

No. 829,263.

PATENTED AUG. 21, 1906.

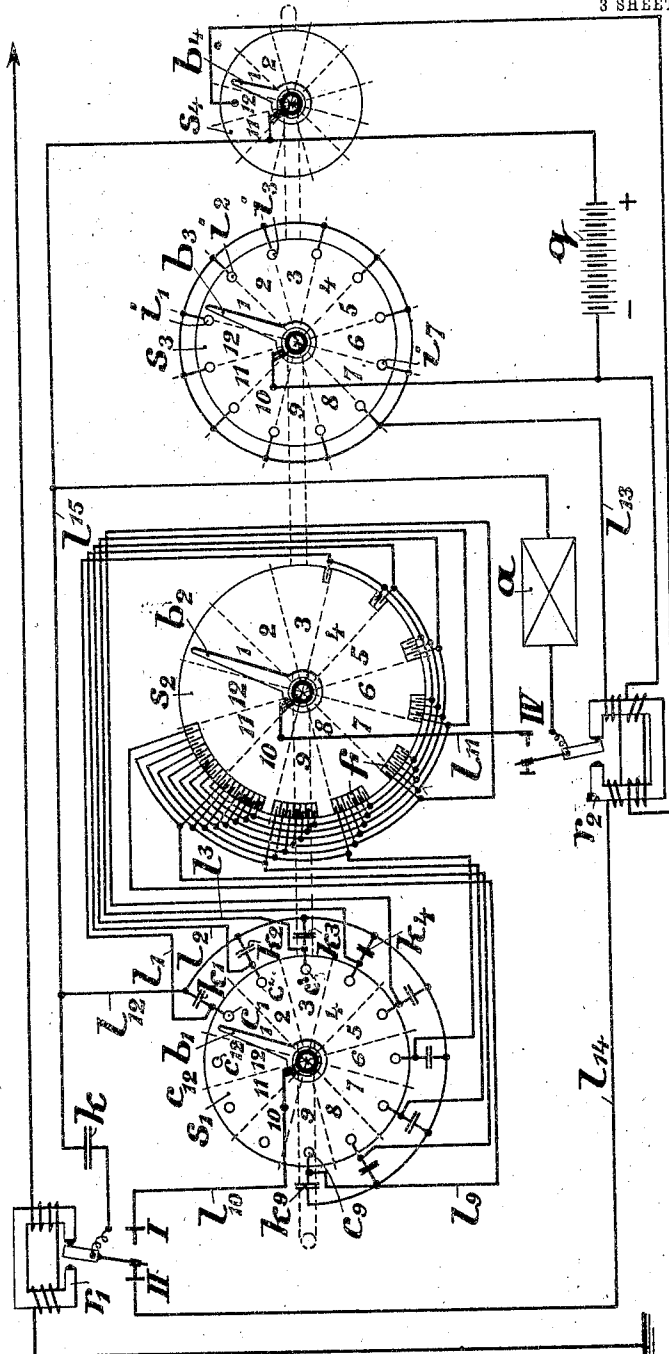
A. FRANKE.

APPARATUS FOR THE TELEGRAPHIC TRANSMISSION OF WRITTEN CHARACTERS.

APPLICATION FILED OCT. 17, 1902.

3 SHEETS—SHEET 1.

Fig. 1.



WITNESSES

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3 SHEETS—SHEET 2.

Fig. 2.

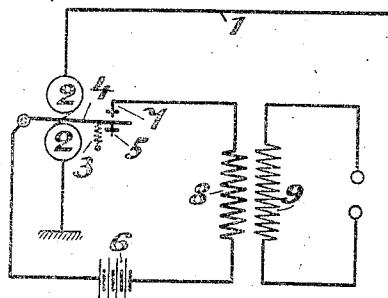
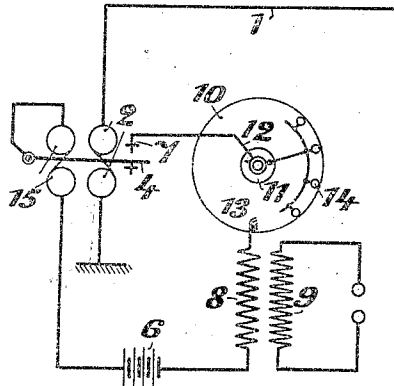


Fig. 3.



