June 30, 1970 J. W. HANNA ET AL 3,518,667

ADJUSTABLE BUZZER WITH MANUAL ADJUSTMENT OF LEVELS OF SOUND

Filed Nov. 27, 1968 2 Sheets-Sheet 1

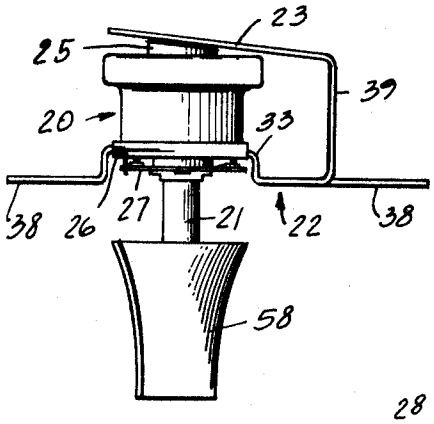
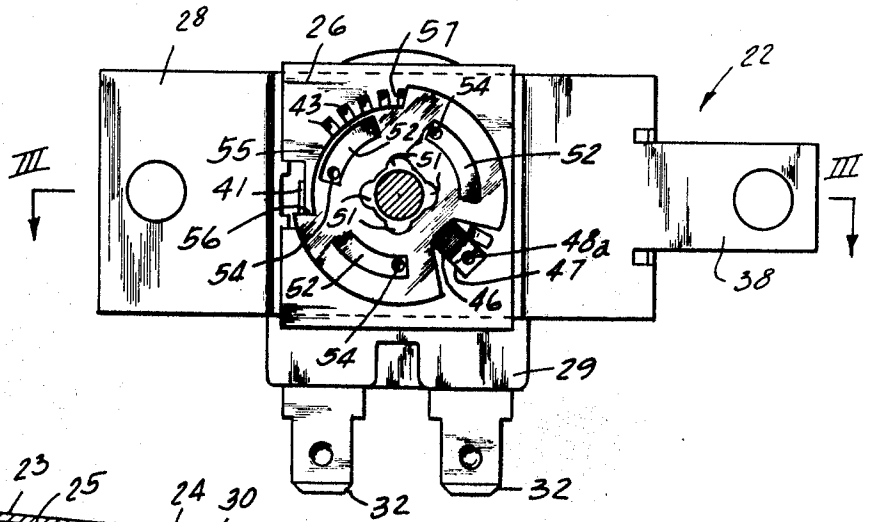


