are sufficiently clear to be understood without extended description. The armatures of the magnets A and A′ carry the contact anvils a—a', and a^2—a^3, respectively. The anvils a' and a^3 are separated from the others, as indicated in Figs. 3 and 5, by insulation, and if desired, both members may be insulated from the armature.

In Fig. 2 the agitators are shown included in circuit with a generator of alternating current, for continuous operation, but as the electric welding to which the sticking is largely due only takes place when the relays are working, I may include the agitator magnets in the local battery circuits, as indicated in Fig. 3, magnet A for example being included in the feed wire from the battery b to the armature spring r^{50}. In this same figure, I have shown a separate coil r^8, with two windings, one on the side w and the other on the side w'. It is an important feature of my invention to use this coil in the local circuit in the correction of the retentiveness of the iron cores. The magnetization above normal as well as the demagnetization by large currents may both be sufficiently disturbing to require correction. It should be borne in mind in examining Fig. 3 that R is the small current relay, and R′ is the large current relay. The two wires at w' in the r^8 coil of relay R, are used to meet the case of over-magnetization, and they run to the other circuits, corresponding to the w wires shown in Fig. 3. In other words, there is an interrelation between the R and R^2 relays, of an electrical nature, as well as a definite interrelation between R and R′ or R^2 and R^3. Thus, currents coming over the line 1 which would be too heavy and tend to over-magnetize one of the small current relays as R, and would tend to demagnetize the other small current relay R^2, by virtue of the corrective windings w on R^2 in series with w' on R, and vice versa, would restrain and correct this tendency in each case while properly operating the large current relay R′ or R^3 of appropriate and responsive polarity.

Fig. 6 shows the impressions produced by the four printing elements controlled by the four magnets M, M′, M^2 and M^3 respectively. A side view of one pair of these magnets with the others removed is shown in Fig. 7, and it should be stated that for printing purposes I may use either the chemical printing disclosed in my prior applications before referred to, or printing by impact using a typewriter ribbon, carbon paper or the like which is indicated at C in Fig. 7 wherein M and M′ are a pair of printing magnets with a pair of pivoted armature levers m and m' carrying the type elements m^2 and m^3. The record surface is shown at S, and may advantageously be a page or strip of paper, fed by suitable mechanism as the printing progresses.

The alphabet composed of four elements shown in Fig. 6 is not a part of my present invention and therefore I consider it unnecessary to illustrate it in full. However, I have indicated several letters on the end of the paper strip in Fig. 7, from which little difficulty will be experienced in understanding the principle involved.

The operation of my system will be fully understood from the foregoing description. The paper tape in Fig. 1 is punched, preferably by a perforating machine operated on the typewriter principle, it is then inserted in the transmitting machine, and drawn along beneath the springs thereof by a suitable motor. The perforations are in four rows corresponding to the four springs which are connected to the battery B′ so as to send positive and negative impulses of two strengths, or at two different potentials. Each row of perforations represents recurring instances of the same element, and these elements are arranged as shown in Fig. 6, and controlled by the respective magnets M, M′, M^2 and M^3, as therein indicated, for the reason that in the usual letter the succession of impulses gives the order of line impulses as M^2, M, M^3 and M′. It is found better to have the weak impulses thus precede the strong ones, and also so far as possible to have the polarities alternate.

It will be evident after reading the foregoing that some changes in detail can be made without departing from the spirit of my invention. For example, instead of having the relay R′ open the local circuit controlled by the relay R, it might act directly to disable that relay, as by shunting or disconnecting it. I consider the arrangement described to be the best, however, and present it as such, without being limited to the

specific details thereof. All non-essential variations are to be considered as within the scope of the appended claims.

Having thus described my invention what I claim and desire to secure by Letters Patent is—

1. In a telegraph system, a transmitter adapted to send strong and weak current impulses to line, and a receiver connected therewith through the line, comprising an element responsive to weak currents, an element responsive only to strong currents, and means controlled by the strong current element for disabling the weak current element, together with printing elements adapted to produce combination impressions and thereby build up directly legible impressions of letters of the alphabet or numerals, one of said printing elements being directly controlled by the element responsive to weak currents, and the second printing element directly controlled by the element responsive to strong currents.

