United States Patent

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[15] **3,668,333**

[45] **June 6, 1972**

[54] **HANDHELD TRANSDUCER OPERATING STATE INDICATOR**

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[73] Assignee: **Litton Business Systems, Inc.**, New York, N.Y.

[22] Filed: **Sept. 4, 1969**

[21] Appl. No.: **862,608**

[52] **U.S. Cl.** ....**179/100.2 C,** 35/35 C
[51] **Int. Cl.** **G11b 5/10,** G11b 19/16
[58] **Field of Search** ....179/100.2 C, 100.2 T, 100.2 R; 35/35 C; 235/61.11 E; 340/149 A, 146.3

[56] **References Cited**

UNITED STATES PATENTS

2,420,716	5/1947	Morton et al.	235/61.11 E
2,548,011	4/1951	Frost	35/35 C
2,822,425	2/1958	Hicks	35/35 C
2,936,342	5/1960	Kallmann	35/35 C
3,224,782	12/1965	Isemura	274/14
3,416,241	12/1968	Weitzner	35/35 C

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[57] **ABSTRACT**

A handheld magnetic transducer comprises a gun-shaped housing having a directional arrow on one surface. The arrow is illuminated by a light within the housing indicating the operating state of the transducer as determined by a signal device. The housing has dimples in opposed side walls for ease of grasping. The armature is in two parts. Each part has a T-shaped portion the crossbars of which overlap. The armature is inserted within the bobbin and is resiliently held at the crossbars to lock into position with a shim. The bobbin front wall in combination with the armature and shim form the muzzle or reading end of the transducer and has a substantially frustro pyramidal shape. The armature-bobbin structure is held in place by fingers which form a part of the transducer housing. The wires from the coil are secured to clips. The clips or terminal are U-shaped members spring retained on arms of the bobbin. The clips each have a flange portion for engaging an aperture in the arm. The reading portion of the transducer is hemispherical in shape with the gap defining an arc thereon such that the transducer is capable of rotation or positioning about one of three axes while moving relative to a record.

