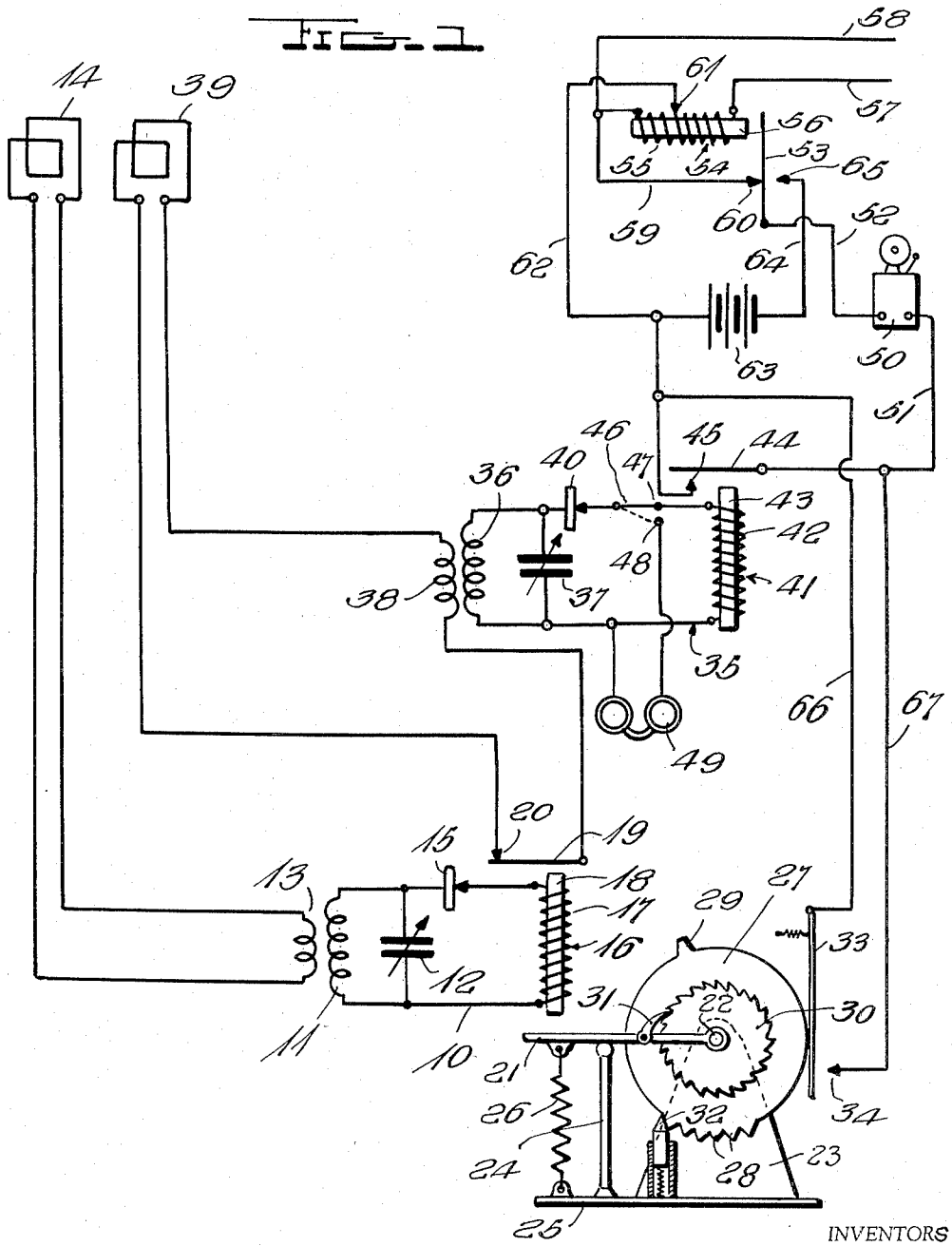
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RADIO CONTROLLED WARNING SYSTEM

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Fig. 1



INVENTORS
JAMES N. McCULLOUGH,
SIMON HALLE,
JOHN H. WALTER,
BY Jacobi & Jacobi
ATTORNEYS

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FIG. 2

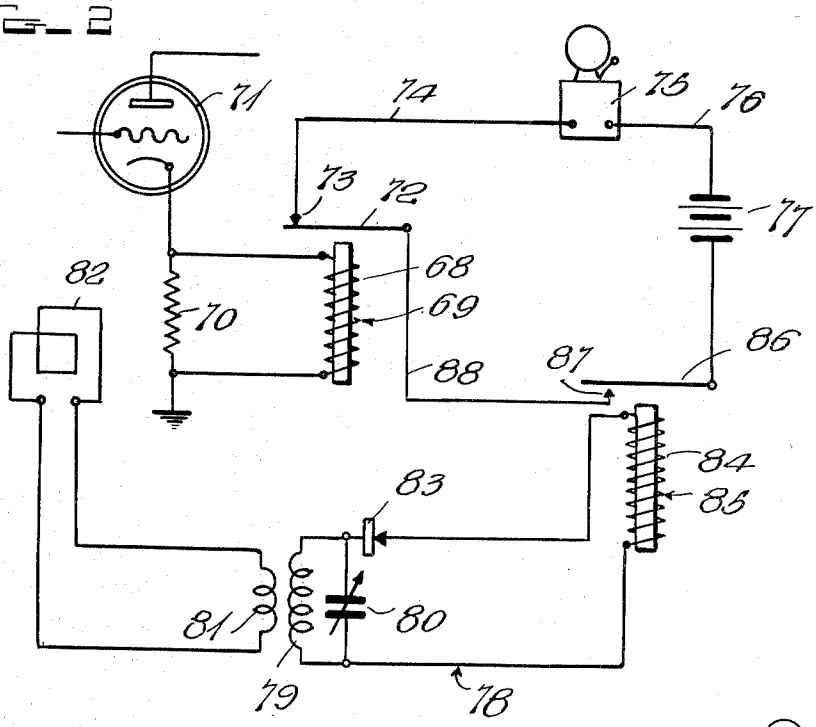
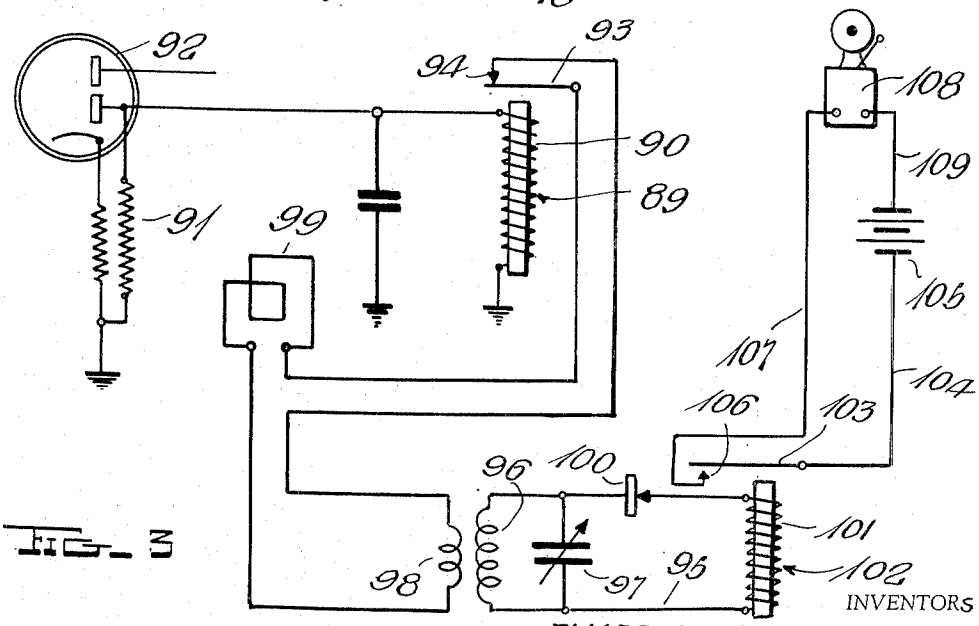


