

April 8, 1941.

G. ERNST

2,237,661

KEYING DEVICE FOR ULTRA-SHORT-WAVE TRANSMITTERS

Filed Nov. 18, 1938

2 Sheets-Sheet 1

Fig. 1

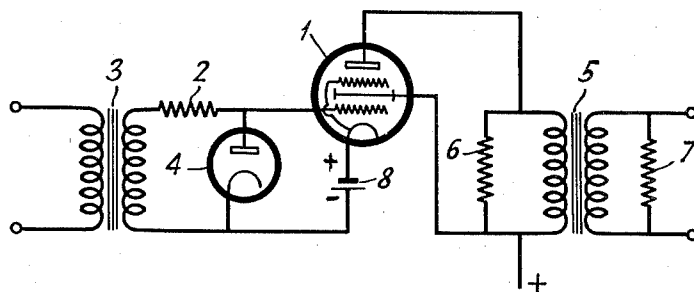


Fig. 2

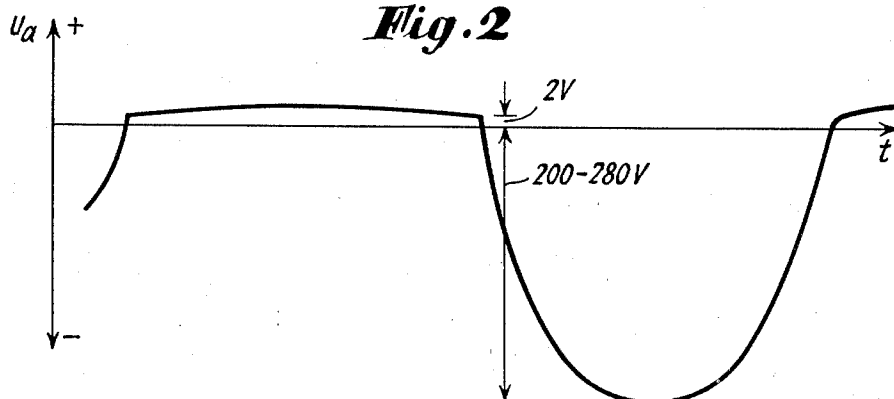
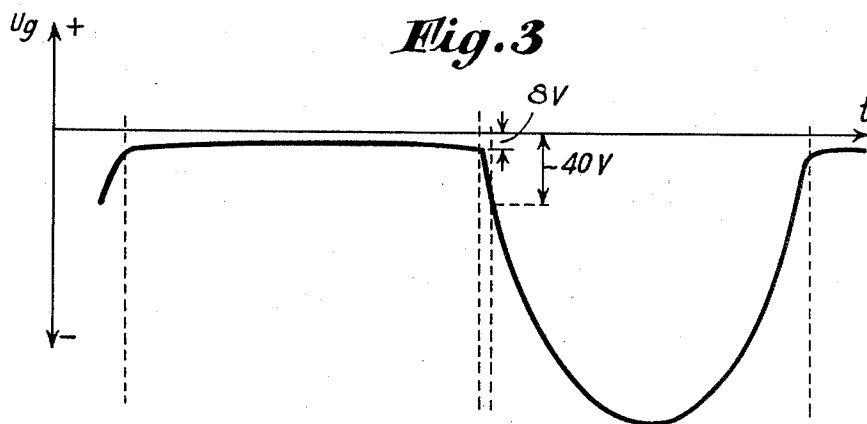


