

June 25, 1940.

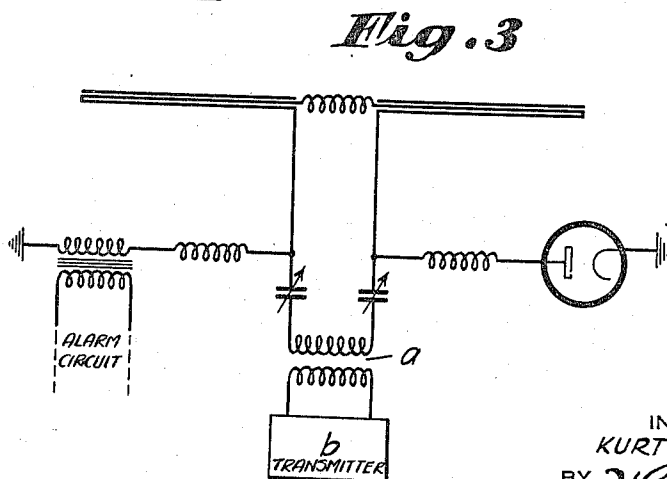
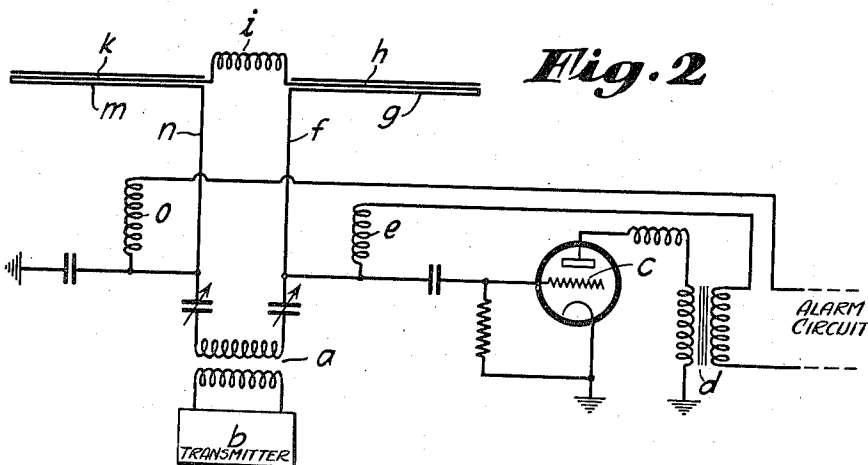
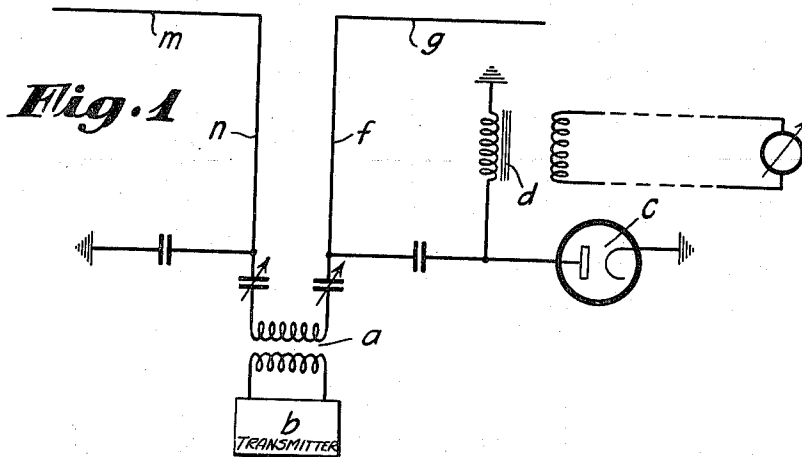
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2,205,881

