

Nov. 9, 1954

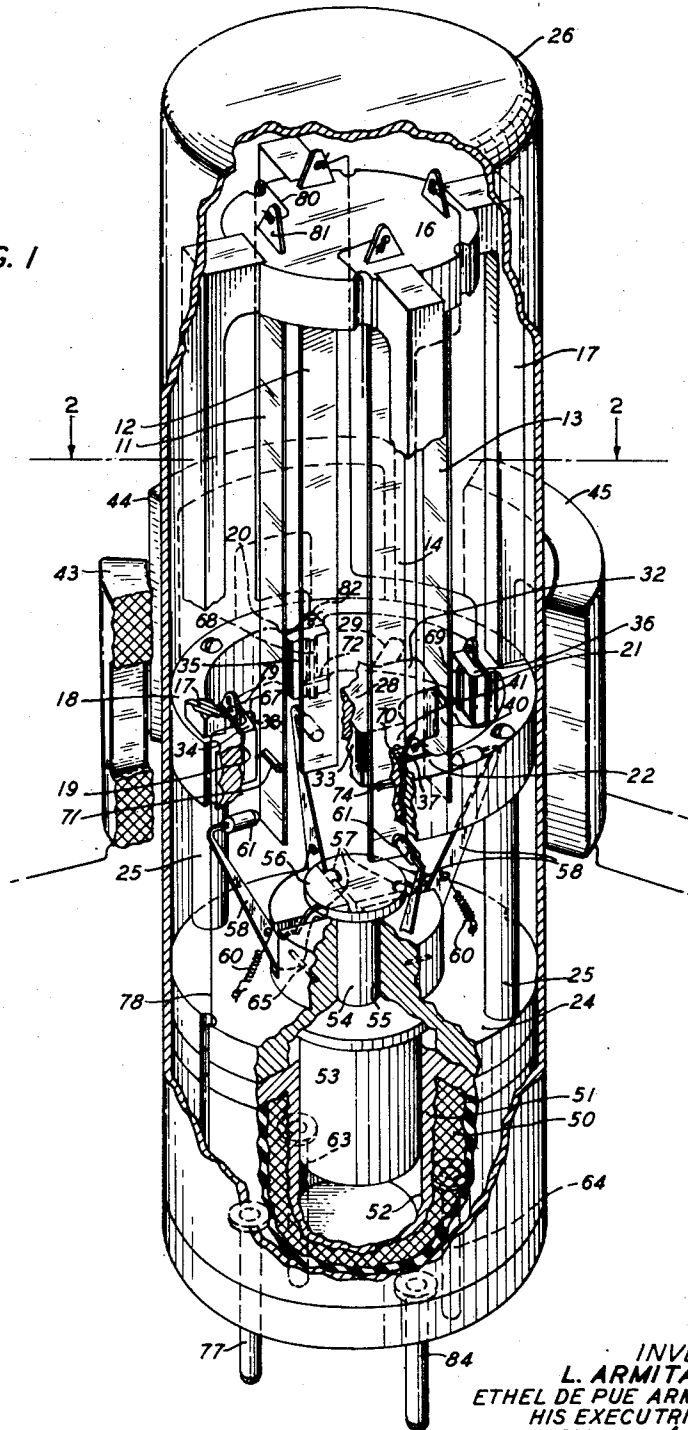
LE ROY ARMITAGE
VIBRATING REED SELECTOR

2,694,119

Filed Nov. 30, 1951

2 Sheets-Sheet 1

FIG. 1



INVENTOR
L. ARMITAGE DECEASED
ETHEL DE PUE ARMITAGE
HIS EXECUTRIX
BY *[Signature]*
ATTORNEY

Nov. 9, 1954

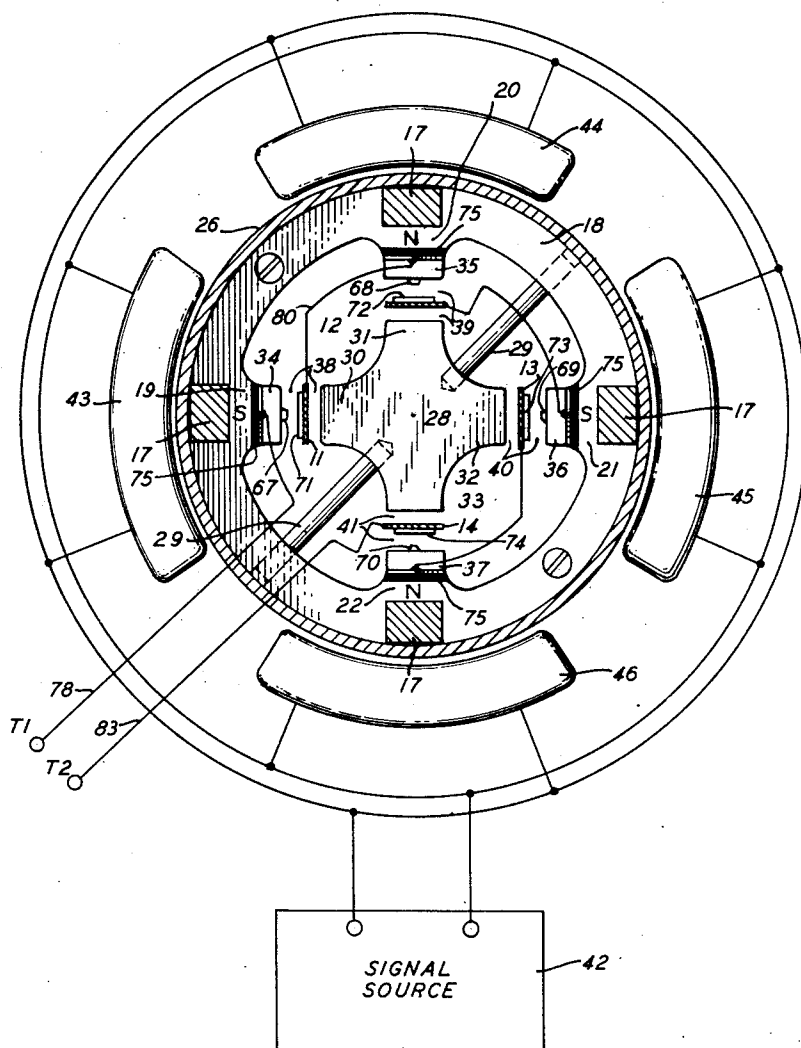
LE ROY ARMITAGE
VIBRATING REED SELECTOR

2,694,119

Filed Nov. 30, 1951

2 Sheets-Sheet 2

FIG. 2



INVENTOR
L. ARMITAGE DECEASED
ETHEL DE PUE ARMITAGE
HIS EXECUTRIX
BY *[Signature]*
ATTORNEY

1

2,694,119

VIBRATING REED SELECTOR

Le Roy Armitage, deceased, late of Nutley, N. J., by Ethel D. Armitage, executrix, Nutley, N. J., assignor to Bell Telephone Laboratories, Incorporated, New York, N. Y., a corporation of New York

Application November 30, 1951, Serial No. 259,132

4 Claims. (Cl. 200—91)

This invention relates to vibrating reed selectors and more particularly to selectors having a plurality of vibrating reeds.

Telephone signaling systems have been suggested wherein apparatus is actuated by a plurality of vibrating reeds; for example, such a system is disclosed in the application of Henry C. Harrison, Serial No. 767,487, filed August 8, 1947, now Patent No. 2,602,853 issued July 8, 1952. In that system, a plurality of vibrating magnetic reed contacts, each reed having a resonant frequency in the audio spectrum, are connected in series to a gas discharge tube. A common coil surrounds all of the tuned reeds providing means for actuating the reeds when the coil is energized by a signal containing components which are the same as the resonant frequencies of the reeds. When all of the reeds are actuated by the simultaneous reception of the frequencies to which they are tuned, coincidence of closure of all of the vibrating contacts fires the gas tube which controls the external signaling device or circuit.

An object of this invention is to improve vibrating reed selectors for systems of the type described above. Other objects are to reduce the space necessary for such selectors, to reduce the driving energy necessary to vibrate the individual reeds, simplify the signaling device or other associated apparatus, avoid the need of a separate gas tube in the control system, positively lock the contacts when they are actuated to their closed position, and provide a simple release mechanism for the locked contacts.

One feature of this invention resides in incorporating a plurality of vibrating reeds in a single housing; such an arrangement permits the incorporation of all of the reeds which are resonant at the frequencies assigned to the signaling station in a single unit which is compact and requires a small driving coil and driving energy.