Fig. 1

Fig. 2



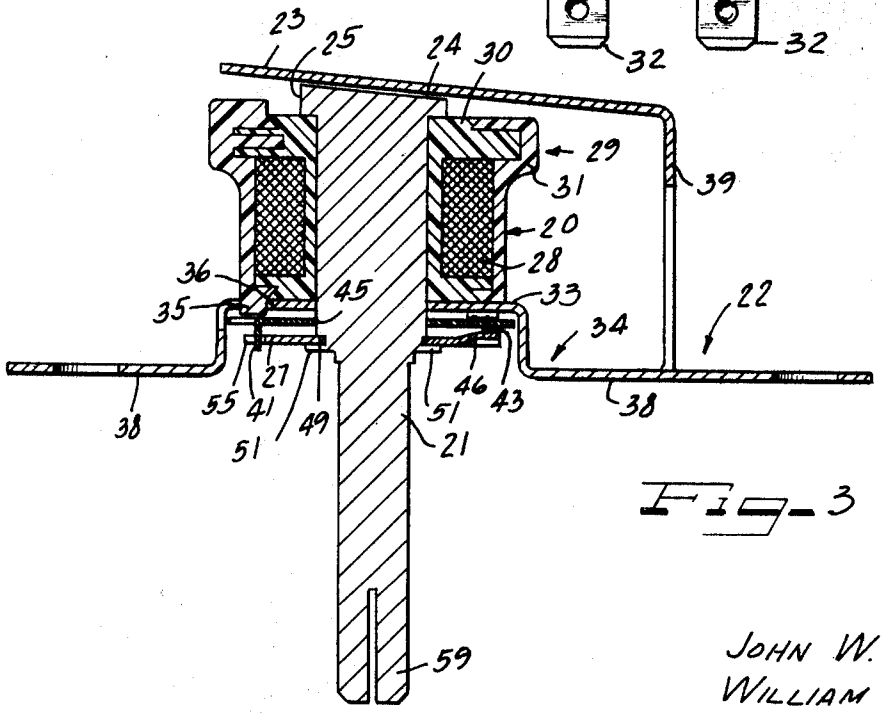


Fig. 3

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Filed Nov. 27, 1968 2 Sheets-Sheet 2

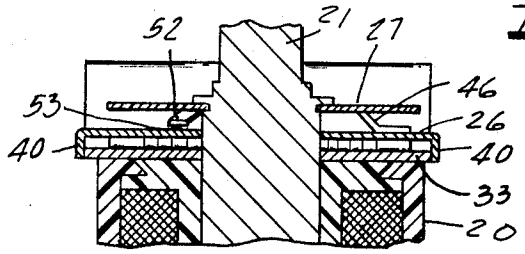


Fig. 4

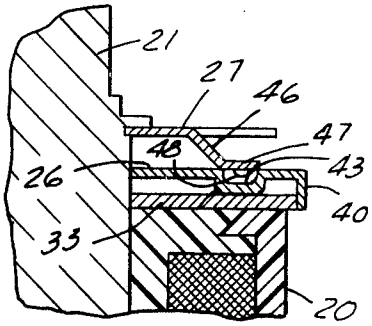


Fig. 5

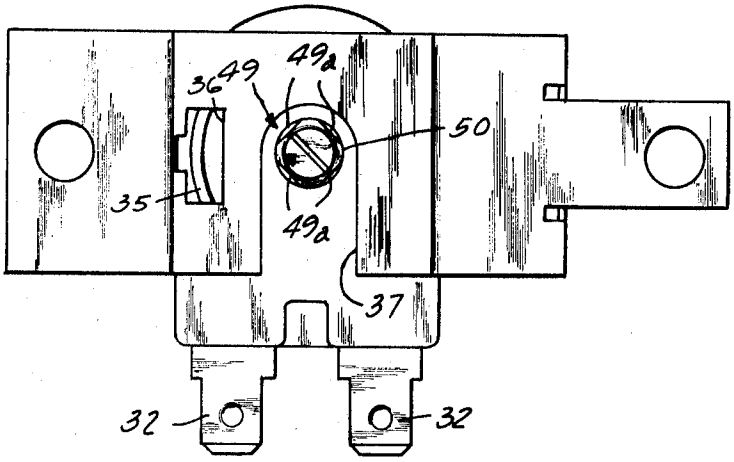


Fig. 6

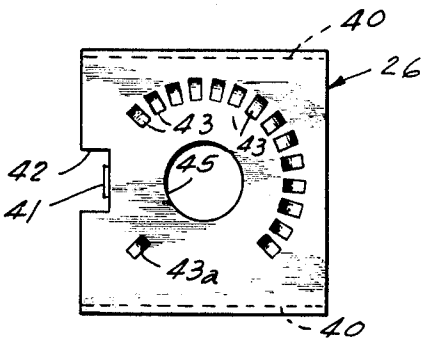


Fig. 7

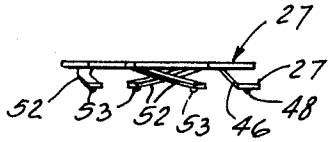


Fig. 8

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United States Patent Office 3,518,667 Patented June 30, 1970

3,518,667

ADJUSTABLE BUZZER WITH MANUAL ADJUSTMENT OF LEVELS OF SOUND

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Filed Nov. 27, 1968, Ser. No. 779,350
Int. Cl. G10k 9/12
U.S. Cl. 340—388 6 Claims