2. In a telegraph system, a transmitter adapted to send strong and weak current impulses to line, and a receiver connected therewith through the line, comprising an element responsive to weak current, a second element responsive to strong currents only, recording means controlled by each element, and disabling means for the weak current recorder, controlled by the strong current element, together with printing elements adapted to produce combination impressions and thereby build up directly legible impressions of letters of the alphabet or numerals, one of said printing elements being directly controlled by the element responsive to weak currents, and the second printing element directly controlled by the element responsive to strong currents.

3. In a telegraph system, a transmitter adapted to send strong and weak current impulses to line, and a receiver connected therewith through the line, comprising recording means responsive to strong current impulses only, and other coöperating recording means controlled jointly by strong and weak impulses, together with printing elements adapted to produce combination impressions and thereby build up directly legible impressions of letters of the alphabet or numerals, one of said printing elements being directly controlled by the element responsive to weak currents, and the second printing element directly controlled by the element responsive to strong currents.

4. In a telegraph system, a transmitter adapted to send strong and weak current impulses to line, and a receiver connected therewith through the line, comprising a relay responsive to strong currents only, a second relay responsive to all currents, a local circuit controlled by the strong current relay, and a second circuit controlled jointly by both relays, together with coöperating printing elements, each adapted to produce a fragmentary portion of letters or numerals, and coöperating in the complete production of letters or numerals by combination of their impressions, one of said printing elements being directly included in the first local circuit, and another of said printing elements being included in the second local circuit, whereby the transmission of strong and weak current impulses may directly produce printing combinations at speed.

5. In a telegraph system, a transmitter adapted to send strong and weak current impulses to line, and a receiver connected therewith through the line, comprising a pair of relays responsive to strong and weak current, and separate but coöperating recording devices controlled thereby, the strong current relay provided with means to prevent effective action of the other relay on strong current impulses, and the magnetic parts of both relays being so located with relation to each other that no cross magnetization will occur, sufficient to cause interference between their circuits.

6. In a telegraph system, a transmitter adapted to send strong and weak current impulses to line, and a receiver connected therewith through the line, comprising a pair of relays mechanically coacting to control local printing circuits, said relays being so positioned that all their corresponding parts are at right angles to each other.

7. In a telegraph system, a line and transmitting apparatus, with receiving apparatus comprising a compound relay composed of two mechanically coacting electromagnetic elements having separate armatures but a common anvil, one of said elements responsive to strong currents only, and the other sensitive to weak currents, and printing means selectively controlled by direct action of said element, without loss of time or shifting of parts other than the movement of the armatures.

8. In a telegraph system, a line and transmitting apparatus, with receiving apparatus comprising a compound relay composed of two mechanically coacting electromagnet elements having separate armatures but a common anvil, one of said elements responsive to strong currents only, and the other sensitive to weak currents, local printing circuits and a source of current therefor, and contacts in one circuit controlled by the strong current armature only with coacting contacts in another circuit giving control thereof to both armatures jointly.

9. In a receiver for telegraph systems, a plurality of electromagnetic elements, one responsive to strong current impulses only and another sensitive to weak current impulses, local circuits controlled by said el-

ments, and auxiliary windings on the cores, connected in the local circuits and adapted to correct and compensate for the retentiveness of the iron cores.

10. A system of rapid telegraphy comprising a line wire, a transmitting station with apparatus adapted to send to line high frequency current impulses of different strengths and different polarities, and a receiving station with a plurality of coils connected to line each comprising a normally energized core and an attenuated armature of magnetic material normally held in inoperative position by the core, printing elements in local circuits controlled by said armatures, a record surface for said printing elements, and means responsive to said line impulses to selectively deënergize the said relays and thereby operate the printing elements in a sequence corresponding to that of the said line impulses.

11. A system of high speed telegraphy comprising the following instrumentalities: a transmitting station with means for producing high frequency current impulses of different strengths and polarities; and a receiving station with a plurality of sensitive relays adapted to selectively respond to different impulses in predetermined order, each of said relays having a contact armature and a contact anvil, a plurality of printing elements selectively controlled through local circuit connections by said armatures, and means apart from the armatures to prevent them from sticking to their anvils.