4 Claims, 14 Drawing Figures

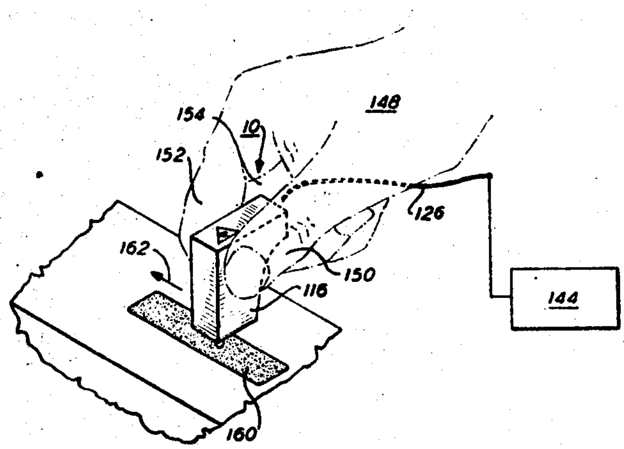

FIG. 7

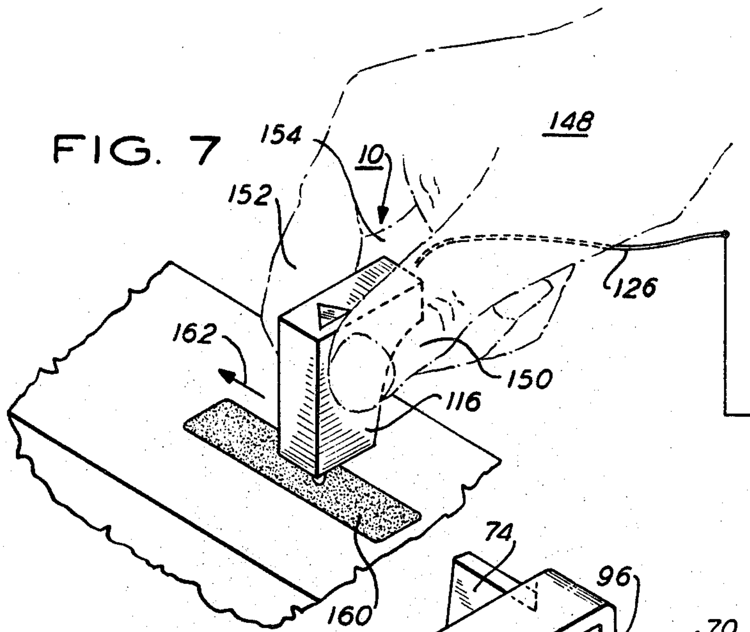

FIG. 1

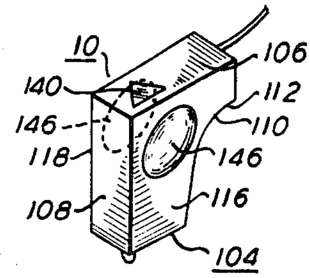

FIG. 2

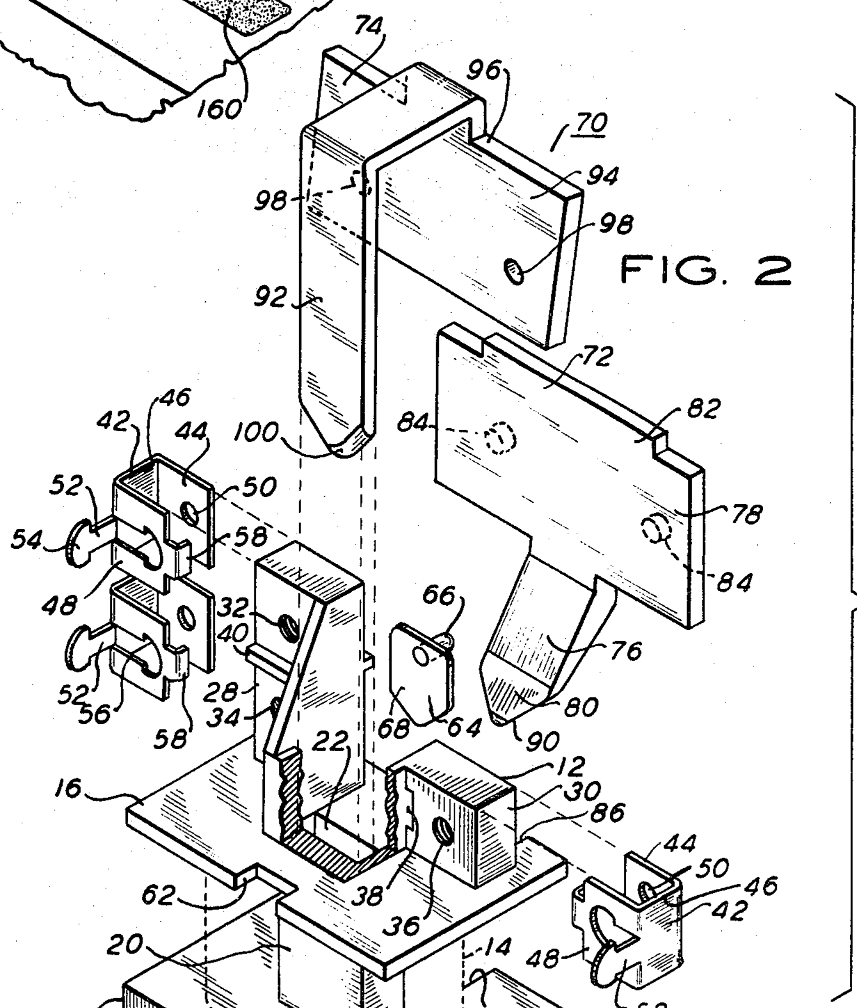

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FIG. 3

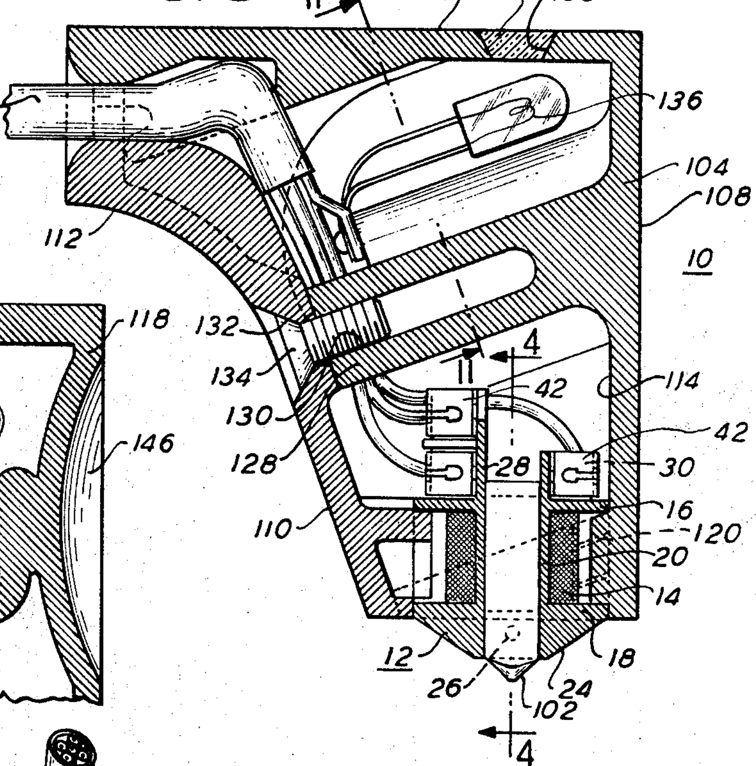
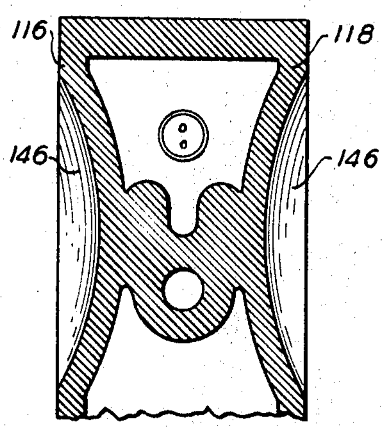