ABSTRACT OF THE DISCLOSURE

Adjustable buzzer having a pole piece adjustable about its own axis to discrete positions. A vibrator and an end of a pole piece to which a vibrator is intermittently attracted for the production of sound are so angled with respect to the axis of the pole piece that adjustment of the pole piece about its axis adjusts the space between the vibrator and the end of the pole piece and therewith the sound produced by the vibrator. An angularly movable detent washer, which incidentally holds the pole piece against a coil unit and the coil unit against a mounting bracket, engages a fixed detent plate in such a way as to be capable of discrete angular positions with respect thereto and is attached to the pole piece so as to cause the same to have discrete angular positions with respect to the vibrator, whereby the loudness of the buzzing sound produced by the vibrator is adjusted in discrete increments.

BACKGROUND OF THE INVENTION

This invention relates to an adjustable buzzer. More specifically the invention relates to a buzzer that is adjustable by angular shifting of a pole piece about its axis.

Adjustable buzzers are known in which a vibrator and the adjacent end surface of a pole piece to which the vibrator is intermittently attracted are so angled that angular adjustments of the pole piece about its axis changes the space between the end surface thereof and the vibrator and thus the level of the sound produced. In such buzzers it has been customary to rely on friction to maintain the pole piece in a given angular position. The drawback with the mere use of friction is that it is difficult to return the pole piece to a given angular position and thus to re-establish a discrete level of sound. Moreover, a considerable amount of friction may be required to prevent change in loudness setting of the buzzer during operation. If considerable effort is needed to overcome the friction in an adjustable buzzer, its use on a household device may be burdensome to women.

An object of the present invention is to provide an improved buzzer assembly of the type in which a pole piece may be moved angularly about its own axis through several positions with respect to a vibrator so that various levels of sound are produced by the vibrator.

A further object is to produce a buzzer assembly of the above type constructed so that there are discrete positions of the pole piece for producing discrete levels of sound.

Another object is to produce a buzzer assembly of the above type in which the pole piece is held firmly in a given angular position and yet may be easily adjusted to other angular positions.

Other and further important objects of this invention will become apparent from the attached drawings and the detailed description following the brief description of the drawings.

SUMMARY OF THE INVENTION

An adjustable buzzer assembly is provided with a detent washer and a detent plate, the detent plate having a series of recesses, and the detent washer having a spring leaf portion engaging the recesses selectively for allowing the pole piece to have discrete angular positions. The detent washer has fingers that apply a force to the pole piece and the coil to hold them against a mounting bracket.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is an elevational view of the buzzer assembly of the present invention;

FIG. 2 is a bottom view of the buzzer assembly;

FIG. 3 is a longitudinal sectional view taken on the line III—III of FIG. 2;

FIG. 4 is a fragmentary transverse sectional view;

FIG. 5 is a fragmentary transverse sectional view somewhat similar to FIG. 4, but a little displaced therefrom;

FIG. 6 is a bottom view of a partial assembly comprising a bracket, a coil unit and a pole piece;

FIG. 7 is a bottom view of the detent plate; and

FIG. 8 is an elevational view of the detent washer.

As shown in FIG. 3, the buzzer assembly of the present invention comprises a coil unit **20**, a pole piece or armature **21** extending therethrough, a bracket **22**, to which the coil unit **20** is attached, and a vibrator **23** formed as part of the bracket **22**. An outer end surface **24** of an enlarged head **25** on the pole piece **21**, and also the vibrator **23** extend at a small angle to the perpendicular to the axis of the pole piece **21**. Thus, as the pole piece **21** is shifted angularly about its own axis, the space between the end surface **24** of the pole piece **21** and the vibrator **23** is changed, and with it there is a change in the sound of the buzzing emitted by the buzzer assembly. The buzzer assembly also includes a detent plate **26** and a detent washer **27** which, as will become clear presently, cooperate to give the pole piece **21** discrete angular positions, which result in discrete levels of sound emitted by the buzzer assembly.

The coil unit **20** comprises a coil **28** and an insulator housing **29** enclosing the coil. The insulator housing comprises a bobbin **30** upon which the coil **28** is wound and an outer shell **31** molded to the bobbin. As shown in FIG. 2, the coil unit **20** also has terminals **32** connected to the coil **28** and projecting from the insulator housing **29**.