ANTENNA SUPERVISORY SYSTEM

Filed Dec. 4, 1937

3 Sheets-Sheet 1



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Fig. 4

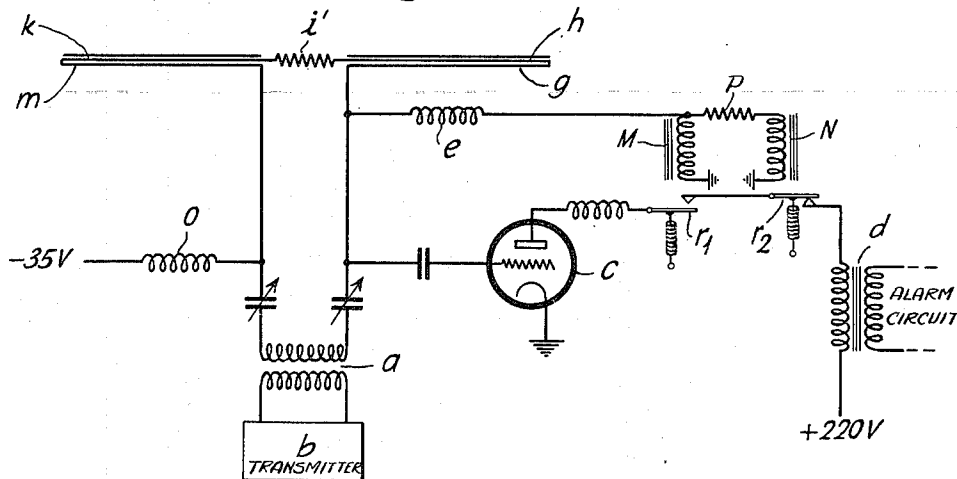
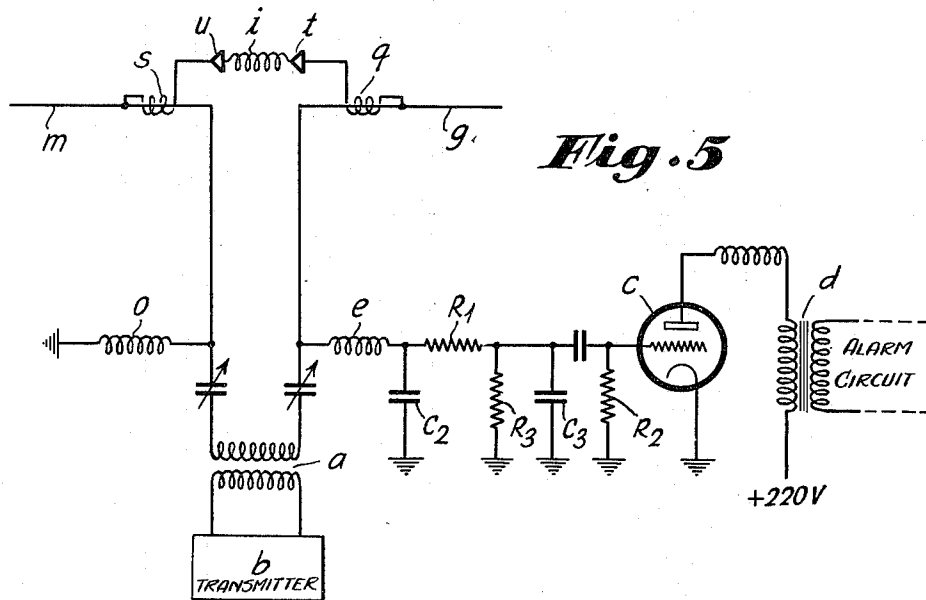