Another feature of this invention resides in magnetically locking the paired contacts associated with each vibrating reed closed, when the reed has been actuated sufficiently to pass through a predetermined amplitude. This provides a continuously closed circuit through the selector thereby avoiding the need of a separate gas tube as employed in the system disclosed in the above H. C. Harrison application.

Another feature resides in providing a single release mechanism for all of the locked reeds of a vibrating reed selector unit, this single release mechanism being actuated electrically and being of either a mechanical or magnetic type.

One specific embodiment of this invention comprises a unit including four magnetic responsive tuned vibrating reeds mounted adjacent four magnetic pole pieces associated with and electrically insulated from four poles of a permanent magnetic ring. Four pairs of associated contacts are mounted on the pole pieces and reeds so that each pair of the contacts will be closed when its associated reed is deflected and held against its corresponding pole piece. A reed is deflected to its contact closing position when a signal including a component of the reed's resonant frequency passes through a surrounding coil. When this component is of prescribed strength it causes the reed to oscillate through sufficient amplitude to bring it within the magnet field of the pole piece so that it is drawn to and held against that pole piece to close the contacts. When all four reeds are thus actuated, a series circuit is completed through the device to close a circuit for any associated apparatus. Those reeds

2

which are thus secured to the pole pieces are reset by an electromechanical tripping device which carries them out of the field around the pole pieces thereby opening the contacts.

Other objects and features of this invention will be more fully understood from the following detailed description when read in conjunction with the accompanying drawing in which:

Fig. 1 is a perspective view of a vibrating reed device illustrative of one embodiment of this invention with portions thereof broken away to more clearly disclose its structure; and

Fig. 2 is a sectional view of this device taken along the line 2—2 of Fig. 1 with portions of the structure disclosed in Fig. 1 omitted for purposes of clarity.

Referring now to the drawing, Fig. 1 shows a vibrating reed selector unit including four vibrating reeds 11, 12, 13, and 14 which are resonant at frequencies in the audio range. These reeds are rigidly attached at one end to a disc shaped member 16 which may conveniently be of insulating material to insure the electrical isolation of the reeds from each other. Supporting columns 17 extend from the disc 16 to a ring shaped permanent magnet 18 having four protuberances located 90 degrees apart on its internal periphery. These protuberances 19, 20, 21, and 22 constitute poles of the magnet, protuberances 19 and 21 being south poles and 20 and 22 north poles as may be seen in Fig. 2. These poles are located radially of the free ends of reeds 11, 12, 13, and 14. Magnet ring 18 in turn is supported from base 24 by columns 25 and the entire selector structure is enclosed in a housing 26 of paramagnetic material, for example of spun aluminum, secured to the base structure.

The effective magnetic circuit of the dominant selector unit comprises principally the ring magnet 18 and a ferromagnet cross shaped member 28 which is supported on the axis of the selector unit and in the plane of the magnet with its arms lying on the radii on which the reeds and poles are located by paramagnetic bars 29 extending to ring 18. The ends of the arms 30, 31, 32, and 33 on cross 28 in cooperation with pole pieces 34, 35, 36, and 37 define gaps 38, 39, 40, and 41 in the magnetic circuit through the magnet and cross in which the free ends of reeds 11, 12, 13, and 14 respectively are located. Thus the principal effective flux path of each pair of north-south poles as exemplified by the pair of poles 20 and 21 is from north pole 20 through a quadrant of ring 18 to south pole 21, through pole piece 36, gap 40, reed 13, gap 40, cross arms 32 and 31, gap 39, reed 12, gap 39, and pole piece 35.

The flux of the permanent polarizing magnet 18 is modulated by a superimposed flux generated by a signal current applied from source 42 to electrically parallel coils 43, 44, 45 and 46. Adjacent coils of this group are wound in opposite directions so that their fluxes are in an aiding relationship. The flux of each coil either opposes or aids the flux of each of the two adjacent permanent north-south pole pairs to alter the flux in the gaps of those pairs thereby tending to change the position of the reeds located in those gaps. When the signal and thus the flux contains a frequency component which is the resonance frequency of a reed, the forces exerted by the flux are effective to cause a substantial displacement of the reed. Vibration of the reed beyond a fixed amplitude carries it into a portion of the permanent magnet field of the polarizing magnet 18 which is sufficiently strong to pull the reed against the pole piece and hold it there until the force of the magnetic attraction is overcome. The magnet attraction can be overcome either by mechanical means moving the reed out of that portion of the field which is sufficiently strong to draw it back to the pole piece or by an opposing magnetic field which reduces the holding power of the permanent magnet sufficiently to permit the reed end to move away from the pole piece by virtue of its natural resilience.