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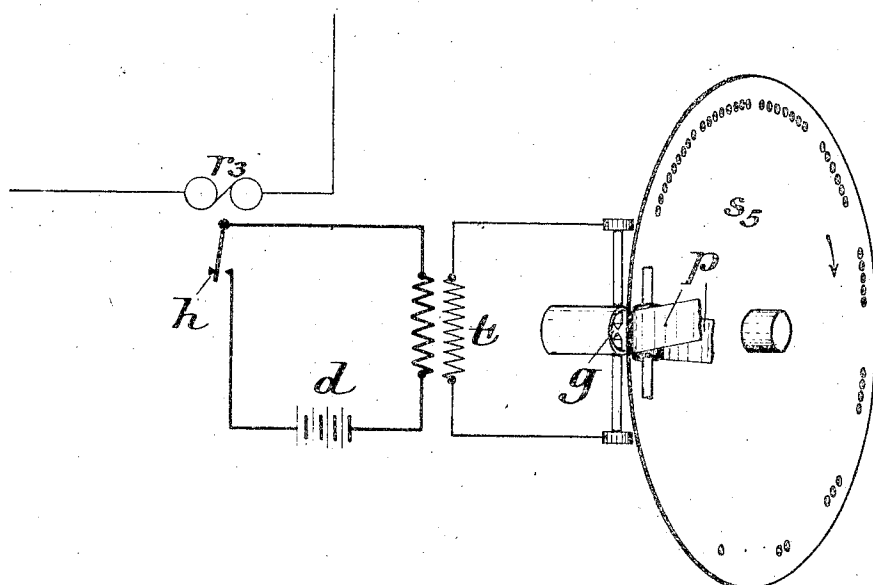
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3 SHEETS—SHEET 3.

Fig 4.



WITNESSES

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APPARATUS FOR THE TELEGRAPHIC TRANSMISSION OF WRITTEN CHARACTERS.

No. 829,283.

Specification of Letters Patent.

Patented Aug. 21, 1906.

Application filed October 17, 1902, Serial No. 127,719.

To all whom it may concern:

Be it known that I, ADOLF FRANKE, engineer, a subject of the German Emperor, residing at 23 Sternstrasse, Gross Lichterfelde, near Berlin, Germany, have invented certain new and useful Improvements in Apparatus for the Telegraphic Transmission of Written Characters; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same.

The present invention relates to an apparatus for the telegraphic transmission of written characters by means of synchronously-acting mechanism, giving a considerable increase in the speed of transmission with increased reliability. These advantages are obtained, essentially, by dividing the types or elements requisite for producing the characters into groups and by providing two current impulses of different direction, the first positive impulse serving to select an element which is exclusively apportioned to a distinct group of letters or characters, while the second negative impulse acts upon an element which does not belong to a group, this element, according to the moment of its operation, serving to select a desired letter from the group.

A particularly advantageous mode of carrying out this method is obtained by apportioning to each group of letters a distinct element—for instance, a condenser—for the purpose of reproducing independently all the letters of this group. The first line impulse has then the effect of selecting that particular condenser to the group of which belongs the letter which it is desired to transmit, while the second impulse causes the selected condenser to act so as to produce the desired letter at the proper time.

The application of the telegraphically-transmitted letter from the synchronously-actuated type-wheel to the paper may be effected by a printing device or by photographic means or in any other way. My invention is shown and described in connection with devices for reproducing the characters by means of photography for the purpose of obtaining the greatest possible speed of transmission.

I shall now proceed to describe an apparatus constructed according to my invention, in which the number of the necessary relays is reduced to a minimum by the use of con-

densers, which by their discharge produce the printing of the type upon the paper. A number of condensers are provided, each of which is adapted to print independently the letters of a definite group. For the purpose of transmitting a particular letter first the condenser in the group of which the desired letter is contained is charged and then discharged at the proper moment. The first and second line impulses effect these two actions; but in order to produce the current impulses exactly at the proper moment there are provided in all the charging and discharging circuits two interrupters, which are connected together in series, one of them being operated by a part actuated synchronously with the type-wheel.

Figure 1 is a diagram of an apparatus suitable for carrying out the invention. Figs. 2 and 3 are diagrams illustrating two different devices for suddenly illuminating the characters for photographic reproduction. Fig. 4 is a diagrammatic view illustrating a photographic-printing device which may be employed for printing the characters in carrying out my invention.

