Oct. 13, 1964 D. LITTMANN 3,152,659

STETHOSCOPE

Original Filed June 16, 1960

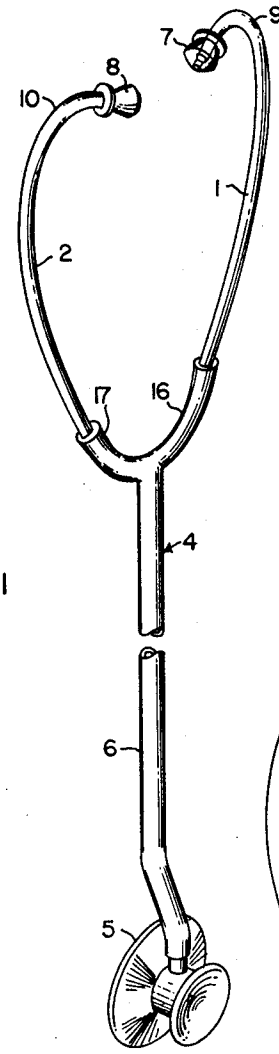


FIG. 1

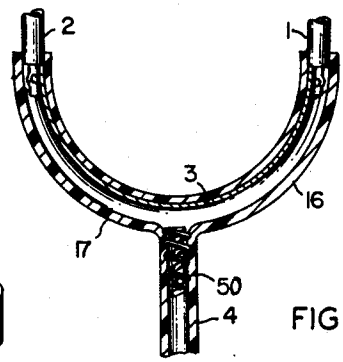


FIG. 2

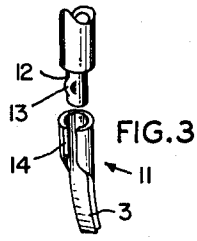


FIG. 3

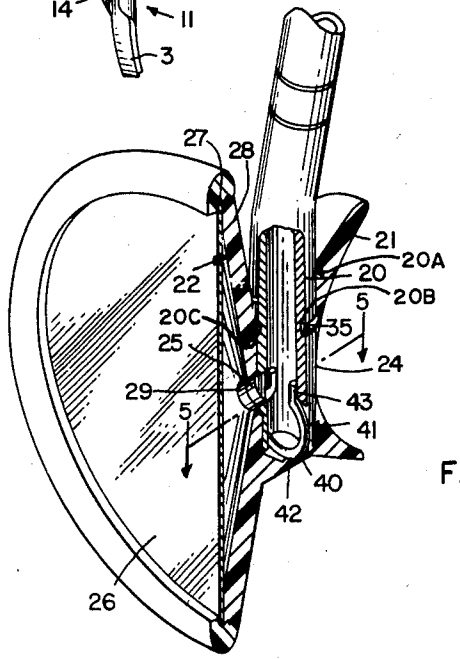


FIG. 4

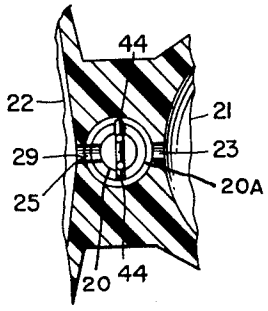


FIG. 5

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STETHOSCOPE

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5 Claims. (Cl. 181—24)

The present invention relates to a stethoscope and more particularly to an improved form of a binaural stethoscope. This application is a divisional application of application Serial Number 36,641 filed June 16, 1960.

Most stethoscopes currently in use are formed with a pair of rigid ear tubes interconnected by a flexible Y member. An external spring arrangement spring tensions the ear tubes towards one another so that they may freely grip the wearer's head. This type of construction is cumbersome and bulky.

Several modifications have been made to improve such structures by integrally forming the spring member with the Y-shaped interconnecting tube. Such modifications, however, have not been satisfactory for several reasons.

For example, the material utilized to form the flexible Y-shaped tube has been unsuited for prolonged use and does not lend itself to an integral structure of the type contemplated. Furthermore, such modifications are difficult to manufacture.

In addition to these problems, the flexible Y-shaped interconnecting sound tubes used to connect the ear tubes and a chest piece or receiver will crack at the junction of the stem of the Y and the two arms with constant flexing.

The present invention is designed ot overcome these problems by providing an integral stethoscope having two ear tubes interconnected by a synthetic resin flexible Y-shaped sound tube. The stem of the Y is formed integrally with a helical spring means adapted to prevent cracking at the base of the stem after prolonged amounts of flexing. The flexible arms of the Y sound tube are formed with a leaf spring tensioned within the tube adapted to tension the arms towards one another. The receiver of the stethoscope is formed with a dual receiver having novel means for connecting one of two microphones to the sound tube.