FIG. 11



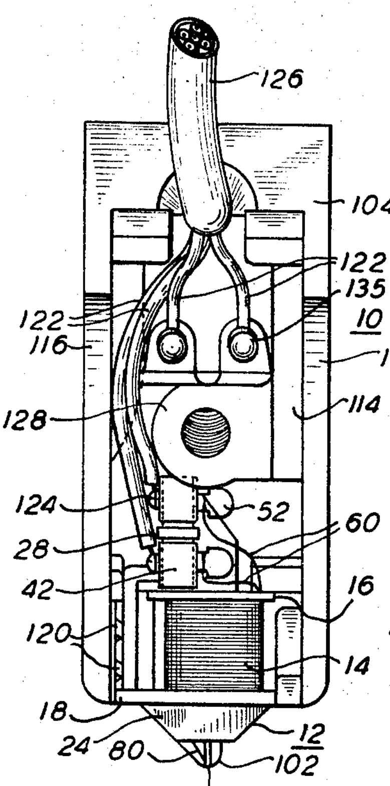


FIG. 5

FIG. 4

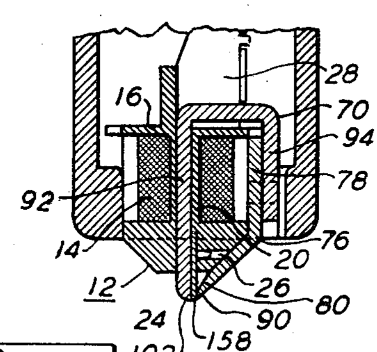


FIG. 6

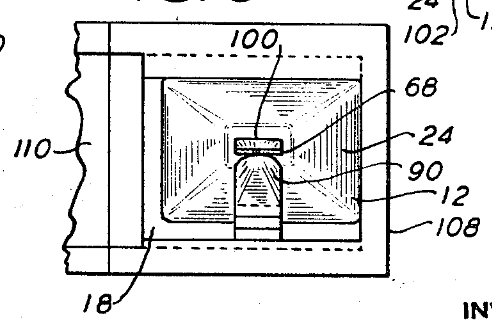


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FIG. 8

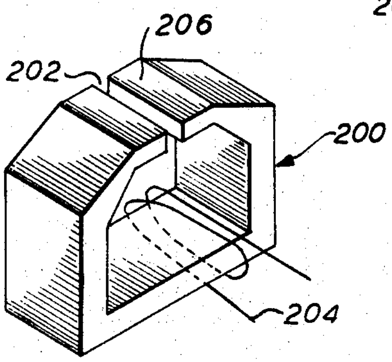


FIG. 9a

PRIOR ART

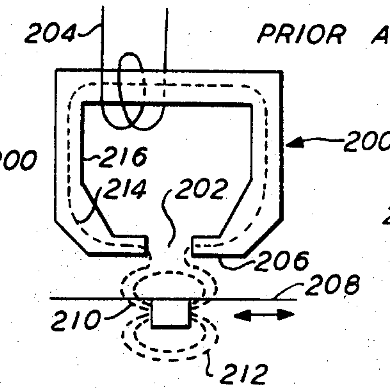


FIG. 9b

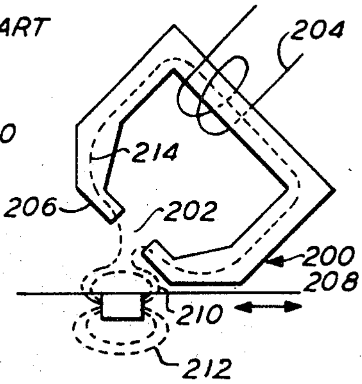


FIG. 10a

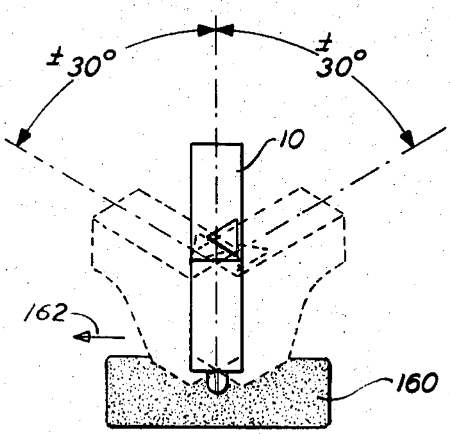


FIG. 10b

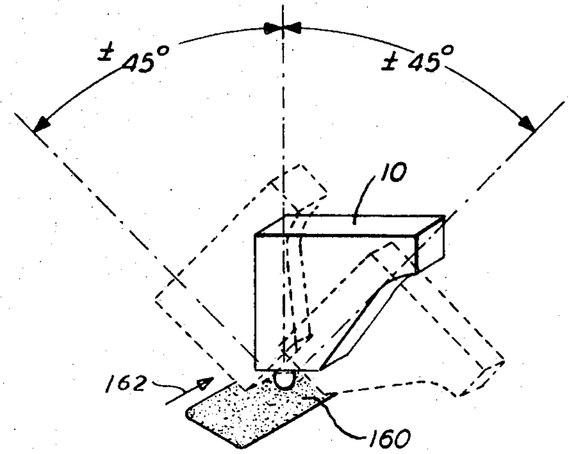
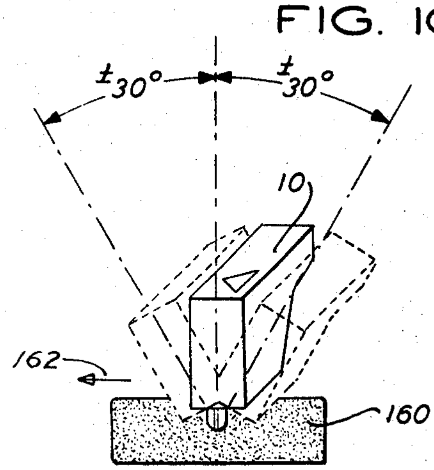


FIG. 10c



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HANDHELD TRANSDUCER OPERATING STATE INDICATOR

BACKGROUND OF THE INVENTION

This invention relates to transducers and more particularly to components thereof.

In the recording onto or reading from a magnetic record, such as a magnetic tape, card, or the like with electromagnetic transducers of the prior art, it is necessary to maintain correct spacing and positioning of the transducer with respect the record. As is well known in the art, electro-magnetic transducers are generally constructed of one or more pole pieces made of iron, ferrite, or the like and fashioned into a generally ring-shaped body. The pole pieces are either cut or formed such that two abutting faces thereof are parallel and closely spaced but do not touch. This resulting space, termed the gap, is required for both the reading and recording functions. The gap may be filled with air or some other material having a lower permeability than the surrounding pole pieces. As a result, flux passing from the pole pieces to the gap material is caused to fringe and strike the magnetic record placed closely adjacent the transducer. In this manner recording is permitted to take place. In a similar manner, the gap is used to sense the flux surrounding a magnetic area of a magnetic record and permit its introduction into the pole pieces which conduct the flux to a pickup coil for conversion to a read current.