In Fig. 1 s^1 , s^2 , s^3 , s^4 represent disks having suitably-distributed contact-pieces, over which rub the brushes b^1 , b^2 , b^3 , and b^4 , that revolve synchronously with the type-wheel. b^1 is connected by lead l^{10} to the contact I of the line-relay r^1 . b^2 is connected by lead l^{11} to contact IV of relay r^2 , while b^3 and b^4 are each connected to one pole of the source of current g . In the construction shown the letters are divided into nine groups, which circumstance, coupled with an expedient for the sake of reliability hereinafter referred to, renders it preferable to divide the disks into twelve fields 1 to 12. To each of the first nine contact-pieces c^1 to c^9 of the disk s^1 is connected a group condenser k^1 to k^9 . These condensers are connected with one another through one of their coatings. Their second coatings are connected, as shown by leads l^1 , l^2 , l^3 to l^9 , to contact-pieces insulated from one another of the disks s^2 .

The letters or characters are distributed on the type-wheel correspondingly to the arrangement and distribution of the last-mentioned contact-pieces, so that the group which is apportioned to the condenser k^1 comprises nine different characters, the group apportioned to the condenser k^2 comprises only eight, and so on, and, finally, the group apportioned to the condenser k^9 com-

prises only one character. The charging of the group condensers is not effected directly from the source of current, but through the intermediary of the charging-condenser k , which for this purpose has one of its coats 5 connected through lead l^2 to the mutually-connected coats of the group condensers, while its other coat is connected to the armature of the line-relay.

Fig. 1 shows the condition of the apparatus before sending a character at the moment in which the brushes are situated at the commencement of the first field. The armature of the line-relay r is on contact II. 10 The condenser k is charged, as will herein-after be described. Let it be assumed, by way of example, that it is desired to transmit the letter which is apportioned to the contact-piece f on disk s^2 . This letter therefore belongs to the third group condenser k^3 , 15 so that this condenser must first be charged from the charging-condenser k . This is done by the first line impulse, which moves the armature of the line-relay over to make contact at I—that is to say, closes one of the two points of break which occur in the connecting-lead between k and k^3 . The other break at c^3 is bridged over by the brush at the moment 20 that it rubs over the corresponding third contact-piece of the disk s^1 . In consequence of the series-connection of two points of interruption, of which one is closed by the part that is actuated synchronously with the type-wheel, the maintenance of the uniform motion is facilitated, because the line impulse must not take place exactly at the moment in which the brush passes over the contact c^3 . In fact, there is available for that 25 purpose the whole period of time which is required by the brush after leaving contact c^2 to reach the next contact c^3 . At this moment—namely, at the moment of contact between b^1 and c^3 —the condenser k discharges into the group condenser k^3 . After 30 a further rotation through one-twelfth of a revolution the brush b^1 establishes connection between the condenser k and the condenser k^4 ; but in spite of this the latter does not receive any discharge of practical importance, because the capacity of the group condensers is greater than the capacity of the charging-condenser, and therefore the latter contains only a small amount of electricity 35 after it has discharged into the condenser k^3 . The condenser k^3 thus charged must now, for the purpose of transmitting the selected letter, be discharged at the moment in which the brush b^2 is just rubbing on the contact-piece f . This discharge is effected according 40 to the present invention by means of a second current flowing in the opposite direction through the line-relay r , which current, according to the example, must arrive at the very moment that the revolving brushes are 45 situated in the sixth field. In passing from this field into the next the brush b^3 rubs over a contact-piece of the disk s^3 , and a current impulse is thereby produced which travels from the negative pole of the source of current g through b^3 , contact i^1 , lead l^3 , coil of the relay r^2 , lead l^4 , contact II to the condenser k , and thence through lead l^2 back to the positive pole of the battery. This impulse produces, on the one hand, the charging of the condenser k for transmitting the next 50 character, and, on the other hand, the reversal of the armature of the relay r^2 , so that now the discharge of the condenser k^3 can take place as soon as the arm b^2 reaches the contact-piece f , which in the seventh field of the discharging-disk s^2 is apportioned to this condenser. Thus in the case of this last-described discharging current-circuit there is employed the principle which was described 55 with reference to the charging of the group condenser and which consists in including in one current-circuit two contacts coupled together in series, of which one that prepares the circuit is actuated by the current impulse arriving through the main line, while the other that closes the circuit is operated by a synchronously-actuated part of the receiving apparatus. This arrangement has, 60 as above stated, the great advantage of not rendering the transmission of a particular character (which in consequence of the use of synchronously-working apparatus depends on the moment at which a current impulse is produced in the receiving apparatus) dependent on the exact arrival as regards time 65 of the current which is sent through the main line, but of allowing for that event a certain period of time which in the example chosen amounts to about one-twelfth of the period of revolution of the receiving apparatus.

