

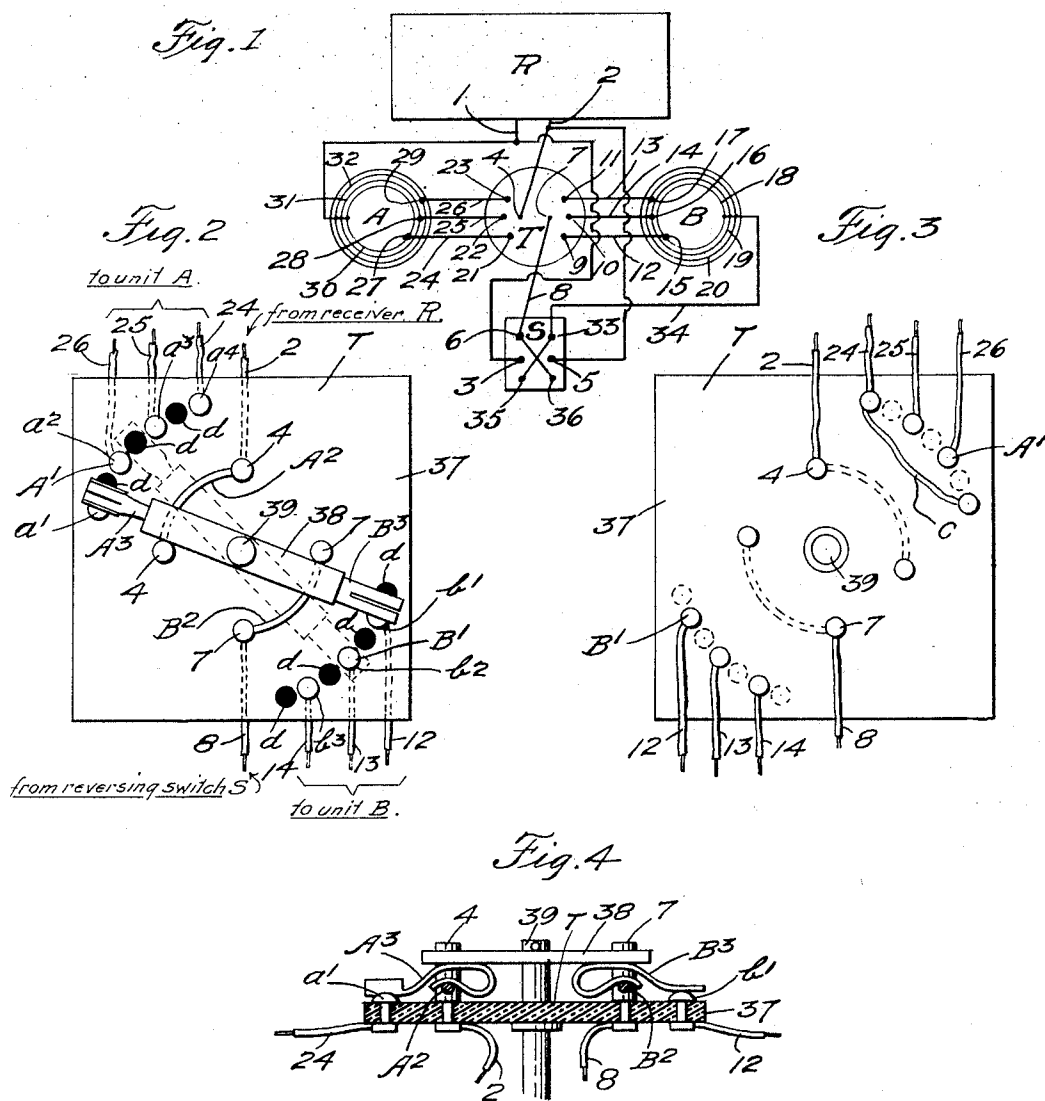
Aug. 18, 1931.