The present invention also provides a unique method of assembly of stethoscopes of the type described. In this method the ear tubes are rigidly secured to the end of an interconnecting leaf spring. These joined elements are then partially threaded through the arms of the Y-shaped sound tube until the ear tubes are symmetrically arranged. The remaining components are then conventionally assembled.

These and other objects and advantages of the present invention will be more clearly understood when considered in conjunction with the accompanying drawings, in which:

FIG. 1 is a perspective view of the stethoscope;

FIG. 2 is a cross sectional fragmentary view on an enlarged scale of a portion of the stethoscope;

FIG. 3 is an exploded detail of adjacent ends of an arm and spring;

FIG. 4 is a fragmentary perspective view on an enlarged scale of the receiver; and

FIG. 5 is a fragmentary cross section taken along line 5—5 of FIG. 4.

As best illustrated in FIG. 1 and FIG. 2, a pair of ear tubes **1** and **2** are secured together by a prestressed leaf spring **3** integral with a Y-tube **4**. A receiver **5** is secured to the lower end of the stem **6** of the Y tube **4**. The ear tubes **1** and **2** have ear plugs **7** and **8** secured respectively to their upper ends. The upper ends are bent as illustrated at **9** and **10** to suitably permit insertion of the

ear plugs in the wearer's ears. The ear tubes are preferably formed of a stainless steel with an outer diameter of approximately 3/16 of an inch and with a .035 inch wall. The length may be varied but preferably should be approximately 7 inches. The lower ends of the ear tubes are rigidly secured to the ends of the spring **3**. The spring **3** is formed of high carbon spring steel having a Rockwell hardness of approximately 40–45. This spring **3** is prestressed to form an arc of substantially 180°. The leaf is flared at both ends as illustrated at **11** in FIG. 3. These flared ends are rolled over to rigidly engage the shoulder sections **12** formed at the bottom end of each of the ear tubes **1** and **2**. The flared end **11** of the spring **3** is crimped about this shoulder section **12**. A dimple **13** formed in the shoulder section projects outwardly through a slot **14** formed between the free edges of the flared end to prevent rotation of the tube relative to the spring. A suitable metal to metal adhesive is used to additionally secure the ear tube to the spring in a rigid relationship. Each of the ear tubes are similarly secured to the ends of the spring **3**.

The spring is longitudinally positioned in the arms **16** and **17** of the Y tube **4**. These arms **16** and **17** form continuous passages with the ear tubes **1** and **2** and form a continuous passage with the stem **6**. The Y tube is preferably formed of a polyvinyl chloride acetate.

A helical spring **50** preferably formed of .016 inch stainless steel wire, having an outer diameter of preferably approximately .026 inch, is integrally molded within the upper end of the stem **6** immediately adjacent the junction of the arms **16** and **17**. It has been found that the combination of the polyvinyl chloride acetate Y tube and the leaf spring add substantially and prolonged resilience to the combination.

The lower end of the stem **6** is sleeve fitted to the tubular shaft **20** of the receiver. The sleeve fit is sufficiently tightened as to permit rotation of the tubular shaft with rotation of the adjacent portion of the stem **6**.

This tubular shaft **20** is rotatably interengaged with the diaphragm microphone **22** and open microphone **21** of the receiver **5**. These microphones **21** and **22** are integrally formed with the body of the receiver of a suitable steel. The open microphone **21** is of conventional bell shape having a relatively narrow diameter but deep cup **24**. An opening **23** at the cup apex is adapted to be aligned with an opening **25** in the tubular shaft **20** when the tubular shaft **20** is rotated. The diaphragm microphone **22** has a greater diameter than the open microphone and is formed with a suitable diaphragm **26** anchored at its periphery by suitable lip means **27** to the periphery of the diaphragm microphone cone **28**. The diaphragm microphone **22** is formed with an opening **29** at its apex adapted to be aligned with the opening **25** in tubular shaft **20**. FIG. 4 illustrates the microphone in this position.

The tubular shaft **20** fits within a cylindrical recess formed between the two microphones **21** and **22** as illustrated in FIG. 5 at **20A**. It is secured against axial movement by means of the retaining ring **35**, FIG. 4 which lies partially within groove **20B** in the outer wall of the tubular shaft **20** and partially within groove **20C** in the wall of cylindrical recess **20A**.

