

[54] **CENTRALIZED CONTROLLING
APPARATUS HAVING CONTROL
FREQUENCIES**

3,080,491 3/1963 Howell..... 337/104 X
3,521,267 7/1970 Lester..... 340/310

[75] Inventor: **Katsumi Taketa**, Fukuyama, Japan
[73] Assignee: **Mitsubishi Kenki Kabushiki Kaisha**,
Tokyo, Japan

Primary Examiner—Harold Pitts
Attorney, Agent, or Firm—Oblon, Fisher, Spivak,
McClelland & Maier

[22] Filed: Nov. 8, 1973

[21] Appl. No.: 413,757

Related U.S. Application Data

[63] Continuation of Ser. No. 110,875, Jan. 29, 1971,
abandoned.

[30] **Foreign Application Priority Data**

Feb. 3, 1970 Japan..... 45-9403
Feb. 3, 1970 Japan..... 45-9404

[52] U.S. Cl. 340/171 R; 340/310; 340/171 A

[51] Int. Cl. H04q 9/10

[58] Field of Search.... 340/156, 310, 171 A, 171 R;
337/104; 325/393, 394

[56] **References Cited**

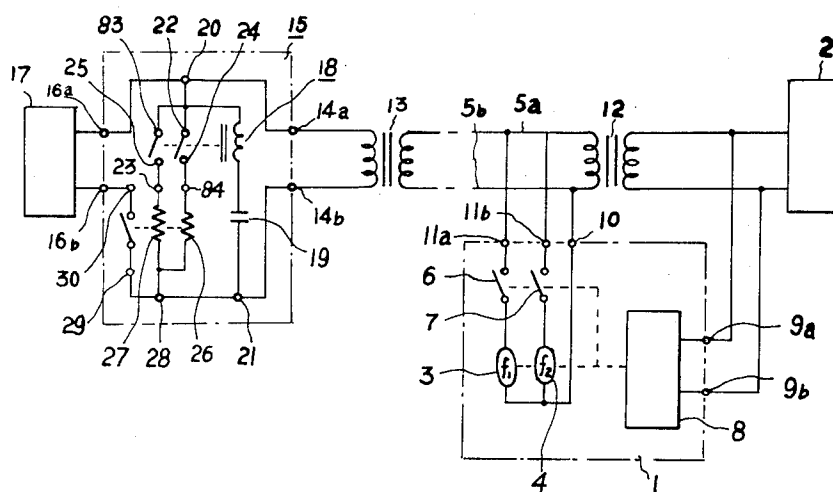
UNITED STATES PATENTS

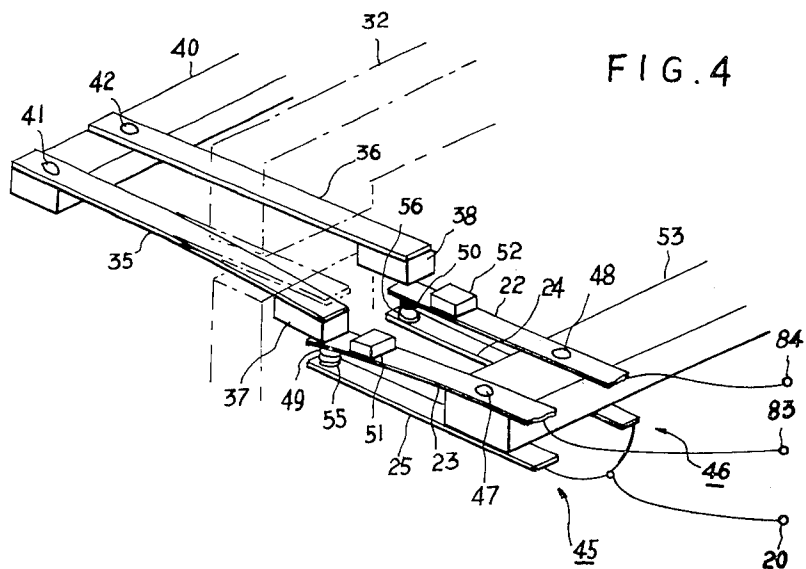
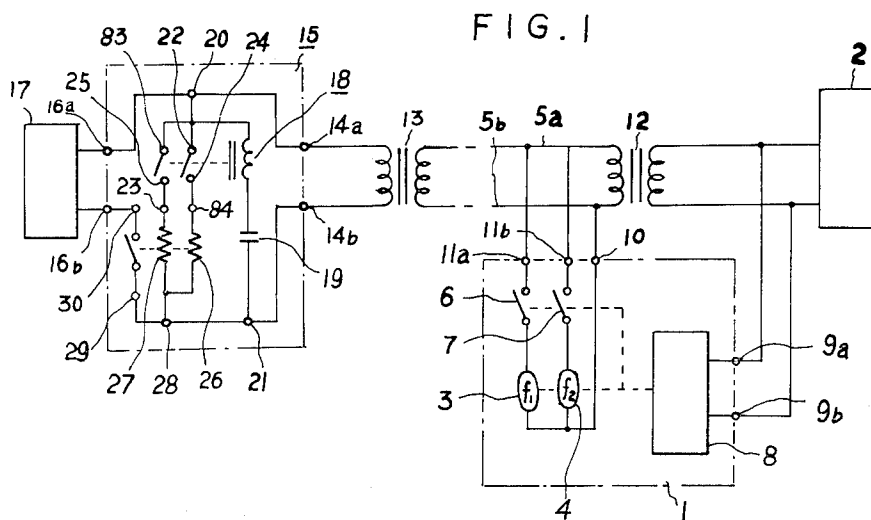
1,635,779 7/1927 Carter..... 340/171 A