The amount of read current available will be dependent upon the original strength of the magnetized area of the magnetic record, the materials of the pole pieces and gap, and the shape, position, and spacing of the gap with respect to the record media. Increasing the spacing between the gap and the magnetized area will reduce the flux reaching the transducer thus reducing the read current. Further, any angular change in the position of the gap with respect to the record media from the required perpendicular position will effectively increase the gap to media spacing and decrease the received flux. Skewing of the position of the gap from its normal position, perpendicular to the lines of flux, may introduce spurious signals from adjacent recorded areas, and decrease the available flux.

In order to minimize positioning errors of the type described above and increase the effective flux employed to produce the reading current, the path of movement of the record is carefully controlled and the transducer is rigidly mounted to maintain desired spacing and alignment with the magnetic record media. Such rigid mounting is also necessary for the transducer during recording because alignment errors reduce the flux reaching the media and thus reduce the recording strength and enlarge the recording area. With this requirement for rigid mounting it is not possible to record and read magnetic records with a transducer which is manually positioned by an operator with respect to a record.

Numerous types of handheld transducers have been suggested. Generally, these transducers are pen-shaped. One such example is disclosed by Frost in U.S. Pat. No. 2,548,011. Pen-shaped transducers have a major disadvantage in that the user may tire of holding same and that the pen-shape may slip. In addition orientation may prove exceedingly difficult, especially where the transducer lacks means for orientation with respect to a record.

It is well known to use two sections of an armature in forming a completed transducer. Such devices have been disclosed by Joanou in U.S. Pat. No. 3,105,965 and Ferber in U.S. Pat. No. 2,785,838. In such arrangements, however, the armatures must be held together by complex gripping members such as clamping blocks or the like. Such combinations make for expensive and complex assemblies.

SUMMARY OF THE INVENTION

A handheld transducer housing comprises three walls. The first wall has a surface disposed in a first imaginary plane and is adapted to accommodate a first finger of the hand of the user. The second wall has a surface disposed in a second imaginary plane spaced from the first imaginary plane and is adapted to accommodate the second finger which is adjacent a second finger of the user. The third wall has a surface intersecting the first and second surfaces and adapted to accommodate a third finger, adjacent the second finger, of the user.

A handheld transducer housing comprises means for transducing the information from a record. The transducing means is substantially responsive upon being moved proximate to the record in at least one predetermined direction. The housing has indicating means disposed in the housing for indicating the predetermined direction.

A handheld transducer housing comprises transducing means within the housing for transducing a signal, the housing having at least two walls each having surfaces lying in an imaginary plane and each of the walls having therein depressions for accommodating the fingers of the hand of the user.

An electromagnetic transducer of the type having an armature. The armature has a coil about it. The transducer is adapted for use with a magnetic record, the record having lines of flux arranged in an intended reading path. The transducer comprises at least one reading head affixed to the armature, the reading head having a substantially hemispherical reading portion.

An armature for an electromagnetic transducer comprises two members. These members have generally enlarged portions. The enlarged portions are placed in proximity such that the members in combination comprise the armature.

A bobbin for an electromagnetic transducer. The bobbin has a core mounted assembly for holding wire thereon. In addition it has means for supporting an armature and includes means for engaging a shim.

An electrical terminal or clip for use with a bobbin of an electromagnetic transducer. The clip is substantially U-shaped having three walls. The first and third walls being inclined to have one another to be spring loaded into assembly with the bobbin.

A handheld transducer comprises a housing and means for illumination within the housing for indicating an operating condition of the transducer. A housing comprises means for transducing the information from a record. A transducing means within the housing is substantially responsive upon being moved proximate the record in at least one predetermined direction. The housing has indicating means disposed in said housing for indicating the predetermined direction and the illuminating means for indicating the operating state of the transducer.

A handheld magnetic transducer comprises a gun-shaped housing, a bobbin within the housing, an armature within the bobbin and extending through a laterally extending wall of the bobbin. The armature and the wall forming the muzzle end of the housing. An electrical cable for transmitting information from that transducer is disposed within he housing and extends from the handle end thereof.

BRIEF DESCRIPTION OF THE DRAWING

FIG. 1 is a perspective view of a transducer constructed in accordance with the invention;

FIG. 2 is an exploded perspective view of a bobbin, shin, armature, and electrical connectors constructed in accordance with the invention;

FIG. 3 is a sectional view of the transducer of FIG. 1.

FIG. 4 is a partial sectional view of the transducer of FIG. 3 taken through lines 4—4;

FIG. 5 is an elevational view looking into the transducer of FIG. 3 with one wall of the housing removed;

FIG. 6 is an elevational view of the bottom or transducing end of the transducer of FIG. 3;

FIG. 7 is a perspective view of the transducer of FIG. 1 in use;

FIG. 8 is a perspective view of a prior art magnetic transducer;

FIGS. 9*a* and 9*b* are schematic views of a prior art transducer;

FIGS. 10*a*, *b*, and *c*, are perspective views of the transducer of this invention disclosing several types of movement thereof; and

FIG. 11 is a section taken on line 11—11 of FIG. 3.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

Disclosed herein is an electromagnetic transducer to be used in conjunction with magnetizable record bearing media. This transducer is so designed as to be manually positionable with respect to a record. Thus, the transducer may be moved without special apparatus for guidance or control with respect to the record bearing media.

The magnetic transducer **10** (as shown in FIG. 1) has therein a bobbin **12** (FIG. 2) which may be constructed of plastic, hard rubber, or other insulating materials.

The bobbin **12**, as commonly used in the art, retains in place a coil of wire **14** (shown in phantom in FIG. 2 and in section in FIGS. 3 and 4). The coil **14** serves as a means for having induced therein an electric current by flux in an armature. It will be understood that the coil **14** may have any shape configuration as is known in the art.

