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[54] ACOUSTIC LOCATOR WITH ARRAY OF MICROPHONES

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[52] **U.S. Cl.** .....**340/16 R**, 340/8 S

[51] **Int. Cl.** **G01s 3/00**

[58] **Field of Search** .....340/6, 16, 16 M, 340/8 S; 181/0.5

[56] **References Cited**

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[57] **ABSTRACT**

Acoustic locator comprising an array of microphones located on the outer ends of radial arms extending from a central support. The inner ends of the arms are pivotally connected to a housing rotatably mounted on a table of the support which also comprises a plurality of legs. A sighting device is applied to the arms for orienting the microphones, once the support is set up. After orientation, longitudinally adjustable posts are swung downwardly from the arms into engagement with the ground for supporting the arms and microphones.

7 Claims, 5 Drawing Figures

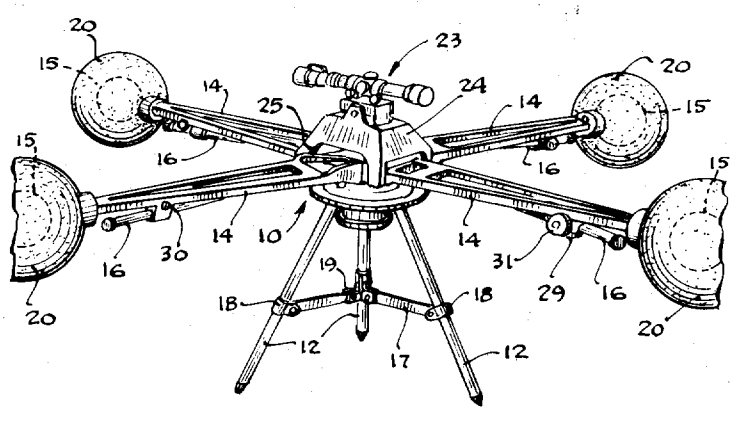


Fig.1

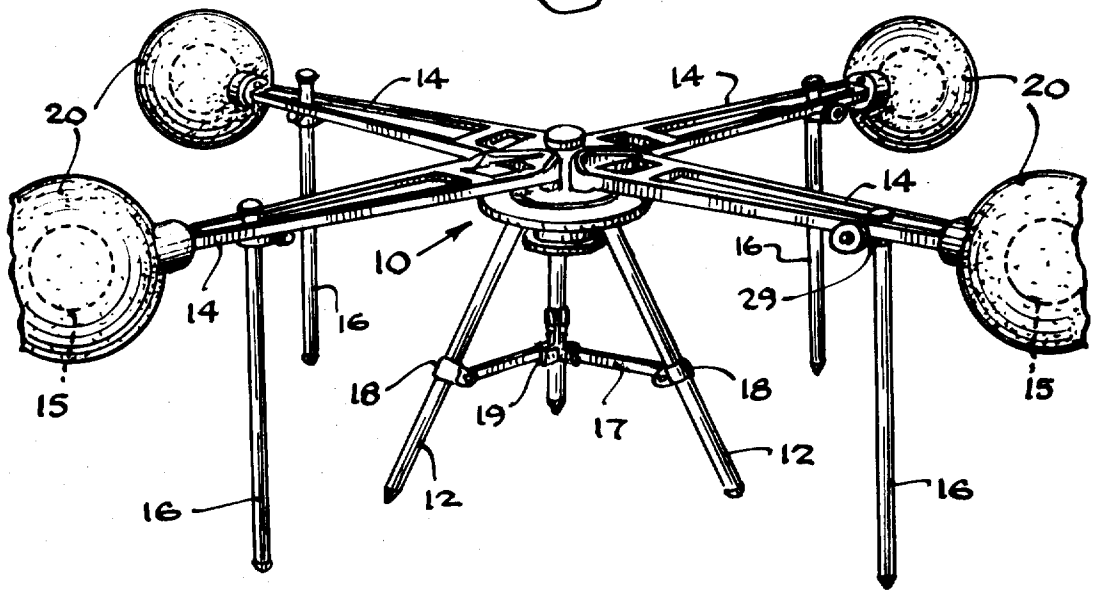
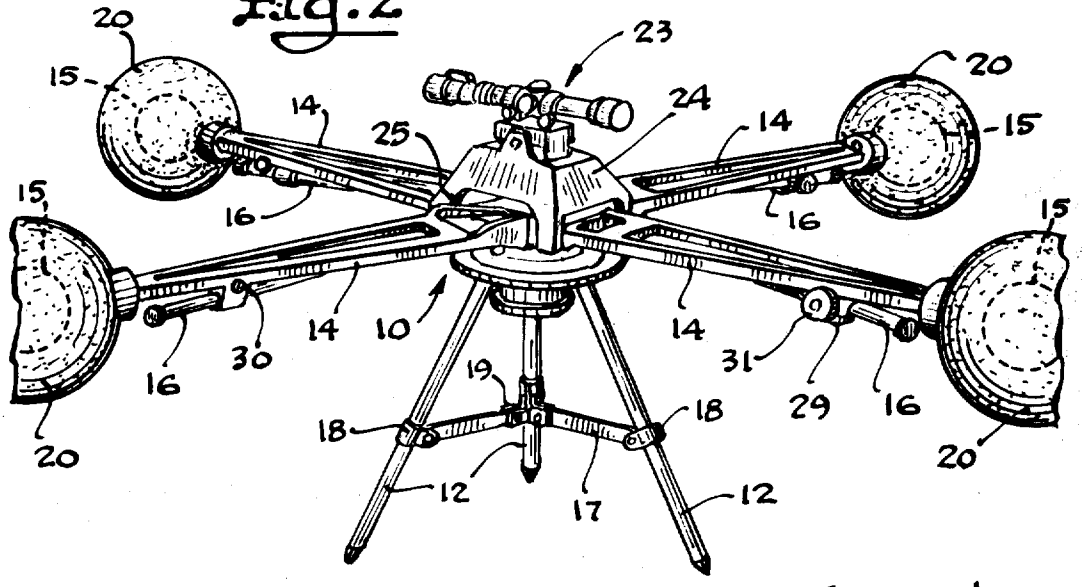