C. H. DUFFY

1,818,987

RADIO LOUD SPEAKER AND THE LIKE

Filed June 30, 1930



UNITED STATES PATENT OFFICE

CHARLES HUGH DUFFY, OF MIAMI, FLORIDA

RADIO LOUD SPEAKER AND THE LIKE

Application filed June 30, 1930. Serial No. 464,788.

REISSUED

(GRANTED UNDER THE ACT OF MARCH 3, 1883, AS AMENDED APRIL 30, 1928; 370 O. G. 757)

The invention described herein may be manufactured and used by or for the Government for governmental purposes, without the payment to me of any royalty thereon.

5 This invention relates to radio loud speakers and the like, but more particularly to a drive system therefor, and has for its object to incorporate improvements over my U. S. Patent No. 1,740,161 dated Dec. 17, 1929, wherein two or more driving units are employed.

In radio and like loud speakers wherein the diaphragm is driven by a single unit, such unit can, by a plurality of field wind-
15 ings or by other known means, be caused to be pitched to a high resonance in order to accentuate the reproduction of the high frequencies and slight the value of the lows, or it may be pitched to a low resonance to
20 accentuate the reproduction of the low frequencies and slight the value of the highs. Such a system however does not contemplate an accentuation of both the high and low frequencies at the same time, nor does it
25 provide for the variations of simultaneous accentuations of both high and low frequencies.

In the present invention, I prefer to employ a plurality of diaphragm driving units,
30 or pulsating current impulse responsive devices, preferably two, each of which has preferably three field windings. One of the windings being of a relatively low impedance or ohmage resistance in order to let through
35 the high frequency pulsations and relatively restrict the lows. The other of the windings being of a relatively medium impedance or ohmage resistance so as to let through the high and low frequencies
40 with equal facility and thus pitch the reproduction at medium values. The other of the windings being of a relatively high impedance or ohmage resistance so as to restrict the highs and let through the lows to
45 pitch the reproduction to a low resonance.

In the example shown in the accompanying drawings, two such diaphragm driving units are illustrated.

50 By such an arrangement, and by the construction which will be presently described,

the reproduced sound may be pitched to produce six different tonal changes, while by reason of the instrumentality provided for causing the driving units to deliver simultaneous but opposed pulsations to the vibra-
55 tory diaphragm, or diaphragms, these six tonal changes may be increased to twelve different tonal changes; all of which instrumentalities will be first fully described and afterwards specifically pointed out in the
60 appended claims.

Referring to the accompanying drawings:

Fig. 1 is a diagrammatic view of one example of the component parts of the system. 65

Fig. 2 is a front elevation of the selective switch.

Fig. 3 is a rear elevation of the same and

Fig. 4 is a cross sectional view through the same. 70

Like numerals of reference indicate the same parts throughout the several figures, in which:

R represents the receiver, and 1 and 2 represent the wires through which the pulsating current is delivered therefrom. 75

As shown in the example illustrated in Fig. 1, the wire 1 passes to the three fields windings of the diaphragm drive unit A, and also to one center pole 3 of the reversing switch S. The other wire 2 passes to a binding post 4 of the selective switch T, and also to the other of the central poles 5 of the reversing switch S.

Connecting a pole 6 of the reversing switch S with a binding post 7 of the selective switch T, is a wire 8. Three switch binding posts 9, 10, and 11, Fig. 3 are connected by wires 12, 13 and 14 to the three taps 15, 16, and 17 of the three field windings 18, 19 and 20 of the drive unit B, while three switch binding posts 21, 22 and 23 are connected by wires 24, 25 and 26 to the three taps 27, 28 and 29 of the three field windings 30, 31 and 32 of the drive unit A. 85

Connecting the pole 33 of the reversing switch S with the three field windings 18, 19, and 20 of the drive unit B, is a wire 34. The poles 35 and 36 of the reversing switch S are 100

connected to the poles 6 and 33 thereof by crossed wires as diagrammatically shown, or the reversal of the direction of flow of pulsating current from the receiver R to the drive unit B may be effected by any other known means.

