PATENT SPECIFICATION

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COMPLETE SPECIFICATION

An Arrangement for the Electro-magnetic Recording of Letter and like Signals

We, SIEMENS & HALSKE AKTIEN-GESELLSCHAFT, a German Company, of Berlin-Siemensstadt, Germany, do hereby declare the nature of this invention and in what manner the same is to be performed, to be particularly described and ascertained in and by the following statement:—

This invention relates to an arrangement for the electro-magnetic recording of letters, figures or other symbols or pictures, in particular for printing telegraphs of the type known as the Siemens-Hell-Printing-Telegraph, in which the individual letters, figures or other symbols are scanned or analysed into a succession of constituent elemental areas or picture lines and are transmitted by corresponding impulse sequences. The manner in which such a system operates, briefly described with reference to Figures 1 to 3 of the accompanying drawings, is as follows:—

Figure 1 shows how the letter U is analysed into twelve individual lines 1. The shortest black or white intervals 2 (current or no current) occupy 1/100th of the length of the circumference of the cam disc 3 which serves to transmit the letter and the space following the letter. The transmission, one after the other, of the twelve picture lines is effected by means of cams on the circumference of the disc 3. After the transmission of the necessary signal pulses there follows a no-current interval of at least one-quarter of the circumference of the disc.

Figure 2 shows diagrammatic representation of the keyboard sender. On a shaft 4 which makes five revolutions per second, are arranged 48 cam discs 5 for the transmission of figures and letters. The teeth 6 of the cams 5 correspond to the picture analysis of a letter, figure, or other sign. In order that only one of these discs 5 may be effective at a time, a keyboard lock must be arranged so that when a key is operated, the remainder are locked. Only during the quarter revolution, while the space between two letters is being transmitted, are the keys unlocked. If, in this time interval, the key "L," for example, is operated, an insulated distance-piece 7 is so positioned that thereafter the contact springs are opened and closed in accordance with the cams on the disc corresponding to the L. All other contact springs remain in the open condition, since their distance pieces are in the normal position under the action of the key lever springs.

The signals are sent by audible frequency alternating current so that they may easily be transmitted over any keying lines to the radio transmitter and on the other hand, to enable advantage to be taken of the telephone links generally employed. The carrier frequency is 900 cycles.

The fundamental method of operation of the Siemens-Hell receiver is shown in Figure 3. It will be seen that the letters are printed in duplicate.

The essential part of the receiver is a printing spindle 8 formed as a small roller running at 60 revolutions per second. Contact between the printing spindle 8 and the paper band 9, at a speed of five letters per second, occurs from the top to the bottom twelve times and prints a line. In order to obtain immediate visible impression on the paper, this is covered with a thin carbon paper of the same width, which for clarity is omitted from the diagram. If the receiver is traversed by a current, the receiving magnet 10 attracts its armature 11. This presses a rounded edge 12 from underneath up against the paper tape 9 so that a line is recorded if the magnet 10 remains energised for the entire duration of the transmission of a picture line. At the next revolution the paper tape is stepped on by the paper feed arrangement 13 so that the next picture line occurs close to the first.

In Figure 3 the printing spindle 8 is shown duplicated on the roller so that the letter picture is recorded simultaneously in two parallel lines. The purpose of this double record is to secure a synchronising arrangement which will be as simple as possible. The lines of print are then only accurately parallel if the number of revolutions of the printing spindle 8 is in exact accordance with the transmitting time of the picture lines. If these speeds

differ from one another the lines of print are not parallel to the paper strip but run upwards or downwards.

Heretofore, direct current magnet systems have been employed for recording the picture lines of the individual characters and this has necessitated rectifying the transmitted alternating current impulses. Receiving systems of this kind are however not simple and economical enough for the aforementioned writing telegraphs, and necessitate a very high degree of amplification of the incoming image signals in order to attain a sufficient sensitiveness.