[57] **ABSTRACT**

A centralized controlling apparatus is provided and includes a pair of frequency relays which are selectively responsive to two types of frequency signals, the same being different from a fundamental frequency and higher harmonics thereof. One of the two types of frequency signals is used as an opening signal and the other is used as a closing signal. The two types of frequency signals are respectively applied along with a fundamental frequency to a distribution or transmission line for a predetermined period of time such that two driving elements of a differential type relay are selectively operated in accordance with the switching of the frequency relays such that a main circuit to a load is either opened or closed.

3 Claims, 9 Drawing Figures

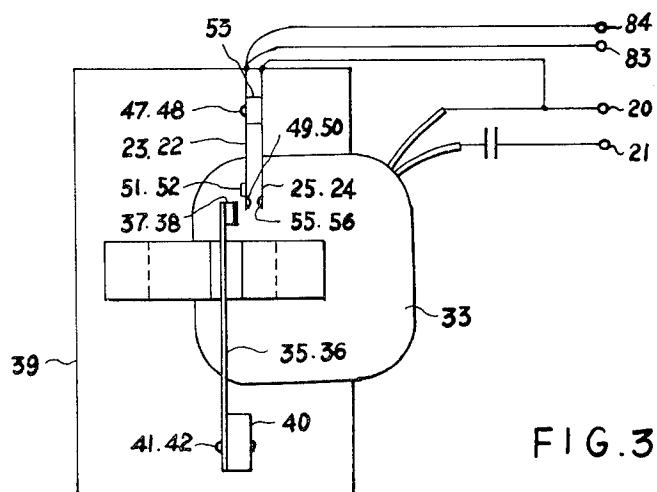
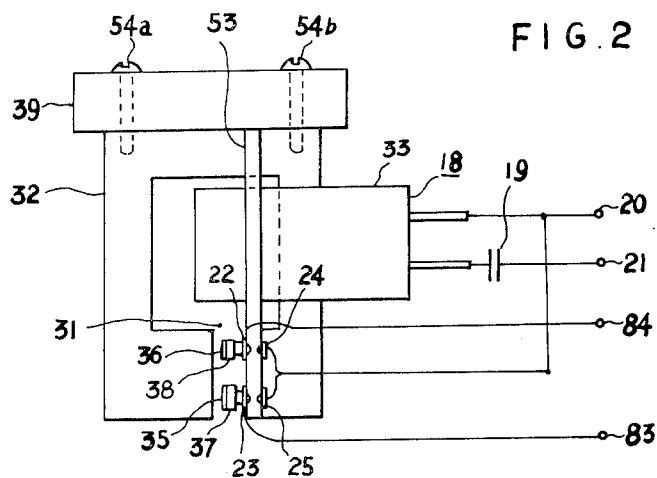