The bobbin **12** is substantially spool-shaped in its construction having two flat, opposed end walls **16** and **18**. Disposed between the end walls **16** and **18** and holding them rigidly apart is a rectangularly shaped core member **20**. The coil **14** is wrapped about the core **20** in a manner commonly known in the art. Extending through the end walls **16** and **18** and the core **20**, is a bobbin aperture **22**. The front end wall **18** has a surface perpendicular to the core **20** which is substantially frustro pyramidal in shape **24**.

A shim aperture **26** (see FIGS. 3 and 4) extends perpendicularly from the bobbin aperture **22** into the frustro pyramidal front end **24** of the front end wall **18** of the bobbin **12**.

The rear end wall **16** of the bobbin **12** has extending upwardly therefrom and substantially parallel with the axis of the bobbin aperture **22** two arms, **28** and **30**. These arms **28** and **30** form a contiguous part of the bobbin **12**. The first arm **28** has therein two apertures, **32** and **34**, adapted to receive screws. The second arm **30** has a similar aperture **36**. In addition, adjacent each of these apertures **32**, **34**, and **36** are flange retaining insets. Only one **38** is visible in FIG. 2.

On the first arm **28** separating apertures **32** and **34** is a laterally extending ridge **40** made of insulating material. In the preferred embodiment this ridge **40** is molded as part of the arm **28**. The ridge **40** may be equidistant between the apertures **32** and **34**. The function of the ridge **40** is more fully described below.

The handheld magnetic transducer **10** employs the use of a novel set of clips **42**. The clips **42** are of substantially U-shaped construction, having rectangularly shaped side walls **44**, **46**, and **48**. The first side wall, **44** has an aperture **50** therein, the function of which is more fully described below. The second side wall **44** forms the base side of the U configuration of the clip **42**. The third side wall **48** has a tab **52** which extends laterally from the third side wall **48** and parallel the bottom wall **44** of the clip **42**. The tab **52** has a substantially T-shaped head portion **54**. This tab **52** may be cut or punched out of the third side wall **48** leaving therein a T-shaped aperture **56**.

At the free end of the third side wall **48** is an L-shaped flange **58**. This flange **58** extends parallel to the second side wall **46** and inwardly of the U-shaped clip **42**. The U-shaped clip **42** may be constructed of a conducting material, such as copper, or spring steel. The side walls **44** and **48** of the U-shaped clip **42** incline inwardly toward one another. In place on the arms **28** and **30**, the L-shaped flange **58** resides in the flange retaining insert **38**. The apertures **32**, **34**, and **36**, respectively, are each in alignment with the apertures **50** and **56** of each of the clips **44**. The side walls **44** and **48** act as springs to hold the clips **42** securely to the arms **28** and **30**.

The tab **52** is designed for the attachment, by solder or otherwise, of wires **60** (FIG. 5) from the coil **14**. The head **54** of the tab **52** serves to prevent the wires **60** soldered thereto from slipping off. The bobbin **12**, has in its rearward wall **16** a notch **62** through which are placed the wires **60** of the coil **14**. The ridge **40** serves to insulate and separate the clips **42** on the first arm **28** from coming into contact with one another.

The handheld magnetic transducer **10** employs a shim **64**. The shim **64** of this invention has an upwardly extending boss **66**. As is commonly known in the art, the shim **64** is made of a nonmagnetic material and may be approximately 5/1000 of an inch in thickness. The boss **66** may be made by means of punching into a die or molding.

The general function of a shim is to keep the reading head of an armature in place. The broader functions of the shim of this invention will be more fully described below.

As may be seen from the drawing, the shim **66** is substantially rectangular in shape, having one side of which being surmounted by a frostro triangularly shaped portion **68**. The shape of the shim **64** is designed so as to conform with the shape of the reading head, more fully described below.

The shim **64** which, except for the boss **66**, is essentially thin and flat, is within the bobbin apperture **22** in the frustro pyramid portion **24** of the bobbin **12** with the boss **66** extending into the shim aperture **26**.

The armature of an electromagnetic transducer serves to cause the flux obtained from a record to flow therethrough and pass a coil. The flux induces a current in the coil.

The armature **70** of this invention comprises two parts **72** and **74**. The armature **70** may be constructed of materials commonly known in the art having high permeability. For example, the armature **70** may be made of a material made of 79 percent nickel, 5 percent molybdenum, and 16 percent iron. The shim **64** can be made of plastic. In the present embodiment the shim **64** is made of beryllium-copper. The shim **64** can also be made of a nonmagnetic stainless steel so that it can withstand wear. The first part or section **72** of the armature (FIG. 2) has a T-shaped construction with the leg **76** thereof extending at an obtuse angle, downwardly with respect to the crossbar **78** of the T. The leg **76** terminates with an inner gap taper **80** (FIG. 5), which is a common method of making the reading portion of an armature.

The crossbar **78** has a small rectangularly shaped section **82**, extending in the same plane as the crossbar **78** and outwardly therefrom and opposed to the leg **76**. There are bosses **84** (shown dotted in FIG. 2) at opposed ends of the crossbar **78**. The function of these bosses **84** shall be more fully explained below.

