

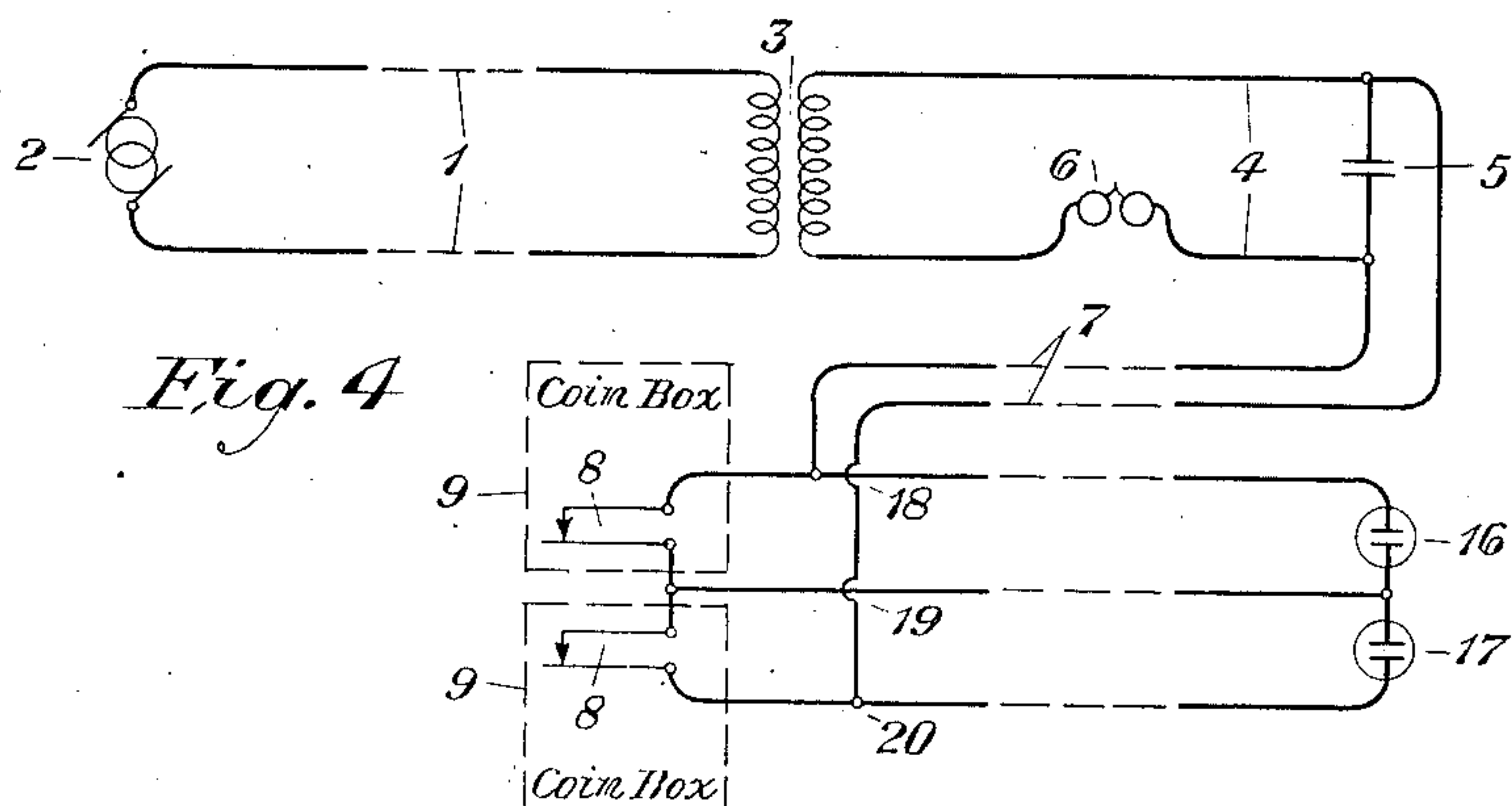
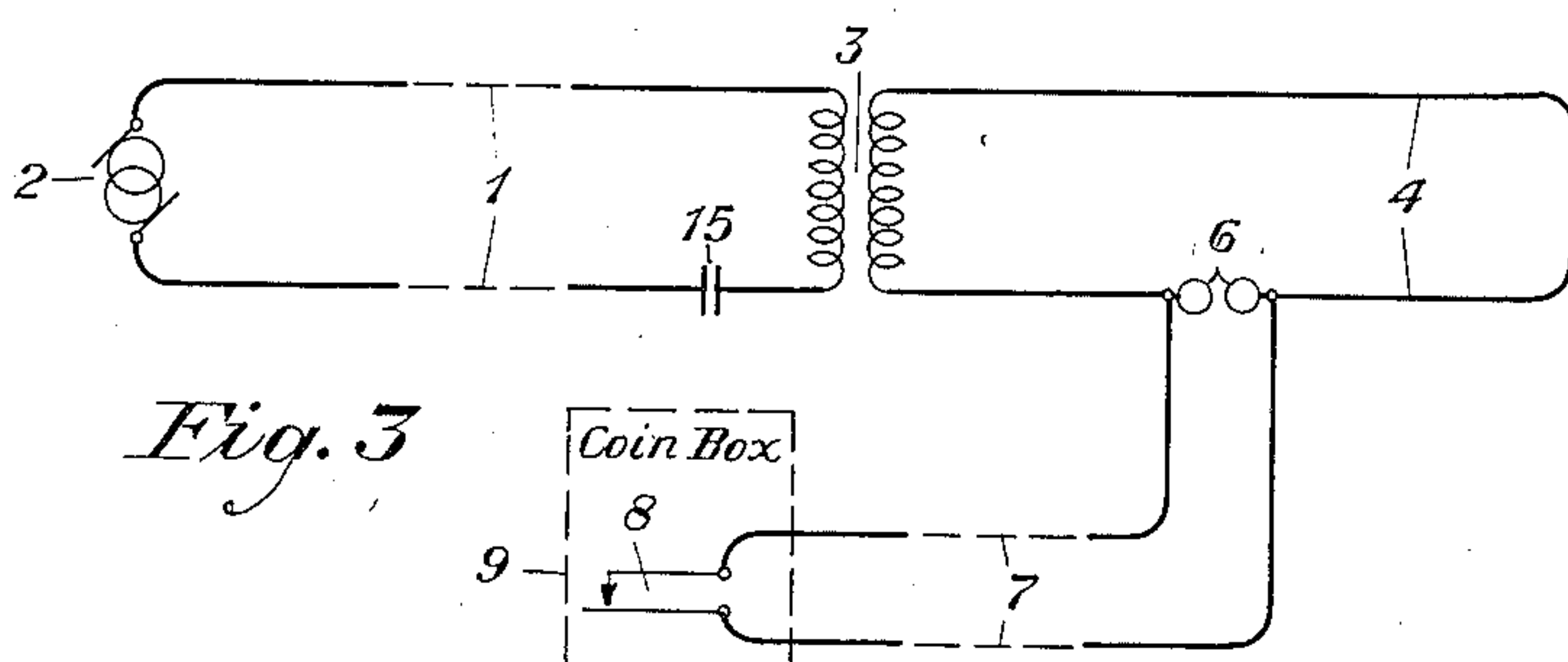
