

Nov. 3, 1942.

K. B. PALME

2,300,463

DEVICE FOR RECEIVING AND RECORDING TELEGRAPHIC SYMBOLS

Filed Jan. 30, 1941

2 Sheets-Sheet 1

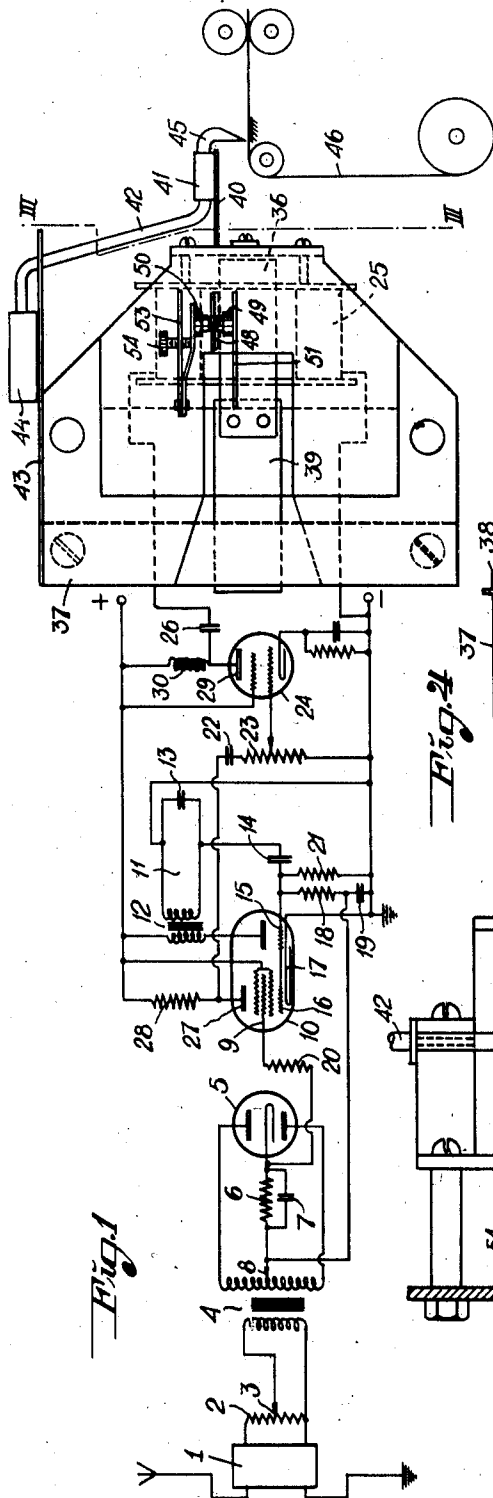


Fig. 1

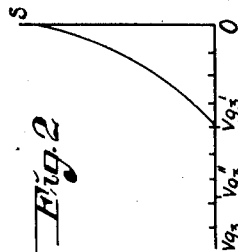


Fig. 2

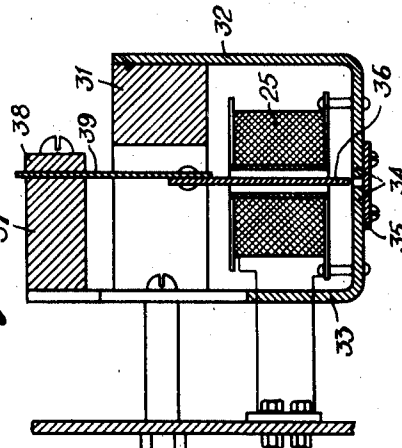


Fig. 3

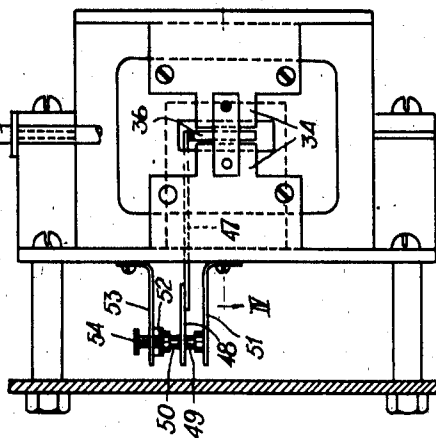


Fig. 4

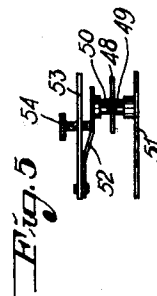


Fig. 5



Fig. 6

Inventor:

Karl Bertil Palme,

By Cushman, Darby & Cushman
Attorneys.