INVENTOR
KATSUMI TAKETA

BY *Obay. Tishu & Spilak*

ATTORNEYS



INVENTOR.
KATSUMI TAKETA

BY

Blay, Fisher & Spilok
ATTORNEYS

FIG. 5

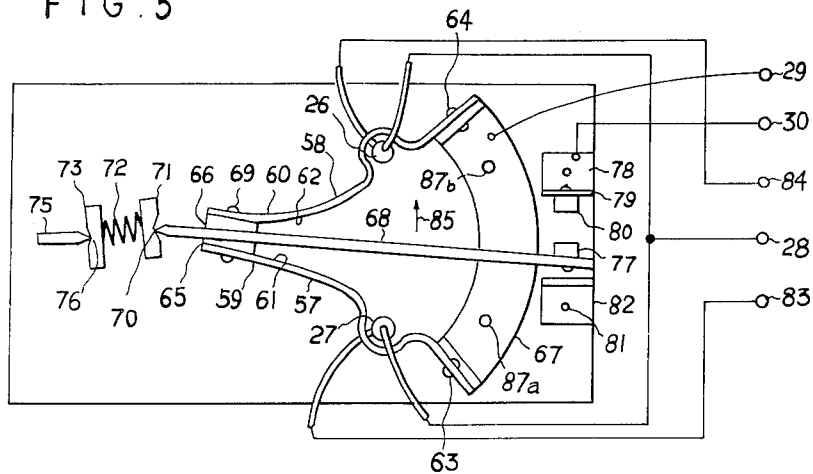


FIG. 6

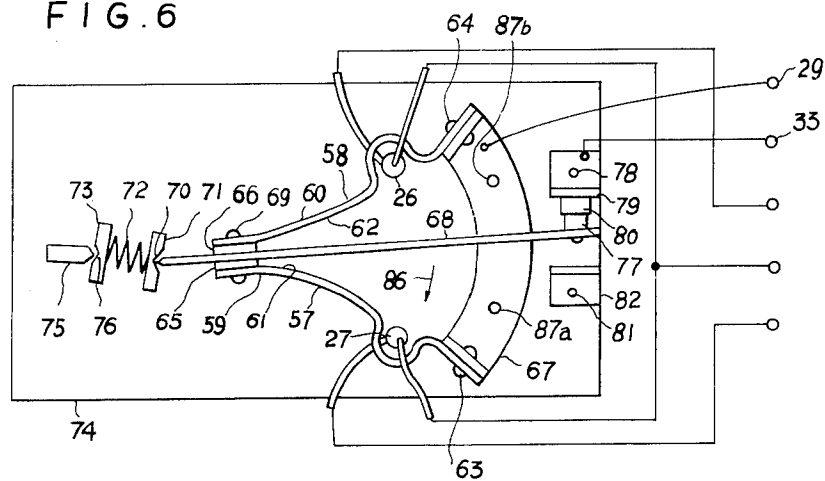
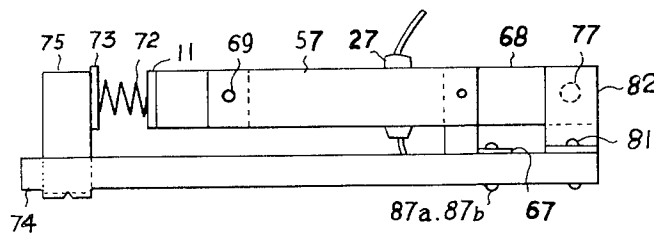


FIG. 7



INVENTOR.
KATSUMI TAKETA

BY
Kay Fisher & Spivak
ATTORNEYS

FIG. 8

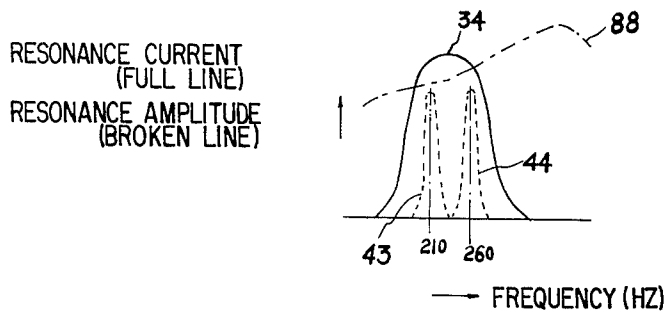
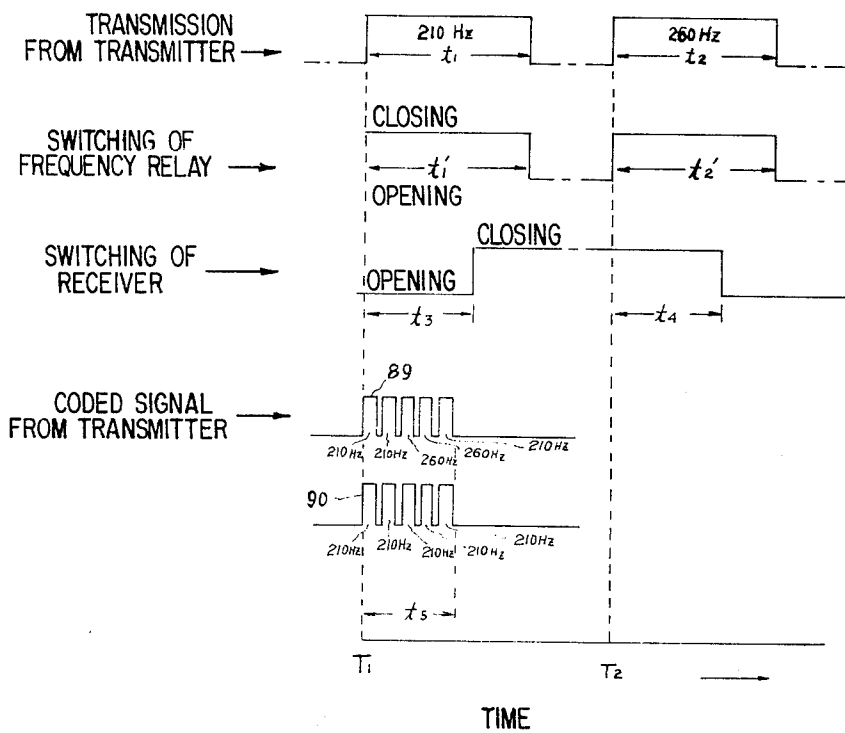


FIG. 9



INVENTOR.
KATSUMI TAKETA

BY
Obay, Fisher & Spink
ATTORNEYS

CENTRALIZED CONTROLLING APPARATUS HAVING CONTROL FREQUENCIES

REFERENCE TO RELATED APPLICATION

This is a continuation, of application Ser. No. 5 110,875 filed Jan. 29, 1971 now abandoned.

BACKGROUND OF THE INVENTION

1. Field of the Invention

The present invention relates to a centralized controlling apparatus in which a load, such as an electric heater for hot water, is controlled by switching at a central station through a transmission line or distribution line.