FIG. 3



INVENTORS
JAMES N. McCULLOUGH,
SIMON HALLE,
JOHN H. WALTER,
BY Jacobi & Jacobi
ATTORNEYS

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2,699,493

RADIO CONTROLLED WARNING SYSTEM

James N. McCullough and Simon Halle, Colorado Springs, and John H. Walter, Denver, Colo., assignors of ten and seventy-five one-hundredths to Leonard V. B. Sutton, three and fifty-eight one-hundredths to Robert L. Spurgeon, and fourteen and thirty-three one-hundredths to Joseph H. Rohrer, all of Colorado Springs, Colo.

Application December 26, 1951, Serial No. 263,427

19 Claims. (Cl. 250—2)

This invention relates to communications and more particularly to a system for warning the general populace of impending enemy action. As is well known modern warfare contemplates the use of large fleets of aircraft for bombing the civilian population and manufacturing plants of an enemy country and it therefore becomes imperative that some means be provided to adequately warn the general populace in order that they may seek shelter and take other desired protective measures.

Heretofore attempts have been made to give such warning by means of audible signals, such as sirens located at strategic points. This has necessitated the use of relatively large sirens which require powerful motors to drive the same and consequently the cost of such sirens has been relatively high with the result that if proper audible coverage of a given area is to be had, many such sirens are necessary and the total cost of such a system is prohibitive. A further disadvantage of such audible systems is the fact that the sound waves emanating from these sirens, may be deflected or absorbed by buildings, hills or other obstacles, with the result that numerous dead spots may exist, with a consequent failure of the system in these parts.

Obviously some system whereby individual dwellings, places of business, such as offices, factories and the like, and any other places might be provided with means for warning persons residing in, or congregated in these places of impending enemy action, would be highly desirable, but with the warning systems heretofore known, this has been impractical due to the relatively high cost of such systems and the installation thereof, as well as the impracticality of placing the responsibility for providing a warning for each person or group of persons, on the government be this municipal or national.

It is therefore apparent that some system whereby each individual or group of individuals may provide themselves with an adequate warning system which may be controlled and actuated from some central source and which at the same time is relatively inexpensive and presents no problems in installation or maintenance which could not be handled by the average person, is highly desirable and represents a distinct contribution to the security and welfare of a country at war or likely to be at war in the future.

Briefly stated, the invention contemplates the provision of a warning system to be installed in individual dwellings, offices, stores, factories or other places where people live or congregate and the invention further contemplates, the use of relatively simple radio receivers which could either be used in conjunction with existing broadcast receivers, or could be provided as self-contained individual units which would not require the modification of any existing radio equipment. These would only require the installation of suitable directional antennas, which may be indoors or outdoors as the case may be and depending somewhat upon the location and field strength of the broadcasting station to which this apparatus would be tuned.

It is further contemplated that a particular broadcasting station in each area would be designated as a key station which station would probably be the most powerful in that area and that this station would normally operate on its regular assigned frequency, except during periods of actual attack, or impending attack. It is proposed that this key station would also be assigned an emergency frequency which could be used if desired during attack

or impending attack and the warning system of this invention is of such nature that the same would be actuated either by interrupting the carrier of the key station a predetermined number of times when broadcasting on its regular assigned frequency and prior to leaving the air for the duration of the attack, or would be operated by the key station shifting to its emergency frequency.

The warning system of this invention, includes means for actuating an audible alarm which may obtain its power from the regular domestic power lines but in the event of failure of such power will automatically change to self-contained battery operation. If it is desired to incorporate the warning system of this invention in existing radio apparatus, this may be done by appropriate modification of either an AM or FM receiver or the system may, if desired be incorporated in an existing television receiver. In the latter cases, of course, the operation of the system would be dependent upon the domestic power supply to the radio or television apparatus.

It is accordingly an object of the invention to provide a relatively simple warning system, which may be constructed of readily available conventional, electronic and electrical components and which may be installed in any desired location and operate entirely independently of existing radio or television equipment.

A further object of the invention is the provision of a warning system which is entirely self-contained, requires no outside power source, and which is controlled from a local radio broadcasting station.

Another object of the invention is the provision of a warning system which is controlled from a local radio broadcasting station, operating either on its assigned regular frequency or on a predetermined emergency frequency.

A further object of the invention is the provision of a warning system including an audible alarm and incorporating means to silence such alarm at will and to permit the receipt of instructions or other information from the radio broadcasting station from which the warning system is controlled.

A still further object of the invention is the provision of a warning system including an audible alarm, the operation of which is controlled from a local radio broadcasting station, and in which means are provided to prevent inadvertent actuation of the alarm in the event the broadcasting station leaves the air due to power failure or other mishap.

Further objects and advantages of the invention will become apparent from the following description taken in conjunction with the accompanying drawings, wherein:

Fig. 1 is a schematic diagram of the basic circuit of the warning or alarm system of this invention, and showing two radio receivers, one for receiving the regular assigned frequency of a radio broadcast station and the other for receiving an emergency frequency of such station as well as the means for actuating an audible alarm, either from the domestic power lines or from a self-contained local battery;

Fig. 2, a schematic diagram showing the warning system of Fig. 1 incorporated in either an FM or a television receiver; and

Fig. 3, a schematic diagram similar to Fig. 2, and showing the basic warning system incorporated in a conventional AM radio receiver.