UNITED STATES PATENT OFFICE

2,300,463

DEVICE FOR RECEIVING AND RECORDING
TELEGRAPHIC SYMBOLS

Karl Bertil Palme, Bofors, Sweden, assignor
to Bolinder's Fabriks Aktiebolag, Stockholm,
Sweden, a corporation of Sweden

Application January 30, 1941, Serial No. 376,707
In Sweden November 6, 1939

4 Claims. (Cl. 178—89)

The invention relates to a device for receiving and recording telegraphic symbols, which is to a large extent independent of interference and gives a particularly clear script, in which the length of the different symbols and the distance between them can be established with considerable accuracy, a feature which can also be of very considerable importance, inasmuch as it renders possible the identification of different transmitters by characteristics peculiar to each telegraphist. By reason of the fact, moreover, that the device operates with practically no lag, the possibility is also afforded of registering symbols clearly even when coming from high speed mechanical transmitters.

The fact that the apparatus is independent of interference is based on the feature that only the amplitude peaks of the telegraphic symbol impulses are utilized for actuating the telewriter, which according to the invention is arranged to be set into operation only by such telegraphic symbol impulses as have an amplitude exceeding a predetermined threshold value lying above the normal interference level.

According to one particularly appropriate form of the invention the telewriter is arranged to be set into vibrations following a course at right angles to the direction of feed of the telegram strip and lying in the plane of the paper.

With these and other objects in view, reference may now be had to the accompanying drawings for a more detailed description of the invention.

In the accompanying drawings, Fig. 1 shows a circuit diagram for the receiving and recording device according to the invention, the telewriter proper being represented in a side elevation. Fig. 2 shows a valve characteristic curve, whilst Figs. 3 and 4 show the telewriter proper and the arrangement for operating it: Fig. 3 represents a front view, partly in section along the line III—III in Fig. 1, and Fig. 4 a view in cross-section along the line IV—IV in Fig. 3. Fig. 5 shows a device for damping the writing device, and Fig. 6 shows a telegraphed message strip with the symbols as written in the apparatus, according to the embodiment shown. Fig. 7 shows an electromagnetic system of a telewriter, said system being known per se. Figs. 8-10 show an electromagnetic system of a telewriter according to the invention. Figs. 8 and 9 represent two side elevations, perpendicular to one another, and Fig. 10 a view in cross-section along the line X—X in Fig. 8. Fig. 11 shows a modification of the armature used in the embodiment shown in Figs. 8-10.

The telegraphic symbol impulses are received in a receiver 1, which transforms the received impulses into audiofrequency A. C. impulses, which are applied to a potential divider 2, from which they are taken at a tapping 3 and at suitable strength to a transformer 4, the ends of the secondary winding of which are connected to the anodes of a double diode valve 5. The cathode of the double diode valve is connected over a resistance 6, in parallel with a condenser 7 to the central tapping 8 of the secondary winding of the transformer 4. The A. C. impulses rectified by the double diode valve 5 charge the condenser 7, and in order that such charging may take place rapidly in relation to the length of the A. C. impulses, the time constant of the circuit 6, 7 has been made small in relation to the length of the impulses, e. g. to about $\frac{1}{500}$ second.

The voltage across the condenser 7 is connected over a large resistance 20 of about 1 megohm to the third grid 9 in the hexode section of a triode-hexode valve 10. The triode section of this electronic valve 10 is connected up as an oscillator, the frequency of which is determined by a circuit 11, consisting of a shunt connection of a transformer 12 and a condenser 13. The circuit 11 is over a condenser 14 connected with the grid 15 in the triode section of the triode-hexode valve. The oscillations from the oscillator system are applied to the hexode section of the valve 10, by the first grid 16 in the hexode section and the grid 15 in the triode section being interconnected.