The crossbar **78** rests across the bobbin **12** with the rectangular section **82** thereof resting upon a similarly shaped notch **86** in the rear wall **16** of the bobbin **12**. Only a part of the notch **86** is visible in FIG. 2. The leg **76** of the first part **72** of the armature **70** is supported by the bobbin **12** in a notch **88** in the front wall **18**. Upon being pressed against the bobbin **12** the first part **72** of the armature **70** will contact at its reading portion **90** with the shim **64**. The second part **74** of the armature **70** is a substantially U-shaped member with one side **92** of the U being substantially longer than the other side **94** thereof. This second side **94** of the U has a T-shaped configuration. The crossbar **96** of the second side **94** is of substantially the same size as the crossbar **78** of the first part **72** of the armature **70**. The opposed ends of the crossbar **96** have apertures **98**. When the two crossbars **96** and **78** of the armature **70** are placed in registry, the bosses **84** and apertures **98** remain in registry and keep the reading tips aligned.

The first side **92** is inserted through the bobbin aperture **22** in such manner as it will press the shim **64** against the opposed wall of the bobbin aperture **22**. The shim **64** is held securely by its boss **66** in the shim aperture **28** of the frustro pyramid section **26** of the bobbin **12**.

As shown in FIG. 2, the second side **94** of the second part **74** of the armature **70** is inclined inwardly. In inserting the second part **74** into the bobbin **12** and over the first part **72** it is necessary to move back or spring the second side **94** into contact with the crossbar **78** of the first part **72** and lock in place by the engagement of the bosses **84** residing in the apertures **98**. The pressure of the spring loaded U-shaped second part **74** together with the bobbin **12**, holds the first part **72** of the armature **70** in place. The tip or reading portion **100** of the second part **74**, taken together with the shim **64** and the reading portion **90** of the first part **72** from a substantially hemispherical reading head **102** (FIGS. **3**, **4**, and **5**). The angular relationship of the first part **72** (as discussed above) and the frustro pyramidal shape **24** of the bobbin **12** serve to permit the relative motion of the reading head with respect to a record where the record is disposed on an uneven surface. In this design the reading material which may be for example a record, which may be for example a label attached to a piece of cloth, will not snag or catch on any part of the reading portion **102**.

The transducer **10** has a housing **104** (as shown in FIG. **1**). The housing **104** has a top and front wall **106** and **108**, respectively, being substantially planar in shape and perpendicular to one another. A third wall **110** is opposed to the first two walls **106** and **108** and lies at an angle thereto. At least a portion of this third wall **110** is curved at its uppermost portion **112** thereof. The purpose of this curved portion **112** is more fully explained below.

Extending perpendicular to the first three walls **106**, **108**, and **110**, and forming therewithin a cavity **114** (FIG. **5**) are two side walls **116** and **118**. These five walls **106**, **108**, **110**, **116**, and **118** taken together comprise a general configuration of the housing **104**. In general this is approximately a gun-shape. The lower or "muzzle" end of the housing **104** is closed by the combination of the bobbin **12** and armature **70**. The combination of the armature **70** and bobbin **12** are held firmly in place without use of glue or other means by fingers **120** (FIG. **4**). The fingers **120**, may be resilient means such as springs or as shown in FIG. **5**, molded as an integral part of one of the side walls **116**.

In the embodiment disclosed, the coil **14** comprises a center tapped transformer. The output leads **60** of the transformer **14** are connected to tabs **52** on the clips **42** connected to the first arm **28** and the center tap is connected to the tab **52** of the clip **42** on the second arm **30** of the bobbin **12**. Wires **122** for carrying the information transduced by the transducer **10** are secured to the arms **28** and **30** and to the clips **42** by screws **124** (FIG. **5**) secured in the apertures **34**, **36**, and **38**. The wires **122** form a part of a cable **126**. These wires **122** may be secured to the clips **44** by soldering or other similar means rather than screws **124**. If soldering is used, the wires **122** may be inserted through the respective apertures **32**, **34**, and **36** and secured to the other side of the clip **42** so that arms **28** and **30** act as strain relief.

Disposed within the housing **104**, and extending perpendicularly to the third wall **110** is a cylindrically shaped post **128** (FIG. **3**). The post **128** has therein an axially extending aperture **130** which may be internally threaded. The third wall **110** has therein an aperture **132** which is a registry with the aperture **130** of the post **128**. This third wall **110** may be removable for purposes of assembly and repair of the transducer **10** and may be secured to the housing **104** by means of a screw **134** or similar means. Secured or molded to the post **128** are two metal terminals **135**. Wires **122** from the cable **126** may be secured thereto, and may be used as a means for illumination. The means for illumination may be, for example, an electric lamp **136**.

The lamp **136**, which resides within the housing cavity **114** adjacent the top wall **106**. The top wall **106** has therein an aperture **138** through which the lamp **136** may be seen. The aperture **138** may be in the shape, for example, of an arrow **140** (FIG. **1**). The arrow **140** is intended to direct the user as to the proper direction of movement for the transducer. The aperture **138** in the top wall **106** may have therein a translucent material of clear or colored glass or plastic **142** (FIG. **5**). Upon illumination, the arrow **140** indicates an operating state of a transducer **10**. As shown in FIG. **3** wires **122** are connected to terminals **135** to provide power to the lamp **136**. The terminals **135** may be secured to a section adjacent the post **128** by means of molding or fixing by glue or similar means. The two wires of the lamp **136** are appropriately attached to respective terminals **135**.

The cable **126** extends from the transducer **10** to a signal device **144** (FIG. **7**). This device **144** may be any information receiving device as is commonly known in the art. The device **144** can, for example, provide a signal to the transducer for lighting the lamp. The signal (not shown) may indicate either an error condition or that the transducer **10** is receiving information correctly, or, in the alternative, that the transducer **10** is now in the state ready to receive new information. The signal to the lamp **136** may be given from the signal device **144** by manual means such as a switch thrown by an operator (not shown) or by automatic means either indicating proper operation or an error condition in which the transducer should not be used. Such a device **144** is well known in the art.