The closing of the circuit for effecting the transmission of the character at the proper moment is thus completely insured, because this moment is determined by the receiving apparatus itself.

It is obvious that at the moment of the discharge of a group condenser by the passage of the brush b^2 over a contact-piece apportioned to that condenser a particular character on the type-wheel is situated opposite 70 to a fixed point near the edge of the wheel, and that therefore this discharging impulse can be utilized for the purpose of transmitting this character to the paper.

The apparatus described for the selection 75 of the characters permits a very high speed of transmission. The speed obtained with an experimental apparatus constructed as herein-after described and with simple as distinguished from multiplex working was about 80 two thousand characters per minute. This, however, is by no means the limit of speed of the apparatus. At such high speed it would appear to be practically impossible to mark the letters or characters upon the paper by 85

mechanical printing. For this reason a photographic method of printing is employed. With this object in view the current impulse coming over the apparatus *a*, Fig. 1, is used to cause an electric discharge across a spark-gap, located opposite the sign or character to be printed, carried by a rotary type-disk. The arrangement of the mechanism for this purpose is shown diagrammatically in Fig. 4. In this view *s*² indicates the type-wheel in which the individual characters are arranged in a manner corresponding to the arrangement of the contacts upon the disk *s*².

The characters are made in the form of a stencil, so that the parts cut out or transparent form the characters. Behind this disk opposite the character then at the printing-point the spark-gap is formed between suitable electrodes, said spark-gap being indicated at *g*. The electrodes are connected to the secondary windings of a transformer *t*. The primary windings of this transformer are included in an electric circuit engaged by the battery *d*, which circuit can be closed by the contacts *h* of the relay *r*³. Instead of the battery *d*, obviously some other source of electricity may be employed, for example, a condenser can be used with advantage. The relay *r*³, which causes the opening or closing of the contacts *h*, is located in the conductors *l*¹, *l*⁵, and *l*² at the point indicated at *a* in Fig. 1. A strip *p* of photographic paper is led over a roller *r* directly opposite the spark-gap and on the opposite side of the type-wheel from said spark-gap, so that upon the production of a spark the character formed in the type-wheel, which is then exactly before the spark-gap, will be photographed upon the paper. The method of operation of this arrangement will be obvious to those skilled in the art. If the relay *r*³ is energized at a certain position of the contact-arm *b*² by the discharge of a group condenser *k*¹, *k*², *k*³, &c., there results immediately a spark at the spark-gap *g*, as will be clear from the drawings, and a photographic impression will be made on the paper strip of the character lying opposite the spark-gap whose position in the type-wheel corresponds to the position of the corresponding contact upon the disk *s*².

It is obvious that the space in front of the type-wheel in which the sensitive strip moves must be inclosed to exclude all light except that coming through the stencil, and the strip after its exposure must be led directly from the dark chamber to developing and fixing baths and then to a suitable washing apparatus. Arrangements of this kind are already old and well known and for this reason have not been illustrated.

After the discharge of the condenser in the described manner the relay *r*³ must be moved again before the commencement of the next revolution. For this purpose there is em-

ployed a second coil which is connected at the end of the revolution for a short time with the source of current by means of the disk *s*⁴, which has a contact only in the twelfth field.