Again with reference to FIG. 3, the coil unit **20** is mounted on a mounting region **33** of a base portion **34** of the bracket **22**, a projection **35** formed on the outer shell **31** of the insulator casing **29** fitting in a recess **36** formed in the mounting region **33** of the bracket **22**. During assembly of the buzzer assembly, the pole piece **21** is inserted in the coil unit **20**, and this sub-assembly is applied to the bracket **22**, being moved laterally thereinto through a slot **37** formed in the mounting region **33** of the bracket **22**, as shown in FIG. 6. The sub-assembly of coil unit **20** and pole piece **21** are moved slightly against the vibrator **23** until the projection **35** can be popped into the opening **36**. Now the sub-assembly is held in place in the bracket **22**, because the head **25** on the pole piece **21** clears the vibrator **23** by only a small amount and the projection **35** on the insulator housing **29** fits in the opening **36** in the bracket **22**.

The base portion **34** of the bracket **22** includes not only the mounting region **33** but also attaching regions **38** which are spaced from one another by the mounting region **33**. The bracket **22** is pressed from a single piece of sheet metal cut and shaped so that a connecting portion **39** is struck from one of the attaching regions **38** and serves to connect the vibrator **23** thereto in spaced relation. The mounting region **33** is displaced from the plane of the attaching regions **38** so that a pocket for the

detent plate **26** and the detent washer **27** is formed by the mounting region and attaching regions. The vibrator **23** is displaced from the mounting region **33** in the same direction as the mounting region **33** from the attaching region **38**. The space between the vibrator **23** and the mounting region **33** is sufficient to accommodate the coil unit **20** and the pole-piece head **25**. The vibrator is slightly out of parallel with the mounting region **33** and the attaching regions **38**, which are perpendicular to the axis of the pole piece **21**.

As shown in FIGS. 4, 5 and 7, the detent plate **26** is generally rectangular and has two flanges **40** extending in the same direction from opposite side edges of the detent plate, and a tab **41** extending in the opposite direction to the flanges **40** from a recess **42** formed on another side edge of the detent plate. A plurality of regions are displaced from the plane of the detent plate **26** so as to constitute depressions **43** and **43***a* in the face of the plate away from the mounting region **33** of the bracket **22** and protuberances **44** on the face of the plate toward the mounting region **33** in engagement therewith. As shown in FIG. 7, the depressions **43** are arranged side by side in a group over an arc of a circle spaced outwardly from a central opening **45** in the detent plate **26**, and the depression **43***a* is about equally spaced from the depressions **43** at the ends of the group and spaced outward from the central opening **45**.

As shown in FIGS. 3, 4 and 5, the detent washer **27** is located at the face of the detent plate **26** away from that adjacent the mounting region **33** of the bracket **22**. As shown in FIGS. 2, 4, 5 and 8, the detent washer **27** has a radial spring leaf **46** displaced from the plane of the detent washer toward the detent plate **26**. Spring leaf **46** has a foot **47**, which is generally parallel to the plane of the detent washer **27**. The foot **47** has on the side toward the detent plate **26** a rounded projection **48**, which may be formed by pressing. As a result of the pressing operation, a dimple **48***a*, which appears in FIG. 2, is formed on the side of the leaf **46** opposite the projection **48**. The spring leaf **46** is engageable with the depressions **43**, projection **48** on the spring leaf entering the depressions, so that the detent washer **27** is held against angular movement with respect to the detent plate **26** about the axis of the pole piece **21**.