Fig.2



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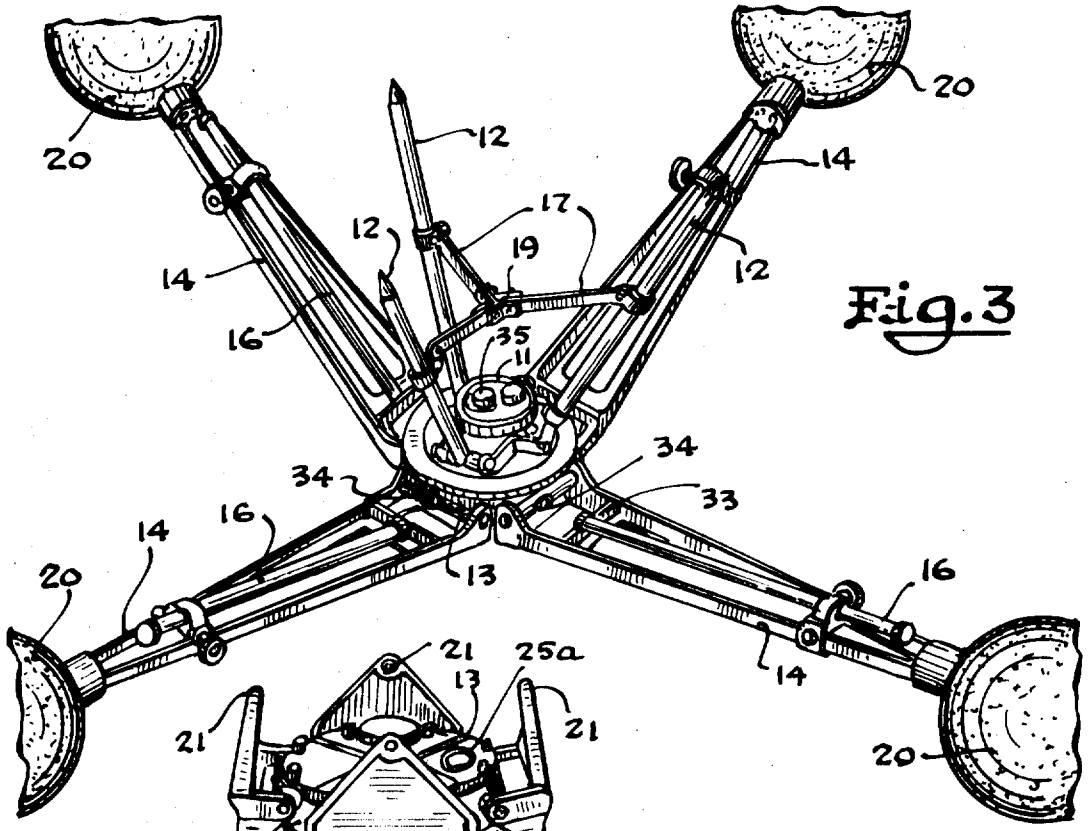


