June 27, 1967 D. INMAN 3,327,679

ULTRASONIC SIGNAL GENERATOR

Filed April 8, 1966 2 Sheets-Sheet 1

FIG. 1

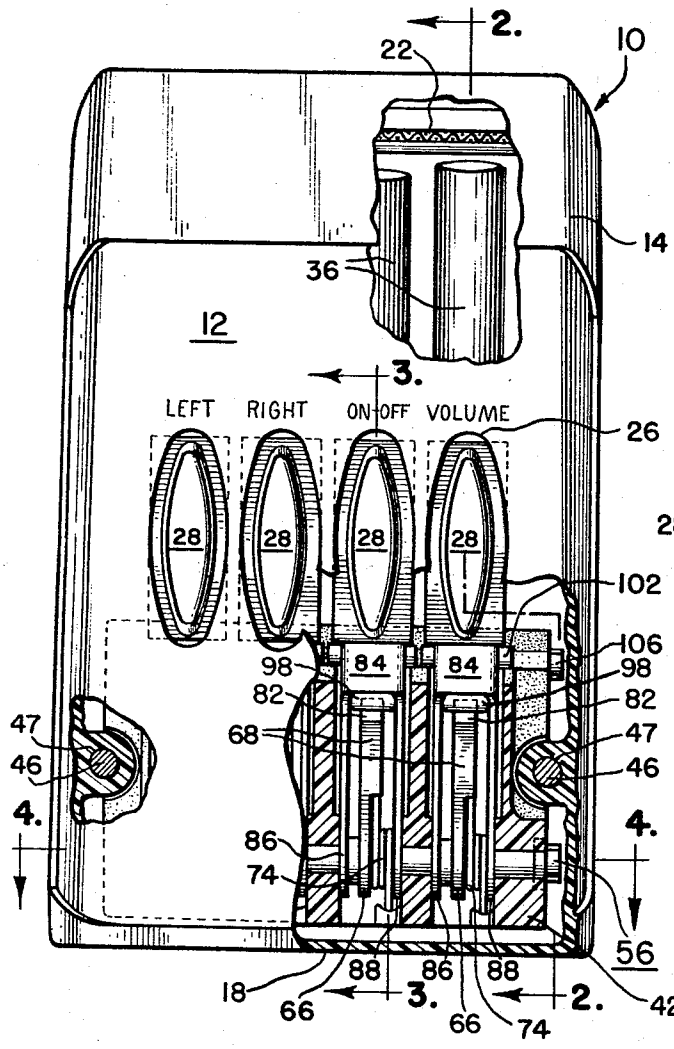


FIG. 2

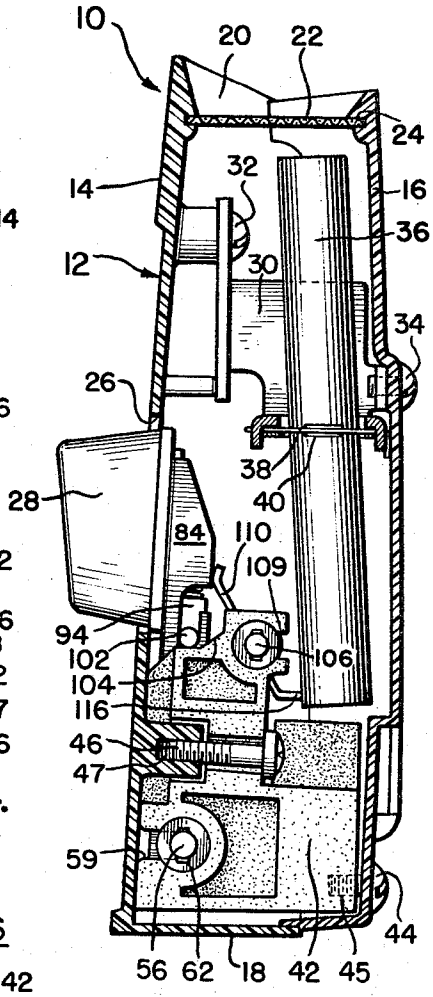
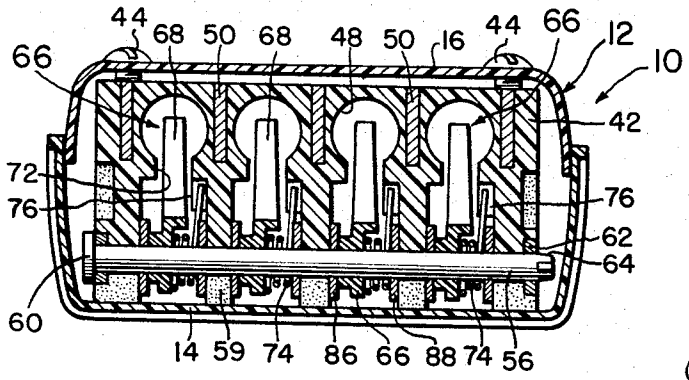