Fig. 5



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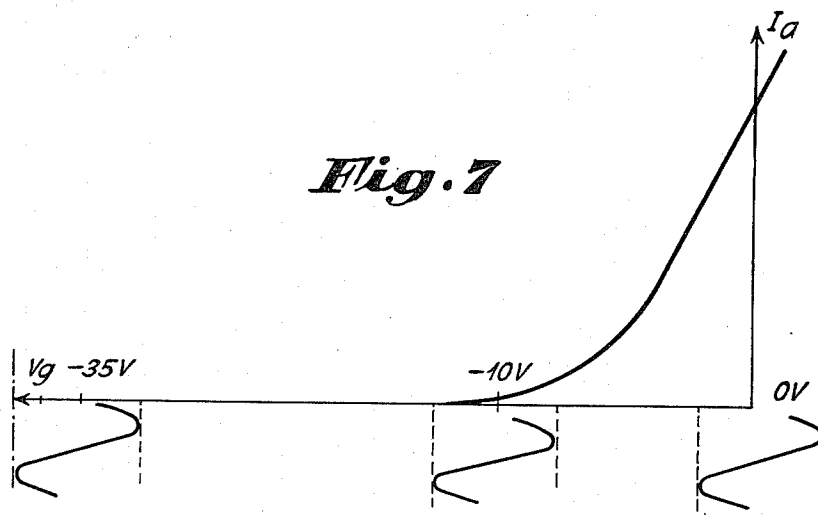
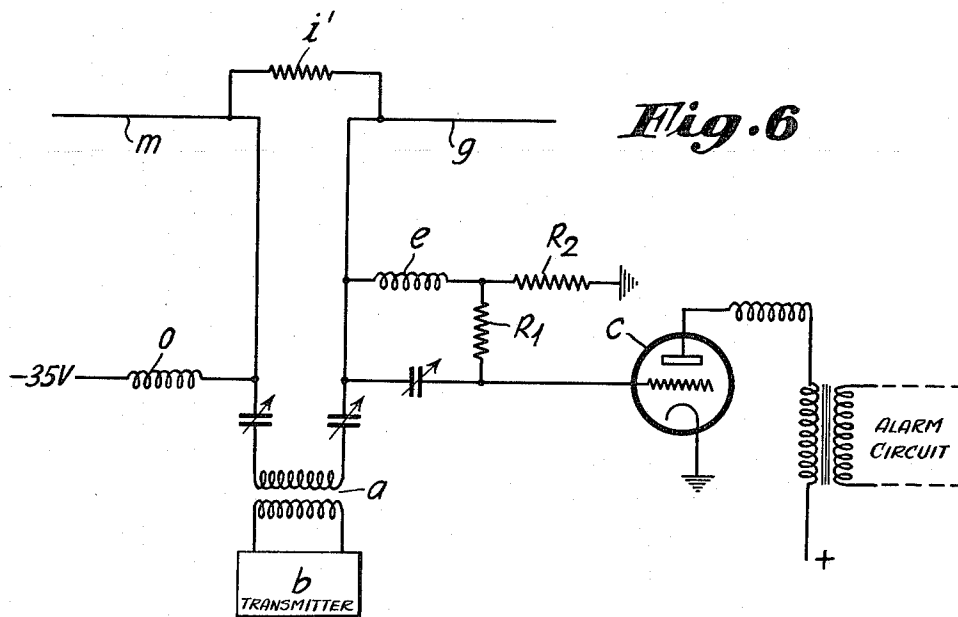
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ANTENNA SUPERVISORY SYSTEM

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3 Sheets-Sheet 3



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ANTENNA SUPERVISORY SYSTEM

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10 Claims. (Cl. 250—17)

For controlling the proper operation of beacon transmitters of landing signals, it is known to rectify at the output of the transmitter and input to the cable, a part of the high frequency energy and to apply the same to the controlling apparatus. The arrangements hitherto used to this end are far from fulfilling all requirements to be demanded of a control of the transmitters which are of great importance to the landing of aircraft. The back signalling arrangement, aside from the performance of the high frequency part of the transmitter and that of the modulation arrangement, is given the task of checking up the connection lines leading from the transmitter to the antenna across the cable.

Arrangements are known such as indicated in Fig. 1 in which the detuning of the transmitter output is to effect a receding of the back signalling voltage, whenever a connection line is disrupted. This arrangement has the serious disadvantage that the back signal voltage depends to a very high degree on the length of the cable and length of the dipole.

In accordance with my invention, therefore, it is proposed to rectify a part of the modulated high frequency of the transmitter and to apply said rectified high frequency to a controlling instrument such that the alternating audio-frequency potential is conducted either as such across the connection lines to be controlled, or else controlled by an auxiliary current passed across the connection lines to be controlled. In this way, all connection places can be checked up at which a control of existing connection is desired.

The idea of the invention permits of various solutions.

Several examples embodying the idea of the invention will be described with reference to the figures in which Fig. 2 shows an embodiment of my invention; Fig. 3 shows a modification of Fig. 2; Fig. 4 shows another embodiment of my invention; Figs. 5 and 6 show further modifications of my invention and Fig. 7 is a graph explanatory of the operation of the modifications shown in Figs. 5 and 6.

In Fig. 2 there is shown an especially simple arrangement for back signalling which would not, however, indicate with sufficient assurance a short circuit in one of the connection lines. At the one side of the output, *a*, of the transmitter circuit, *b*, placed symmetrically to ground, modulated high-frequency is derived and applied to a rectifier, *c*. The alternating audio-frequency potential produced in the plate circuit of this tube

is received by a transformer, *d*, and then conducted across the lines to be controlled. In the example of construction according to Fig. 2, this audio-frequency would have to be passed from the secondary side of the transformer, *d*, to the back signalling arrangement across choke, *e*, feed line, *f*, dipole end, *g*, return line, *h*, connection choke, *i*, line, *k*, dipole half, *m*, then second feed line, *n*, and choke, *o*. Since the lines, *h* and *k*, are arranged within the dipole having a tubular shape and are insulated therefrom as regards audio-frequency, a breaking off of the point of a dipole would cause an interruption of the audio-frequency back signalling circuit, thereby actuating a warning relay. Failing of the modulator or of the high-frequency energy would likewise cause the back signal voltage to drop to zero. When substituting the choke, *i*, by a resistor, or when placing a resistor in series to the choke, a short circuit of the cable or dipole produces a bridging of the resistor and hence an increase of the back signal voltage so that a short circuit can also be indicated in the controlling instrument. However, it is true that this case depends to a high degree on coincidence. In this example in place of the triode, *c*, also a simple diode may be used. In this case the circuit would have to be arranged as represented by Fig. 3.