Fig.3

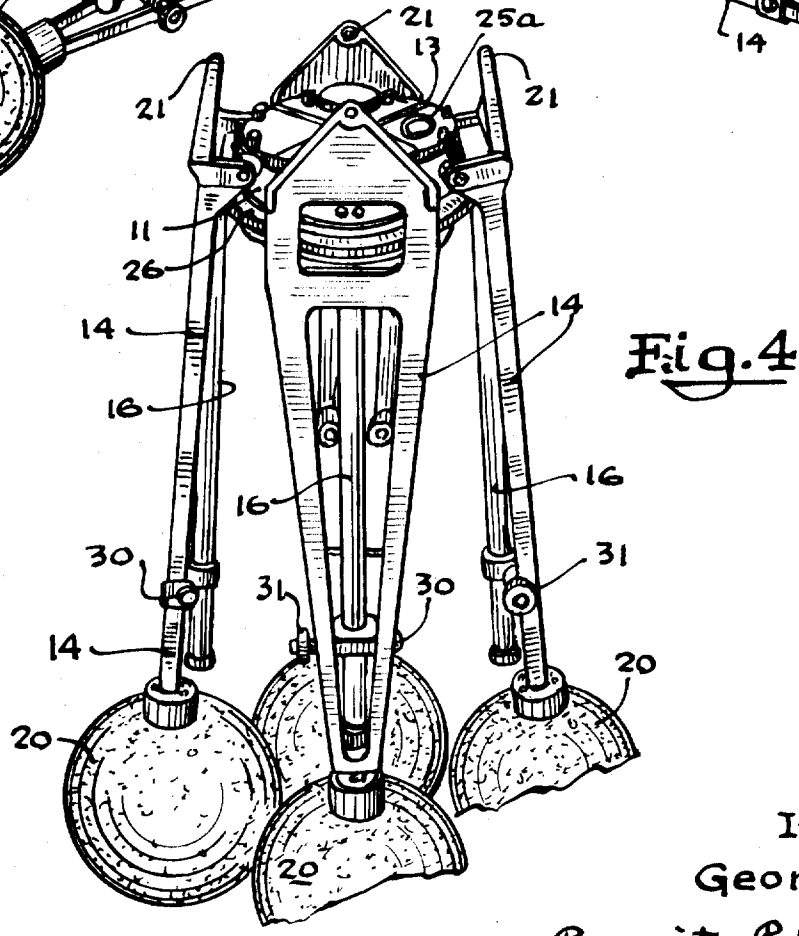