Referring now to the selective switch T, it will be seen from Figs. 2, 3, and 4 of the drawings that the same embodies an insulating base 37, and insulating arm 38 carried on a shaft 39 centrally mounted in the base 37.

Arcuately arranged on the base 37, are two series of switch contacts A' and B'. Each of the contacts of these series have preferably semi-spherical heads standing above the plane of the base 37, and each series comprises live and dead contacts alternately arranged, the dead contacts being shown black.

In the series A' the first and last or end contacts are live, each alternate contact being dead, while in series B', the first and last or end contacts are dead, each alternate contact being live. The result of this arrangement is that a live contact of one series is diametrically opposite to a dead contact of the other series, and a dead contact of one series is diametrically opposite to a live contact of the other series. The four live contacts of series A' are indicated by the characters a^1 , a^2 , a^3 and a^4 , while the three live contacts of series B' are indicated by the characters b^1 , b^2 and b^3 . The dead contacts of both series are indicated by the letter d .

Arranged intermediate the series of contacts A' and the central shaft 39 is an arcuate or segmental stationary contact A², common to the series A', and supported at each end in two posts 4 which form stops for the insulated arm 38, one of which posts forms a binding post for the wire 2 from the receiver R.

Intermediate the series of contacts B' and central shaft 39 is an arcuate or segmental stationary contact B² common to the series B' and supported at each end in two posts 7, one of which forms a binding post for the wire 8 from the reversing switch S.

The insulated contact-carrying arm 38 extends over the two arcuate or segmental contacts A² and B² and carries at each end thereof a spring double contact or brush. One of these A³ is formed, for instance, as shown in Fig. 4, the outer end terminating in a V shaped contact or brush to engage the series of contacts A', while the inner end is curved as shown and engages the common arcuate or segmental contact A². The other of these spring double contacts B³ is formed, for instance, as shown in Fig. 4, the outer end being flat and bifurcated (Fig. 2) to engage the series of contacts B', while the inner end is curved as shown and engages the common arcuate or segmental contact B².

Having thus described the construction,

the operation of the selective switch is as follows:

From Fig. 3 it will be seen that the two end line contacts of series A' are connected together by a wire C, and from Fig. 2, it will be seen that the V shaped end of the spring contact A³ is in electrical contact with the live end contact and the adjacent dead contact of series A', while it will be understood from Fig. 4, the inner end of the spring contact A³ is always in electrical contact with the common arcuate or segmental contact A².

It will be seen from Fig. 2 that the flat bifurcated end of the spring contact B³ is wide enough to make contact with two of the contacts of series B', and when the V shaped end of contact A³ is in contact with two live and dead contacts of series A', the flat bifurcated end of spring contact B³ is in contact with two live and dead contacts of series B', while the inner curved end of spring contact B³ is always in contact with the common arcuate or segmental contact B² (Fig. 4).

The switch being in position shown in Fig. 2, the circuit from the receiver R passes to the drive unit A or pulsating current impulse responsive device through the selective switch T. This circuit is through wire 2 from receiver R to binding post 4 of the common arcuate or segmental contact A² and through the spring double contact A³ to the switch contact a^1 and through the wire 24 to the tap 27 of the low impedance field winding 30, which for instance may be of the order of 500 ohms. This winding pitches the drive unit A or impulse responsive device to a high resonance.

The circuit from the receiver R to the drive unit B passes through the wire 2 to the central pole 5 of the reversing switch S and to the binding post 33 of the reversing switch and through the wire 34 to the low impedance field winding 18 and through the wire 12 to the switch contact b^1 of series B'; then through the spring double contact B³ to the common arcuate or segmental contact B² and its binding post 7 through the wire 8 to the pole 6 of the reversing switch S. From the center pole 3 of the reversing switch S the circuit leads to the receiver R.