The side wall **116** and **118** have therein depressions or dimples **146** (FIG. **1**) at opposed sides of the transducer **10**. These dimples **146** are placed so that the hand **148** of a user may conveniently grasp the transducer **10** (FIGS. **7** and **11**). The thumb **150** and forefinger **152** may easily grasp and reside within the dimples **146** of the transducer **10**. The curved third wall **110** can serve as a support for a third finger **154** of the land **148**. In normal use, the cable **126** may be held in the palm of the hand **148**.

The prior art typical electromagnetic transducer as shown in FIG. **8**. Such a transducer **200** generally takes the shape of a ring or may be somewhat flattened out, in the manner as shown. The transducer **200** may be constructed of a solid magnetic material, such as soft iron, nickel, cobalt, steel, ferrite, or similar material. The gap **202** may be provided when the material is formed into its particular shape or may be milled from the material itself after formation. In the back portion of the transducer **200** is placed a coil **204** which may be used alternatively for supplying writing current to the transducer **200** or for receiving or providing reading current therefrom, depending upon the mode of operation. Alternatively, two coils may be provided, one for reading and one for writing purposes.

The gap **202** is generally arranged (FIG. **9a**) perpendicular to a face or reading surface **206** of the magnetic transducer **200**. The transducer **200** may be aligned with a record bearing medium **208** in such a manner that the face **206** of the magnetic transducer **200** is parallel with the direction of relative movement of the transducer **200** and the record bearing medium **208**. The gap **202** is placed perpendicularly to the surface of the record bearing medium **208**. The gap **202** is placed in such a position as to cause the reading of the magnetized area **210** of the record bearing medium **208**. A plurality of flux lines **212** are shown eminating from the left-hand portion of the magnetized area **210**, extending about the magnetized area **210**, above and below it, and closing to the right-hand portion of the magnetized area **210**. One of these lines of flux **214** is shown entering the magnetic structure **216** of the magnetic transducer **200** at the gap **202**. This line of flux **214** continues through the entire structure **216** and exits from the opposite side of the gap **202** from which it entered. Thereafter the line of flux **214** re-enters the magnetized area **210** in order to form a closed loop.

Flux, like current, follows the path of least resistance. Hence, it enters the magnetic structure **216** because the reluctance of the air space (or shim, if present) across the gap **202** is greater than the reluctance of the magnetic structure **216**.

From this highly simplified representation, only a portion of the available flux **212** from the magnetized area **210** is available for entry into the magnetic structure **216** transducer **200**. The strength of the flux which is permitted to enter and which, as a result, induces readout current in the coil **204** is dependent on the strength of the magnetized area **210**, the spacing between the record bearing medium **208** and the transducer gap **202**, the width of the gap **202** along the direction of travel relative to the magnetized medium **206**, the length of the gap **202** perpendicular to the direction of the travel, the speed of relative movement between the transducer **200** and the medium **208**, and the composition of the magnetic structure **216** of the magnetic transducer **200**.

When the transducer **200** is placed in a tilted position (FIG. **9b**) such that the face **206** is no longer parallel to the lines of flux **212** the flux exiting from the magnetized area **210** is caused to travel a greater distance through the air in order to enter one of the faces of the gap **202** in the transducer **200**. This will cause a greater reduction in the amount of flux which is permitted to enter the magnetic body of the transducer **200**. The remaining flux is able to close in the air through the shorter distance. This failure of flux to enter the transducer **200** is due to the lower total reluctance of the air path as compared to a long air to pole piece path. This bypassing of the transducer **200** causes a greater reduction in the amount of flux available to the body of the transducer **200** and thus decreases the amount of signal available at the winding at the coil **204**.

In order to minimize the possibility of such inclination of a gap with respect to the magnetized surface of a record to be read or recorded upon, it is the general practice in the prior art to rigidly mount a transducer and to control the path of movement of the magnetic medium so as to assure proper alignment and proper positioning of the gap with respect to the magnetic medium. It should be understood that in an ideal condition (FIG. **9a**) write current supplied to the coil **204** is permitted to enter the magnetic medium and produce a greater strength recording that is possible in the tilted position (FIG. **9b**). Turning now to FIG. **10**, the transducer **10** of this invention is disclosed having a hemispherically shaped reading portion **102**. The gap **158** (defined by the shim **64** and the adjoining edges of the reading portions **90** and **100**) of the two parts of the armature **72** and **74**, respectively, forms an arc on the surface of the hemisphere **102**. Much of the difficulties of prior art devices are avoided by means of this unique design. As referred to above, rotating of the gap of a prior art transducer relative to a record causes severe loss of signal strength.

The unique shape of the transducer **10** permits relative rotation between the gap **158** and the record **160** in any one or combination of axes without significant loss of signal or incurring distortion. Thus, with a tip **102** having a radius of one thirty second of an inch and a one-half NRZ recording cell width of 0.0125 inch, a transducer **10** of this construction may read successfully during relative movement (arrow **62**) and have relative rotation or positioning with respect to the record **160** about an axis which is both perpendicular to the surface of the record **160** and to the lines of flux to ± 30° (FIG. **10a**), with respect to an axis perpendicular to the lines of flux about an axis which is parallel the surface of the record **160** and parallel to the lines of flux to ±45° with respect to an axis perpendicular to the record surface (FIG. **10b**), and about an axis which is parallel the record surface and perpendicular to the lines of flux to ± 30° with respect to an axis perpendicular to the surface of the record (FIG. **10c**). It is to be understood that the third axis of rotation, which is perpendicular the lines of flux and parallel the record **160** (FIG. **10c**), the axis is substantially proximate the record. Thus, in FIG. **10c** the axis passes through the reading portion **102**. In addition, relative rotation may be considered the same as positioning. That is, that the head of this construction and the record can assume a fixed position relative to one another about any of the axes and the transducer will produce a signal having a substantially constant or average strength and shall be free from distortion or noise. One advantage of this design is that the user can hold such a transducer in his hand (FIG. **7**) and produce acceptable signals although the hand causes the transducer to move or be positioned about the above-noted axes. It has been found that the degrees of movement or rotation are sufficient to permit handheld use.