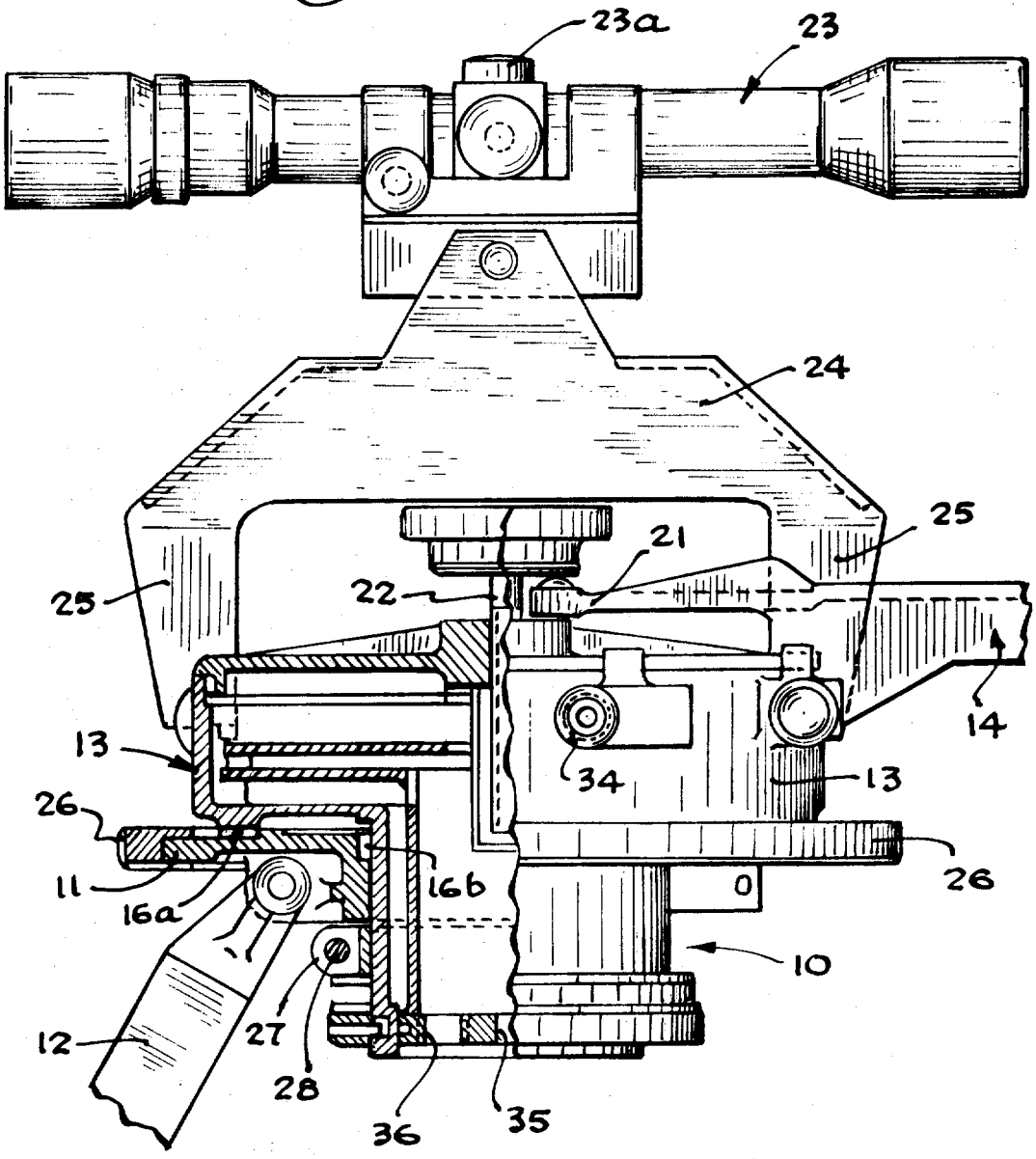