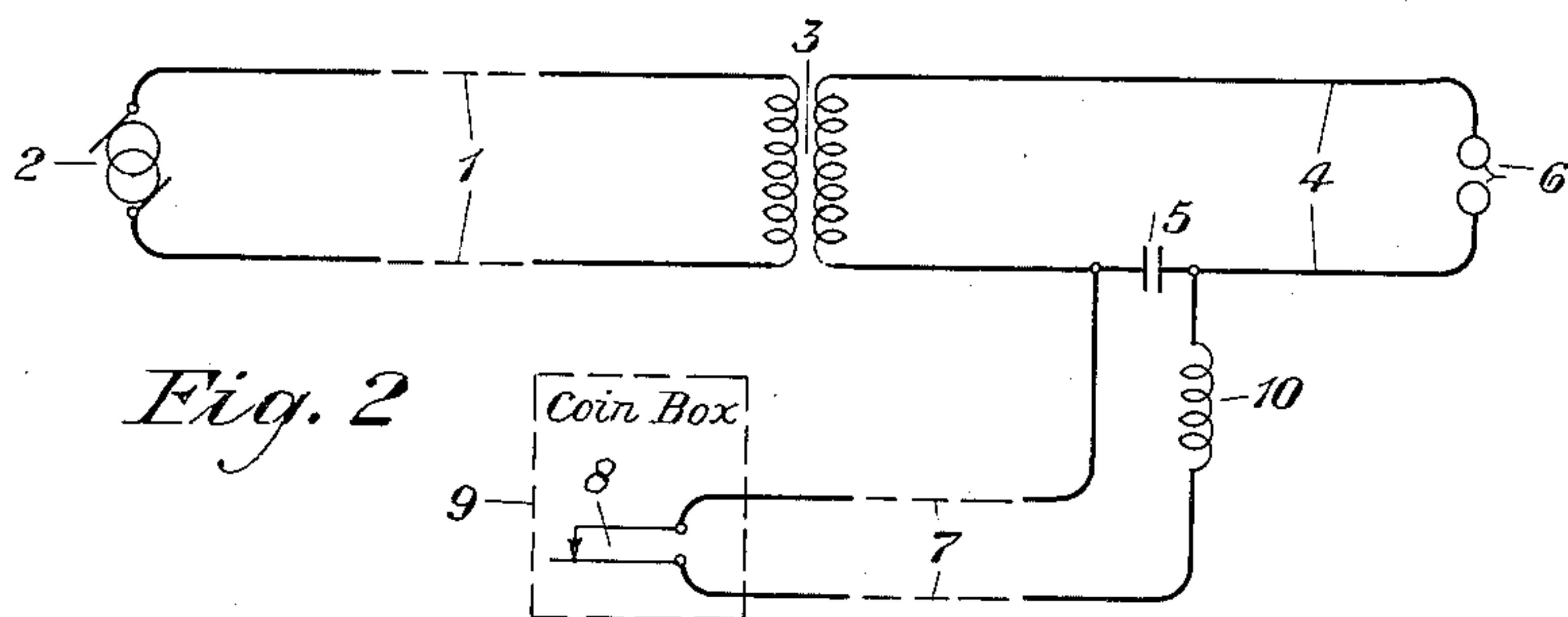
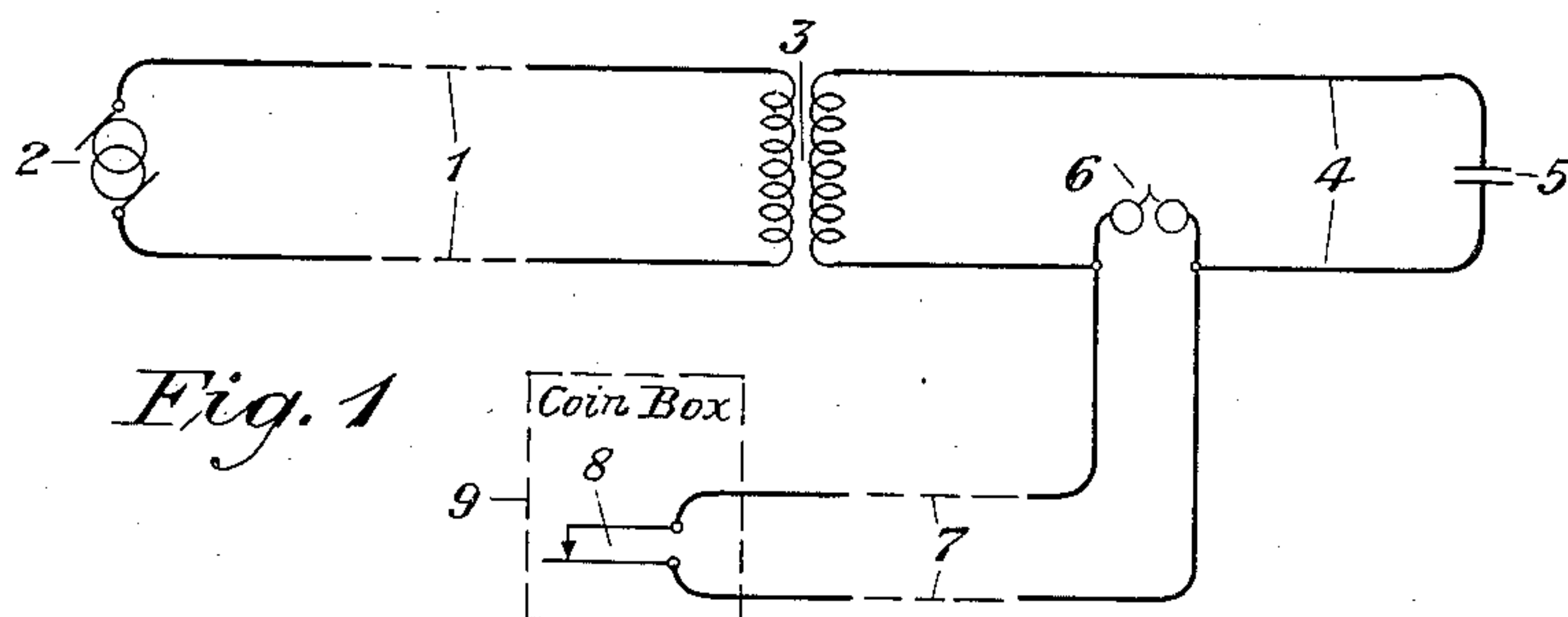
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ALARM CIRCUIT