The transducer of this invention represents an improvement over the transducer described in copending application, Ser. No. 128,602 by Richard J. LaManna and Alan K. Jensen, entitled "Magnetic Transducer". It has been observed that the transducer of that invention is limited in skew rotation (rotation about the axis which is perpendicular to the record and to the lines of flux). In addition it is much more complicated in construction in that the gap must be carefully inscribed on the surface of a keeper over a long length thereof. In addition, small cell recording mitigates against flexibility in movement.

Turning now to other features of the transducer of this invention, it will be noted that the top wall **106** of the transducer **10** has therein an arrow **140**. This arrow **140** indicates the preferred direction of movement as determined by the signal device **144**. This direction is dependent upon the ability of the device **144** to interpret the information received. Transducers in general whether they be magnetic, optical, or the like, are not believed to have such an arrow indication thereon.

Another aspect of the invention is that of dimples **146** (FIG. **1**). These dimples are located in the first and second side walls **116** and **118**, respectively. It should be noted that the first and second side walls **116** and **118** lie in imaginary planes parallel to one another. As noted earlier, the general configuration of the transducer **10** is generally gun-shaped. Thus the user of the transducer will naturally grasp the transducer with the fingers of the hand falling into the dimples **146**. The gun-shape of the transducer **10** is also adapted to accommodate the fingers of the hand as shown in FIG. **7**.

Turning to another aspect of this invention it should be noted that in FIG. **2** the T-shaped construction of the two-part armature **72** and **74** have enlarged or T-shaped portions. The armature parts **72** and **74** enable the armature to be placed together. However, the enlarged area presents such a greater area that, in relation to any possible spacing or gapping due to the joining of the two parts together, there is relatively little or no loss of flux at the joining part. This is believed to be an advantage over the prior art devices for ease of construction.

Further, the crossbar portions, the outer portions thereof are employed to secure to the two parts together to form a single armature. By securing the two T portions by the boss and aperture combination the flux paths are not disturbed. Clearly these two parts may be joined together by screwing, gluing, or similar means. However, the boss and aperture combination provides an efficient means of joining the two parts together as will be more fully explained below.

The bobbin described herein and shown more clearly in FIG. **2** with its frustro pyramidal shaped front wall **24** in assembly with the armature **70** provides a guide or protective end as the transducer reading portion **156** of the armature **70** is passed over a label **160**. See FIGS. **6** and **7**. In assembly of the armature **70** and bobbin **12** of the transducer **10** it should be noted that the second part **74** is inserted into the apertures **22** and the second part **74** is spring loaded onto the first part **72** and thereby holding both in place and at the same time holding the shim **64** locked into position with the boss of the shim **66** fitted into the shim aperture **26**. Thus, without means of screws, or glue, or other securing means and by virtue of resiliency of joining parts, the entire three elements are held together. In the same manner, the clips **42** are inserted into the arms **28** and **30**. The only means requiring to actually join one element to another by soldering or screwing is that of the joining of the wires of the cable **126** and the wires of the coil **14**. The wide surface area of the clips **42** serves to dissipate heat when soldering. It is believed that most connectors used in combination with bobbins are of a narrow type having a small relative area compared to the wire used in such a bobbin and to the area proximate the bobbin. Thus, heat applied to solder the coil wires onto such clips or terminals will invariably injure the wire, the insulation, on the wire, and/or the bobbin itself. The clip-on form of these terminals **42** by means of the flange **58** insures quick and easy assembly as of the combination of the armature, bobbin, and shim.

The use of a means of illumination such as the light bulb **136** provides the means of indication as to when the device is operative or not. This lighting is controlled by an error or an error signal from the device **144** as is commonly known. By this means the user receives an indication from the device **144** which tells the user whether or not the transducer **10** should be used. Thus if the light is lit it can be used to indicate that to the user that the transducer is receiving the information or conversely that the transducer has not received the proper information and the transducer should be moved over the record again or that the transducer is now ready to receive additional information. By combining the light with the arrow the transducer provides an indication of the state of readiness or usefulness of the transducer and its direction of use to the user. Except for the soldering or joining of wires to terminals and the screwing of the curved third wall **112** to the transducer it should be noted that the entire transducer is assembled without means of screwing, soldering, or the like. Thus the bobbin bottom wall **24** of the bobbin **12** serves as the muzzle or transducing end of the transducer **10** and is held in place by the fingers **120** on the side walls of the inner side wall of the cavity **114** of the transducer **10**. Thus, there is described herein a novel magnetic transducer having many features applicable to other types of transducers and which is economical in construction.

What is claimed is:

1. A handheld magnetic transducer having a plurality of operating states comprising:
   a. housing means of a configuration facilitating the grasping thereof by the hand of a user;
   b. transducing means housed in said housing means for transducing information from a record; and
   c. indicating means carried by said housing means and including means which is illuminated to indicate that the transducer is operating in a predetermined one of the operating states.

2. A handheld transducer as recited in claim **1** wherein said means which is illuminated comprises a light bulb.

3. A magnetic transducer of the type including an armature and coil means about the armature comprising:
   a. a manually held and positionable housing for housing the armature and coil means;
   b. signal means for providing a predetermined signal indicative of the operating state of the transducer;
   c. indicating means carried by said housing and including illuminating means responsive to said signal means to be illumminated thereby so as to provide an indication that the transducer is in a predetermined operating state.

4. A magnetic transducer as recited in claim **3** wherein said illuminating means comprises an electric bulb.

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