As shown in FIG. 3, the pole piece extends from the coil unit **20** through the mounting region **33** of the bracket **22** through the detent plate **26** and the detent washer **27** and for a considerable distance beyond them. The pole piece **21** is circular and cylindrical from its head **25** to a shoulder **49**, which is located somewhat beyond the detent plate **26** at the face thereof away from the mounting region **33** of the bracket **22**. The shoulder **49** faces away from the detent plate **26**, as shown in FIG. 3 and is formed in four separate sections **49***a*, as shown in FIG. 6. Beyond the shoulder **49** the pole piece **21** has a short non-circular section **50**, which is square with rounded corners. The detent washer **27** has a central opening that is also non-circular and fits the region **50** of the pole piece **21** so that the pole piece and the detent washer move together about the axis of the pole piece. The detent washer **27** is held against the shoulder **49** on the pole piece **21** by metal displaced from the rounded corners of the section **50** of the pole piece against the detent washer as indicated at **51** in FIG. 3.

As shown in FIGS. 2, 4 and 8, the detent washer **27** has three spring-like fingers **52** which are struck from the washer and project out of the plane thereof into engagement with the detent plate **26**. The fingers **52** are distributed about the central opening in the detent washer **27** and extend thereabout. As shown in FIG. 8, the ends of the fingers **52** have rounded projections **53** formed by pressing. As a result of the pressing, a dimple **54**, which appears in FIG. 2, is formed on the side of each finger **52** away from the projection **53**. A shown in FIG. 4, the projections **53** engage the detent plate **26**. As shown in FIG. 2, the fingers **52** lie radially inward of the depressions **43** in the detent plate **26** and engage portions thereof radially inward of the depressions and radially outward of the central opening **45**. As shown in FIG. 2, the detent washer **27** has a peripheral recess **55** having ends **56** and **57**. One end of the tab **41** on the detent plate **26** engages the end **56** of the recess **55** in the detent washer **27** so as to limit the angular movement of the detent washer and the pole piece **21** secured thereto for a conjoint angular movement in one direction. Engagement of the other end of the tab **41** with the end **57** of the peripheral recess of the detent washer **27** limits angular movement of the washer and the pole piece **21** in the opposite direction.

The flanges **40** on the detent plate **26** engage the edges of the mounting region **33** of the bracket **22** and thus hold the detent plate **26** against angular movement with respect to the bracket **22**. The detent plate **26** rests against the mounting region **33** of the bracket **22** by means of the protuberances **44** formed on one face of the detent plate **26**. Reference has already been made to the single depression **43***a* which as shown in FIG. 7 is peripherally displaced from the group of closely spaced depressions **43**. The purpose of this single depression **43***a*, or more particularly its associated protuberance **44** is one of cooperation with the other protuberances **44**, i.e., to give the detent plate **26** a balanced support on the mounting region **33** so that no tipping will occur.

In operation of the buzzer assembly, alternating current is supplied through the terminals **32** to the coil **28** so that the vibrator **23** is intermittently attracted to the pole piece **21** through the magnetic force exerted thereby due to energization of the coil **28**. The level of the buzzing sound produced by the coil **28** and the vibrator **23** is dependent upon the relationship of the outer end **24** of the pole piece **21** to the vibrator **23**. This level of sound may be varied by angular adjustment of the pole piece about its axis through a knob **58** applied to a slotted end **59** of the pole piece **21**. Discrete levels of sound are produced as the pole piece **21** assumes various discrete angular positions determined by engagement of the spring leaf **46** of the detent washer **27** with various recesses **43** in the detent plate **26**. Angular shifting of the pole piece **21** and the detent washer **27** is facilitated by the rounded projection **48** on the spring leaf **46**, this projection allowing the spring leaf to pass from one depression **43** to another with a minimum of effort. The spring-like fingers **52** on the detent washer **27** act in one direction to urge the detent plate **26** against the mounting region **33** of the bracket **22**. The fingers **52** act through the detent washer **27** and the displaced portions **51** of the pole piece **21** in the opposite direction against the pole piece and the enlarged head **25** thereof to hold the same against the coil unit **20** and the coil unit against the mounting region **33** of the bracket **22**.