Fig.4

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Fig.5



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ACOUSTIC LOCATOR WITH ARRAY OF MICROPHONES

This invention relates to an acoustic locator with an array of microphones. More specifically, the invention relates to an acoustic locator on which the microphones can be easily oriented in the field after the support for the locator is set up.

The difficulty encountered in locators of the aforementioned type is that it is hard to set up such a locator in the field and at the same time orient the microphones as desired. Customarily, locators of this type have been constructed so that the microphones are tied to the support in such a way that angular shifting of the array of microphones for proper orientation also requires movement of the support. This makes the locator difficult to handle in the field where it is important to set up the locator within a minimum of time for locating a gun being fired or soon to be fired.

The present locator facilitates the setting up in the field, that is to say makes it possible to place the support quickly on the ground and thereafter independently with a minimum loss of time orient the array of microphones for best use of the locator.

In the drawings:

FIG. 1 is a perspective view of the device of the present invention ready for use in the field;

FIG. 2 is a perspective view of the present device as it is being oriented;

FIG. 3 is a perspective view of the device in upside-down position;

FIG. 4 is a perspective view of the device in collapsed position and with the support legs removed; and

FIG. 5 is a fragmentary elevational view, partly in section of the present device.

As shown in FIGS. 1, 2 and 3, the device of the present invention comprises a support 10 composed of an upper central portion or table 11 and a plurality of legs 12, a housing 13, a plurality of arms 14 distributed about the housing 13 and extending radially outwards therefrom, a plurality of microphones 15 carried on the outer ends of the arms 14, and a plurality of posts 16 supporting the arms 14 in horizontal position. The housing 13 is rotatably mounted in the table 11 by means of bearings 16*a* and 16*b*. A significant feature of the present invention is that the housing 13, the arms 14, and the microphones 15 are rotatable as a unit with respect to the support 10.

The legs 12 of the support 10, which are shown as three in number, are interconnected by three links 17, collars 18 secured to the legs 12, and a 3-prong central piece 19. The outer ends of the links 17 are pivotally connected to the collars 18, and the inner ends of the links to the central piece 19. The upper ends of the support legs 12 are pivotally connected to the underside of the table 11, and the lower ends of the legs dig into the ground.

The microphones 15 are encased in wind screens 20 formed of a suitable material such as an open cellular plastic foam.

The arms 14, which are illustrated as being four in number, are distributed about the housing 13 at right angles to one another, and their inner ends are pivotally connected to the housing 13 on horizontal axes transverse to the legs. The inner ends of the arms 14 beyond their pivots on the housing 13 come to generally right-angle points 21 fitting together. The head of a screw 22 threaded into the housing 13 engages the points 21 of the arms 14 and thus holds the arms horizontal.

A sighting device 23, which includes an adjusting unit 23a, is mounted on a carrier 24 supported on the housing 13 and the arms 14. The carrier 24 has four feet 25 so arranged with respect to one another as to fit in the spaces between the arms 14 adjacent their pivots on the housing 13, whereby the sighting device 23 extends along two of the opposed arms 14. A leveling unit 25*a* is on housing 13, as shown in FIG. 4.

The table 11 of the support 10 carries at its periphery an annular azimuth dial 26, which is rotatably adjustable with respect to the table 11 and is held against rotation by friction between the dial and the table or by other suitable means. The table 11 carries a split collar 27 which, with the help of a clamping screw 28 in threaded engagement with portions of the collar 27 on opposite sides of the split, holds the housing 13 and the arms 14 against rotation with respect to the support 10.

The posts 16 are carried in split clamps 29, which are located near but spaced from the outer ends of the arms between spaced side portions thereof. The clamps 29 are carried on the arms 14 by bolts 30, each of which passes through the spaced sides of an arm 14 and through an associated clamp 29 at the split therein, has an enlarged head 31 engaging one side of the arm 14 at the exterior thereof, and is threadedly engaged by a nut at the exterior of the other side of the arm. When the nut 31 is loosened, the post 16 may be swung between the positions of FIGS. 1 and 2 and may be shifted longitudinally or axially in the associated clamp 29. Tightening of the nut 31 fixes the post 16 against angular movement with respect to the arm 14 and axial movement with respect to the clamp 29. Thus, all four arms 14 may be kept horizontal and in the same place, in spite of the fact that the terrain may be irregular and at different distances from the arms 14. As shown in FIG. 3, the post 16 may be held in inoperable transport position in which they extend along the arms 14 by engagement of their lower pointed ends with openings in transverse flanges 33 on the arms 14 located near but spaced from their inner ends.

Electrical leads (not shown) extend from the microphones 15 along legs through fittings 34 which, as shown in FIGS. 3 and 5, are attached to the housing 13, to the interior of the housing to amplifiers therein (not shown). From the amplifiers other electrical leads (not shown) extend down through opening 35, which is formed in the base of the housing 13, as shown in FIGS. 3 and 5. Because the set of leads and amplifiers are arranged and positioned as described, the microphones 15 and housing 13 may have as much as 360° of movement with respect to the table 10, without interference by, or adverse effect upon, the leads and amplifiers.

In operation of the present device, the four microphones 15, spaced 90° from one another about a circle, transmit through electronic mechanism (not shown) contained in the housing 13, signals produced by the firing of a gun in the general neighborhood of the present device. Because of the spacing between the microphones 15, the signals produced by the microphones differ from one another and so can indicate in a general way the location of the gun being fired. A second device similar to the one illustrated in the present application combines therewith to locate the firing gun more exactly.