With continued reference to the drawing, there is shown schematically in Fig. 1, a warning system constructed in accordance with this invention and incorporating a radio receiver 10, having an inductance 11 tuned by a variable condenser 12 to the regular assigned frequency of the radio broadcast station which is selected as the key station in the area in which the warning system is to be utilized. Inductively coupled to the coil 11 by a coupling coil 13 is a directional antenna 14 which may be of the loop type or any other desired type of directive antenna. This directive antenna 14 is properly oriented to receive signals from the key broadcast station.

Incorporated in the reeciving circuit with the inductance 11 and the variable condenser 12 is a crystal detector 15 and the output of this circuit is connected to a double relay 16 having a coil 17 surrounding a core 18. This core and coil forms the electro-magnet of the double relay 16

which includes an armature 19 and a fixed contact 20. The armature 19 is normally held in engagement with the contact 20 by means of a tension spring or other equivalent means not shown.

The opposite end of core 18 serves to attract and actuate an armature 21 which may be pivotally mounted on a pin or shaft 22 carried by a frame 23. The armature 21 is normally biased away from the core 18 and into engagement with a stop 24 mounted on the base 25 which carries the frame 23 by a tension spring or other equivalent means 26. Rotatably mounted on the shaft 22 is a disc 27 having a plurality of teeth 28 on a portion of the periphery thereof and a single projection 29 extending from another portion of the periphery of the disc 27. If desired, the projection 29 may be adjustably mounted on the disc 27 in order to locate the same in any desired angular position. Also carried by the disc 27 for rotation therewith is a ratchet-wheel 30 and a pawl 31 is carried by the armature 21 for engagement with the teeth of the ratchet-wheel 30. Also mounted on the base 25 is a spring-pressed detent 32 which engages the teeth 28 on the periphery of disc 27. Pivotally mounted adjacent the disc 27 is a movable contact arm 33 which is adapted to engage a fixed contact 34 for a purpose to be presently described.

The above described structure constitutes a pulse-type relay which operates as follows: Upon energization of the coil 17 the armature 21 is moved towards the core 18 against the action of spring 26 and by reason of the engagement of pawl 31 with the teeth of ratchet-wheel 30 the disc 27 is rotated a distance equal to the distance between two adjacent teeth 28 on the periphery of disc 27. The disc 27 is retained in this advanced position by engaging the detent 32 with the teeth 28. Upon deenergization of the coil 17 the armature 21 returns to its original position in engagement with the stop 24 and upon the coil 17 being again energized the disc 27 is advanced another step. It will thus be seen that with the directive antenna 14 and the receiver 10 connected thereto receiving a continuous signal from the key station, the coil 17 will remain energized and the disc 27 will only be advanced one step. Should the carrier of the key station being received by the antenna 14 and the receiver 10 connected thereto be interrupted a predetermined number of times the disc 27 will be intermittently advanced until the projection 29 engages the movable contact arm 33 and moves the same into engagement with the fixed contact 34. As shown in Fig. 1, five spaces are provided between the teeth 28 and consequently it will be necessary to interrupt the carrier of the key station five times in order to actuate the movable contact 33. However, any desired number of teeth 28 may be provided, it only being necessary that all of the warning systems in a given area be provided with the same number of teeth 28 in order that they will all be actuated by the interruption of the carrier of the key station, the same predetermined number of times.

Means may also be provided in the form of a spring or electric motor or any other suitable operating means for returning the disc 27 and projection 29 carried thereby to their original position after a predetermined time interval, in order that the movable contact 33 will not be actuated by the key station leaving the air and resuming broadcasting in the course of normal operation.

While one form of pulse-type relay usable in the warning system of this invention has been described above, it is understood that this is for illustrative purposes only and that any suitable pulse-type relay and any suitable mechanism for resetting of the same to original position, which will operate as above described, may be utilized in this system without in any way altering the principles thereof or affecting the operation. Since this pulse-type relay is only shown and described in order to provide a clear understanding of the operation of the system, it is not considered necessary to show or describe the specific details of the reset mechanism.

The warning system of this invention as shown in Fig. 1, also includes a second radio receiver 35 having an inductance 36 tuned by a variable condenser 37 to the emergency frequency of the key broadcast station. Coil 36 is inductively coupled by a coupling coil 38 to a directive antenna 39 which is oriented to receive signals from the key broadcast station. The antenna circuit between coupling coil 38 and the antenna 39 includes the fixed contact 20 and armature 19 of the relay 16. The

armature 19 being moved away from fixed contact 20 upon energization of the coil 17 of relay 16 by the output of radio receiver 10 thereby rendering the receiver 35 inoperative due to opening of the antenna circuit.

Receiver 35 is provided with a crystal detector 40 and the output of this receiver is connected to a relay 41 having a coil 42 surrounding a core 43 to form an electromagnet. Relay 41 is provided with an armature 44 and a fixed contact 45. Armature 44 is normally out of engagement with contact 45.

Incorporated in the output circuit of receiver 35 is a single-pole, double-throw switch 46 having a pair of contacts 47 and 48. Contact 47 is connected to the coil 42 of relay 41 and contact 48 is connected to a pair of head-phones 49 although if the output of receiver 35 is sufficient contact 48 may be connected to a loudspeaker.

Relay 41 in conjunction with the armature 33 and fixed contact 34 forming part of the relay 16 serves to control the operation of an alarm circuit incorporating a bell or other suitable audible alarm 50. This bell being connected through a conductor 51 with the armature 44 of relay 41 and through another conductor 52 with the armature 53 of a relay 54. Relay 54 is provided with a coil 55 surrounding a core 56 one end of coil 55 being connected to one side 57 of a source of electrical energy such as the conventional domestic power line. The opposite side 58 of the power line is connected to the opposite end of coil 55 and through a conductor 59 with a fixed contact 60 which when the coil 55 is energized is in engagement with the armature 53 of the relay 54.

The coil 55 of relay 54 is provided with a tap 61 which is connected through a conductor 62 with the fixed contact 45 of the relay 41 and also with one side of a battery 63. The opposite side of battery 63 is connected through a conductor 64 with a fixed contact 65 also forming part of the relay 54 and engageable with the armature 53 when the coil 55 of relay 54 is deenergized due to failure of the domestic power line. The fixed contact 45 of relay 41 is also connected through a conductor 66 with the movable contact arm 33 of relay 16 and the armature 44 of relay 41 is connected through a conductor 67 with the fixed contact 34 of the relay 16.