FIG. 4



INVENTOR.
Darwin Inman
BY
John J. Pederson
Attorney

June 27, 1967 D. INMAN 3,327,679

ULTRASONIC SIGNAL GENERATOR

Filed April 8, 1966 2 Sheets-Sheet 2

FIG. 3

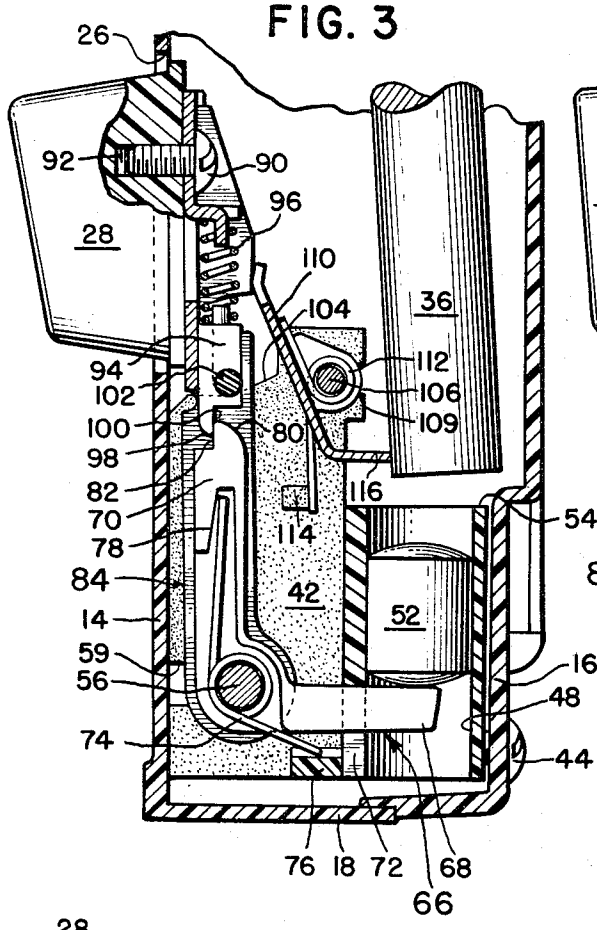


FIG. 3a

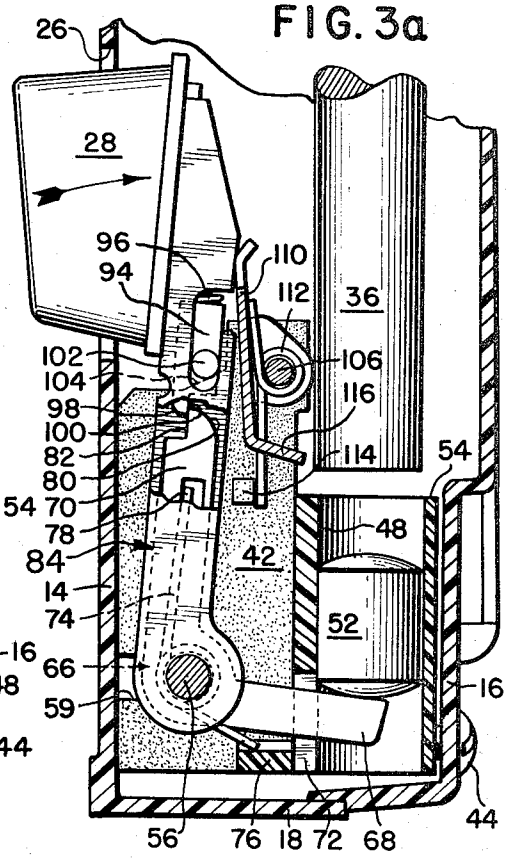
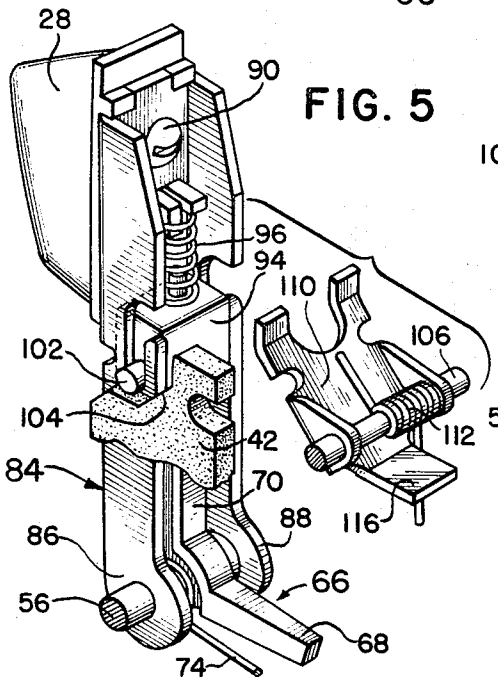