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2,069,394

ALARM CIRCUIT

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5 Claims. (Cl. 177—314)

This invention relates to alarm circuits and more particularly to alarm circuits adapted to be associated with certain types of devices so that an alarm may be given in the event that such devices are tampered with.

A specific instance in which the alarm devices disclosed in this invention might be utilized would be in connection with coin boxes in telephone booths. It often happens that such coin boxes are tampered with or broken open by unauthorized persons. By connecting an alarm circuit of the type disclosed in this invention to the coin box an alarm may be given at any desired spot to indicate when the box or its associated equipment is being tampered with. Similar alarm circuit arrangements are shown in a copending application, Serial No. 695,054, filed October 24, 1933, in the name of F. E. Schmidt and in a copending application, Serial No. 695,055, filed October 24, 1933, in the name of E. R. Wood. The alarm circuit arrangements of the invention have the advantages that when the circuit is in its normal condition with the alarm not operated there will be a very small current drain from the supply circuit. However, when the alarm is operated the conductance of the alarm circuit is automatically greatly increased. Hence, more positive alarm action is provided. Another object of this invention is to provide for operating an audible signal common to a number of coin box alarm contacts and to provide an individual lamp signal associated with each coin box. A further object of the invention is to provide for safe operation of the alarm circuits over telephone wiring when the alarm circuit energy is obtained from power circuits. Other objects and features of the invention will appear more fully from the detailed description thereof hereinafter given.

The invention may be more fully understood from the following description together with the accompanying drawing. Figure 1 illustrates one form of the invention. Fig. 2 shows a modification of the circuit to still further reduce the current normally flowing in it. Fig. 3 shows another arrangement which provides for safe operation without the use of a current limiting transformer. Fig. 4 shows a different form of circuit disclosed in Fig. 1 and provides a number of coin box alarm circuits with individual lamp signals for each associated with the common audible signal.