In operation and assuming the domestic power line represented by conductors 57 and 58 to be energized, and further assuming that the key broadcasting station is operating on its regular assigned frequency, the coil 55 of relay 54 will be energized and the armature 53 will be in engagement with fixed contact 60. This will supply electrical energy to one side of the alarm or bell 50 through the conductor 59, fixed contact 60, armature 53 and conductor 52. At the same time the radio receiver 10 will be in operation thus energizing the coil 17 of relay 16 which will move the armature 19 out of engagement with the fixed contact 20 and thus render the second radio receiver 35 inoperative even though the key broadcast station might be broadcasting or testing on its emergency frequency. Since the second receiver 35 is inoperative due to opening of the antenna circuit the relay 41 will be deenergized and the armature 44 will be out of engagement with the fixed contact 45 to open the electrical circuit to the bell 50 from the tap 61 on the coil 55 of relay 54 and from the battery 63. The movable contact arm 33 of the relay 16 will likewise be out of engagement with the fixed contact 34 and the supply of electrical energy to the bell 50 through conductors 66 and 67 from either the tap 61 or the battery 63 will be interrupted.

Should the key broadcasting station be notified of impending enemy action, such station may be either instructed to cease broadcasting entirely or to shift to the predetermined emergency frequency. Should the key broadcasting station be instructed to leave the air, prior to completing this operation the carrier would be interrupted five times or any other desired number of times in accordance with the number of teeth 28 on the disc 27, which would result in actuation of the armature 21 to progressively rotate the disc 27 and move the projection 29 into engagement with the movable contact arm 33 which would result in engagement of this arm with the fixed contact 34 thus closing the circuit to the bell 50 and causing operation of the same.

After interrupting the carrier the required number of times the key broadcasting station would leave the air and the bell 50 would continue to operate for a predeter-

mined length of time at the expiration of which the re-set mechanism would move the disc 27 and projection 29 back to original position, thus opening the circuit to the bell 50.

It is to be noted that during the above described operation the second radio receiver 35 is inoperative due to opening of the antenna circuit by operation of the relay 16 and should the key broadcasting station be instructed to shift to the emergency frequency, the receiver 10 would become inoperative, the coil 17 of the relay 16 deenergized and the armature 19 moved into engagement with the fixed contact 20 thus closing the antenna circuit to the second receiver 35 thereby rendering the same operative. With the switch 46 in position to close the circuit through contact 47 to coil 42 of relay 41, coil 42 would be energized to move the armature 44 into engagement with the fixed contact 45 whereupon the circuit to the bell 50 would be closed thus actuating the same to give the alarm. The alarm 50 may be shut-off by moving the switch 46 to open the circuit to coil 42 of relay 41 and to close the circuit through contact 48 to head-phones 49 whereupon, instructions and other information may be received from the key broadcasting station.

The above description of operation assumes that the domestic power supply is in operating condition but in the event of failure of this supply either before or during enemy action, the coil 55 of relay 54 would be deenergized resulting in movement of the armature 53 out of engagement with the fixed contact 60 and into engagement with the fixed contact 65 which would introduce the battery 63 into the supply circuit to the bell 50. The operation of the bell would then be controlled as described above, either from the receiver 10 by appropriate interruption of the carrier from the key broadcasting station or by operation of such station on the emergency frequency, with the consequent utilization of the second radio receiver 35.

It will be seen that by the above described invention, there has been provided a warning system which is not dependent on any outside power source, which is extremely simple and economical to construct and install, thereby resulting in little if any maintenance and providing equipment which may be depended upon to operate promptly and efficiently when required. Furthermore, this warning system does not require the use of modification of existing radio or television receivers and may be installed wherever needed regardless of whether outside electrical power is available or not. The equipment may be constructed from relatively inexpensive and readily available electronic and electrical components and consequently the equipment constituting this warning system is susceptible to mass production and represents a practical and economical solution to the problem of providing an adequate warning system for installation in private dwellings, or any other desired location.

The warning system of this invention may also be utilized in connection with existing FM or television receivers and the same could either be incorporated into the actual receiver itself or be supplied as a separate unit to be plugged into the receiver by means of a simple modification.

Such a system is shown schematically in Fig. 2 of the drawing and in this case the FM or television receiver takes the place of the receiver 10 shown in Fig. 1, and described above. As shown in Fig. 2, the coil 68 of a relay 69 is connected across the cathode resistor 70 of the limiter tube 71 of the FM or television receiver. The relay 69 is provided with an armature 72 which is normally in engagement with a fixed contact 73 connected through a conductor 74 with one side of a bell or other alarm 75. The opposite side of bell 75 is connected through a conductor 76 with one side of a battery 77.

Also incorporated in this system is a radio receiver 78 having an inductance 79 tuned to the emergency frequency of the key broadcasting station by a variable condenser 80. Coil 79 of receiver 78 is inductively coupled by means of a coupling coil 81 with a directive antenna 82 which is oriented to receive signals from the key broadcasting stations. The receiver 78 is also provided with a crystal detector 83 and the output of this receiver is connected to the coil 84 of a relay 85. Relay 85 is provided with an armature 86 connected to the opposite side of battery 77 and with a fixed contact 87 connected through a conductor 88 with the armature 72 of relay 69.

In operation and assuming the key broadcasting station to be operating on its regular assigned frequency, the voltage drop across the cathode resistor 70 of the limiter tube 71 will energize the coil 68 of relay 69 and hold the armature 72 out of engagement with the fixed contact 73 thus opening the circuit to the bell 75. In the event the key broadcasting station is notified to leave the air and shift to the emergency frequency because of impending enemy action the coil 68 of relay 69 will be deenergized thus allowing the armature 72 to move into engagement with the fixed contact 73 thereby closing one side of the electrical supply circuit to the bell 75. Upon shifting to the emergency frequency the radio receiver 78 will become operative, thus energizing the coil 84 of relay 85 and moving the armature 86 into engagement with the fixed contact 87 thereby completing the electrical supply circuit to the bell 75 and resulting in operation thereof.

In a similar manner the warning system may be incorporated in a conventional AM broadcast receiver, either as an integral part thereof, or as a unit to be plugged into the same after suitable modification. This system being shown schematically in Fig. 3 of the drawing. This system utilizes a high impedance relay 89 having a coil 90 connected between ground and the source of AVC voltage developed across the AVC load resistor 91 of the detector tube 92. The relay 89 is provided with an armature 93 and a fixed contact 94.