FIG. 5



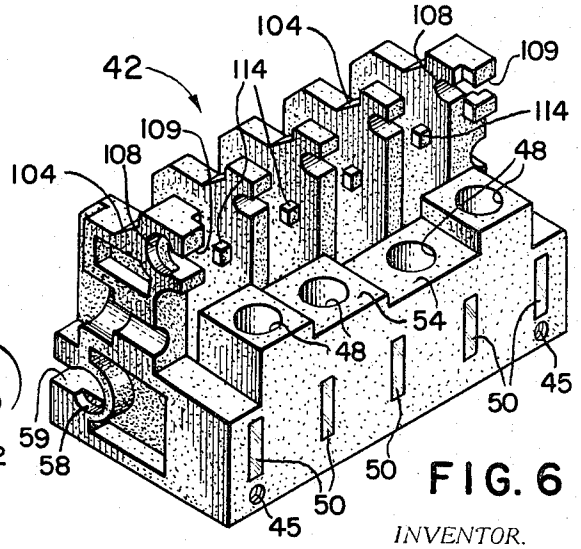


FIG. 6

INVENTOR.
Darwin Inman
BY John J. Pederson
Attorney

United States Patent Office 3,327,679 Patented June 27, 1967

3,327,679

ULTRASONIC SIGNAL GENERATOR

Darwin Inman, Highland Park, Ill., assignor to Zenith Radio Corporation, Chicago, Ill., a corporation of Delaware

Filed Apr. 8, 1966, Ser. No. 541,216
7 Claims. (Cl. 116—137)

The present invention relates to a portable signal generator of the type having a mechanical vibrator element for generating an ultrasonic signal and, more particularly, to a new and improved mechanism for imparting mechanical energy to the vibrator element to set it into vibratory motion.

Ultrasonic transmitters for use is remote control systems are well known in the television art. These transmitters generally produce an ultransonic signal by striking or otherwise exciting a vibrator element, which signal is received and amplified by a receiver within a television set and utilized to remotely control any of a plurality of desired functions. An example of such a transmitter is described and claimed in U.S. Patent 3,118,423 issued to Schmid and assigned to the assignee of the present invention. In a transmitter constructed for operation in this manner, the desirability of reduced size and weight is apparent when it is appreciated that the transmitter is intended to be held and operated with only one hand so that the user need not divert his attention from the television set during operation of the transmitter. It is also apparent that the transmitter should be constructed to provide long and continuous service without mechanical failure.

Accordingly, an object of the present invention is the provision of an ultrasonic signal generator having a unique mechanical actuating mechanism.

Another object is to provide an ultrasonic signal generator which is capable of providing long and continuous service without mechanical failure.

A further object of the invention is the provision of a signal generator having a new and improved mechanism for delivering mechanical energy to the vibrator element therein.

Still another object of the invention is to provide a portable ultrasonic signal generator having a mechanical actuating mechanism which permits a substantial and effective reduction in the complexity of the transmitter without in any way interferring with the operation thereof.

Yet another object of the present invention is the provision of an ultrasonic signal generator which is characterized by simplicity of construction, low cost and ease of operation and use.