In accordance with the present invention a simple, but nevertheless very sensitive arrangement is intended to be provided for the recording of letter and other symbols for printing telegraphs which works with letter signals analysed into a succession of constituent elemental areas or picture lines, whereby the number of the elemental areas in each second is less than the frequency of the carrier wave, wherein an alternating current magnet is employed as receiving system, which is excited by means of the incoming received audio-frequency modulated carrier wave, or, for instance, by such a wave generated by means of super-imposition, and which causes the direct recording of the picture lines. In this connection, the armature of the alternating current magnet system can also be made to act as contact carrier and to effect switching processes which are directly associated with the recording, as for example the cutting in and out of the driving motor by means of a sluggish relay when the signalling begins or ends, or it can serve for the conveyance of subsidiary signals. In this connection a well known phase relay is employed as receiving magnet, which is tuned to resonance, the resonance being made dependent on the position of the armature of the phase relay, and this provides a very advantageous record of the picture lines.

By a phase relay, an alternating current magnet system is meant which exerts a constant pull on its armature when excited by alternating current. In order to bring this about, two parallel-connected windings, in the present case the windings M_1 and M_2, act on a common armature, which is designated by S. The self-inductances of the two windings are so dimensioned that a phase shifting of the potential with respect to the current through 45° takes place, a condenser C_2 being connected in series with one winding M_1, so that two magnetic fields displaced by 90° with respect to one another are set up, which cause the relay to exert a constant attractive force on the armature S.

A method of carrying out the invention is shown, by way of example, in Figure 4 of the accompanying drawings. The incoming modulated carrier wave reaches the amplifying valve R through the transformer T, the choke D and the condenser C_1 being arranged in the anode circuit of the valve in order to keep the anodic direct current clear of the magnet system. The magnet system comprises the two magnets M_1 and M_2 constituting the phase relay, acting upon a common armature, which causes the direct recording of the individual picture lines. The phase of the magnet M_1 is displaced in relation to that of the second magnet M_2 by means of the condenser C_2 by approximately 90 degrees. The carrier wave has a frequency of about 800 Hz, to which the anode circuit as a whole is electrically tuned. When dimensioning the condenser C_2 care should be taken that resonance takes place in the circuit M_1—C_2, in order to obtain a suitable increase in the current, even if then the phase displacement between the currents in the magnets M_1 and M_2 does not attain the otherwise optimum value of 90°. In order to obtain approximately uniform ampere winding value in both magnets it is necessary to make the coils M_1 and M_2 of unequal size, by giving M_2 a larger number of turns, more than double as many, because the amplitude of the current through M_1 is in itself increased by connecting a condenser C_2 in series and tuning the circuit to the carrier frequency.

The tuning of the entire receiving system, consisting of M_1 and C_2 in series and M_2 in parallel, to resonance with the selected frequency by suitably dimensioning the condener C_1 or by connecting an additional condenser C_4 in series with it, is of particular importance. The latter condenser is employed if the amplifier already contains a condenser C_1 having the customary capacity of about 1 microfarad as a fixed part since the value of the condenser C_4 for the attainment of the required frequency is considerably less than 1 microfarad. Owing to the series connection of the two condensers the resulting capacity differs only slightly from the capacity of the condenser C_4. As the tunings to resonance are dependent on the self-inductances of the magnet coils M_1 and M_2, whereas these alter owing to the air-gap which occurs when the armature is attracted, the tunings must be effected with released armature if it be desired to obtain a strong initial current or rapid response of the armature, but tuning must be effected with attracted armature if it be desired to secure a

strong printing pressure for the recording. If a rapid response and a strong printing pressure are equally important, the resonance figure must be selected at a mean position of armature.

Owing to the tuning of the entire system to resonance by means of the condensers C_4 or C_1, there is a high sensitiveness to lower frequencies due to the great increase of the impedance of C_4 or C_1 at such frequencies, whereby in the case of wireless working a very good selectivity against disturbing transmitters is guaranteed. A similar insensitiveness to higher frequencies can be secured by connecting up a bridging condenser C_5 across the choke D.