2. Description of the Prior Art

In the past, it has been customary in controlling many instruments in a power plant or the like to transmit from a generator through a distribution line by multiplying by a fundamental frequency of the distribution line which was different from the fundamental frequency and higher harmonics thereof, such as by 3.5 times the fundamental frequency. The signal being about 3.5 times that of the fundamental frequency could be effectively transmitted to electric consumers along the distribution line with very small damping, even though passed through a distribution transformer.

Accordingly, it has been possible to centrally control a load, such as an electric heater for hot water, connected to any one of a plurality of receivers, by keying an appropriate transmitter and by separating the 3.5 times of frequency signal from the fundamental frequency and providing the signal to a corresponding receiver.

While somewhat satisfactory, one of the problems with the above described centralized controlling system using many receivers was that it was hard to commercialize the system, because the receivers thereof were very expensive and erroneous operation would often occur in the presence of various noises on the distribution line. Moreover, in the past, many types of coded signals would be applied with the fundamental frequency so that other controls could be handled and at the same time the same would simplify the system, since it had been found that the previously described single keying signal would provide only a limited operation. However, again, it was found that when the system employing coded signals was used erroneous operation due to the presence of noise or the like would often occur.

SUMMARY OF THE INVENTION

It is an object of this invention to provide a new and improved unique centralized controlling apparatus for enabling controls to be provided without errors due to the presence of noise.

It is another object of the present invention to provide a new and improved unique centralized controlling apparatus for enabling controls to be provided without errors due to change in ambient temperature or the like.

One other object of the present invention is to provide a new and improved unique centralized controlling apparatus for enabling any one of a plurality of loads to be readily controlled from a central station without any errors being caused by the presence of noise or the like.

Briefly, in accordance with the present invention, the foregoing and other objects are in one aspect attained by the provision of a centralized controlling apparatus having a transmitter for supplying signals of two different frequencies and wherein one of the signals is used as a closing signal and the other signal is used as an opening signal and wherein the signals are supplied, for a comparatively long period, along with the fundamental frequency on a distribution line. Two frequency relays which are separately responsive to the two different frequencies are provided and selectively will operate to switch the main circuit after a delay determined by the differential operation of the two moving elements of a differential relay.

BRIEF DESCRIPTION OF THE DRAWINGS

A more complete appreciation of the invention will be readily obtained as the same becomes better understood by reference to the following detailed description when considered on connection with the accompanying Drawings, wherein:

FIG. 1 is a block diagram of a part of one embodiment of a centralized controlling apparatus in accordance with the present invention;

FIG. 2 is a side view of a resonance circuit and two frequency mechanical resonance relays of one portion of the receiver shown in FIG. 1;

FIG. 3 is a front view of the apparatus shown in FIG. 2;

FIG. 4 is a partially enlarged perspective view showing one frequency resonance position of two frequency mechanical resonance relays;

FIG. 5 is a front view of one operation of a thermal type differential relay in the position of opening the load;

FIG. 6 is a front view of the apparatus of FIG. 4 in the position of closing the load circuit;

FIG. 7 is a side view of the apparatus of FIGS. 5 and 6;

FIG. 8 is a resonance frequency characteristic curve of the apparatus of FIG. 2; and,

FIG. 9 is a diagram showing transmission and reception codes and states of opening and closing of the load circuit for different times of operation.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring now to the drawings, wherein like reference numerals designate identical, or corresponding parts throughout the several views, and more particularly to FIG. 1 thereof, wherein a two frequency transmitter 1 is shown as being provided within a conventional substation 2. The transmitter 1 includes an oscillator 3 of 210 Hertz, an oscillator 4 of 260 Hertz, switching means 6 and 7 for supplying signals to parallel distribution lines 5a and 5b, and a conventional controlling device 8 which periodically controls the two oscillators 3 and 4 and the switching means 6 and 7. An electric power source for driving the transmitter 1 is supplied from the substation 2 through the terminals 9a and 9b. The output frequency signal of 210 Hertz is connected through the common terminal 10 and terminal 11a and the output frequency signal of 260 Hertz is connected through the common terminal 10 and terminal 11b to the distribution lines 5a and 5b. A fundamental frequency of 60 Hertz is supplied from the substation 2 to the distribution lines 5a and 5b through a

distribution transformer 12 and serves as a fixed signal. The 60 Hertz signal is also supplied to a receiver 15 having input terminals 14a and 14b through a distribution transformer 13. The output terminals 16a and 16b of the receiver 15 are connected to a load 17, which may be an electric heater for hot water or the like. The input terminals 14a and 14b of the receiver 15 are respectively connected to terminals 20 and 21 of a reactor 18 and a condenser 19 which form a series resonance circuit thereby providing electrical resonance, and moving elements 22 and 23 (shown in FIG. 4) of resonance relays 45 and 46 (shown in FIG. 4) which are closed during the period of resonance, by resonators 35 and 36 (shown in FIGURES 2 and 3). The resonators 35 and 36 are respectively mechanically resonated at a frequency of 210 Hertz and 260 Hertz and are provided between a space of the reactor 18, and a terminal 28 which is connected to one side of heat resistances 26 and 27 which are connected in series to fixed elements 24 and 25 of the resonance relays 45 and 46. A contact terminal 29 of a thermal type differential relay is connected to the input terminal 14b and a contact terminal 30 is connected to the output terminal 16a.