In summary, it may be stated that the spring leaf **46** on the detent washer **27** and the recesses **43** in the detent plate **26** provide the coil piece **21** with discrete angular positions so that discrete levels of sound may be achieved by the buzzer assembly. The angular shifting of the pole piece from one position to another may be achieved without a great deal of effort because reliance is placed for holding the pole piece against angular shifting, not on friction alone, but on the engagement of the projection **47** of the spring leaf **46** with the recesses **43**. The enlarged head **25** of the pole piece **21** is firmly held against the coil unit **20**, and the latter is held firmly against the mounting region **33** of the bracket **22**, because of the action of the spring-like fingers **52** on the detent washer **27** against the detent plate **26**, which has previously been described.

The buzzer assembly of the present invention may be used in conjunction with a timer of a household appliance. When the timer has run the required period, current is supplied to the present buzzer assembly, and the resultant buzzing sound indicates to an operator that something

needs to be done for further operation of the household appliance. The present buzzer assembly may be applied to the interior of a casing wall for the timer or for the household appliance itself. When considered with respect to FIG. 3, the casing wall (not shown) would be attached to the bottom of the attaching portions **38** of the bracket **22**. Since the mounting region **33** is displaced from the plane of the attaching regions **38** of the bracket **22** so that a depression or well is formed in which the detent plate **26** and detent washer **27** are located, there is no interference between the interior of the casing wall to which the attaching regions **38** are secured, and the detent washer and plate.

It will be understood that the illustrated embodiment of the invention has been used for illustrative purposes only and that various modifications and variations of the present invention may be effected without a departure from the spirit and scope of the novel concepts thereof.

We claim as our invention:

1. A buzzer assembly comprising:

(a) a base,

(b) a coil unit having one end mounted on one face of the base,

(c) a pole piece extending through the coil unit and the base and having an enlarged head engaging the coil unit on the end thereof away from that mounted on the base,

(d) a vibrator overlying the head of the pole piece in such a way that the quality of the sound produced by the vibrator toward and away from the head of the pole piece is varied by adjustment of the pole piece about its own axis,

(e) a detent plate member mounted adjacent the face of the base away from the coil unit so as to be held against angular movement with respect to the bracket about the axis of the pole piece and having a central opening freely receiving a region of the pole piece, and

(f) a detent washer member mounted adjacent the face of the base away from the coil unit, attached to the pole piece so as to be prevented from having movement with respect thereto about the axis thereof and along the axis,

one of the members having a plurality of recesses arranged in a group over an arc of a circle generally concentric with the pole piece,

the other member having a spring leaf displaced from the plane thereof toward the one member so as to be engageable with the recesses therein, the said other member also having a plurality of spring-like fingers displaced from the plane thereof toward the said one members so as to engage the same;

whereby the engagement of the said spring leaf of the said other member with various depressions in the said one member enables the detent washer to have discrete angular positions with respect to the detent plate, and thus the pole piece, with which the detent washer has conjoint angular movement, has discrete angular positions with respect to the vibrator, with the result that the pole piece and vibrator produce discrete and repeatable levels of buzzing, and whereby the spring-like fingers of the said other member urge the head of the pole piece against the coil unit and the coil unit against one face of the base by virtue of acting through the said members in one direction against the opposite face of the base and in the opposite direction against the pole piece.

2. A buzzer assembly comprising:

(a) a base,

(b) a coil unit having one end mounted on one face of the base,

(c) a pole piece extending through the coil unit and the base and having an enlarged head engaging the coil unit on the end thereof away from that mounted on the base,

(d) a vibrator overlying the head of the pole piece in such a way that the quality of the sound produced by the vibrator moving toward and away from the head of the pole piece is varied by adjustment of the pole piece about its own axis,

(e) a detent plate member mounted on the face of the base away from the coil unit so as to be held against angular movement with respect to the base about the axis of the pole piece and having a central opening freely receiving the pole piece, and