Also utilized in this system is an auxiliary radio receiver 95 having an inductance 96 tuned to the emergency frequency of the key broadcasting station by a variable condenser 97. The coil 96 is inductively coupled by a coupling coil 98 to a directive antenna 99 oriented to receive signals from the key broadcasting station. Also connected in the antenna circuit of receiver 95 is the armature 93 and fixed contact 94 of relay 89. The receiver 95 is provided with a crystal detector 100 and the output of this receiver is connected to the coil 101 of a relay 102.

The relay 102 is provided with an armature 103 which is connected through a conductor 104 with one side of a battery 105 and a fixed contact 106 which is connected through a conductor 107 with one side of a bell or other suitable alarm 108. The opposite side of bell 108 is connected through a conductor 109 with the other side of battery 105.

In operation and assuming the key broadcasting station to be conducting normal operations on its regular assigned frequency, the AVC voltage developed in the regular broadcast receiver energizes the coil 90 of relay 89 thus holding the armature 93 out of engagement with the fixed contact 94 and opening the antenna circuit to the receiver 95. Upon being notified of impending enemy action the key broadcasting station will shift to the predetermined emergency frequency whereupon the coil 90 of relay 89 will be deenergized and the armature 93 will move into engagement with the fixed contact 94 thus closing the antenna circuit to the receiver 95 and energizing the coil 101 of relay 102. This will result in moving the armature 103 into engagement with fixed contact 106 which will close the electrical supply circuit to bell 108 and cause operation of the same. Obviously shifting of the key station back to its regular assigned frequency will cause the bell 108 to cease operation.

If desired the pulse-type relay described above in conjunction with the system shown in Fig. 1, may be incorporated in the systems shown in Figs. 2, and 3, and likewise the alarm circuit which permits utilization of either the domestic power supply or a local battery to energize the bell or other alarm may be utilized.

It is presumed that the system of Fig. 1 will be designed to operate within the standard broadcast band of frequencies which are relatively low and consequently two separate directive antennas are employed in order to minimize interference from other stations and also to prevent reflected signals from initiating operation of the warning system. A directive antenna is also incorporated in the system of Figs. 2 and 3, for the emergency receivers 78 and 95 but in these systems there is no danger of inadvertent operation of the warning system due to interfering or reflected signals since the systems are not operable unless the key station ceases operation on its

regular assigned frequency and shifts to the emergency frequency. The directive antennas in these systems however are advantageous in providing a relatively high signal input to the receivers.

If the warning systems of this invention are to be utilized in rural areas or other locations where the field strength of the key broadcasting station is relatively low suitable amplifiers may be incorporated in the receivers to provide adequate output for energizing and actuating the various control-relays. Likewise, if desired, the warning systems of this invention may be utilized to control the operation of equipment other than an alarm bell such as tuning other radio equipment, initiating the operation of fire detection apparatus, for controlling the operation of ventilating or air-conditioning equipment associated with bomb-shelters and the like, for initiating the operation of emergency electrical power supplies or for any other purposes to which the apparatus and systems of this invention might be adapted.

It will be obvious to those skilled in the art that various changes may be made in the invention without departing from the spirit and scope thereof, and therefore the invention is not limited by that which is shown in the drawing and described in the specification but only as indicated in the appended claims.

What is claimed is:

1. A radio controlled warning system comprising a radio receiver tunable to the regular frequency of a key broadcasting station, a second radio receiver tunable to an emergency frequency of said broadcasting station, a normally open relay having two contacts connected to the output of said second receiver, a power source, an alarm connected to one side of said power source, the opposite side of said power source being connected to one contact of said normally open relay and the opposite side of said alarm being connected to the other contact of said normally open relay and means connected to said first mentioned receiver and operable upon energization of said first mentioned receiver by a signal to render said alarm inoperative whereby upon interruption of the regular frequency carrier of said broadcasting station and upon said broadcasting station shifting to said emergency frequency said second receiver will be energized to operate said normally open relay to close the circuit to said alarm.

2. A radio controlled warning system comprising a radio receiver tunable to the regular frequency of a key broadcasting station, an antenna coupled to said receiver, a second radio receiver tunable to an emergency frequency of said broadcasting station, an antenna coupled to said second receiver a normally open relay having two contacts connected to the output of said second receiver, a power source, an alarm connected to one side of said power source, the opposite side of said power source being connected to one contact of said normally open relay and the opposite side of said alarm being connected to the other contact of said normally open relay and means connected to said first mentioned receiver and operable upon energization of said first mentioned receiver by a signal to render said alarm inoperative whereby upon interruption of the regular frequency carrier of said broadcasting station and upon said broadcasting station shifting to said emergency frequency said second receiver will be energized to operate said normally open relay to close the circuit to said alarm.

3. A radio controlled warning system comprising a radio receiver tunable to the regular frequency of a key broadcasting station, an antenna coupled to said receiver, a relay connected to the output of said receiver, a movable contact arm, a fixed contact engageable by said contact arm, means to move said movable arm into engagement with said fixed contact upon intermittent energization of said relay, a second radio receiver tunable to an emergency frequency of said broadcasting station, an antenna coupled to said second receiver through said contact arm and said fixed contact of said relay whereby upon energization of said relay the antenna circuit of said second receiver is opened to render the same inoperative, a normally open relay connected to the output of said second receiver, a battery, an audible alarm connected to one side of said battery, the opposite side of said battery being connected to one contact of said normally open relay and to said contact arm and the opposite side of said alarm being connected to the other contact of said normally open relay and to said fixed contact whereby upon interruption of the regular frequency carrier of said broadcasting station a predetermined number of times said contact arm will move into engagement with said fixed contact to close the circuit to said alarm or upon said broadcasting station shifting to said emergency frequency said first mentioned relay will be deenergized to render said second receiver operative and said normally open relay will operate to close the circuit to said alarm.

4. A radio controlled warning system comprising a radio receiver tunable to the regular frequency of a key broadcasting station, an antenna coupled to said receiver, a relay connected to the output of said receiver including an electromagnet, a fixed contact, an armature normally in engagement with said fixed contact but movable out of engagement therewith under the action of said magnet, a movable contact arm, a second fixed contact engageable by said contact arm, means to move said movable arm into engagement with said second fixed contact upon intermittent energization of said magnet, a second radio receiver tunable to an emergency frequency of said broadcasting station, an antenna coupled to said second receiver through said first mentioned fixed contact and said armature whereby upon energization of said magnet the antenna circuit of said second receiver is opened to render the same inoperative, a normally open relay connected to the output of said second receiver, a battery, an audible alarm connected to one side of said battery, the opposite side of said battery being connected to one contact of said normally open relay and to said contact arm and the opposite side of said alarm being connected to the other contact of said normally open relay and to said second fixed contact whereby upon interruption of the regular frequency carrier of said broadcasting station a predetermined number of times said contact arm will move into engagement with said second fixed contact to close the circuit to said alarm or upon said broadcasting station shifting to said emergency frequency said first mentioned magnet will be deenergized to render said second receiver operative and said normally open relay will operate to close the circuit to said alarm.