Referring now to FIGS. 2, 3, 4, and 8, the reactor 18 is shown as including an iron core 32 having a space 31 formed in a portion thereof. The reactor 18 is connected in series to a coil 33 and the condenser 19 and the combination is connected between the terminals 20 and 21 shown in FIG. 1. The reactor 18 has the resonance characteristic 34 as shown in FIG. 8. The ends of the two resonators 35 and 36 may be made of an elastic magnetic substance and the same are provided within the space 31. Dead weights 37 and 38, which provide a predetermined frequency when mechanically resonated, are respectively fixed to the ends of the two resonators 35 and 36. The other ends of the two resonators 35 and 36 are respectively fixed with pins 41 and 42 to a fixed resonator plate 40 which is attached to a fixed plate 39. It should be understood that the resonators will vibrate when the fixed vibration frequency of the resonators coincide with the applied AC frequency under the well known doctrine of mechanical resonance movement which is caused when an AC magnetic flux passes through the iron core 32. Typical resonance frequency characteristics are shown in FIG. 8, wherein the resonator 35 is shown as providing a resonance characteristic 43 having a center frequency of 210 Hertz and the resonator 36 is shown as providing a resonance characteristic 44 having a center frequency of 260 Hertz.

Referring now to FIG 4, a partially enlarged perspective view is provided for showing the apparatus within the space 31 of the core 32 of the reactor 18 shown in FIGS. 2 and 3. The moving elements 22 and 23 may be made of an elastic electroconductive substance and are provided by facing the same to the dead weights 37 and 38 which are centered at one end of the respective resonators 35 and 36. The other ends of the moving elements 22 and 23 are fixed with respective pins 47 and 48 to a fixed switch plate 53 which may be made of an insulating substance and which is attached to the fixed plate 39 (see FIG. 2). Movable contacts 49 and 50 are provided and are respectively positioned opposite to the dead weights 37 and 38 and fixed on the surface of the moving elements 22 and 23 which are opposite to the dead weights 37 and 38. Dead weights 51 and 52

are respectively provided near the ends of the moving elements 22 and 23, as shown, and serve the purpose of preventing chattering. The fixed elements 24 and 25 may be made of an elastic electroconductive substance and are respectively fixed at one end to the fixed switch plate 53 by facing them to the moving elements 22 and 23 and insulating them therefrom. The other ends of the fixed elements 24 and 25 are respectively positioned with a small gap from the moving elements 49 and 50 and faced to fixed contacts 55 and 56. Lead wires are respectively connected to the fixed terminals of the fixed elements 24 and 25 for connecting the same to the terminal 20. The moving element 23 is connected to a terminal 83 and the moving element 22 is connected to a terminal 84.

When the signal having a frequency of 210 Hertz is applied with the fundamental frequency of 60 Hertz provided to the reactor 18, the resonator 35 having the resonance characteristic shown in FIG. 8 will be resonated so as to vibrate at the amplitude shown in FIG. 4 with a full line and phantom line, whereby the moving element 23 is bent to make contact with the fixed contact 55. Since the moving element 23 has the dead weight 51 attached thereto for preventing chattering, the same is prevented from following the high vibration of the resonator 35 such that the moving element 23 will operate as a 210 Hertz frequency relay 45 and maintain connection between the contacts 49 and 55. When the fundamental fixed signal of 60 Hertz is removed, the resonator 35 will stand still, whereby the moving element 23 will return to its original position, and the contacts 49 and 55 will open. It should be understood that in a manner similar to that described above, the resonator 36 will operate as a 260 Hertz frequency relay. As shown in FIG. 2, the fixed plate 39 of the iron core 32 of the reactor 18 is screw tapped and is fixed thereto with bolts 54a and 54b.

Referring now to FIGS. 5, 6, and 7, the thermal type differential relay is shown as including bimetals 57 and 58, having well known characteristics, which are provided so as to operate without contacting the adjacent heat resistances 26 and 27. The bimetals 57 and 58, respectively, have lower expansion sides 59 and 60 and higher expansion sides 61 and 62. One end of the bimetals is fixed to a bimetal fixing plate 67 which may be made of an electrical conductive substance and which has a sector shape whose ends are bent in the form of an L-shape. The other end of the bimetals is fixed with a pin 69 to a moving element 68 which may be made of an electric conductive substance through spacers 65 and 66 which may be made of an insulated substance, by caulking or the like. The bimetal fixing plate 67 is fixed to a fixed block 74 with pins 87a and 87b. The moving element 68 extends beyond bimetals 57 and 58 and end 70 thereof is sharp and is fitted in a recess of a spring bearing plate 71. The spring bearing plate 71 is faced to another spring bearing plate 73 through a compressed spring 72. A recess of the spring bearing plate 73 is fitted to a sharp element 76 of a holder 75 which is made of an insulating substance and molded to the fixed block 74. The bimetals have elasticity as known and are balanced by the pressure of the compressed spring 72. The spring bearing plates 71 and 73 are respectively fitted by the sharp end of the moving element 70 and the end of the holder 75, so that the moving element 68 has a dead center point. It should be understood that in operation, the moving element