(f) a detent washer member adjacent the face of the detent plate member away from the base and being attached to the pole piece so as to be prevented from having movement with respect thereto about the axis thereof and along the axis,

one of the members having a plurality of recesses arranged in a group over an arc of a circle outward and generally concentric with the pole piece,

the members resiliently engaging one another so as to enable the detent washer member by virtue of its attachment to the pole piece to urge the detent washer member against the base;

whereby the engagement of the various depressions in the said one member with the other member enables the detent washer member to have discrete angular positions with respect to the detent plate member, and thus the pole piece, with which the detent washer member has conjoint angular movement, has discrete angular positions with respect to the vibrator, with the result that the pole piece and vibrator produce discrete and repeatable levels of buzzing, and

whereby the resilient engagement of the said members with one another urges the head of the pole piece against the coil unit and the coil unit against one face of the base by virtue of an action in one direction through the detent plate against the opposite face of the base and in the opposite direction through the detent washer member against the pole piece.

3. A buzzer assembly comprising:

(a) a base,

(b) a coil unit mounted on one face of the base,

(c) a pole piece extending through the coil and the base

(d) a vibrator movable toward and away from an end of the pole piece at an end of the coil unit away from the base in response to energization of the coil unit,

(e) a detent plate mounted on the face of the base away from the coil unit so as to be held against angular movement with respect thereto about the axis of the pole piece and having

(1) a central opening freely receiving the pole piece and

(2) a plurality of recesses arranged in a group over an arc of a circle outward of the central opening in the detent plate and generally concentric with the pole piece, and

(f) a detent washer adjacent the face of the detent plate away from the base, attached to the pole piece so as to be prevented from having movement with respect thereto about the axis thereof and along the axis, and having

(1) a spring leaf displaced from the plane of the detent washer toward the detent plate so as to be engageable with the recesses therein, and

(2) a plurality of spring-like fingers displaced from the plane of the detent washer toward the detent plate so as to engage the same and urge it against the base.

4. A buzzer assembly according to claim **3**, the spring

leaf extending radially, the spring-like fingers extending and being distributed about the pole piece, and engaging portions of the detent plate radially displaced from the recesses therein.

5. A buzzer assembly comprising:
(a) a base,
(b) a coil unit having one end mounted on one face of the base,
(c) a pole piece extending through the coil unit and the base and having
(1) an enlarged head engaging the coil unit on the end thereof away from that mounted on the base,
(2) a shoulder located on the side of the base away from the coil unit in spaced relation to the base and facing away therefrom, and
(3) a noncircular portion extending from the shoulder in a direction away from the base,
(d) a vibrator overlying the head of the pole piece in such a way that the quality of the sound produced by the vibrator moving toward and away from the head of the pole piece is varied by adjustment of the pole piece about its own axis,
(e) a detent plate mounted on the face of the base away from the coil unit so as to be held against angular movement with respect to the base about the axis of the pole piece and having
(1) a central opening receiving a region of the pole piece located between the shoulder thereof and the bracket, and
(2) a plurality of regions displaced from the plane of the detent plate toward the base so as to constitute depressions in the face of the detent plate away from the base and protuberances on the face toward the base in engagement therewith, all the regions except one being arranged side by side in a group over an arc of a circle spaced outwardly from the central opening in the detent plate and generally concentric with the central opening, the remaining region being spaced from the end regions of the group and spaced outward from the central opening and being in generally diametrically opposed relation to an intermediate region of the group, and
(f) a detent washer adjacent the face of the detent plate away from the base, held against the shoulder of the pole piece and having
(1) a central noncircular opening receiving the noncircular section of the pole piece for rotation of the detent washer with the pole piece,
(2) a radial spring leaf displaced from the plane of the detent washer toward the detent plate so as to be engageable with the depressions of the group in the detent plate, and
(3) a plurality of spring-like fingers displaced from the plane of the detent washer toward the detent plate so as to engage the region thereof radially inward of the depressions and radially outward of the central opening in the detent plate, the fingers being distributed about said central opening,
whereby the engagement of the spring leaf of the detent washer with various depressions in the detent plate enables the detent washer to have discrete angular positions with respect to the detent plate, and thus the pole piece, with which the detent washer has conjoint angular movement, has discrete angular positions with respect to the vibrator with the result that the pole piece and vibrator produce discrete and repeatable levels of buzzing, and
whereby the spring-like fingers of the detent washer urge the head of the pole piece against the coil unit and the coil unit against one face of the base by virtue of acting in one direction through the detent plate against the opposite face of the base and in the opposite direction through the detent washer against the pole piece.