It will thus be seen that when the selective switch T is in position shown in Fig. 2, the low impedance windings of both drive units A and B are in circuit, which pitches both drive units or impulse responsive devices to a high resonance. It will also be seen that when the central poles 3 and 5 of the reversing switch S are connected to the poles 6 and 33 as in the circuit just described, the direction of flow of the pulsating current from the receiver R to the drive unit B is the reverse of that to the drive unit A. This causes positive impulses of drive unit A to be simultaneously accompanied by negative impulses of drive unit B. When the units A and B are

connected at different points to a common diaphragm or to two diaphragms and in such a circuit, positive sound producing impulses are imparted by one portion of the single diaphragm, or by one diaphragm simultaneously

with negative sound producing impulses imparted by another portion of the diaphragm or by another adjacent diaphragm from the same side of the diaphragm or diaphragms. The acoustical effect of this diaphragm action is that diaphragm and unnatural resonance is eliminated, the audibility of the low frequencies is impaired and the moderate and high frequencies are sharpened. When the action of one of the drive units is thus reversed, the effect is particularly favorable to the reproduction of the speaking voice, where the elimination of fuzzy resonance is desirable and sharpness and definition of the spoken words essential.

Referring again to Fig. 2, it will be seen that as the arm 38 is moved clockwise, the V shaped end of the spring contact A^3 breaks contact with the live switch contact a' and rides up over the adjacent dead contact d . At the same time the bifurcated flat end of the spring contact B^3 leaves the end-most dead contact d of the series B' and wipes over the adjacent live contact b' . During these movements, the circuit to the drive unit A is broken, but the circuit to the drive unit B is maintained. The movement is therefore accompanied by no break nor interruption in the reproduction, as the entire output from the receiver R is passing to the drive unit B during this brief period. The clockwise movement being continued, the said V shaped end of the spring contact A^3 drops down between the dead contact d , over which it has ridden, and the next adjacent live contact a^2 and establishes electrical contact with the live contact a^2 . At the same time, the bifurcated flat end of the spring contact B^3 passes over the live contact b' and on to the adjacent dead contact d without breaking contact with said live contact b' . The drive unit B is thus maintained in its circuit, but a new circuit has been established for the drive unit A. The switch contact a^2 of series A' is connected to the highest impedance field winding 32 of the drive unit A, by the wire 26 and this field winding is thus brought into the circuit. This pitches the drive unit A to its lowest resonance, while the drive unit B is still pitched to its highest resonance. The acoustical effect of this combination is that the fullest range of which the system is capable is obtained. The high frequencies are reproduced at their maximum by the drive unit B, while the low frequencies are reproduced at their fullest values by the drive unit A. An audible click is produced at the instant the V shaped end of the spring contact A^3 drops down into contact with the live switch contact a^2 and the tension of the

spring contact A^3 is sufficient to maintain both contacts A^2 and B^2 against casual movement in either direction.

When it is desired to change to any of the other combinations to modify the resonance of the reproduction, as for instance to pitch the same to the lowest resonance of which the system is capable, the arm 38 is again moved clockwise. This causes the V shaped end of the spring contact A^3 to ride up on the live switch contact a^2 and maintain its contact therewith. At the same time the bifurcated flat end of spring contact B^3 breaks contact with the live switch contact b' and passes over the adjacent dead contact d . These movements result in maintaining the drive unit A in circuit and breaking the circuit of the drive unit B, so that during this brief interval, the reproduction is unbroken and uninterrupted. Continued movement of the arm 38 clockwise causes the V shaped end of the spring contact A^3 to drop down between the live switch contact a^2 , with which it is in contact, and the adjacent dead contact d , thus maintaining contact with said live switch contact a^2 and maintaining the highest impedance field winding 32 of the drive unit A in circuit. At the same time the bifurcated flat end of spring contact B^3 passes into electrical contact with the adjacent live switch contact b^2 and connects the highest impedance field winding 20 of the drive unit B in the circuit through the wire 13. This changes the pitch of the resonance of the drive unit B from the highest to the lowest and as the corresponding highest impedance field winding 32 of the drive unit A is maintained in circuit as just described, both drive units A and B are pitched to their lowest resonance.