In accordance with the present invention, a portable hand-held signal generator for use in a remote control system comprises mechanically excitable vibrator means, a support member having a guide channel with an opening terminating adjacent the vibrator means, and a hammer slidably received within the guide channel. In addition, means are provided for captivating the hammer within the guide channel and a shaft is secured to the support member with a striker means pivotally mounted thereon. Spring bias means associated with the striker means urge the striker means towards the hammer while actuator means pivotally mounted on the shaft are provided for rotating the striker means against the urging of the spring bias means. Trip means are mounted upon the actuator means for releasing the striker means after rotation thereof through a predetermined angular displacement to allow

the spring bias means to rotate the striker means and cause the hammer to be propelled through the guide channel and into contact with the vibrator means for initiating vibrations therein.

The features of the present invention which are believed to be novel are set forth with particularity in the appended claims. The organization and manner of operation of the invention, together with further objects and advantages thereof, may best be understood by reference to the following description taken in connection with the accompanying drawings, in the several figures of which like reference numerals identify like elements, and in which:

FIGURE 1 is a plan view, partly broken away and partly in section, of a preferred embodiment of the invention;

FIGURE 2 is a side view of the device, partly in section, taken on the lines 2—2 of FIGURE 1 looking in the direction of the arrows;

FIGURE 3 is a partial sectional view of the device shown in an unactuated position taken on the lines 3—3 of FIGURE 1 looking in the direction of the arrows;

FIGURE 3*a* is a view similar to FIGURE 3 but showing the device of FIGURE 1 in a partially actuated position;

FIGURE 4 is an end view of the device, partly in section, taken along the lines 4—4 of FIGURE 1 looking in the direction of the arrows;

FIGURE 5 is a detailed perspective view, partly broken away, of the actuator mechanism of the present invention; and

FIGURE 6 is a detailed perspective view of the support member of the present invention.

Referring now to the drawings, there is shown in FIGURES 1 and 2 a portable hand-held ultrasonic signal generator **10** having a housing **12** of convenient size and shape to afford easy holding and manipulation by the user. The housing **12** comprises a top panel **14** and a bottom panel **16**, both of the panels having rounded edges which form the side portions of the housing. The housing **12** is closed at its rear end **18** by overlapping portions of the top and bottom panels **14** and **16**, respectively, while the front end **20** of the generator **10** is open except for a screen **22** disposed thereacross. The screen **22** is secured to the housing **12** by grooves **24** formed in the top and bottom panels **14** and **16**. A plurality of openings **26** are provided in the top panel **14** through which a plurality of manually operable push buttons **28** protrude. Although there are four independent signal generating mechanisms shown in the drawings, only one complete mechanism will be described for purposes of simplicity of description.

The ultrasonic signal generating mechanism is mounted within the housing **12**. More particularly, a bracket **30** is secured to the top panel **14** by a threaded fastener **32** and to the bottom panel **16** by a threaded fastener **34**. Vibrator means comprising an elongated cylindrical metallic vibrator rod **36** is secured to the bracket **30** by a spring clip **38** engaging a pair of slots **40** formed at the nodal plane of the vibrator rod **36**, as described and claimed in U.S. Patent 2,821,956 to Wold, assigned to the same assignee as the present application.

A support member **42** is secured in the housing **12** near the rear end **18** by a pair of threaded fasteners **44** passing through the bottom panel **16** and engaging threaded apertures **45**, and by a pair of threaded fasteners **46** passing through the support member **42** and

engaging threaded apertures **47** in the top panel **14**. The support member **42**, as best illustrated in FIGURE 6, comprises a unitary block of a suitable material, such as plastic, having four cylindrical guide chanels **48** formed therein. A plurality of permanent magnet captivating means **50** are disposed in slots formed within the support member **42** on either side of each of the guide channels **48**, and a cylindrical hammer **52** (see FIGURES 3 and 3*a*), formed of ferromagnetic material, is slidably received within each of the guide channels **48**. Each guide channel **48** terminates in an opening **54** adjacent the end of the vibrator rod **36** and is spaced a predetermined distance therefrom. The vibrator rods **36** are of different lengths to produce signals of different frequencies when set into longitudinal-mode vibratory motion. Therefore, the guide channels **48** formed in the support member **42** are of different lengths corresponding to the length of the respective vibrator rod **36** associated therewith so that the overall length of the housing **12** may be kept to a minimum. The permanent magnets **50** establish a magnetic field traversing the guide channel **48** to magnetically captivate the ferromagnetic hammers **52** within the guide channels **48** as described and claimed in U.S. Patent 3,118,423 to Schmid. In addition, each of the ferromagnetic hammers **52** has an axial length greater than the predetermined distance between the opening **54** of the guide channel **48** and the end of the vibrator rod **36** so that the hammer **52**, when striking the actuator rod **36**, is retained at least partially within the guide channel **48**.