Fig. 3



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Fig. 4

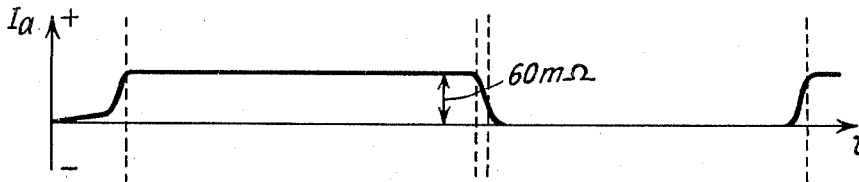


Fig. 5

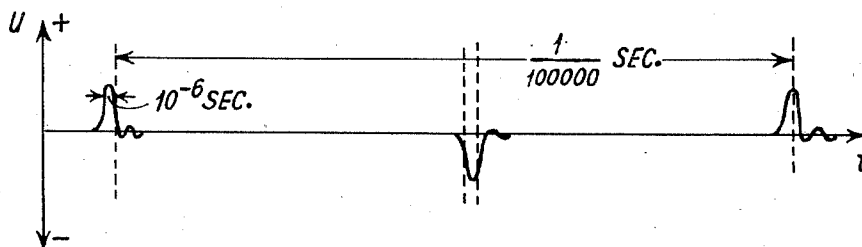
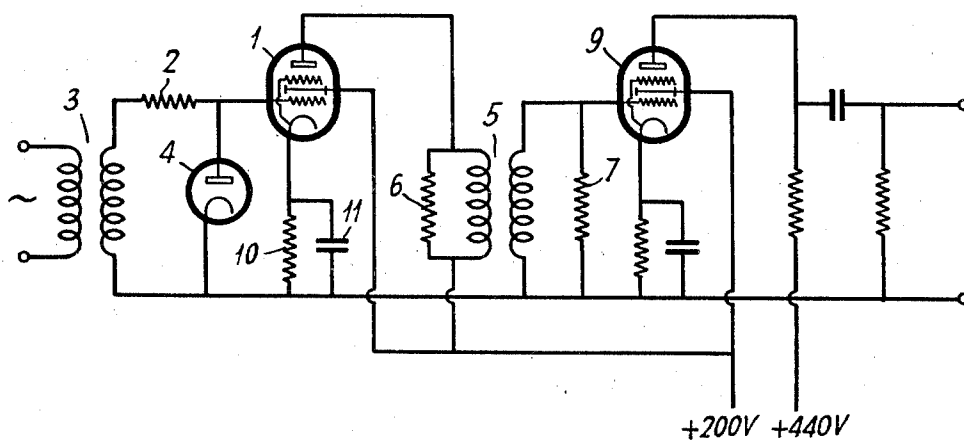


Fig. 6



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KEYING DEVICE FOR ULTRA-SHORT-WAVE TRANSMITTERS

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In Germany October 7, 1937

1 Claim. (Cl. 250—36)

The invention is concerned with ways and means adapted to produce extremely brief impulses and serving to key modulate an ultra-short-wave transmitter.

According to former practice it has been customary to produce the impulses required for keying transmitters by the aid of grid-controlled gas or vapor-filled discharge tubes or discharge tubes without such control. However, discharge tubes of this kind involve the drawback that they are useful only up to a certain frequency, on the ground that, beyond such frequency limit, the impulses experience a certain "wear," that is, become blurred. On the other hand, however, the tendency in modern art is to operate with even shorter waves in many fields and for many purposes, and for these, arrangements as known in the prior art are no longer usable.

The present invention has the aim and object to create a keying device adapted to ultra-short-wave transmitters so that an amplifier tube, say, a triode, a pentode or the like, may be employed, which, by the aid of a sinusoidal potential, is overloaded, and that as a result the plate current being of rectangular shape is differentiated by the aid of a transformer.

Further details of the invention flow from the following more detailed description thereof by reference to the appended drawings, in which:

Figure 1 is a circuit organization for a keying device as here disclosed;

Figures 2 to 5 illustrate the shape of current and potential in a circuit organization as shown in the exemplified embodiment;

Figure 6 shows the same circuit arrangement as in Figure 1 to which an amplifying stage has been added.

Referring to the circuit organization shown in Figure 1, 1 denotes an amplifier tube which in the present embodiment consists of a power pentode whose grid is fed with a sinusoidal potential by way of an input transformer 3 and an ohmic resistance 2. In parallel relationship to the grid of said pentode 1 is a diode 4, the cathode of which has preferably a negative potential with reference to the cathode of the pentode. During the positive alternations, the said diode constitutes and acts as a short-circuit with reference to the series resistance 2 and prevents any undue growth of the grid potential and thus of the plate current of pentode 1. The plate circuit includes a transformer 5, preferably of the iron cored radio frequency type, the secondary winding of which delivers the brief impulses. In parallel relation to transformer 5, a

damping resistance indicated at 6 and 7, respectively, is connected both at the primary and at the secondary end.