In series with the parallel connection of the resistance 6 and the condenser 7 is a voltage which is negative in respect to the cathode 17 of the triode-hexode valve, and in the embodiment of the invention concerned in the present case this voltage is taken from the grid connection of the oscillator system over a resistance 18 and a condenser 19 connected to earth. This negative bias voltage which is in series with the voltage produced by the incoming telegraphic symbol impulses can, of course, also be obtained in some other way, for example by means of a battery. In Fig. 2 is shown the slope of emission characteristic s of the hexode, for the first grid 16, with regard to the anode current, plotted as a function of the negative bias voltage v_{g3} on the third grid 9. It will be appreciated from this characteristic that if the bias voltage on the third grid is kept at point v'_{g3} , the slightest alteration of the voltage in a positive direction, for example by charging of the condenser 7 due to incoming impulses, such as interference or

effective impulses, will result in the hexode section of the valve 13 supplying anode current which reaches its maximum value when the negative bias voltage on the third grid has risen to zero. Further increase of the signal voltage will not cause the anode current to increase.

If, however, the negative bias voltage on the third grid is selected as being equal to v''_{g3} , the voltage produced over the condenser 7 by the incoming impulses must exceed the difference between the absolute values v''_{g3} and v'_{g3} before the hexode will supply any anode current. This system is, accordingly, utilized in this case for suppressing interference impulses, by the negative bias voltage being selected so high that interference within the normal interference range will not remove this negative bias voltage.

Any considerable variations of the positive voltage across the condenser 7, which might possibly occur, will not be noticeable on the third grid 16 in the hexode section of the valve 10, owing to the voltage drop of the grid current in the large resistance 20. Any variations on the part of the incoming impulses will not, therefore, become noticeable as far as the anode current from the hexode section in the valve 10 is concerned.

In order to render it possible to regulate the negative bias voltage in the circuit shown, the voltage can possibly be taken from a point on the grid leakage resistance 21.

If the voltage across the condenser produced by the impulses taken from the potential divider is sufficiently large to remove the negative bias voltage altogether, the anode current of the hexode will be totally independent of fluctuations in the amplitude of the incoming impulses as long as the voltage produced across the condenser 7 is adequate to remove the negative voltage altogether.

The anode current supplied by the hexode section of the valve 9 due to incoming telegraphic impulses and having the frequency determined by the oscillator circuit 11 is taken out over a condenser 22 and a potential divider 23 and amplified in an amplifier 24, which duly supplies the operating coil 25 of the actual telewriter over a condenser 26. The anode 27 of the hexode section of the valve 10 is connected with the source of anode voltage over a resistance 28 and the anode 29 of the amplifier 24 is connected with the same over a choke coil 30.

Reference is directed to Figs. 1 and 3-5 with regard to the telewriter and the device for operating it. The operating device comprises a U-shaped magnet 31, to which are fixed the pole plates 32 and 33 ending in pole shoes 34. The pole shoes are kept at a constant distance from one another by means of the non-magnetic distance piece 35. The armature 36 oscillating in front of the air gap between the pole shoes 34 comprises an oblong piece of iron fixed to a phosphor-bronze spring 39 held between the frame block 37 and a plate 38. The armature 36 passes through the coil 25 and is actuated by the oscillations applied to this coil having the frequency determined by the oscillator circuit 11 (Fig. 1).

Fixed to the armature 36 is a narrow metal plate beam piece 40, made at one end into the form of a cylinder 41, into which is introduced one end of a piece of rubber tubing 42, e. g. so-called valve rubber tubing. The rubber tubing is guided by an arm 43 fixed to the block 37 and provided with a recess to accommodate the tubing. Ink is conveyed through the tubing from an ink reservoir 44 to a capillary tube point 45

of glass, which when not in use lies against the center of the telegram strip 46. The telegram strip is fed forward in the direction as indicated by the arrow.

When A. C. is applied to the coil 25, due to the arrival of telegraphic symbol impulses relieving blocking of the anode current of the triode-hexode valve 10 in the hexode section, the armature 36 will start oscillating in front of the air gap between the pole shoes 34 of the magnet 31. Since the capillary tube point is in fixed connection with the armature it will simultaneously inscribe oscillations on the continuously fed telegram strip. As stated above, Fig. 6 shows this strip inscribed in the manner referred to. Viewed from the left, there will be seen on the telegram strip two dots, one dash and one dot, and knowing the oscillation frequency of the armature, which is predetermined by the frequency of the oscillations applied to the coil 25, and hence by the frequency of the oscillator system, it is possible to read off with accuracy the length of the different symbols on the telegram strip by counting the number of oscillations. For determining the length of the different symbols, therefore, it is not necessary to know the feeding speed of the telegram strip, and it is immaterial whether this speed varies or not. It should be quite obvious that with the system described above it is possible to determine the length of the different symbols with considerably greater ease and accuracy than has hitherto been the case. The possibility of obtaining clear registration of symbols from rapid mechanical transmitters can be afforded by imparting a high frequency of oscillation to the inscribing point and simultaneously causing the paper strip to be fed forward at a relatively high speed. Fig. 6, for instance, shows that the second dot has lasted two periods longer than the first dot. By varying the frequency of the oscillator system facilities are also made available for adapting the frequency of the telewriter to different conditions, e. g. the feeding speed of the telegram strip.