Further selective movement of the arm 38, maintains the drive unit B in circuit to continue the reproduction without break or interruption and after momentarily breaking the circuit of drive unit A, establishes another circuit by bringing the intermediate field winding 31 of drive unit A into circuit through the switch contact a^2 and the wire 25. This movement maintains the pitch of the drive unit B at its lowest resonance and changes the pitch of the drive unit A to a medium resonance.

Further movement of the arm 38, maintains the drive unit A in circuit, but breaks the circuit to the drive unit B and establishes another circuit in which the intermediate field winding 19 is brought in circuit. This pitches both drive units A and B to a medium resonance.

Further movement of the arm 38 maintains the drive unit B in circuit to continue the reproduction without break or interruption, but establishes another circuit for drive unit A in which the low impedance field winding of the drive unit A is brought in circuit. This pitches the drive unit A to a high reso-

nance and maintains the drive unit B at a medium resonance.

It will be seen from Fig. 3 illustrating a rear view of the selective switch shown in Fig. 2 that the two endmost live contacts of series A', which as will appear from Fig. 2 are contacts a' and a^4 , are electrically connected together. Consequently when the movable contact A^3 is in contact with either of these two endmost live contacts a' and a^4 , the same circuit to the drive unit A is closed through the wires 2 and 24, as will be apparent from Fig. 3. For instance from Fig. 2, it will be seen that while contacts B^2 and b' are connected as shown, contact A^2 and a' are connected, but as contacts a' and a^4 are electrically connected (Fig. 3), the circuit is the same as if the movable contact A^3 were in physical contact with the contact A^4 .

It will be noted that in the operation of the selective switch T, to change from one point to another the circuits of the drive units A and B are alternately broken, and that at no time is there any break in the reproduction, because while the switch is changing one of the drive units from one pitch resonance to another, the circuit of the other of the drive units is maintained unbroken.

In the example shown in which the drive units are each provided with three field windings of different impedances, six combinations are obtainable to effect six different tonal changes in the reproduction by the selective switch T. As each of these combinations can be again changed by the reversing switch S, a total of twelve different tonal change is available in the example shown.

While I have disclosed one example of the system, the pitch of the resonance of the two drive units or impulse responsive devices may be changed in any known manner other than by different or tapped field windings, as for instance by fixed or variable condensers, and the units or impulse responsive devices selectively brought into various combinations as by a selective switch such for instance as herein described.

Having thus described one example of the invention, what I claim as new and desire to secure by Letters Patent of the United States is:

1. A drive system for radio loud speaker diaphragms and the like including two diaphragm actuating units, each of which includes a plurality of field windings of different impedances, a source of pulsating electric current, an electrical circuit, a selective switch including two series of switch contacts, one series of said contacts for each actuating unit and for electrical connection with the plurality of field windings of each actuating unit, and a reversing switch in electrical circuit with one of the actuating units and disposed electrically between the source of pulsating current and the selective switch, where-

by the direction of flow of pulsating current through the field windings of one unit may be reversed with respect to the direction of flow of the pulsating current through the field windings of the other of the actuating units.

2. A drive system for radio loud speaker diaphragms and the like, including two diaphragm actuating units, each of which includes a plurality of field windings of different impedances, a source of pulsating electric current, an electrical circuit, a selective switch including two series of switch contacts for electrical connection with the plurality of field windings of the actuating units, whereby any one of the field windings of one actuating unit may be connected in circuit with any one of the field windings of the other actuating unit, and a reversing switch in electrical circuit with one of the actuating units, whereby the direction of flow of pulsating current through the field windings of one unit may be reversed with respect to the direction of flow of pulsating current through the field windings of the other of the actuating units.

3. A drive system for radio loud speaker diaphragms and the like, including two diaphragm actuating units, each of which includes a plurality of field windings of different impedances, a source of pulsating electric current, an electric circuit, a selective switch including two series of switch contacts for electrical connection with the plurality of field windings of the actuating units, whereby any one of the field windings of one actuating unit may be connected in circuit with any one of the field windings of the other actuating unit.