Referring now to FIGURES 3 through 6, a shaft **56** is secured to the support member **42** by means of a pair of counterbored apertures **58** formed at the sides of the support member **42** and slotted as at **59**. One end of the shaft **56** has a head **60** formed thereon and the other end of the shaft **56**, after being assembled onto the support member **42**, is provided with a washer **62** and then swedged as at **64** to prevent withdrawal through the washer. A plurality of manually operable actuator mechanisms are pivotally mounted on the shaft **56** to selectively and independently cause any selected hammer **52** to be propelled through the guide channel **48** and into contact with its associated vibrator rod **36**.

As illustrated in FIGURES 3 and 5, each of the actuator mechanisms comprises a bell crank striker **66** having a first leg **68** and a second leg **70**, the bell crank striker **66** being pivoted on the shaft **56** intermediate the legs **68** and **70**. The first leg **68** of the bell crank striker **66** passes through a slot **72** in the guide channel **48** and is urged into engagement with the forward edge of the slot **72** by means of a spring **74** coiled around the shaft **56** and engaging a lug **76** formed on the support member **42** and a recess **78** formed within the second leg **70**. Therefore, as illustrated in FIGURE 3, the bell crank striker **66** is biased by the spring **74** in a counterclockwise direction. The end of the second leg **70** of the bell crank striker is provided with a rounded surface **80** and a flat surface **82**, the purpose of which will be hereinafter set forth.

An actuator in the form of a bifurcated lever **84** having a pair of arms **86** and **88** is pivotally mounted upon the shaft **56**, the arms **86** and **88** being disposed on opposite sides of the bell crank striker **66** so that the second leg **70** of the bell crank striker **66** lies between the arms **86** and **88**. The push button **28** is secured to one of the bifurcated lever **84** by a threaded fastener **90** threadedly engaging an aperture **92** in the base of the push button **28**. Trip means in the form of a latch **94** is slidably received within the bifurcated lever **84** and is spring biased by a spring **96** in a direction towards the shaft **56**, the latch **94** being coextensive with the longitudinal axis of the bifurcated lever **84**. The end portion of latch **94** is provided with a rounded surface **98** and a flat surface **100**, the flat surface **100** normally engaging the flat surface **82** of the bell crank striker **66**. A pair of transverse cam followers **102** are formed on the side edges of the latch **94** for engaging a cam surface **104** formed on the support member **42**.

A second shaft **106** is secured to the support member **42** by a pair of counterbored apertures **108** slotted as at **109**, the shaft **106** being secured to the support member **42** in a manner similar to that of shaft **56**. A muting lever **110**, as best illustrated in FIGURES 3 and 5, is pivotally secured to the shaft **106** and is spring biased into engagement with the bifurcated lever **84** by a spring **112** engaging the muting lever **110** and a lug **114** formed on the support member **42**. The muting lever **110** is provided with a leg **116** which normally contacts a lateral surface of the vibrator rod **36** to serve as a vibration damper when the bifurcated lever is in an unactuated position, as described and claimed in Adler Patent No. 2,821,954, assigned to the present assignee. Such muting levers may be desired to prevent undesired double actuation of such functions as channel selection or stepped volume adjustment, but are not ordinarily provided in association with vibrator rods employed to perform single step operating functions such as turning the receiver on or off, or muting the audio portion of the received telecast.