Having now particularly described and ascertained the nature of our said invention and in what manner the same is to be performed, we declare that what we claim is:—

1. An arrangement of the type described wherein the number of elemental areas scanned in each second is less than the frequency of the carrier wave, characterised in that an alternating current magnet system is employed as receiving system, which is excited by means of the incoming modulated carrier wave and causes the direct recording of the image marks or picture lines.

2. An arrangement according to Claim 1, characterised in that the receiving system is tuned to resonance in dependence on that position of the armature which gives the optimum record.

3. An arrangement according to Claim 1, characterised in that the armature of the alternating current magnet system is constructed to carry a contact which serves to control switching processes directly associated with the recording, in particular the cutting in and out of the driving motor of the printing apparatus.

4. The improved arrangement for the electro-magnetic recording of letter and photo signals substantially as hereinbefore described with reference to Figure 4 of the accompanying drawings.

Dated this 3rd day of October, 1933.

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Fig. 1.

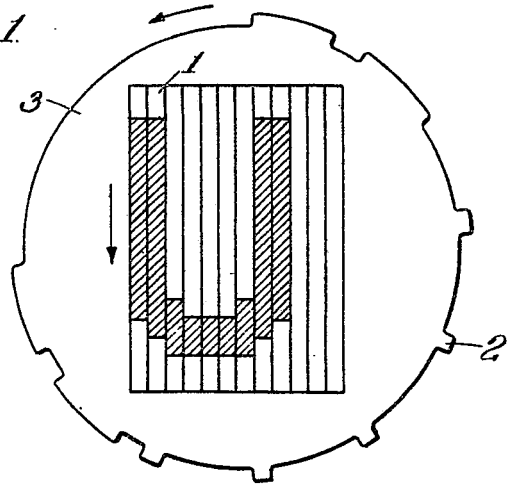


Fig. 2.

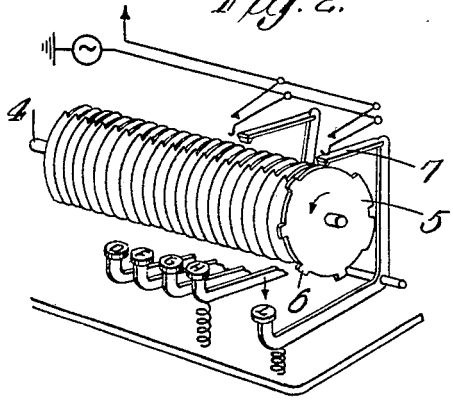


Fig. 3.

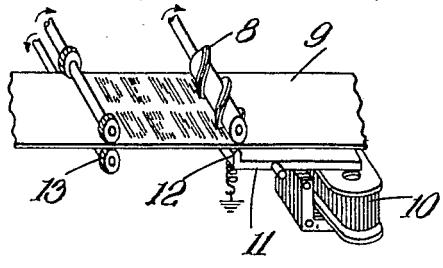
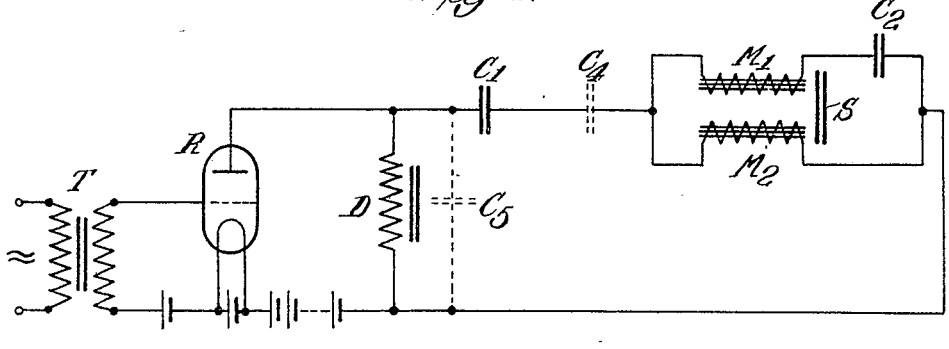


Fig. 4.



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