4. A drive system for radio loud speaker diaphragms and the like, including two diaphragm actuating units, each of which includes a plurality of field windings of different impedances, an electrical circuit, a selective switch including two series of switch contacts for electrical connection with the plurality of field windings of the actuating units, whereby any one of the field windings of one actuating unit may be connected in circuit with any one of the field windings of the other actuating unit.

5. A drive system for radio loud speakers and the like including two diaphragm actuating units, and including means for imparting to each of the two units a plurality of different pitch resonances, an electrical circuit and a selective switch including means for electrically connecting in the circuit any one of the plurality of different pitch resonance imparting means for one unit and any one of the plurality of different pitch resonance imparting means for the other unit, whereby the sound reproduced by each of the two units may have the same pitch resonance, or the sound reproduced by one unit may have a high pitch resonance and the sound jointly re-

produced by the other unit may have a low pitch resonance.

6. A drive system for radio loud speakers and the like, including two diaphragm actuating units, an electrical circuit, means for imparting to each of the two units a plurality of different pitch resonances, and a selective switch for selectively connecting the two units in the circuit to impart to each of them the same pitch resonance, or to impart to one of them a certain pitch resonance and to the other of them a different pitch resonance.

7. A drive system for radio loud speakers and the like including two diaphragm actuating units, an electrical circuit, means for imparting to each of the two units a plurality of different pitch resonances, and means for selectively connecting the two units in the circuit to impart to each of them the same or different pitch resonances.

8. A drive system for radio loud speakers and the like, including two pulsating current impulse responsive devices, an electrical circuit, means for imparting to each of the two impulse responsive devices a plurality of different pitch resonances, and means for selectively connecting the two impulse responsive devices to impart to each of them the same or different pitch resonance.

9. A drive system for radio loud speaker diaphragms and the like, including two diaphragm actuating units, each of which includes a plurality of field windings, of different impedances, an electrical circuit, a selective switch including two series of switch contacts, one series of said contacts for each actuating unit and for electrical connection with the plurality of field windings of each actuating unit, switch contacts movable over both series of switch contacts to selectively engage a contact of each series of switch contacts to bring any one of the field windings of one unit, and any one of the field windings of the other unit in the electrical circuit, and a reversing switch in electrical circuit with one of the actuating units, whereby the direction of flow of the current through the selected field winding of one unit may be reversed with respect to the direction of flow of the current through the selected field winding of the other of the actuating units.

10. A device system for radio loud speaker diaphragms and the like, including two diaphragm actuating units, each of which includes a plurality of field windings of different impedances, an electrical circuit, and a selective switch including two series of switch contacts, one series for each actuating unit and for electrical connection with the plurality of field windings of each actuating unit, switch contacts movable over both series of switch contacts to selectively engage a contact of each series of switch contacts to bring any one of the field windings of one

unit and any one of the field windings of the other unit in the electrical circuit.

11. A drive system for radio loud speaker diaphragms and the like, including two diaphragm actuating units, each of which includes a plurality of field windings of different impedances, an electrical circuit, and a selective switch including two series of switch contacts, one series for each actuating unit, the contacts of each series being opposite to one another, a switch contact movable over both series of switch contacts to selectively engage opposite switch contacts of each series to bring any one of the field windings of both units in the electrical circuit, and a reversing switch in circuit with one of the units to reverse the direction of flow of current to one unit with respect to the other unit.

12. A drive system for radio loud speaker diaphragms and the like including two diaphragm actuating units, each of which includes a plurality of field windings of different impedances, an electrical circuit, and a selective switch including two series of switch contacts, one series for each actuating unit, the contacts of each series being opposite to one another, switch contacts movable over both series of switch contacts to selectively engage opposite switch contacts of each series to bring any one of the field windings of both units in the electrical circuit.