An electromechanical reed release is shown in the illustrative embodiment of Fig. 1. It comprises a solenoid including a coil 50 wound on an insulating spool 51 forming an extension on base 24. An axial bore 52 in spool 51 receives a ferromagnetic slug 53 having a portion 54 which extends through an axial bore 55 in base 24. A

cap 56 on extension 54 provides a camming surface on its under side which is engaged by the riders 57 on the ends of bell crank levers 58. These bell crank levers are biased by springs 60 so that slug 53 is held in its raised position and electrically insulating fingers 61 on the opposite ends of the levers from riders 57 are out of engagement with reeds 11, 12, 13, and 14. When it is desired to release the reeds from the pole pieces of magnet 18 a suitable current is passed through coil 50 from terminal pin 63 to pin 64 secured to the head of spool 51. Slug 53 is drawn into the coil by the flux generated therein, and thus levers 58 are caused to pivot on pins 65 moving fingers 61 towards the axis of the selector to carry the reeds away from the pole pieces.

The switching function of the selector unit is effected by pairs of contacts mounted on the pole pieces and the reeds. Bars of contact metal 67, 68, 69, and 70 are mounted on pole pieces 34, 35, 36, and 37 respectively, in a position parallel to the selector axis to provide stationary contacts. Movable contacts comprising bars of contact metal 71, 72, 73, and 74 are secured on reeds 11, 12, 13, and 14 respectively transverse contacts 67, 68, 69, and 70. The pole pieces 34, 35, 36, and 37 are electrically insulated from ring magnet 18 and each other by layers of insulating material 75, positioned between and secured to the pole pieces and the inner faces of protuberances 19, 20, 21, and 22. Each pole piece is connected electrically with a reed of an adjacent pole piece so that adjacent pairs of associated contacts are serially connected. Thus when the reeds are locked to their respective pole pieces as described above each movable contact is bound to its associated stationary contact to complete a circuit from base pin 77 constituting terminal T1 of Fig. 2 through lead 78 to lug 79 on pole piece 34, through contact 67 to contact 71 and reed 11. Lead 80 is secured to the lug 81 on the upper end of reed 11 and electrically connects lug 82 on pole piece 35 thereto. A similar path is completed through reed 12 to pole piece 36, reed 13, pole piece 37, and reed 14 and thence to lead 83 connected to terminal T2 or base pin 84.

In operation, the selector is initially in a condition with all reeds separated from their pole pieces and stationary. Upon application of a signal current to coils 43, 44, 45 and 46 containing frequency components of the proper strength and the resonance frequency of all of the reeds, each reed vibrates through an amplitude which carries it into a region of the magnetic field surrounding its respective pole in which the field is strong enough to overcome the resilience of the reed and draw it to the pole piece, thereby engaging the reed contact with the pole piece contact. A circuit through the selector from pin 77 through pin 84 is thus completed actuating the equipment with which the device is associated, for example a visible or audible signal indicating that that station of a mobile radio system is being called. When the selector has served its purpose, for example, when a person at the called mobile radio station acknowledges or completes the call, a suitable impulse is applied to terminal pins 63 and 64 to actuate coil 50 and its associated reed releasing mechanism.

While the above disclosure has been restricted to a specific embodiment it is to be understood that numerous modifications may be devised by those skilled in the art without departing from the spirit and scope of this invention. For example, the movable contacts can be carried by flexible fingers associated with the vibrating reeds so that only those fingers need be locked in a stationary position. Locking magnets separate from the polarizing magnet 18 may be employed and various means of temperature compensation may be applied to the reeds and polarizing magnet to stabilize reed frequencies. Also other contact release and reed driving systems are within the concept of this invention.