In Fig. 1 is shown a circuit 1 which may include a source of alternating current 2. This circuit may be termed the current supply circuit. It will be connected through bell ringing transformer 3 to the alarm circuit 4. The circuit 4

will have serially included therein the alarm device 6 and the element of capacitance 5. The alarm device 6 may be a bell, buzzer or a telephone type ringer. The alarm device 6 necessarily includes a certain amount of inductance which as pointed out hereinafter is used to advantage in these arrangements. The alarm device 6 will normally be short-circuited by the circuit 7 which will be completed over contacts 8. These contacts may be fixed on the device 9 to be protected in any desired manner so that when the device is tampered with the contacts will be opened.

With the circuit in its normal condition the contacts 8 are closed. Under these conditions the alarm device 6 is short-circuited and will not be operated by current from the supply circuit 1. The capacitance of condenser 5 will be so chosen that the circuit 4 will have a large capacitive reactance and hence a low conductance to current from circuit 1. This feature affords the advantage that when the alarm is not operated, or under normal conditions, there will be a low current drain from the supply circuit 1. However, when the device is opened or tampered with the contact 8 will be opened. This may be arranged in any well known manner. When the contacts 8 are opened the short circuit 7 around the alarm device 6 is removed. The current from the supply circuit 1 will then operate the alarm device 6. As heretofore pointed out, the alarm device contains a certain amount of inductance. This inductance will, when short circuit 7 is removed, be added in series in circuit 4 with the condenser 5. The values of the inductance in device 6 and the capacity of condenser 5 should be so chosen that the circuit 4 will then be resonant at the frequency of source 2. This will greatly increase the conductance of the circuit over its normal condition and give much more powerful and positive operation of the alarm device 6.

If the alarm device comprises a bell or ringer suitable for operation on a 60-cycle A. C. supply source, the current in the secondary circuit when the switch 8 is open would be shown by the following equation:

$$I = \frac{E}{(R_T + jX_T) + (R_R + jX_R) - jX_C}$$

In this equation $(R_T + jX_T)$ represents the impedance of the transformer secondary which for purposes of this discussion may be neglected. $(R_R + jX_R)$ represents the impedance of the ringer, jX_C represents the impedance of the condenser and E is the open circuit voltage of

the transformer which may be assumed to be 50 volts. If X_R and X_C are made numerically equal, then the current is determined by the effective resistance R_R . Assuming that this is approximately 500 ohms, the operating current for the ringer would be .1 ampere.

Under normal conditions with the switch 8 closed, short circuiting the ringer 6, its impedance $R_R + jX_R$ does not appear in the equation and with a 1-mf. condenser having a capacitive reactance of 2650 ohms at 60 cycles the current would be .019 ampere. It will be seen that this arrangement requires a normal current drain of only $\frac{1}{5}$ the current required to operate the bell when the alarm system functions.

A modification of the arrangement shown in Fig. 1 is illustrated in Fig. 2. In this case the alarm contacts 8 are connected through leads 7 and an inductance 10 across condenser 5. When the alarm contacts are open the operating current for the ringer is as before, .1 ampere. However, under the normal condition with the alarm circuit closed the condenser 5 and the inductance 10 constitute a parallel resonant circuit which offers a very high impedance to the current flowing. If the impedance of the inductance 10 is represented by $R_L + jX_L$ and that of condenser 5 is $-jX_C$, and if X_C , X_L and X_R are all equal, current flowing when the alarm circuit is closed is given by the following formula:

$$I = \frac{E}{(R_T + jX_T) + (R_R + jX_R) + \left(\frac{X_L X_C}{R_L} - jX_C \right)}$$

As in the previous case, R_T and X_T may be neglected. R_L should be made as small as convenient, say 100 ohms. If X_L , X_C and X_R are each 2650 ohms, then the current with switch 8 closed is .0007 ampere, which is less than .01 of the operating current.

Fig. 3 shows another arrangement which is similar in principle to Fig. 1. In this case a condenser 15 is connected in series with the primary of the transformer 3. The transformer need not be of the bell ringing or current limiting type since a short circuit across its secondary will not materially change the primary current because of the high reactance of condenser 15. For a given ringer the condenser 15 may be made smaller than the condenser 5 of Figs. 1 and 2 since the ringer impedance is in effect stepped up by the transformer. Under normal conditions the condenser 15 limits the current to a small value and when the short circuit is removed from the ringer it produces a resonant condition which permits the required operating current to flow. The ratio between normal and operating current will be substantially the same as that which obtained in the case of Fig. 1.