13. A drive system for radio loud speaker diaphragms and the like, including two diaphragm actuating units and means for imparting to each of the units a plurality of different pitch resonances, an electrical circuit, a selective switch including two series of switch contacts, the contacts of each series being opposite to one another, a switch contact movable over both series of switch contacts to selectively engage opposite switch contacts of each series to connect one of the plurality of different pitch resonance imparting means of one unit and one of the plurality of different pitch resonance imparting means of the other unit in the circuit and means for reversing the direction of flow of current to one unit with respect to the direction of flow of current to the other unit.

14. A drive system for radio loud speaker diaphragms and the like, including two diaphragm actuating units and means for imparting to each of the units a plurality of different pitch resonances, an electrical circuit, a selective switch including two series of switch contacts, the contacts of each series being opposite to one another, and switch contacts movable over both series of contacts to selectively engage opposite switch contacts of each series to connect one of the plurality of different pitch resonance imparting means of one unit and one of the plurality of dif-

ferent pitch resonance imparting means of the other unit in the circuit.

15. A drive system for radio loud speaker diaphragms and the like, including two diaphragm actuating units, an electrical circuit, the units including a plurality of field windings of different impedances, a selective switch including a series of switch contacts for each unit, each series of contacts including a live contact for electrical connection with each of the plurality of field windings, and also including in alternate arrangement with the live contacts a plurality of dead contacts, the live contacts of one series being diametrically opposite the dead contacts of the other series, an arm having contacts movable over each series of contacts, the movable contacts being of a width to engage a live and a dead contact of each series to selectively connect any field winding of one unit and any field winding of the other unit in the circuit, the herein recited arrangement of switch contacts insuring the holding of a field winding of one unit in the circuit when the connection is broken to a field winding of the other unit as the movable contacts are selectively moved, to the end that the different field windings of the two units may be selectively connected and disconnected in the circuit without interruption or break in the sound reproduction, and means for reversing the direction of flow of the current to one of the units with respect to the direction of flow of the current to the other of the units.

16. A drive system for radio loud speaker diaphragms and the like, including two diaphragm actuating units, an electrical circuit, the units including a plurality of field windings of different impedances, a selective switch including a series of switch contacts for each unit, each series of contacts including a live contact for electrical connection with each of different field windings and also including in alternate arrangement with the live contacts a plurality of dead contacts, the live contacts of one series being diametrically opposite the dead contacts of the other series, an arm having contacts movable over each series of contacts, the movable contacts being of a width to engage a live and a dead contact of each series to selectively connect any field winding of one unit and any field winding of the other unit in the circuit, the herein recited arrangement of switch contacts insuring the holding of a field winding of one unit in the circuit when connection is broken to a field winding of the other unit, as the movable contacts are selectively moved, to the end that the different field windings of the two units may be selectively connected and disconnected in the circuit without interruption or break in the sound reproduction.

17. A drive system for radio loud speaker

diaphragms and the like, including two diaphragm actuating units, an electrical circuit, each unit including a plurality of field windings of different impedances, a selective switch including a series of switch contacts for each unit, each series of contacts including an upstanding live contact for electrical connection with each of the different field windings, and also including in alternate arrangement with the live contacts, a plurality of upstanding dead contacts, an arm having contacts movable over each series of contacts, the movable contacts being of a width to engage a live and a dead contact of each series to selectively connect any field winding of one unit and any field winding of the other unit in the circuit, one of the movable contacts being V shaped to drop in between a live and a dead contact of one series to prevent casual movement of the movable contacts.

18. A drive system for radio loud speaker diaphragms and the like including two diaphragm actuating units, an electrical circuit, each unit including a plurality of field windings of different impedances, a selective switch in electrical connection with the different field windings of both units, the selective switch including means for selectively connecting any field winding of one unit and any field winding of the other unit in the circuit without simultaneously breaking the circuit through the field windings of both units, and means for reversing the direction of flow of current to one unit with respect to the direction of flow of current to the other unit.

19. A drive system for radio loud speaker diaphragms and the like including two diaphragm actuating units, an electrical circuit, each unit including a plurality of field windings of different impedances, a selective switch in electrical connection with the different field windings of both units, the selective switch including means for selectively connecting any field winding of one unit and any field winding of the other unit in the circuit without simultaneously breaking the circuit through the field windings of both units.