5. A radio controlled warning system comprising a radio receiver including an inductance tunable to the regular frequency of a key broadcasting station and a crystal detector, an antenna coupled to said receiver, a relay connected to the output of said receiver including an electromagnet, a fixed contact, an armature normally in engagement with said fixed contact but movable out of engagement therewith under the action of said magnet, a movable contact arm, a second fixed contact engageable by said contact arm, means to move said movable arm into engagement with said second fixed contact upon intermittent energization of said magnet, a second radio receiver including an inductance tunable to an emergency frequency of said broadcasting station and a crystal detector, an antenna coupled to said second receiver through said first mentioned fixed contact and said armature whereby upon energization of said magnet the antenna circuit of said second receiver is opened to render the same inoperative, a normally open relay, a battery, an audible alarm connected to one side of said battery, the opposite side of said battery being connected to one contact of said normally open relay and to said contact arm and the opposite side of said alarm being connected to the other contact of said normally open relay and to said second fixed contact whereby upon interruption of the regular frequency carrier of said broadcasting station a predetermined number of times said contact arm will move into engagement with said second fixed contact to close the circuit to said alarm or upon said broadcasting station shifting to said emergency frequency said first mentioned magnet will be deenergized to render said second receiver operative and said normally open relay will operate to close the circuit to said alarm.

6. A radio controlled warning system comprising a radio receiver including an inductance tunable to the regular frequency of a key broadcasting station and a crystal detector, an antenna coupled to said receiver, a relay connected to the output of said receiver including an electromagnet, a fixed contact, an armature normally in engagement with said fixed contact but movable out of engagement therewith under the action of said magnet, a rotatably mounted disc, a projection on said disc, a movable contact arm disposed in the path of movement of said projection, a second fixed contact engageable by

said contact arm, a second armature operable by said magnet and a driving connection between said second armature and said disc whereby upon intermittent energization of said magnet said disc will be rotated in step by step movements to bring said projection into engagement with said contact arm and move the same into engagement with said second fixed contact, a second radio receiver including an inductance tunable to an emergency frequency of said broadcasting station and a crystal detector, an antenna coupled to said second receiver through said first mentioned fixed contact and said armature whereby upon energization of said magnet the antenna circuit of said second receiver is opened to render the same inoperative, a normally open relay, a battery, an audible alarm connected to one side of said battery, the opposite side of said battery being connected to one contact of said normally open relay and to said contact arm and the opposite side of said alarm being connected to the other contact of said normally open relay and to said second fixed contact whereby upon interruption of the regular frequency carrier of said broadcasting station a predetermined number of times said projection will move said contact arm into engagement with said second fixed contact to close the circuit to said alarm or upon said broadcasting station shifting to said emergency frequency said first mentioned magnet will be deenergized to render said second receiver operative and said normally open relay will operate to close the circuit to said alarm.

7. A radio controlled warning system comprising a radio receiver including an inductance tunable to the regular frequency of a key broadcasting station and a crystal detector, an antenna coupled to said receiver, a relay connected to the output of said receiver including an electromagnet, a fixed contact, an armature normally in engagement with said fixed contact but movable out of engagement therewith under the action of said magnet, a rotatably mounted disc, a projection on said disc, a movable contact arm disposed in the path of movement of said projection, a second fixed contact engageable by said contact arm, a second armature operable by said magnet and a pawl and ratchet driving connection between said second armature and said disc whereby upon intermittent energization of said magnet said disc will be rotated in step by step movements to bring said projection into engagement with said contact arm and move the same into engagement with said second fixed contact, a second radio receiver including an inductance tunable to an emergency frequency of said broadcasting station and a crystal detector, an antenna coupled to said second receiver through said first mentioned fixed contact and said armature whereby upon energization of said magnet the antenna circuit of said second receiver is opened to render the same inoperative, a normally open relay, a single-pole double-throw relay having a coil and a core forming an electromagnet, a tap on said coil, a source of electrical energy connected to said last mentioned coil, a battery, an audible alarm, said last mentioned relay serving to normally connect one side of said source to one side of said alarm and upon failure of said source to connect one side of said battery to one side of said alarm, said tap and the opposite side of said battery being connected to one contact of said normally open relay and to said contact arm and the opposite side of said alarm being connected to the other contact of said normally open relay and to said second fixed contact whereby upon interruption of the regular frequency carrier of said broadcasting station a predetermined number of times said projection will move said contact arm into engagement with said second fixed contact to close the circuit to said alarm or upon said broadcasting station shifting to said emergency frequency said first mentioned magnet will be deenergized to render said second receiver operative and said normally open relay will operate to close the circuit to said alarm.

8. A radio controlled warning system comprising a radio receiver including an inductance tunable to the regular frequency of a key broadcasting station and a crystal detector, an antenna coupled to said receiver, a relay connected to the output of said receiver including an electromagnet, a fixed contact, an armature normally in engagement with said fixed contact but movable out of engagement therewith under the action of said magnet, a rotatably mounted disc, a series of teeth on the periphery of said disc, a yieldable detent engaging said teeth, a projection on said disc, a movable contact arm disposed in the path of movement of said projection, a second fixed contact engageable by said contact arm, a second armature operable by said magnet and a pawl and ratchet driving connection between said second armature and said disc whereby upon intermittent energization of said magnet said disc will be rotated in step by step movements to bring said projection into engagement with said contact arm and move the same into engagement with said second fixed contact, a second radio receiver including an inductance tunable to the emergency frequency of said broadcasting station and a crystal detector, an antenna coupled to said second receiver through said first mentioned fixed contact and said armature whereby upon energization of said magnet the antenna circuit of said second receiver is opened to render the same inoperative, a normally open relay, a single-pole double-throw relay having a coil and a core forming an electromagnet, a tap on said coil, a source of electrical energy connected to said last mentioned coil, a battery, an audible alarm, said last mentioned relay serving to normally connect one side of said source to one side of said alarm and upon failure of said source to connect one side of said battery to one side of said alarm, said tap and the opposite side of said battery being connected to one contact of said normally open relay and to said contact arm and the opposite side of said alarm being connected to the other contact of said normally open relay and to said second fixed contact whereby upon interruption of the regular frequency carrier of said broadcasting station a predetermined number of times said projection will move said contact arm into engagement with said second fixed contact to close the circuit to said alarm or upon said broadcasting station shifting to said emergency frequency said first mentioned magnet will be deenergized to render said second receiver operative and said normally open relay will operate to close the circuit to said alarm.