In order to avoid overstraining the line-relay by too-rapidly recurring impulses for charging and discharging the group condensers, the discharge of the group condenser *k*¹ by the action of the second line impulse can take place in the fields 3 to 11 of the discharging-disk *s*³, the discharge of the group condenser *k*² in the fields 4 to 11, and the discharge of the group condenser *k*³ in the fields 5 to 11, as will be seen from the drawings—that is to say, the contacts are so arranged that the *n*th group condensers can only be discharged in the *n* + 2th and the following fields of the disk *s*³. Consequently the shortest period of time comprised between the delivery of the two current impulses required for transmitting a letter is always equal to about one-twelfth of the period of one revolution of the type-wheel or of the brushes. For the same reason a vacant field is provided between the last field in which a discharge can still take place and the first field in which a charge can again occur in the next revolution. When nine group condensers are used, this renders it necessary to divide the disks or wheels into twelve fields, and it determines the number and distribution of the discharging contact groups shown on the disk *s*³. Figs. 2 and 3 illustrate diagrammatically devices for reproducing the characters by means of photography for the purpose of attaining the greatest possible speed of transmission. For this purpose a sudden illumination of the characters is effected by the current impulses sent from the transmitter which are utilized to produce electric discharges along a "path of sparks" at the receiving-station. This method has the advantage of providing by the use of a small amount of energy a powerful source of light which is well suited for photographing the characters.

In Fig. 2 *l* is the line which goes to earth through the winding of the relay 2. In the position of rest the spring 3 presses the relay-armature 4 against the rest contact-piece 5, so that the current-circuit of the battery 6 is interrupted. On the arrival of the current impulse the relay-armature is pressed against the working contact-piece 7, and the current-circuit is closed through the primary winding 8 of the induction-coil, so that in the secondary circuit 9 there is produced a spark which illuminates the type that is situated at that moment in front of the path of sparks. This arrangement makes a great demand on the synchronism of the transmitting and receiving apparatus, because the current impulse which sets free the sparks must be sent at exactly the moment at which the desired type arrives in front of the path of sparks, and the

slightest discrepancy in point of time would necessarily produce transmission of a wrong character. In order to obviate this and obtain a certain margin of time for sending the

current impulse which is necessary to transmit a particular character, the arrangement may be such that the current impulse of the line shall not set free the spark, but shall only prepare for its occurrence, while the actual discharge is effected exactly at the proper time by the type-wheel itself or by means of a part revolving with it. The primary current-circuit of the induction-coil must, therefore, contain two places of interruption connected with each other in series, of which the one is influenced by the armature of the line-relay and the other by the part which revolves synchronously with the type-wheel. The passage of current in the induction-circuit takes place only when both contacts are closed. Therefore the armature of the relay must remain in the position in which it was moved by the line current to transmit the character until the second contact has also been closed and the discharge of sparks has taken place. From this it follows that the relay must be indifferent or neutral and that special means must be provided for opening it or moving it over into the other position.

Fig. 3 illustrates an arrangement of this kind. The same reference characters indicate the parts similar to those in Fig. 2. 10 indicates a disk which revolves synchronously with the type-wheel and has on its periphery suitably-distributed contact-pieces, one for each type on the type-wheel, in such a manner that one of the types is always situated exactly in front of the path of sparks when the brush 13 slides over the corresponding contact-piece. All these contact-pieces are connected electrically with the metal ring 11, on which the brush 12 slides, while the periphery of the disk is traversed by the brush 13. For the purpose of sending a particular character—for instance, the character which is apportioned to contact-piece 14—both the contacts which are in the path of the current, the contact at 7, as well as that at 14, must be closed simultaneously; but it is not necessary that 7 should be closed exactly at the instant in which the brush 13 reaches the contact-piece 14, and in fact this can take place previously, immediately on the brush 13 leaving the preceding contact on disk 10. Thus a certain margin of time is given for sending the current impulse so that only a small deviation in the synchronism does not affect the transmission of the characters.

The operation is as follows: The arriving line current moves the armature of the relay up against the contact 7, where it remains for the moment. As soon as the brush 13 comes in contact with contact 14 of the disk 10 the circuit of battery 6 is closed, and a current impulse is produced which gives rise to

sparking. This current impulse serves at the same time to move the armature of the relay back again, for which purpose the impulse is led through a second winding 15 of the relay.

The excitation of the primary coil may be done in any of the ways well known in the art—as, for example, by means of the working current in the manner described. Also instead of connecting the battery directly with the primary coil the battery may be used to charge a condenser, and the primary coil may be energized by the discharge of the condenser.

Further description of this and similar modifications are not necessary, because they are identical as regards their main features, and they are based substantially on one and the same principle.