The operation of this exemplified embodiment will now be demonstrated by the use of a numerical example. Suppose the sinusoidal potential here furnished is 200 v., at 15 kc., and that resistance 2 has a value of 200 k.-ohm. Owing to the fact that diode 4, during the negative alternation, has an infinitely high resistance, whereas its resistance, upon passage through zero to the positive alternation, inside a range of around 2 v., decreases to 1.5 k.-ohm, it causes in the positive alternation a marked drop of potential across the resistance 2. The shape of the potential between cathode and anode of diode 4 is shown in Figure 2. The anode of the diode is now connected with the grid of the power pentode 1, the filament of which, by the aid of a battery 8, is maintained about 10 v. higher than the cathode of the said diode. The potential at the grid of the pentode then assumes a shape such as shown in Figure 3. Owing to marked overrunning or overloading the shape of the plate current of the pentode is rectangular as illustrated in Figure 4. The U_g-J_a characteristic of the pentode is covered inside a period of time equal to

$$\frac{30}{\sqrt{2 \cdot 200 \cdot 2 \cdot 15000}} = 10^{-6} \text{ sec.}$$

In other words, inside this period of time the plate current rises from zero to maximum. Now, this current is differentiated by the transformer 5 whose dimensions have been suitably chosen ($L_{\text{prim}} = L_{\text{sec}} = 0.3 \text{ mh.}$) with the result that at the secondary end there arises a potential of

$$U = L \frac{di}{dt} = 0.3 \cdot 10^{-3} \cdot \frac{0.06}{10^{-6}} = 18 \text{ volts}$$

(See Figure 5.)

Since transformer 5 by the action of this voltage impulse would be caused to oscillate at its natural wave, damping means are provided in that both at the primary and the secondary end of the transformer the resistances 6 and 7 each of 7.5 k.-ohm are connected in parallel. The identical effect would be obtainable by means of a single resistance about one-half the said size and connected either at the primary end or at the secondary end. As a consequence, the impulse potential drops to around 10 v. However, inasmuch as this potential is inadequate for keying an ultra-short-wave transmitter, an ampli-

fier is added to the outfit illustrated in Figure 1. This circuit organization is shown in Figure 6 in which such parts as are shown also in Figure 1 are denoted by identical reference numerals. It will be seen that the impulse potential put out at the secondary end of the transformer 5 is impressed upon the grid of an amplifier tube 9 in which it is amplified to around 60 to 80 v. Contradistinct to the circuit scheme shown in Figure 1, the potential of the cathode of the diode tube which is negative in relation to the cathode potential of the pentode is automatically produced in that resistance 10 and a condenser 11 are included in the cathode lead of the pentode 1.

In case it is found that the impulses generated with this arrangement are not short enough, then the length of the impulses may be still further abbreviated to an appreciable extent by repeated differentiation of the plate current of the amplifier stage by the aid of another transformer of suitable dimensions, which has not been shown in the drawings.

Ultra-short-wave transmitters of this nature which are keyed by a device as hereinbefore disclosed are, for instance, used to advantage in connection with electrical altimeters which are predicated for their operation upon echo and reflection of signals. As known from practice, if perfect measuring results are to be obtained, it is necessary that the duration of the transmitted impulse should be short compared with its travel or transit time. Another practical field of application for the scheme of the invention is in connection with impulse direction-finding work.

In short, it will be evident that the arrangement of the invention may be usefully adopted wherever ultra-short-waves are used in practice.

What is claimed is:

In a system for generating impulses of a definite duration separated by intervals of a definite duration, an electron discharge device having an anode, a cathode and a control grid, a reactor, means for impressing alternating current voltages on said reactor, a resistance in series with said reactor connected between said control grid and cathode, a diode rectifier having an anode and a cathode, means connecting said rectifier anode to cathode impedance in shunt to said series reactor and resistance whereby voltages alternate half cycles of which are of different amplitude are set up on the anode and cathode of said rectifier, means connecting the anode of said rectifier to the control grid of said device, a source of potential having its positive terminal connected to the cathode of said device and its negative terminal connected to the cathode of said diode rectifier, said source of potential biasing said diode cathode relative to the cathode of said device by an amount sufficient to substantially cut off the positive portion of the cycles of said sinusoidal potentials, a transformer having a primary winding connected to the anode of said device and a secondary winding from which impulses initiated by the negative portions of the cycles of said sinusoidal potentials only may be derived, and resistances in shunt to the primary and secondary windings of said transformer.

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