6. A buzzer assembly comprising:
(a) a one-piece bracket comprising
(1) a base portion having a mounting region and attaching regions spaced from one another by the mounting region and displaced in the same direction from the plane of the mounting region,
(2) a vibrator portion overlying the mounting region in spaced relation thereto and being slightly out of parallel therewith, the vibrator portion being displaced from the mounting region in the opposite direction of the attached regions, and
(3) a connecting portion extending transversely from one attaching region to the vibrator portion so as to tie the vibrator portion to the base portion,
(b) an electric coil,
(c) an insulator casing enclosing the coil and being mounted on one face of the mounting region of the bracket so as to position the coil between the mounting region and the vibrator portion, the casing having a central opening extending through the coil and having its axis perpendicular to the mounting region,
(d) a pole piece mounted in the central opening in the insulator casing for angular movement about its own axis, the axis of the pole piece being perpendicular to the mounting region of the bracket, the pole piece having an enlarged head adjacent the vibrator portion of the bracket, an end of the insulator casing engaging the inner side of the enlarged head, the outer side of the enlarged head being at a small angle to the perpendicular to the axis of the pole piece, the pole piece projecting from the insulator casing through the mounting region of the bracket, for a long distance therebeyond, the pole piece having a shoulder located a short distance beyond the mounting region and facing away therefrom, the pole piece also having a region of noncircular section beyond the shoulder,
(e) a detent plate located at the mounting region on the face thereof away from the insulator casing and having
(1) a central opening receiving a region of the pole piece located between the shoulder thereof and the mounting region of the bracket,
(2) flanges located at opposite side edges of the detent plate and extending over opposite edges of the mounting region so as to hold the detent plate against angular movement with respect to the mounting region;
(3) a tab extending in the opposite direction to the flanges and away from the mounting region,
(4) a plurality or regions displaced from the plane of the detent plate toward the mounting region so as to constitute depressions in the face of the detent plate away from the mounting region and protuberances on the face toward the mounting region, in engagement therewith, all the regions except one being arranged side by side in a group over an arc of a circle spaced outwardly from the central opening in the detent plate and generally concentric with the central opening, the remaining region being spaced from the end regions of the group and spaced outward from the central opening and being in generally diametrically opposed relation to an intermediate region of the group, and
(f) a detent washer adjacent the face of the detent plate away from the mounting region of the bracket, held against the shoulder by material displaced from the pole piece against the face of the detent washer away from the detent plate, and having

(1) a central noncircular opening receiving the noncircular section of the pole pieces for rotation of the detent washer with the pole piece,

(2) a spring leaf displaced from the plane of the detent washer toward the detent plate so as to be engageable with the depressions of the group in the detent plate, and

(3) a plurality of spring-like fingers displaced from the plane of the detent washer toward the detent plate so as to engage the region thereof radially inward of the depressions and radially outward of the central opening in the detent plate, the fingers extending about the central opening in the detent washer and being distributed about said central opening, and

(4) a peripheral recess having ends engageable with the projection on the detent plate for limiting angular movement of the detent washer and the pole piece with respect to the detent plate and the bracket;

whereby the engagement of the spring leaf of the detent washer with various depressions in the detent plate enables the detent washer to have discrete angular positions with respect to the detent plate, and thus the pole piece, with which the detent washer has conjoint angular movement, has discrete angular positions with respect to the vibrator portion, with the result that the pole piece and vibrator portion produce discrete and repeatable levels of buzzing, and

whereby the spring-like fingers of the detent washer urge the head of the pole piece against the insulator casing of the coil and the insulator casing against one face of the mounting region of the bracket by virtue of acting in one direction through the detent plate against the opposite face of the mounting region and in the opposite direction through the detent washer against the pole piece.

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U.S. Cl. X.R.

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