9. A radio controlled warning system comprising a radio receiver including an inductance tunable to the regular frequency of a key broadcasting station and a crystal detector, a directive antenna inductively coupled to said receiver, a relay connected to the output of said receiver including an electromagnet, a fixed contact, an armature normally in engagement with said fixed contact but movable out of engagement therewith under the action of said magnet, a rotatably mounted disc, a series of teeth on the periphery of said disc, a yieldable detent engaging said teeth, a projection on said disc, a movable contact arm disposed in the path of movement of said projection, a second fixed contact engageable by said contact arm, a second armature operable by said magnet and a pawl and ratchet driving connection between said second armature and said disc whereby upon intermittent energization of said magnet said disc will be rotated in step by step movements to bring said projection into engagement with said contact arm and move the same into engagement with said second fixed contact, a second radio receiver including an inductance tunable to an emergency frequency of said broadcasting station and a crystal detector, a directive antenna inductively coupled to said second receiver through said first mentioned fixed contact and said armature whereby upon energization of said magnet the antenna circuit of said second receiver is opened to render the same inoperative, a normally open relay, a single-pole double-throw relay having a coil and a core forming an electromagnet, a tap on said coil, a source of electrical energy connected to said last mentioned coil, a battery, an audible alarm, said last mentioned relay serving to normally connect one side of said source to one side of said battery to one side of said alarm, said tap and the opposite side of said battery being connected to one contact of said normally open relay and to said contact arm and the opposite side of said alarm being connected to the other contact of said normally open relay and to said second fixed contact whereby upon interruption of the regular frequency carrier of said broadcasting station a predetermined number of times said projection will move said contact arm into engagement with said second fixed contact to close the circuit to said alarm or upon said broadcasting station shifting to said emergency frequency said first mentioned magnet will be deenergized to render said second receiver operative and said normally open relay will operate to close the circuit to said alarm.

10. A radio controlled warning system comprising a radio receiver including an inductance tunable to the regular frequency of a key broadcasting station and a crystal detector, a directive antenna inductively coupled to said receiver, a relay connected to the output of said receiver including an electromagnet, a fixed contact, an armature normally in engagement with said fixed contact but movable out of engagement therewith under the action of said magnet, a rotatably mounted disc, a series of teeth on the periphery of said disc, a yieldable detent engaging said teeth, a projection on said disc, a movable contact arm disposed in the path of movement of said projection a second fixed contact engageable by said contact arm, a second armature operable by said magnet and a pawl and ratchet driving connection between said second armature and said disc whereby upon intermittent energization of said magnet said disc will be rotated in step by step movements to bring said projection into engagement with said contact arm and move the same into engagement with said second fixed contact, a second radio receiver including an inductance tunable to an emergency frequency of said broadcasting station and a crystal detector, a directive antenna inductively coupled to said second receiver through said first mentioned fixed contact and said armature whereby upon energization of said magnet the antenna circuit of said second receiver is opened to render the same inoperative, a normally open relay, a pair of headphones, a switch in the output circuit of said second receiver for selectively connecting the same to said last mentioned relay or said headphones, a single-pole double-throw relay having a coil and a core forming an electromagnet, a tap on said coil, a source of electrical energy connected to said last mentioned coil, a battery, an audible alarm, said last mentioned relay serving to normally connect one side of said source to one side of said alarm and upon failure of said source to connect one side of said battery to one side of said alarm, said tap and the opposite side of said battery being connected to one contact of said normally open relay and to said contact arm and the opposite side of said alarm being connected to the other contact of said normally open relay and to said second fixed contact whereby upon interruption of the regular frequency carrier of said broadcasting station a predetermined number of times said projection will move said contact arm into engagement with said second fixed contact to close the circuit to said alarm or upon said broadcasting station shifting to said emergency frequency said first mentioned magnet will be deenergized to render said second receiver operative and said normally open relay will operate to close the circuit to said alarm.

11. A radio controlled warning system comprising a radio receiver including an inductance tunable to the regular frequency of a key broadcasting station and a crystal detector, a directive antenna inductively coupled to said receiver, a relay connected to the output of said receiver including an electromagnet, a fixed contact, an armature normally in engagement with said fixed contact but movable out of engagement therewith under the action of said magnet, a rotatably mounted disc, a series of teeth on the periphery of said disc, a yieldable detent engaging said teeth, a projection on said disc, a movable contact arm disposed in the path of movement of said projection, a second fixed contact engageable by said contact arm, a second armature operable by said magnet and a pawl and ratchet driving connection between said second armature and said disc whereby upon intermittent energization of said magnet said disc will be rotated in step by step movements to bring said projection into engagement with said contact arm and move the same into engagement with said second fixed contact, means to return said disc to original position after a predetermined time interval, a second radio receiver including an inductance tunable to an emergency frequency of said broadcasting station and a crystal detector, a directive antenna inductively coupled to said second receiver through said first mentioned fixed contact and said armature whereby upon energization of said magnet the antenna circuit of said second receiver is opened to render the same inoperative, a normally open relay, a pair of headphones, a switch in the output circuit of said second receiver for selectively connecting the same to said last mentioned relay or said headphones, a single-pole double-throw relay having a coil and a core forming an electromagnet, a tap on said coil, a source of electrical energy connected to said last mentioned coil, a battery, an audible alarm, said last mentioned relay serving to normally connect one side of said source to one side of said alarm and upon failure of said source to connect one side of said battery to one side of said alarm, said tap and the opposite side of said battery being connected to one contact of said normally open relay and to said contact arm and the opposite side of said alarm being connected to the other contact of said normally open relay and to said second fixed contact whereby upon interruption of the regular frequency carrier of said broadcasting station a predetermined number of times said projection will move said contact arm into engagement with said second fixed contact to close the circuit to said alarm or upon said broadcasting station shifting to said emergency frequency said first mentioned magnet will be deenergized to render said second receiver operative and said normally open relay will operate to close the circuit to said alarm.