The operation of the signal generator **10** is best illustrated in FIGURES 3 and 3*a*, the former showing the signal generator in an unactuated position and the latter showing the signal generator in a partially actuated position. When it is desired to actuate a selected one of the vibrator rods **36**, the push button **28** associated therewith is depressed and released. As the push button **28** is depressed, the bifurcated lever **84** to which it is secured is rotated clockwise about the shaft **56**. The latch **94**, being slidably received within the bifurcated lever **84** and engaging the flat surface **82** of the bell crank striker **66**, causes the bell crank **66** to rotate with the bifurcated lever **84** about the shaft **56**. As the button **28** is depressed and the bifurcated lever **84** and bell crank striker **66** are rotated clockwise about the shaft **56**, the latch **94** is cammed away from the shaft **56** against the urging of spring **96** by the cam follower **102** riding along the inclined cam surface **104** formed on the support member **42**. The bell crank striker **66** is thus caused to rotate about the shaft **56** against the urging of spring **74** until the latch **94** is cammed out of engagement with the flat surface **82**, whereupon the bell crank striker **66** is released and caused to rotate counterclockwise about shaft **56** by the urging of spring **74** thereby propelling the hammer **52** through the guide channel **48** and into contact with the vibrator rod **36**. The first leg **68** of the bell crank striker **66** is restrained from further rotation by the end of the slot **72**. After the ferromagnetic hammer **52** strikes the end of the vibrator rod **36**, the permanent magnets **50** disposed on either side of the guide channel **48** cause the hammer **52** to return through the guide channel **48** until it abuts the first leg **68** of the bell crank striker **66**.

The spring **112** on the muting lever **110** causes the end of the muting lever **110** to abut the end of the bifurcated lever **84** and urges the bifurcated lever **84** towards its unactuated position. In this position, the end **116** of the muting lever **110** contacts the vibrator rod **36** to damp vibrations therein. However, upon actuation of the push button **28** and rotation of the bifurcated lever **84**, the end **116** of the muting lever **110** is rotated out of contact with the vibrator rod **36** during the interval of time that the vibrator rod **36** is struck by the hammer **52**. Upon release of the button **28**, the spring **112** urges the bifurcated lever **84** towards its unactuated position, thereby allowing the muting lever **110** to rotate counterclockwise about the shaft **106** and cause the end **116** of the muting lever **110** to again contact and damp vibrations in the vibrator rod **36**. As the bifurcated lever **84** is rotating towards its unactuated position under the influence of spring **112**, the rounded surface **98** of the latch **94** engages the rounded surface **80** of the bell crank striker **66** and cams the latch in a direction away from the shaft **56** against the bias of spring **96** so that the end of the latch **94** passes around the

end of the second leg **70** of the bell crank striker **66**. Once around the end of the bell crank striker **66** the latch **94** is caused to slide towards the shaft **56** and into engagement with the flat surface **82** of the bell crank striker **66** by the urging of spring bias means **96**, thereby positioning the latch **94** for the next actuation.

Although the signal generator **10** has been primarily described in connection with the construction and operation of but a single actuator mechanism and vibrator rod, it should be understood that the remaining actuators and vibrators are identical to the one described except for the different lengths of the vibrator rods. In the embodiment of the invention illustrated in the drawings, four such actuator and vibrator combinations are shown, however, either a greater or a lesser number may be provided depending upon the number of functions desired to be remotely controlled, and the damper element **116** may be omitted in connection with some or all of the rods as desired.

There has thus been described an ultrasonic signal generator for use in a remote control system which is capable of selectively generating one of a plurality of ultrasonic signals for selectively actuating a corresponding plurality of control functions. The ultrasonic signal generator of the present invention provides novel means for actuating the hammer element, which means allows for a more compact assemblage of necessary components and a degree of reliability not heretofore attainable. This is primarily accomplished by providing a common pivotal axis for both the bell crank striker **66** and the bifurcated lever **84** and by combining a vibration damper and bifurcated lever spring bias means in a single muting lever **110**.

While only a particular embodiment of the invention has been shown and described, it will be obvious to those skilled in the art that changes and modifications may be made without departing from the invention in its broader aspects, and, therefore, the aim of the appended claims is to cover all such changes and modifications as fall within the true spirit and scope of the invention.

I claim:

1. A portable hand-held signal generator for use in a remote control system comprising:

mechanically excitable vibrator means;

a support member having a guide channel therein, said guide channel having an opening terminating adjacent said vibrator means;

a hammer slidably received within said guide channel;

means captivating said hammer within said guide channel;

a shaft secured to said support member;

striker means pivotally mounted on said shaft;

spring bias means associated with said striker means for urging said striker means towards said hammer;

actuator means pivotally mounted on said shaft for rotating said striker means against the urging of said spring bias means; and

trip means mounted on said actuator means for releasing said striker means after rotation of the latter through a predetermined angular displacement, thereby allowing said spring bias means to rotate said striker means and cause said hammer to be propelled through said guide channel and into contact with said vibrator means for initiating vibrations therein.