Fig. 4 shows another example of construction by which in case of a short circuit as well as interruption, a dependable indication with the back signalling arrangement is rendered possible. In this case the operation is carried out with an auxiliary current which is passed across the connections of the entire installation to be checked up. Two relays, *M* and *N*, inserted in the circuit of said auxiliary current have a resting contact, *r*₁, and a working contact, *r*₂, placed in the plate circuit of the detector tube, *c*. While the relay winding of relay *M* is placed in series to the circuit formed by choke, *o*, dipole feed line, *n*, dipole half, *m*, line, *k*, resistor, *i'*, line, *h*, dipole half, *g*, dipole feed line, *f*, and choke, *e*, the relay winding *N* is connected to this circuit through a resistor, *p*. The two resistors, *i'* and *p*, should have approximately the same ohmic values. This arrangement functions in the following manner:

A part of the high-frequency energy coming from the transmitter, *b*, passes upon the grid of tube, *c*. In the plate circuit of this detector tube a transformer, *d*, is inserted which applies the audio-frequency potential to the back signalling arrangement. In the normal state of operation

the two contacts, r_1 and r_2 , are both closed. The auxiliary potential, for instance, derived from the grid voltage detector of -35 volts present in the transmitter, is conducted across the above mentioned connection lines and relay windings. Since ahead of the relay N the resistor, p , is placed, only the relay M will respond and close its resting contact, r_1 . Since the contact of relay N is designed as working contact it will likewise be in the closed position when the relay is not excited. An interruption in the connections causes stopping of the auxiliary current and hence a release of the resting contact, r_1 , at the relay M. A short circuit in the line of the circuit of the auxiliary current and which may cause for instance a bridging of the resistor, i' , entails a response of the relay N and hence the opening of the working contact, r_2 . In both cases the plate circuit of tube, c , will be interrupted so that owing to the stoppage of the audio-frequency control potential an alarm relay is put in operation. It is obvious that through this arrangement also the working performance of the transmitter and its modulator will be controlled.

A further possibility of practicing the invention resides in the arrangement according to Fig. 5. In this arrangement the two dipoles, m and g , have coupled thereto two current transformers, q and s , each connected with a detector, t and u , respectively. The audio-frequency potential furnished by the detectors, u and t , is applied to the grid of tube, c , through the three chokes, o , i and e , and condenser-resistor arrangement, R_1 , C_2 . The resistor R_3 serves for by-passing the direct current produced by the detectors. The high-frequency is blocked against the grid of the tube by means of the filter chain, C_2 , R_1 , C_3 . In case of a short circuit in the cable, the audio-frequency potential will be bridged and when the cable is interrupted it no longer arrives at the grid of the tube so that in both cases the back signal voltage collapses. Any kind of tube detectors or other detectors may be used as detectors, u and t .

Finally, an embodiment of the idea of the invention is also possible in accordance with Fig. 6. The resistors, i' , R_1 , and R_2 and the amplitude of the high frequency arriving at the grid of tube, c , are chosen such that when the arrangement is in the proper state of operation the grid biasing potential is such that the working point of the tube lies at the lower bend of the characteristic, for instance, at -10 volts. This is shown in the characteristic curve of Fig. 7 wherein the plate current I_a is plotted against the grid voltage V_g . In this working point, the tube has an optimum detector action. At the bridging of the resistor, i' , the tube would receive the entire negative bias potential of, for instance, -35 volts, so that the back signal voltage collapses in accordance with Fig. 7. In case of interruption in the connection lines to be controlled, the tube receives zero grid biasing potential or an appropriate low negative bias whereby the tube, according to Fig. 7, operates in the straight part of its characteristic and the audio-frequency back signal potential fails, owing to the absence of detection. In this case, however, an appreciable increase of the high-frequency potential at the grid of the tube in case of short circuit or interruption can be prevented only if a definite rule would be provided as regards the length of the cable and that of the dipole.