The accuracy with which the length of the different symbols can be read off is also to a considerable extent dependent upon the building-up time of the oscillating system connected to the inscribing point 45, i. e. the time taken for it to build up or get into full constant operation. To attain rapid building-up it is necessary that the ratio between the frequency of the applied oscillations and the natural frequency of the oscillating system shall be less than 1. In addition, the oscillating system should be intensely damped. For this purpose there is fixedly connected to the armature 36 over an arm 47 a plate 48 moving between two abutments 49, 50 for example of leather, one of which 49 is fixed to a support 51 and the other attached to a spring 52 fastened to a fixed support 53. The abutment 50 can by means of a screw 54 be pressed more or less forcefully against the plate 48 contiguous to the abutment 49. The abutments 49, 50, therefore, exercise a kind of braking action on the plate 48 and thus damp the entire oscillating system. Of course the damping device is capable of being designed in other ways, without the function of the apparatus being in any way altered in principle. The essential thing is that the oscillating system shall be intensely damped, since otherwise the accurate determination of the length of the different telegraphic symbols will be rendered more complicated and may pos-

sibly even be lost sight of altogether, as will be more exactly described in the following.

In telewriters of the described kind it is very important that the writing device rapidly reaches the end state, i. e. the oscillation applied to said device shall preferably be completely built up during the first half-period of the oscillation. In addition the problem is to obtain a sine shaped script having a great amplitude and a high frequency. Such a script is most easily obtained by means of an undamped system oscillating in resonance. The oscillation of such a system, however, is very slowly built up to the end state.

By increasing the damping of the system, which causes increase of applied energy, the system can rapidly reach the end amplitude.

Dependent on the phase, in which the oscillation begins, the first amplitude may be somewhat greater than the end amplitude. If, however, the applied frequency is decreased to a value below the natural frequency of the system, e. g. down to 50%, the first amplitude becomes approximately equal to the amplitude in the end state, provided that the damping is appropriate.

If, therefore, an electromagnetical operating system is desired, which by a given mass of the load, for example a style, has a great amplitude, e. g. at a frequency of 200 c., the problem is to produce an electromagnetical system having a mechanical natural frequency of about 350 c. and requiring the least possible energy.

A solution of this problem is illustrated in Fig. 7 showing a known embodiment in section. Between two pairs of poles 55, 56 and 57, 58 respectively an oblong tongue 59 is oscillating. The tongue is fixed to a plane phosphor-bronze spring 60, extending normally to the plane of the paper. The tongue or the armature 59 can then vibrate round an axis lying perpendicularly to the plane of the paper and is driven by the electric energy supplied to a coil divided into two sections 61 and 62.

Supposing the damping is so chosen, that at each moment the deviation is proportional to the current in the coil, the moment of the current at each moment must balance the elastic force of the system. The natural frequency ν_0 of the system is

$$\nu_0 = 1/2\pi\sqrt{D/\theta}$$

D indicates the returning moment (the elastic force) and θ the moment of inertia of the armature system.

Further the deviation is

$$\alpha = k \cdot in/D$$

where k indicates an apparatus constant and in the ampere-turns.

The essential thing is then to make k/D large and even $\sqrt{D/\theta}$ large, if it is desired that the system shall have a high natural frequency. Thus k is to be large and θ small.

In the arrangement shown in Fig. 7 and operating with very small air gaps k will be large.

The electromagnetical operating system shown in Fig. 7, however, suffers from certain disadvantages, which are to be removed according to the invention. The supporting spring 59 for instance takes up space in the longitudinal direction of the tongue, encroaching upon the space at the disposal of the coils. The necessity to divide up the winding into two coils requires an increased insulation quantity, which further increases the space required for the necessary ampere-turns. Consequently, the tongue must have

a relatively great length for the necessary winding. Therefore, the moment of inertia of the armature system becomes large, e. g. it grows proportionally to the third power of the length of the tongue.