The tubular shaft **20** is adapted to rotate around a full 360° but snaps into two selected positions which locate the opening **25** in alignment with either the opening **29** or the opening **23** for connections of one of the two microphones **21** and **22**. This snap fastening is actuated by the spring arrangement illustrated generally at **40**. In this spring arrangement, a U-shaped spring or index spring **41** having an enlarged bight section **42** is positioned at the lower end of the shaft **20**. This spring **41** has its upper ends **43** positioned within the shaft **20** in locked or

fixed engagement with its side walls. The enlarged bight portion 42 projects radially outwardly beyond the shaft 20 and is adapted to engage the diametrically opposite grooves 44, FIG. 5, formed in the wall which forms the cylindrical recess within which the tubular shaft 20 is located. On rotation of the tubular shaft 20 relative to the microphones 21 and 22, the spring 40 is forced from the grooves under tension until the microphones are rotated a full 180° relative to the shaft 20, at which point the spring reengages the grooves 44. The bight portion 42 preferably extends radially outward at the lower end of shaft 20 and also rests against the bottom of the cylindrical recess.

In the assembly of this structure, the ear tubes 1 and 2 are first rigidly connected at their ends to opposite ends of the spring 3. The flared ends 14 are bent over and engaged to shoulder 12 and the structure is thereafter cemented to form a more rigid joint of the tubes 1 and 2 with the spring 3. Before insertion of the ear pieces of the free ends of the ear tubes 1 and 2, the series joined ear tubes and springs are threaded through the arms 16 and 17 of the Y tube 4 until the Y tube is symmetrically located with respect to the tubes 1 and 2 in the position generally illustrated in FIG. 2. The ear pieces are then attached as illustrated in FIG. 1 and the receiver is sleeve fitted to the free end of the stem 6. The helical spring 50 is preferably molded into the Y tube before the assembly as described above takes place.

What is claimed is:

1. In a stethoscope construction a microphone construction comprising a member forming diametrically opposed diaphragm and open microphones,

said member having a cylindrical recess symmetrically interposed between said microphones,

means forming aligned openings from the apexes of said microphones through said member,

a tubular shaft, means rotatably securing said shaft within said recess against axial movement,

means forming an opening through the wall of said shaft adapted on rotation of said shaft to be aligned selectively with said two openings to said microphones,

and means for spring tensioning said shaft in either of said aligned positions comprising a U-shaped spring having an enlarged bight section and parallel legs,

said U-shaped spring positioned at the bottom of said shaft with said bight section projecting radially beyond said shaft,

and said legs engaging said shaft, and means forming opposed slots in said cylindrical recess positioned normal to said holes connecting said microphones and adapted to releasably engage said bight section on rotation of said shaft.

2. In a stethoscope construction a microphone construction comprising a member forming opposed microphones each having an apex,

said member having a cylindrical recess interposed between said microphones,

a hollow shaft, means movably securing said shaft in said recess,

means forming spaced openings through said member from said apexes to said recess,

means forming an opening in said shaft adapted to be aligned with a selected member opening upon selective movement of said shaft,

spring means engaging said shaft and portions of said member for releasably engaging said shaft in selected positions in said recess whereby said shaft opening is aligned with a selected opening in said member,

said spring means comprising a substantially U-shaped spring having an enlarged bight section, said spring lying in a single plane with portions of said plane parallel to the axis of said shaft,

said U-shaped spring being positioned at the bottom of said shaft with said bight section projecting beyond said shaft,

means forming opposed slots in said cylindrical recess, said spring being adapted to be snapped into releasable engagement with said slots on movement of said shaft.

3. In a stethoscope construction, a microphone construction comprising a member forming substantially diametrically opposed diaphragm and open microphones each having an apex,

said member having a cylindrical recess substantially symmetrically interposed between said microphones,

a tubular shaft, means rotatably securing said shaft in said recess against axial movement,

means forming spaced openings through said member from said apexes to said recess,

means forming an opening in said shaft adapted to be aligned with a selected member opening upon selective rotation of said shaft,

a U-shaped spring having an enlarged bight section and substantially parallel legs,

said legs engaging said shaft with said enlarged bight section projecting radially beyond said shaft,

means forming opposed slots in said cylindrical recess adapted to releasably engage said bight section on rotation of said shaft whereby said shaft opening is aligned with a selected opening in said member when said bight section is releasably engaged.

4. An article in accordance with claim 3 wherein said member openings are axially aligned and said slots lie in a plane substantially perpendicular to an axis drawn through said member openings, whereby said shaft may be rotated to a first position wherein said bight section snaps into engagement with said slots and said shaft opening is aligned with one of said member openings and said shaft may be rotated substantially 180° whereupon said bight section again snaps into engagement with said slots and said shaft opening is aligned with a second member opening.

5. An article in accordance with claim 3 and further comprising a retaining ring encircling said shaft and lying partially within a groove provided in said shaft and partially within a groove in said cylindrical recess, said retaining ring preventing movement of said shaft in either direction along the axis of said shaft.

References Cited in the file of this patent

UNITED STATES PATENTS

1,813,931	Johnson	July 14, 1931
2,719,594	Smithline	Oct. 4, 1955
2,722,989	Tynan	Nov. 8, 1955
3,035,656	Kebel	May 22, 1962