68 is adjusted so that the position shown in FIG. 5 or FIG. 6 is present when the moving element is over the dead center point. The free end of the moving element 68 has a main movable contact 77 which is positioned with a small gap to face a main fixed contact 80 which is attached to the L-shaped fixed element 79 which in turn is fixed to the fixing block 74 with the pin 78. An L-shaped suppressing element 82 is provided and attached with a pin 81 to the fixing block 74 so that the movement of moving element 68 is suppressed. One end of the heat resistance 26 is shown as being connected to the terminal 84 and the other end of the heat resistance 26 is shown as being connected to the terminal 28 together with one end of the heat resistance 27. The bimetal fixing plate 67 is shown as being connected to the terminal 29 through a lead wire and the fixed element 79 is shown as being connected to the terminal 30 through a lead wire.

The operation of the apparatus of the present invention will now be described in connection with FIG. 1. The switching means 6 is closed after the oscillator 3 of the controlling device 8 generates a signal of 210 Hertz. In this condition, the oscillator 4 having a frequency of 260 Hertz will not operate and the switching means 7 will be in an open position. When the switching means 6 is closed, the signal having a frequency of 210 Hertz is applied in parallel with the fundamental frequency of 60 Hertz on the distribution lines 5a and 5b. The signal is transmitted to a lower voltage through the distribution transformer 13 and then fed to the reactor 18 and the condenser 19 which constitutes the series resonance circuit, through the input terminals 14a and 14b. However, as shown in the characteristic curve 34 of FIG. 8, the resonance circuit is adjusted so as to be supplied a large amount of electrical current in the frequency range of 210 Hertz to 260 Hertz, but only a small amount of current at the fundamental frequency of 60 Hertz. Accordingly, in this instance, the signal having a frequency of 210 Hertz is mainly supplied. When the signal of frequency of 210 Hertz is passed through the coil 33 of the reactor 18 shown in FIGS. 2 and 3, the magnetic flux of the 210 Hertz signal is passed through the space 31 of the iron core 32. Since the resonator 35 of the 210 Hertz frequency relay 45, shown in FIG. 4, has the characteristic curve 43 shown in FIG. 8, the resonator will vibrate in resonance. When the resonator 35 is so vibrated, the moving element 23 is bent by a striking force therefrom so that the moving contact 49 is connected to the contact 55. The connected condition is maintained by the operation of the dead weight 51. When the contacts 49 and 55 are connected the terminals 20 and 83 will be short-circuited such that the input voltage at the input terminals 14a and 14b is impressed across the heat resistance 27 to result in heating, as clearly understood by FIG. 1. In FIG. 5, the bimetal 57 which surrounds the heat resistance 27 will be heated from the heat generated by the heat resistance 27, whereby a torque having the arrowhead direction 85 will be applied to the moving element 68 by the known operation of a bimetal having a high expansion side 61 and a low expansion side 59. As the heating of the bimetal 57 is continued, the temperature thereof will rise and result in a high torque for bending the bimetal, whereupon eventually the same will be sufficient to cause the moving element 68, which is held by the compressed spring 72, to suddenly move beyond the dead center point in the arrowhead

direction 85 to result in the condition shown in FIG. 6 wherein the main movable element contact 77 is connected to the main fixed contact 80. The terminal 30 is shown as being connected to the fixed element 79 which may be made of an electrical conductive substance. The fixed element 79, the main fixed contact 80, the main movable element 77, the moving element 68, the spacers 65 and 66, the bimetals 57 and 58, and the fixed plate 67 are connected in series such that when the contacts 77 and 80 are connected, the terminals 29 and 30 will be short-circuited. The input voltage in the input terminals 14a and 14b, as shown in FIG. 1, is impressed on the output terminals 16a and 16b, whereby the distribution voltage is supplied to the load 17 of the electric heater for hot water or the like. After multiple transmissions of the signal having a 210 Hertz frequency, the switching means 6 shown in FIG. 1 will be opened such that the signal having a 210 Hertz frequency is removed. When the 210 Hertz frequency signal is removed, the vibrations of the resonator 35 of the frequency relay 45 will stop and the moving element 23 will be returned to its original position, whereby the contacts 49 and 55 will open and the electrical signal passing through the heat resistance 27 will be cut off so that heat is no longer generated therefrom. However, since the moving element 68 is already beyond the dead center point, the position of the moving element 68 will be maintained, as shown in FIG. 6, wherein electric power will still be transmitted to the load 17. In order to stop the supply of electric power to the load 17, the switching means 7 is closed by generating the signal having a frequency of 260 Hertz with the oscillator 4 in accordance with the controlling device 8, as shown in FIG. 1. It should be understood that the signal of 260 Hertz frequency is supplied with the fundamental frequency of 60 Hertz and is transmitted in a manner like that described with reference to the operation of the 210 Hertz frequency signal. During the transmission of the 260 Hertz signal, only the resonator 36 having the characteristic curve 44 as shown in FIG. 8 will be resonated in the receiver 15. The contacts 50 and 56 will be closed by the resonance of the resonator 36, whereby the heat resistance 26 will receive current and generate heat therefrom. A torque having the arrowhead direction 86, shown in FIG. 6, will now be generated in the bimetal 58. As the heating of the bimetal 58 is continued, the moving element 68 will move beyond the dead center point by the torque applied thereto to result in the condition shown in FIG. 5, wherein the main movable contact 77 and the main fixed contact 80 are open, and the supply of electric power to the load 17 of the electric heater for hot water or the like is cut off. After a predetermined period of time, the switching means 7, shown in FIG. 1, will open whereby the signal having a frequency of 260 Hertz will no longer be present. However, the moving element 68 will be maintained in the position shown in FIG. 5, wherein the supply of electric power to the load is cut off.