It is a further object of the present invention to remove said disadvantage and to render possible a reduction of the moment of inertia and an increase of the winding space. An embodiment fulfilling said requirements is shown in Figs. 8-10.

The permanent magnet system consists of one or more permanent magnets, e. g. cylindrical hollow bars 79, 80, connected in shunt and enclosing bolts of non-magnetic material. The same poles of the magnets are turned in the same direction so that each of the plates 63 and 64 of soft iron limiting the whole system has its polarity. Pole shoes 65, 67 and 66, 68 are formed of down bent parts of these plates 63 and 64 respectively in such a manner that they stand opposite one another. The pole shoes 65 and 66 are formed from the plate 63 and for example constitute south poles, while the pole shoes 67 and 68 are formed from the plate 64 and constitute the north poles. The air gaps between these pairs of poles 65, 67 and 66, 68 respectively are kept constant by means of distance pieces 69 and 70 respectively of non-magnetic material. The armature is fastened to a phosphor-bronze spring 72 fixed in two supports 73 and 74 secured to the plate 63. The armature consists of a narrow oblong part, at one end of which a lateral projection 75 is provided and at the other end of which, in opposite direction, a projection 76 extends, so that the armature receives a Z-shape. The projections extend towards the pole pairs 65, 67 and 66, 68 respectively without contacting the latter, so that the projections can vibrate freely round the fastening spring 72 as an oscillation axis. The operating coil 77 is arranged round the narrow centre part of the armature. Dotted lines illustrate at 78 how a writing device of the kind as above described may be fixed to the armature.

The embodiment above described has the advantage that the narrow part 77 of the armature can be made considerably long without increasing the inertia moment, the latter being substantially determined by the projections 75 and 76. Thereby a great winding space is gained without increasing the moment of inertia. An operating system of the described kind can, for a given purpose, be produced with as great an apparatus constant as before but with a considerably smaller moment of inertia as hitherto could be reached. Therefore, an operating system of this kind is very suitable for all fields of application, where it is desired to have an oscillation of a great amplitude at a high frequency and of a rapid building-up-process of the oscillation.

Fig. 11 shows a modification of the armature used in the embodiment shown in Figs. 8-10. In Fig. 11 the projections 75a and 76a from the armature 77a extend in the same direction. In this case the pairs of magnet poles must be arranged so that the poles are reversed at one end as compared with the embodiment shown in Figs. 8-10.

According to still another modification not shown projections in two opposite directions can be provided at each end so that the armature takes the shape of an I. The arrangement of the magnet system then becomes more complicated but no difficulty seems to arise for those skilled in the art.

The embodiments of the invention as illustrated in the drawings and described in the pres-

ent specification are shown only by way of example and do not involve any limitation of the invention to the details presented in these embodiments. The invention does also embrace a writing device which is arranged to be set into vibrations following a course at right angles to the direction of feed of the telegram strip and lying in the plane of the paper, even though such a writing device may not necessarily be combined with an interference suppressing apparatus according to the invention.

What I claim is:

1. A device for receiving and recording telegraphic symbols, comprising a receiver of telegraphic impulses, a local oscillator system, a telewriter adapted to record said symbols in the form of oscillations, means for operating said telewriter with the frequency of said oscillator system, interference-blocking means, comprising an electronic valve, a control grid in the same, controlling the operation of said telewriter, means for applying a negative bias voltage to said grid, and means for producing a positive voltage, determined by the amplitude of the telegraphic symbol impulses received, in series with said negative bias voltage, means whereby the negative

bias voltage blocks the anode current of the electronic valve until the positive voltage has risen to the value corresponding to the predetermined threshold value, whereby only impulses exceeding said value cause the telewriter to operate and to record the telegraphic symbols in the form of groups of oscillations having the frequency of said oscillator system, which frequency is chosen sufficiently high in order that its period will only constitute a fraction of the duration even of very rapid impulses.

2. A device as claimed in claim 1, in which said means for producing a positive voltage comprises a parallel connection of a resistance and a condenser, the time constant of which connection is low in relation to the minimum length of the telegraphic symbol impulses.

3. A device as claimed in claim 1, in which a large resistance is connected nearest said control grid in series with the means for applying a positive and negative voltage to said control grid for damping large variations of positive voltage.

4. A device as claimed in claim 1, in which means are provided for taking the negative bias voltage from the local oscillator system.

KARL BERTIL PALME.