2. A signal generator in accordance with claim **1** wherein:

said striker means comprises a bell crank having first and second legs, said bell crank being pivotally mounted on said shaft intermediate said legs, said first leg being disposed adjacent said hammer;

and said actuator means comprises a bifurcated lever having a pair of arms pivotally mounted on said shaft on opposite sides of the intermediate portion of said bell crank, said lever having means secured thereto for manual actuation.

3. A signal generator in accordance with claim **2** further comprising:

a muting lever pivotally mounted on said support member the opposite ends of said muting lever respectively contacting said bifurcated lever and said vibrator means when said bifurcated lever is in an unactuated position, said bifurcated lever rotating said muting lever out of contact with said vibrator means as the bifurcated lever and the bell crank are simultaneously rotated, said muting lever being spring biased for urging the bifurcated lever towards an unactuated position.

4. A signal generator in accordance with claim **1** wherein:

said support member is provided with a cam surface; and

said trip means comprises a latch slidably received within said actuator means, said latch being provided with a cam follower which engages said cam surface for sliding said latch in a direction away from said shaft as said lever is rotated.

5. A signal generator in accordance with claim **4** wherein:

said latch is biased into engagement with said striker means for rotating the latter as said actuator means is rotated, said latch being subsequently cammed out of engagement with said striker means by said cam surface to release the latter after rotation through said predetermined angular displacement.

6. A signal generator in accordance with claim **5** wherein:

the end of said striker means adjacent said latch is provided with a rounded surface for camming said latch around the end of said striker means as said actuator means is rotated towards an unactuated position.

7. A portable hand-held ultrasonic signal generator for use in a remote control system, which signal generator comprises:

a mechanically excitable cylindrical vibrator rod;

a support member having a cam surface thereon and a cylindrical guide channel therein, said guide channel having a central axis substantially coincident with the axis of said vibrator rod, said guide channel terminating a predetermined distance from one end of said vibrator rod;

a cylindrical ferromagnetic hammer slidably received within said guide channel, said hammer having a length greater than said predetermined distance;

permanent magnet means establishing a magnetic field traversing said guide channel for magnetically captivating said ferromagnetic hammer;

a shaft mounted on said support member;

a bell crank striker having first and second legs and being pivotally mounted intermediate said legs on said shaft, the end of said second leg having a rounded surface and a flat surface;

spring bias means for urging the first leg of said bell crank in a direction towards said hammer;

a manually operable push button;

a bifurcated lever secured to said push button, said lever having a pair of arms pivotally mounted on said shaft on either side of said bell crank, said lever being movable through a path from a first unactuated position to a second actuated position as said push button is depressed;

a latch slidably received within said bifurcated lever, said latch being spring biased towards said shaft and coextensive with the longitudinal axis of said bifurcated lever, said latch having a pair of transverse cam followers extending from the side edges thereof for engaging the cam surface on said support member, said latch having an end portion with a rounded surface and a flat surface, the flat surface of said latch engaging the flat surface of said bell crank for rotating the latter against the urging of said spring

bias means as said button is depressed, said latch being cammed out of engagement with said bell crank upon rotation of the latter through a predetermined angular distance to allow the bell crank to rotate under the urging of said spring bias means and to propel the hammer through said guide channel and into impact with said rod to initiate vibrations therein, said rounded surfaces of said bell crank and latch subsequently camming said latch around the end of said bell crank as said lever is rotated towards its unactuated position; and

means pivotally secured to said support member for urging said lever towards its unactuated position, said means contacting said vibrator rod when said lever is in its unactuated position to damp vibrations therein and being pivoted to a position out of contact with said rod when said lever is in its actuated position.

References Cited

UNITED STATES PATENTS

2,821,956	2/1958	Wold	116—169
2,868,156	1/1959	DeCola et al.	116—137
2,920,604	1/1960	McDonald	116—137
2,979,022	4/1961	Adel	116—137
3,017,849	1/1962	Grossenheider	116—137
3,054,380	9/1962	Sielaff	116—137
3,118,423	1/1964	Schmid	116—137
3,164,127	1/1965	Schmid	116—137
3,165,090	1/1965	Smith	116—137
3,189,000	6/1965	Salners	116—137

LOUIS J. CAPOZI, *Primary Examiner.*