In accordance with the above, it should now be apparent that the supply of power to the load is provided by supplying the signal of 210 Hertz for certain periods of time, and on the other hand, the supply of power to the load is cut off by supplying the signal of 260 Hertz for certain periods of time.

The operation of the apparatus of the present invention will now be described with reference to FIG. 9,

wherein the abscissa axis is shown as representing time. If the signal having a frequency of 210 Hertz is generated at the initial time of T_1 and continues for t_1' minutes, only the frequency relay 45 of 210 Hertz resonance will operate as explained above. The heat resistance 27 will be heated by the closure of contacts 49 and 55. Since the heat is gradually transferred to the bimetal 57, it will take t_3 minutes until the main contacts 77 and 80 are connected by the switching of the moving element 68, so that the electric power source is supplied to the load only after a given delay period. If the signal of frequency of 210 Hertz is removed within the period t_3 , the main contacts 77 and 80 will not connect so that the electric power source will not be supplied to the load. Thus, no erroneous operation can occur, if, for example, a noise of frequency 210 Hertz is fed for a short period of time to the distribution line. The transmission period of t_1 for the 210 Hertz signal is the same as the closed period t_1' of the frequency relay. At the time T_2 for cutting the supply of electric power to the load 17 the signal of 260 Hertz frequency is applied to the distribution line. The contacts of the frequency relay of the 260 Hertz resonator are then closed so that the heat resistance 26 will be heated to result in a gradual heating of the bimetal 58. After the period of t_4 minutes, the main contacts 77 and 80 will be opened by switching the moving element 68 so that the supply of electric power to the load 17 is cut off. The transmission period of the frequency 260 Hertz is t_2' and t_2 is greater than t_4 . In accordance with the above, it should be understood that the centralized controlling of a load from a central station can be readily attained. In the case of transmission of a signal of 260 Hertz, erroneous operation which could be caused by a noise on the distribution line or the like will also be prevented.

The condition will now be described wherein noise which is neither of the fundamental frequency nor higher harmonics is provided to the distribution line for a long period of time. Such noise, because of the indefinite frequency thereof, covers a broad scope of frequency bands. Thus, for example, the noise may have the characteristic 88 as shown in FIG. 8. Since the above noise contains both the frequency signals 210 Hertz and 260 Hertz, both of the frequency relays 45 and 46 will be operated to close their respective switch contacts. As such, both of the heat resistances 26 and 27 will be heated and thereby cause both of the bimetals 57 and 58 to be bent. Since the characteristics of the heating resistances 26 and 27 are respectively the same as those of the bimetals 57 and 58, a symmetrical movement of the moving element 68 will be provided. Accordingly, the torques given by the heating of both of the bimetals will balance so that the moving element 68 is not moved beyond the dead center point. As a result thereof, neither of the switching operations shown in FIGS. 5 or 6 will occur and thus no erroneous operation will be caused by the presence of an indefinite noise.

It should be further understood that the torque of bimetals 57 and 58 will also be balanced by a change of ambient temperature, so that no erroneous operation will occur during a broad scope of temperature changes. Also, even if noise having a broad frequency band is applied to the distribution line for a period of time during which the transmission of the signals of 210 Hertz or 260 Hertz for switching the main contacts 77

and 80 is supplied, it is apparent that both of the frequency relays will be closed so that no switching in the main contacts 77 and 80 will occur. Accordingly, the receiver will not operate during a period of time wherein a large amount of noise is present such that any erroneous operation is avoided. If the main contacts are closed by a transmission of the signal of 210 Hertz, then the transmission condition is good and no noise will be present so that highly reliable centralized control is attained. Similarly, a highly reliable centralized control will be obtained if the main contacts are closed during a transmission of the signal of 260 Hertz.

Up to now, the apparatus has been described with the assumption that the receiver is simply utilized for switching a single load. However, in actual use, it is not economical to control the switching of a specific load from a centralized control, using a distribution line. In order to resolve the difficulty, in the past various types of electrical apparatus were first classified at the centralized control and then coded with the two types of signals of 210 Hertz and 260 Hertz. However, the coding of various types of apparatus has been found to be both complicated and expensive. Thus, the code method was not found to be suitable for the simultaneous switching of a lot of apparatus. It is preferable to be able to control the various types of apparatus without operating by applying other code signals on the distribution line. The apparatus of this invention is satisfactory for such purposes as shown in FIG. 9.