12. A system of high speed telegraphy comprising the following instrumentalities: a transmitting station with means for producing high frequency current impulses of different strengths and polarities; and a receiving station with a plurality of sensitive relays adapted to selectively respond to different impulses in predetermined order, each of said relays having a contact armature and a contact anvil, a plurality of printing elements selectively controlled through local circuit connections by said armatures, and means for agitating the said contact anvils to prevent sticking of the armatures.

13. A system of high speed telegraphy comprising the following instrumentalities: a transmitting station with means for producing high frequency current impulses of different strengths and polarities; and a receiving station with a plurality of sensitive relays adapted to selectively respond to different impulses in predetermined order, each of said relays having a contact armature and a contact anvil, a plurality of printing elements selectively controlled through local circuit connections by said armatures, and electromagnetic means for constantly agitating the said contact anvils to prevent sticking of the armatures.

14. A system of high speed telegraphy comprising the following instrumentalities: a transmitting station with means for producing high frequency current impulses of different strengths and polarities; and a receiving station with a plurality of sensitive relays adapted to selectively respond to different impulses in predetermined order, each of said relays having a contact armature and a contact anvil, a plurality of printing elements selectively controlled through local circuit connections by said armatures, and electromagnetic agitators for said contact anvils, with means for supplying varying current thereto.

15. A system of high speed telegraphy comprising the following instrumentalities: a transmitting station with means for producing high frequency current impulses of different strengths and polarities; and a receiving station with a plurality of sensitive relays adapted to selectively respond to different impulses in predetermined order, each of said relays having a contact armature and a contact anvil, a plurality of printing elements selectively controlled through local circuit connections by said armatures, electromagnetic means for agitating said contact anvils, and a source of alternating current connected thereto.

16. In a system of high speed telegraphy, sending apparatus adapted to transmit high frequency impulses of different strengths and polarities, a line wire, and receiving apparatus comprising a plurality of sensitive relays selectively responsive to said varying currents, each relay comprising a magnetized core, an actuating coil thereon, and an armature of magnetic material having a high natural period and normally held attracted by the core, together with a contact anvil for each armature, a plurality of printing elements each adapted to produce a fragmentary portion of a letter or character, electromagnets controlling the said printing elements, local circuit connections from said printing magnets to the contact armatures of the relays, and means for disabling a circuit controlled by the weak current relays when receiving strong current impulses of the same polarity.

17. In a system of high speed telegraphy, sending apparatus adapted to transmit impulses of different strengths and polarities, a line wire, and receiving apparatus comprising a plurality of relays selectively responsive to said varying currents, each relay comprising a magnetized core, an actuating coil thereon, and an armature of magnetic material normally held attracted by the core, together with a contact anvil for each armature, a plurality of printing elements each adapted to produce a fragmentary portion of a letter or character, electromagnets controlling the said printing elements, local circuit connections from said printing mag-

nets to the contact armatures of the relays, and neutralizing coils for the relays wound and connected so as to compensate in the weak current relays for the strong current impulses.

18. In a system of high speed telegraphy, sending apparatus adapted to transmit high frequency impulses of different strengths and polarities, a line wire, and receiving apparatus comprising a plurality of sensitive relays selectively responsive to said varying currents, each relay comprising a magnetized core, an actuating coil thereon, and an armature of magnetic material having a high natural period and normally held attracted by the core, together with a contact anvil for each armature, a plurality of printing elements each adapted to produce a fragmentary portion of a letter or character, electromagnets controlling the said printing elements, local circuit connections from said printing magnets to the contact armatures of the relays, and neutralizing coils on the respective relays wound and connected so as to prevent demagnetization of the weak current relays by strong current impulses.

19. A system of high speed telegraphy comprising sending apparatus adapted to transmit high frequency impulses of different strengths and polarities, a line wire, and receiving apparatus comprising a plurality of printing elements each controlled by a printing magnet, each element adapted to produce the impression of part of a character, and controlling relays for said printing magnets, arranged in pairs with their magnetic elements and coils at angles of 90° to prevent interference, an anvil agitator with energizing means for each pair of relays, and triple windings for each relay comprising an energizing coil connected to a suitable local source of current, an actuating coil connected to line and adapted to neutralize the core magnetization so as to permit actuation of the armature, and a neutralizing coil preferably intermediate of the other two coils for preventing interference between the relays.

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

CARL KINSLEY.

Witnesses:
CHAS. O. PROCTOR,
PETER MATHIAS.