Fig. 4 shows a further modification of Fig. 1 in which the switch 8 is arranged to short circuit the condenser 5 instead of the ringer 6. Several switches, 8, 8', etc., located at coin boxes 9, 9', etc., may be wired in series across leads 7 so that the alarm circuit functions to protect a number of coin boxes. Opening any one of the switches removes the short circuit from the condenser which resonates with ringer 6 to permit the required operating current to flow. Neon lamps 16 and 16' may be wired across switches 8 and 8' to indicate which of the switches has been opened. When one of the switches is opened, the voltage drop across condenser 5 is also impressed across the corresponding neon

lamp which breaks down, thus indicating that its associated switch has been opened.

It is pointed out that the alarm circuit of the invention will also operate if the conductors of circuit 7 are cut rather than opened at the contacts 8.

Obviously, the alarm circuit of the invention is capable of use with many other devices than coin boxes.

Accordingly, while the invention has been disclosed as embodied in certain specific arrangements which are deemed desirable, it is understood that it is capable of embodiment in many and other widely varied forms without departing from the spirit of the invention as defined by the appended claims.

What is claimed is:

1. An alarm circuit comprising a circuit including a source of alternating current, a signal device included in said circuit, a normally closed short circuit around said signal device, switching means for opening said short circuit, and means included in said alarm circuit for causing it to be non-resonant at frequencies from said source and to have a high capacitive reactance when said short circuit is closed and to be resonant at frequencies from said source when said short circuit is opened.

2. An alarm circuit comprising a circuit including a source of alternating current, a second circuit inductively connected to said first circuit, a signaling device comprising inductance included in said second circuit, means for closing a short circuit around said signaling device, and an element of capacitance included in said second circuit, the capacitance of said last mentioned element being such that when said short circuit is closed said second circuit will have a low conductance for said alternating current, the inductance of said signaling device being such that when said short circuit is opened the combination of said inductance and capacitance in series with each other in said second circuit will make said second circuit resonant at said alternating current frequency.

3. An alarm arrangement comprising a circuit including a source of alternating current, a second circuit inductively connected to said first circuit, a signaling device comprising inductance included in said second circuit, a device to be protected, a set of normally closed contacts associated with said device, means for closing a short circuit around said signaling device over said normally closed contacts; and an element of capacitance included in said second circuit, the capacitance of said last mentioned element being such that when said short circuit is closed said second circuit will have a low conductance for said alternating current, the inductance of said signaling device being such that when said short circuit is opened the combination of said inductance and capacitance in series with each other in said second circuit will make said second circuit resonant at said alternating current frequency.

4. An alarm circuit comprising a source of alternating current, a reactance device capable of being operated as a signal device included in said alarm circuit, a normally closed short circuit around said reactance device, switching means for opening said short circuit, and means included in said alarm circuit for causing it to be non-resonant at frequencies from said source and to present a high impedance to currents transmitted

thereto from said source when said short circuit is closed and to be resonant at frequencies from said source and to present a low impedance to said currents when said short circuit is opened
5 whereby said reactance device will be operated as a signal device.

5. An alarm circuit comprising a source of alternating current, a first reactance device and a second reactance device included in said alarm
10 circuit, one of said reactance devices comprising capacitive reactance and another of said reactance devices comprising inductive reactance, said last mentioned reactance device being capable of being operated as a signal device and a normally

closed short circuit around one of said reactance devices, said reactance devices being so proportioned that when said short circuit is closed said alarm circuit will be non-resonant at frequencies from said source and will present a high im-
5 pedance to currents applied thereto from said source and when said short circuit is opened said alarm circuit will be resonant at frequencies from said source and will present a low impedance to currents applied thereto from said source where-
10 by said inductive reactance device will be operated as a signal device.

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