As shown in FIG. 9, coded pulses 89 and 90 at the frequency of 210 Hertz and 260 Hertz are respectively applied to the distribution line from the transmitter in a short period of time. When the code signal is transmitted to the receiver 15, the contacts of the 210 Hertz frequency are closed to heat the heat resistance 27, or the contacts of the 260 Hertz frequency relay are closed to heat the heat resistance 26. It takes t_3 or t_4 minutes of continued heating for switching the moving elements 68, shown in FIG. 9. If the period of generation of the code pulse t_5 is shorter than the period of t_3 or t_4 , then the period of pulse t_5 is shorter than the switching operation period, even though a worse condition is provided in the coded pulse 90. Accordingly, the main contacts of the receiver are not switched. If the code is provided as 89, then the total generating period t_5 for the coded pulse is prolonged to 5/3 times, because continuous three pulses having the same frequency is provided even for the worst case.

Obviously, numerous modifications and variations of the present invention are possible in light of the above teachings. Thus, for example, although the centralized controlling apparatus according to the present invention has been illustrated with the two types of signals of frequency 210 Hertz and 260 Hertz, it should be apparent that any two types of signals of different frequency which are different from the fundamental frequency, such as 60 Hertz and higher harmonics thereof, can readily be employed.

It should also be apparent that it is possible to control more than one type of apparatus from a centralized control in accordance with the present invention, by switching the load of one apparatus with the signals of 210 Hertz and 260 Hertz, and by switching the load of another apparatus with signals, such, for example, as of 330 Hertz and 380 Hertz. The centralized control of loads of more than two types of different apparatus can

be effectively attained by changing the resonance point of the resonance frequency relays.

Also, while in the described embodiment, a mechanical resonance relay is used as the frequency relay, it should be understood that any type of relay capable of switching by electrical signals of a specific frequency can be employed for the purpose in the same manner. It is therefore to be understood that within the scope of the appended claims, the invention may be practiced otherwise than as specifically described herein.

What is claimed as new and desired to be secured by Letters Patent of the United States is:

1. A centralized controlling apparatus, comprising:
 - a transmitter for supplying first and second signals of two different frequencies;
 - a resonance circuit including a coil and a condenser which are electrically resonated by receiving said first and second signals transmitted from said transmitter;
 - a stator core which supports said coil and forms a magnetic flux circuit and has an opening formed in a portion thereof;
 - a first resonator placed in said opening and which is mechanically vibrated by the magnetic flux in said opening when said resonance circuit is resonated in response to said first signal;
 - a second resonator placed in said opening which is mechanically vibrated by the magnetic flux in said opening when said resonance circuit is resonated in response to said second signal;
 - a first movable contact which is activated by said first resonator in its vibrating condition to turn on a first switch;
 - a first weight fixed on said first movable contact for maintaining said first switch in its on condition during the time of activation of said first movable contact;
 - a second movable contact which is activated by said second resonator in its vibrating condition to turn on a second switch;
 - a second weight fixed on said second movable contact for maintaining said second switch in its on condition during the time of activation of said second movable contact;
 - a first bimetal which is curved for a predetermined degree after a delay of a predetermined time at the turning on of said first switch;
 - a second bimetal which is curved for a predetermined

degree after a delay of a predetermined time at the turning on of said second switch; and

- a main switch inserted in a load circuit which is driven by said first bimetal to turn on said load circuit and to maintain such a condition when said first bimetal is curved in a predetermined degree and which is driven by said second bimetal to turn off said load circuit and to maintain such a condition when said second bimetal is curved a predetermined degree.

2. The centralized controlling apparatus according to claim 1, wherein said delay time is selected so as to be shorter than the duration of said signals and to be longer than the duration of a coded signal having a relatively short duration.

3. A centralized controlling apparatus comprising: a transmitter for supplying signals of two different frequencies through a distribution line; means for supplying ac power to a load through said distribution line;

a pair of frequency sensitive relays including mechanical resonators which separately operate in response to receiving a corresponding one of said two different frequency signals supplied from said transmitter;

two different control elements of the thermal induction type which are indirectly responsive to current flowing through said frequency sensitive relays; and,

switching means for controlling the connection of said ac power to said load that switch from one position to another after predetermined delay period in accordance with the selective actuation of one of said two differential control elements, said one differential control element being responsive to the operation of one of said two frequency sensitive relays for temporarily maintaining a particular position of said switching means, said delay period of said switching means being shorter than the duration period of either of said signals from said transmitter, but being longer than a predetermined period and wherein said switching means is closed for energizing said load when one of said thermal induction elements is bent beyond a given point and opened for de-energizing said load when the other of said thermal induction elements is bent beyond a given point.

* * * * *

50

55

60

65

UNITED STATES PATENT OFFICE
CERTIFICATE OF CORRECTION

PATENT NO. : 3,903,508
DATED : September 2, 1975
INVENTOR(S) : KATSUMI TAKETA FUKUYAMA

It is certified that error appears in the above-identified patent and that said Letters Patent are hereby corrected as shown below:

Change Assignee from "Mitsubishi Kenki Kabushiki Kaisha" to
--Mitsubishi Denki Kabushiki Kaisha--.

Signed and Sealed this
twenty-fourth Day of February 1976

[SEAL]

Attest:

RUTH C. MASON
Attesting Officer

C. MARSHALL DANN
Commissioner of Patents and Trademarks