Having thus particularly described the nature of my said invention and the best means I know of carrying the same into practical effect, I claim—

1. In a telegraph-receiver, the combination, with means operated by a current impulse in one direction and arranged to select an element apportioned exclusively to a particular group of characters, of a second element, means for operating said second element by a current impulse in the opposite direction to the first-mentioned current impulse, and means for selecting thereby from the group a character determined by the time of operation of the said second element.

2. In a telegraph-receiver, the combination, with means operated by a current impulse in one direction and arranged to select a condenser apportioned exclusively to a particular group of characters, of a relay, means for operating said relay by a current impulse in the opposite direction to the first-mentioned current impulse, and means for selecting thereby from the group a character corresponding to the time of operation of the relay.

3. In a telegraph-receiver, the combination, with means operated by a current impulse in one direction and arranged to charge a condenser apportioned exclusively to a particular group of characters, of means operated by a second current impulse and arranged to discharge said condenser at a given moment, and means for selecting thereby from the group a certain character.

4. In a telegraph-receiver, the combination, with a relay, of condensers apportioned to particular groups of characters, means for charging one of the condensers if the relay is operated in one direction, means for discharging the said condenser if the relay is operated in the opposite direction and means for producing thereby a character.

5. In a telegraph-receiver, the combination, with a line-relay, of condensers apportioned to particular groups of characters

rotating contact device for charging one of the condensers if the line-relay is operated in one direction, a rotating contact device for discharging the said condenser if the relay is operated in the opposite direction and means for producing thereby a character.

6. In a telegraph-receiver, the combination, with a line-relay, of condensers apportioned to particular groups of characters, a rotating contact device for charging one of the condensers if the line-relay is operated in one direction, a discharge-relay closing a contact in the discharge-circuit if the line-relay is operated in the opposite direction, a rotating contact device for discharging the condenser if the said contact is closed and means for producing thereby a character.

7. In a telegraph-receiver, the combination, with a line-relay, of condensers apportioned to particular groups of characters, a main condenser, a rotating contact device for charging one of the first-named condensers by the main condenser if the line-relay is operated in the one direction, a discharge-relay closing a contact in the discharge-circuit if the line-relay is operated in the opposite direction, a rotating contact device for discharging the condenser if the said contact is closed, means for producing thereby a character, a rotating contact device for opening the contact made by the discharge-relay and thereby charging the main condenser.

8. In a telegraph-receiver, the combination, with a relay, of condensers apportioned to particular groups of characters, means for charging one of the condensers if the relay is operated in one direction, means for discharging the said condenser if the relay is operated in the opposite direction, means for producing a spark and thereby illuminating the character determined, and means for photographically reproducing the said character.

9. In a telegraph-receiver, the combination, with a line-relay, of condensers apportioned to particular groups of characters, a rotating contact device for charging one of the condensers if the line-relay is operated in one direction, a rotating contact device for discharging the said condenser if the relay is

operated in the opposite direction, means for producing thereby a spark for illuminating the character determined, and means for photographically reproducing the said character.

10. In a telegraph-relay, the combination, with a sunflower contact device, means operated by current impulses in one direction and arranged to close a circuit through one of the contacts of the sunflower, and an element connected to said contact and apportioned exclusively to a particular group of characters, of one second element, means for operating said second element by a current impulse in the opposite direction to the first-mentioned current impulse, means for selecting thereby from the group a character, and contacts for producing the printing of the character selected and arranged in continually increasing numbers between the contacts of the sunflower contact device.

11. In an apparatus for telegraphic transmission of written characters, the combination, with means for selecting a character, of means for photographic reproduction, and means for the sudden illumination of said character.

12. In an apparatus for telegraphic transmission of written characters, the combination, with means for selecting a character, of means for photographic reproduction, and an electric sparking-path for the sudden illumination of the characters.

13. In an apparatus for telegraphic transmission of written characters, the combination, with means for selecting a character, of means for the photographic reproduction of the characters, an electric sparking-path for suddenly illuminating them, two contacts, means for closing one by an arriving line impulse, a type-wheel, and a part actuated synchronously therewith and adapted to close the other contact.

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

ADOLF FRANKE.

Witnesses:

WOLDEMAR HAUPT,
HENRY HASPER.