20. A drive system for radio loud speaker diaphragms and the like, including two diaphragm actuating units, an electrical circuit, the system including means for imparting to each of the units a plurality of different pitch resonances, a selective switch for electrical connection with the means for imparting to each unit a plurality of different pitch resonances, the selective switch including means for selectively connecting in the circuit any one of the plurality of different pitch resonance imparting means for one of the units and any one of the plurality of different pitch resonance imparting means for the other of the units without simultaneously breaking the circuit through the resonance pitching means of both units, and means for

reversing the direction of flow of current through the resonance pitching means of one of the units.

21. A drive system for radio loud speakers 5 diaphragms and the like, including two diaphragm actuating units, an electrical circuit, the system including means for imparting to each of the units a plurality of different pitch resonances, a selective switch for 10 electrical connection with the means for imparting to each of the units a plurality of different pitch resonances, the selective switch including means for selectively connecting in the circuit any one of the plurality of different pitch resonance imparting means for one 15 of the units and any one of the plurality of different pitch resonance imparting means for the other of the units without simultaneously breaking the circuit through the resonance pitching means of both units. 20

22. A drive system for radio loud speaker diaphragms and the like, including two diaphragm actuating units, an electrical circuit, the system including means for imparting 25 to each of the units a plurality of different pitch resonances, means for electrical connection with the means for imparting to each of the units a plurality of different pitch resonances and including means for selectively connecting in the circuit any one of the 30 plurality of different pitch resonance imparting means for one of the units and any one of the plurality of different pitch resonance imparting means for the other of the units and for maintaining one of the plurality of 35 different pitch resonance imparting means for one of the units in the circuit, while the circuit is broken through a pitch resonance imparting means for the other unit.

23. A drive system for radio loud speakers 40 and the like including a plurality of pulsating current impulse responsive devices, an electrical circuit, the system including means for imparting to any of the impulse responsive devices a plurality of different pitch 45 resonances and including means for selectively connecting in the circuit any one of the plurality of different pitch resonance imparting means for a part of the impulse responsive devices and any one of the plurality 50 of different pitch resonance imparting means for another part of the impulse responsive devices and for maintaining one of the plurality of different pitch resonance imparting means for one of the impulse responsive devices in the circuit while the circuit is broken 55 through the pitch resonance imparting means of part of the plurality of impulse responsive devices, and means for reversing the direction of flow of current to a part of the impulse responsive devices. 60

24. A drive system for radio loud speakers and the like, including a plurality of pulsating current impulse responsive devices, an 65 electrical circuit, the system including means

for imparting to any of the impulse responsive devices a plurality of different pitch resonances and including means for selectively connecting in the circuit one of the plurality of different pitch resonance imparting means 70 for a part of the impulse responsive devices and one of the plurality of different pitch resonance imparting means for another part of the impulse response devices and for maintaining one of the plurality of different pitch 75 resonance imparting means for one of the impulse responsive devices in the circuit while the circuit is broken through the pitch resonance imparting means of part of the impulse responsive devices. 80

25. A drive system for radio loud speakers and the like, including a plurality of pulsating current impulse responsive devices, an electrical circuit, the system including means 85 for imparting to one of the plurality of impulse responsive devices a plurality of different pitch resonances and means for connecting in the circuit any one of the plurality of different pitch resonance imparting means of one of the impulse responsive devices with 90 another of the impulse responsive devices.

26. A drive system for radio loud speakers or the like, including a plurality of pulsating current impulse responsive devices, an electrical circuit, the system including 95 means for imparting to one of the plurality of impulse responsive devices a plurality of different pitch resonances, means for connecting in the circuit any of the plurality of different pitch resonance imparting means of 100 one of the impulse responsive devices with another of the impulse responsive devices, and means in the circuit for reversing the direction of flow of pulsating current to a part of the impulse responsive devices. 105

In testimony whereof I affix my signature.

CHARLES HUGH DUFFY.