What is claimed is:

1. A vibrating reed selector unit comprising a plurality of ferromagnetic vibrating reeds, each of said reeds having a free end arranged for vibration along a radius from the longitudinal axis of said unit, each of said reeds having a resonance frequency, a plurality of pairs of associated contacts, one contact of each of said pairs of contacts being movable and associated with one of said plurality of reeds, the other contact of each of said pairs of contacts being stationary, a ring shaped polarizing magnet having a pole on each radius along which one of said reeds vibrates, means for superimposing an oscillating magnetic field on the field in the region of said magnetic

poles, said means comprising a plurality of circularly-disposed electrically parallel coils juxtaposed to said ring-shaped magnet, said polarizing magnet binding each of said movable contacts to its associated stationary contact when said movable contact is carried to a predetermined position by its associated reed, and means for releasing said movable contacts from their bound position.

2. A vibrating reed selector unit comprising a plurality of ferromagnetic vibrating reeds, each of said reeds being mounted in electrically insulated relationship to each of said other reeds with its free end arranged for vibration along a radius from the longitudinal axis of said unit, each of said reeds having resonance frequency, a plurality of pairs of associated contacts, one contact of each of said pairs of contacts being movable and mounted on one of said reeds, a ring shaped polarizing magnet circularly polarized to provide a pole on each of the radii along which said reeds vibrate, adjacent poles being of opposite polarity, a ferromagnetic pole piece secured on each of the poles of said magnet and electrically insulated therefrom, the other contact of each of said pairs of contacts being stationary and mounted on one of said pole pieces, and means for superimposing an oscillating magnetic field on the field in the region of said magnet poles whereby each of said reeds may be vibrated to engage each of said movable contacts with its associated stationary contact.

3. A vibrating reed selector unit comprising a plurality of ferromagnetic vibrating reeds, each of said reeds being mounted in electrically insulated relationship to each of said other reeds with its free end arranged for vibration along a radius from the longitudinal axis of said unit, each of said reeds having a resonance frequency, a plurality of pairs of associated contacts, one contact of each of said pairs of contacts being movable and mounted on one of said reeds, a ring shaped polarizing magnet having a pole on each of the radii along which said reeds vibrate, a ferromagnetic pole piece secured on each of the poles of said magnet and electrically insulated therefrom, a ferromagnetic cross-shaped member supported on the axis of said unit and in the plane of said magnet having arms positioned on the radii of said magnet poles, the other contact of each of said pairs of contacts being stationary and mounted on one of said pole pieces, means for superimposing an oscillating magnetic field on the field in the region of said magnet poles, said polarizing magnet effective when said reeds vibrate through a predetermined amplitude to bind them to their associated pole pieces whereby said movable contacts engage their associated stationary contacts.

4. A vibrating reed selector unit comprising a plurality of ferromagnetic vibrating reeds, each of said reeds being mounted in electrically insulated relationship to each of said other reeds with its free end arranged for vibration along a radius from the longitudinal axis of said unit, each of said reeds having a resonance frequency, a plurality of pairs of associated contacts, one contact of each of said pairs of contacts being movable and mounted on one of said reeds, a ring shaped polarizing magnet having a pole on each of the radii along which said reeds vibrate, a ferromagnetic pole piece secured on each of the poles of said magnet and electrically insulated therefrom, the other contact of each of said pairs of contacts being stationary and mounted on one of said pole pieces, means for superimposing an oscillating magnetic field on the field in the region of said magnet poles, magnetic means effective when said reeds vibrate through a predetermined amplitude to bind them to their associated pole pieces whereby said movable contacts engage their associated stationary contacts, a solenoid situated on the axis of said unit, a plunger for said solenoid situated on the axis of said unit and axially movable thereof, and a bell crank lever associated with each of said reeds and pivotally mounted with one of its arms engaging said plunger and the other of its arms engageable with its associated reed whereby the actuation of said solenoid causes each bell crank lever to carry its respective reed away from its magnetic pole piece.

References Cited in the file of this patent

UNITED STATES PATENTS

Number	Name	Date
388,092	Rysseberghe	Aug. 21, 1888

(Other references on following page)

5

UNITED STATES PATENTS

Number	Name	Date
1,035,501	Viry -----	Aug. 13, 1912
1,262,333	Hall -----	Apr. 9, 1918
2,113,617	Harrison -----	Apr. 12, 1938
2,164,161	Nekolny -----	June 27, 1939
2,357,925	Appel -----	Sept. 12, 1944
2,534,354	Keller -----	Dec. 19, 1950

Number
13,237
229,388

5

6

FOREIGN PATENTS

Country	Date
Great Britain -----	June 6, 1910
Great Britain -----	Feb. 23, 1925