In the examples of construction according to

Figs. 5 and 6 the dipoles are shown schematically only but are understood to correspond with those shown in Figs. 2-4. Identical reference characters designate the same circuit elements.

The idea of the invention is not limited to the examples of construction stated above. These arrangements can be rendered more elaborate and can be modified.

I claim:

1. In combination with an antenna and a transmission line for connecting said antenna to a source of high frequency energy, means for rectifying a portion of said energy and applying it to a series circuit including one conductor of said transmission line, said antenna and the other conductor of said transmission line, and means responsive to a change of the current in said circuit for energizing an alarm.

2. In combination with an antenna and a transmission line for connecting said antenna to a source of modulated high frequency energy, means for rectifying a portion of said energy and applying it to a series circuit including one conductor of said transmission line, said antenna and the other conductor of said antenna and means responsive to a change of the current in said circuit for energizing an alarm.

3. In combination with a dipole antenna and a transmission line for connecting said antenna to a source of high frequency energy, a series circuit including one conductor of said transmission line, one half of said antenna, a resistor connecting the ends of said antenna, the other half of said antenna and the other conductor of said transmission line, means for applying control energy thereto and means responsive to the change of the current in said circuit for energizing an alarm.

4. In combination with a dipole antenna and a transmission line for connecting said antenna to a source of modulated high frequency energy, a series circuit including one conductor of said transmission line, one half of said antenna, a resistor connecting the ends of said antenna, and the other half of said antenna and the other conductor of said transmission line, means for rectifying a portion of said high frequency energy and applying it thereto and means responsive to a change of the current in said circuit for energizing an alarm.

5. In combination with a dipole antenna and a transmission line for connecting said antenna to a source of modulated high frequency energy, means for rectifying a portion of said energy and applying it to a series circuit including one conductor of said transmission line, one half of said antenna, a resistor connecting the ends of said antenna, the other half of said antenna and the other conductor of said transmission line and means responsive to a cessation of the current in said circuit for energizing an alarm.

6. In combination with a dipole antenna and a transmission line for connecting said antenna to a source of modulated high frequency energy, means for rectifying a portion of said energy and applying it to a series circuit including one conductor of said transmission line, one half of said antenna, a resistor connecting the extreme ends of said antenna, and the other half of said antenna and the other conductor of said transmission line and means responsive to a change of the current in said circuit for energizing an alarm and chokes in said series circuit for preventing the flow of high frequency energy to said last mentioned means.

7. In combination with a dipole antenna and a transmission line for connecting said antenna to a source of modulated high frequency energy, means for rectifying a portion of said energy and applying it to a series circuit including one conductor of said transmission line and one half of said antenna, a resistor connecting the ends of said antenna, the other half of said antenna and the other conductor of said transmission line, means responsive to a cessation of the current in said circuit for energizing an alarm and series condensers between said transmission line and said source for isolating said last mentioned means from said source of high frequency energy.
8. In combination with a dipole antenna comprising a pair of hollow tubes and a two conductor transmission line for connecting said antenna to a source of modulated high frequency energy, means for rectifying a portion of said energy and applying it to a series circuit including one conductor of said transmission line and one tube of said antenna, a resistor connecting the opposite ends of the tubes of said antenna and passing through said tubes, the other tube of said antenna and the other conductor of said transmission line and means responsive to a change of the current in said circuit for energizing an alarm.
9. In combination with a dipole antenna comprising a pair of hollow tubes and a two conductor transmission line for connecting said antenna to a source of modulated high frequency energy, means for rectifying a portion of said energy and

applying it to a series circuit including one conductor of said transmission line and one tube of said antenna, a resistor connecting the opposite ends of the tubes of said antenna and passing through said tubes, the other tube of said antenna and the other conductor of said transmission line, means responsive to a change of the current in said circuit for energizing an alarm, said last mentioned means including a pair of marginal relays connected in parallel, one of said relays having a normally actuated armature and the other of said relays having a normally released armature, and contacts closed by said armatures in their normal position in an alarm circuit.

10. In combination with a dipole antenna and a transmission line for connecting said antenna to a source of modulated high frequency energy, means for rectifying a portion of said energy and applying it to a series circuit including one conductor of said transmission line and one half of said antenna, a reactance connecting the ends of said antenna, the other half of said antenna and the other conductor of said transmission line, means responsive to a change of the current in said circuit for energizing an alarm, said last mentioned means including a thermionic discharge tube having its grid circuit connected to said series circuit and means responsive to a substantial change in the plate current of said tube for actuating said alarm.

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