12. A radio controlled warning system comprising a radio receiver tunable to the regular frequency of a key broadcasting station and including a limiter stage, a normally closed relay connected to said limiter stage whereby when said receiver is operating said relay will be energized to open the same, a second radio receiver tunable to an emergency frequency of said broadcasting station, a normally open relay having two contacts connected to the output of said second receiver, a power source, an alarm, one side of said power source being connected to one side of said alarm, the other side of said alarm being connected to one contact of said normally closed relay, the other contact of said normally closed relay being connected to one contact of said normally open relay and the other contact of said normally open relay being connected to the other side of said power source whereby upon said broadcasting station shifting from said regular frequency to said emergency frequency said normally closed relay will be deenergized to close the same and said second receiver will become operative to energize said normally open relay to close the same and close the circuit to said alarm.

13. A radio controlled warning system comprising a radio receiver tunable to the regular frequency of a key broadcasting station and including a limiter stage, a normally closed relay connected across the cathode resistor of said limiter stage whereby when said receiver is operating the voltage drop across said cathode resistor will energize said relay to open the same, a second radio receiver tunable to an emergency frequency of said broadcasting station, an antenna coupled to said second receiver, a normally open relay having two contacts connected to the output of said second receiver, a battery, an audible alarm, one side of said battery being connected to one side of said alarm, the other side of said alarm being connected to one contact of said normally closed relay, the other contact of said normally closed relay being connected to one contact of said normally open relay and the other contact of said normally open relay being connected to the other side of said battery whereby upon said broadcasting station shifting from said regular frequency to said emergency frequency said normally closed relay will be deenergized to close the same and said second receiver will become operative to energize said normally open relay to close the same and close the circuit to said alarm.

14. A radio controlled warning system comprising a radio receiver tunable to the regular frequency of a key broadcasting station and including a limiter stage, a normally closed relay connected across the cathode resistor of said limiter stage whereby when said receiver is operating the voltage drop across said cathode resistor will energize said relay to open the same, a second radio receiver including an inductance tunable to an emergency frequency of said broadcasting station and a crystal detector, a directive antenna inductively coupled to said second receiver, a normally open relay having two contacts connected to the output of said second receiver, a battery, an audible alarm, one side of said battery being connected to one side of said alarm, the other side of said alarm being connected to one contact of said normally closed relay, the other contact of said normally closed relay being connected to one contact of said normally open relay and the other contact of said normally open relay being connected to the other side of said battery whereby upon said broadcasting station shifting from said regular frequency to said emergency frequency said normally closed relay will be deenergized to close the same and said second receiver

will become operative to energize said normally open relay to close the same and close the circuit to said alarm.

15. A radio controlled warning system comprising a radio receiver tunable to the regular frequency of a key broadcasting station and including an AVC circuit, a normally closed relay connected to said AVC circuit whereby when said receiver is operating the AVC voltage will energize said relay to open the same, a second radio receiver tunable to an emergency frequency of said broadcasting station, an antenna coupled to said second receiver through said relay, a normally open relay having two contacts connected to the output of said second receiver, a power source, an alarm, one side of said power source being connected to one side of said alarm, the other side of said alarm being connected to one contact of said normally open relay and the other contact being connected to the other side of said power source whereby during normal operation of said broadcasting station said normally closed relay will be opened to render said second receiver inoperative and upon said broadcasting station shifting from said regular frequency to said emergency frequency said normally closed relay will close to render said second receiver operative and energize said normally open relay to close the same and close the circuit to said alarm.

16. A radio controlled warning system comprising a radio receiver tunable to the regular frequency of a key broadcasting station and including an AVC circuit, a normally closed relay connected to said AVC circuit whereby when said receiver is operating the AVC voltage will energize said relay to open the same, a second radio receiver tunable to an emergency frequency of said broadcasting station, an antenna coupled to said second receiver through said relay, a normally open relay having two contacts connected to the output of said second receiver, a battery, an audible alarm, one side of said battery being connected to one side of said alarm, the other side of said alarm being connected to one contact of said normally open relay and the other contact being connected to the other side of said battery whereby during normal operation of said broadcasting station said normally closed relay will be opened to render said second receiver inoperative and upon said broadcasting station shifting from said regular frequency to said emergency frequency said normally closed relay will close to render said second receiver operative and energize said normally open relay to close the same and close the circuit to said alarm.

17. A radio controlled warning system comprising a radio receiver tunable to the regular frequency of a key broadcasting station and including an AVC circuit, a normally closed high impedance relay connected to said AVC circuit whereby when said receiver is operating the AVC voltage will energize said relay to open the same, a second radio receiver including an inductance tunable to an emergency frequency of said broadcasting station and a crystal detector, a directive antenna inductively coupled to said second receiver through said relay, a normally open relay having two contacts connected to the output of said second receiver, a battery, an audible alarm, one side of said battery being connected to one side of said alarm, the other side of said alarm being connected to one contact of said normally open relay and the other contact being connected to the other side of said battery whereby during normal operation of said broadcasting station said normally closed relay will be opened to render said second receiver inoperative and upon said broadcasting station shifting from said regular frequency to said emergency frequency said normally closed relay will close to render said second receiver operative and energize said normally open relay to close the same and close the circuit to said alarm.

18. A radio controlled warning system comprising a radio receiver tunable to the regular frequency of a key broadcasting station, a second radio receiver tunable to an emergency frequency of said broadcasting station, a normally open relay connected to the output of said second receiver, a power source and an alarm connected to one side of said power source, the opposite side of said power source being connected to one contact of said normally open relay and the opposite side of said alarm being connected to the other contact of said normally open relay and switch means connected to said first-mentioned receiver and operable upon energization of said first mentioned receiver by a signal to render said alarm inoperable whereby upon interruption of the regular frequency carrier of said broadcasting station and upon said broadcasting station shifting to said emergency frequency said second receiver will be energized to operate said normally open relay to close the circuit to said alarm.

19. A radio controlled warning system comprising a radio receiver tunable to the regular frequency of a key broadcasting station, a second radio receiver tunable to an emergency frequency of said broadcasting station, a normally open relay connected to the output of said second receiver, a power source, an alarm connected to one side of said power source, the opposite side of said power source being connected to one contact of said normally open relay and the opposite side of said alarm being connected to the other contact of said normally open relay and circuit, making and breaking means connected to said first-mentioned receiver and operable upon energization of said first mentioned receiver by a signal to render said alarm inoperable, whereby upon interruption of the regular frequency carrier of said broadcasting station and upon said broadcasting station shifting to said emergency frequency said second receiver will be energized to operate said normally open relay to close the circuit to said alarm.

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