More particularly, the present device is carried out into the field in the neighborhood of the gun being fired and is set up so that the three support legs **12** dig into the ground and hold up the device as shown in FIG. **2.** The arms **14** are in horizontal position by virtue of the fact that the head of the screw **22** engages the point **21** of the arms **14.** The sighting device **23** is brought into line with a known landmark, and optionally the arms **14** aligned with the sighting device are displaced a certain angle from the aforesaid position of alignment, which angle may be read off on the azimuth dial **26.** Now the collar **27** is clamped by the screw **28** against the housing **13** to fix it and the arms **14** against rotation. Next, the sighting device **23** and its carrier **24** may be removed, and the posts **16** are swung from the horizontal position of FIG. **2** in which they extend along the arms **14** to the vertical position of FIG. **1** in which they are perpendicular to the ground and engage it so as to support the arms.

The interconnection of the support legs **12** by the links **17** in the 3-prong central piece **19** facilitates the setting up of the support **10** in the field. When the support **10** is being transported, the central piece **19** is downward from its position of FIG. **2** so that the support legs **12** are close to one another and the links **17** extend downward from the collars **18** to the central piece **19.** As support **10** is brought toward the ground for positioning thereon, the central piece **19** is raised with respect to the legs **12,** moving them all out way from one another at one time. As a result, the legs are properly spaced and provide stable support when their ends are made to engage the ground.

As previously mentioned, a significant feature of the present invention is that the arms **14** and microphones **15** are rotatable with respect to the support legs **12** by virtue of the rotatable mounting of the housing **13** in the table **11.** Thus, the support legs **12** may be brought into engagement with the ground without regard to angular orientation of the arms **14.** Thereupon, the arms **14** may be properly oriented with respect to a known landmark by the use of the sighting device **23.** This can be done quickly and easily because the support legs **12** have already been brought into engagement with the ground.

Those skilled in the art will readily utilize the teachings of the foregoing invention in ways in addition to and beyond those here described, and it is therefore intended that the scope of the present invention be limited not by the foregoing disclosure, but rather only by the appended claims.

I claim:

1. An assembly comprising a support having an upper central portion and a plurality of legs distributed about the central portion and extending downwardly and radially outwardly therefrom, a housing rotatably mounted on the central portion of the support, a plurality of arms distributed about the housing and extending radially outwardly therefrom, means connecting a region of each arm adjacent its inner end with the housing for pivoting of the arm about a horizontal axis transverse to the length of the arm, a plurality of microphones equal in number to the arms and mounted on the outer ends thereof, one microphone to an arm, the housing, arms, and microphones being capable of up to 360° of movement with respect to the support without interference from electrical leads extending from the microphones along the arms to amplifiers in the housing and electrical leads extending from the amplifiers in the housing downwardly through the bottom of the housing, a sighting device, and a carrier therefor having a plurality of feet engaging sides of the arms adjacent their inner ends for enabling the sighting device to orient the microphones.

2. An assembly comprising a support having an upper central portion and a plurality of legs distributed about the central portion and extending downwardly and radially outwardly therefrom, a housing rotatably mounted on the central portion of the support, a plurality of arms distributed about the housing and extending radially outwardly therefrom, means connecting a region of each arm adjacent its inner end with the housing for pivoting of the arm about a horizontal axis transverse to the length of the arm, and the inner ends of the arms narrowing to points so as to fit closely together in a horizontal position of the arms, the assembly further comprising a screw having a shank extending into the housing in threaded engagement therewith, the screw having a head overlapping the inner ends of the points of the arms so as to hold the arms in a horizontal position, a plurality of microphones equal in number to the arms and mounted on the outer ends thereof, one microphone to an arm, the housing, arms, and microphones being capable of up to 360° of movement with respect to the support without interference from electrical leads extending from the microphones along the arms to amplifiers in the housing and electrical leads extending from the amplifiers downwardly through the bottom of the housing.

3. The assembly specified in claim **2** and further comprising a plurality of posts, one to an arm, and a plurality of clamps, one to an arm, mounted adjacent the outer ends of the arms, each clamp holding a post and being releasably fixable with respect to the arm so as in one position to cause the post when inoperative to extend along the arm and when operative to extend transversely of the arm into engagement with the ground, the post being longitudinally adjustable with respect to the clamp.

4. An assembly comprising a multilegged support, a plurality of arms distributed about the support and extending radially outwardly of the support, means connecting the inner end of each arm with the support for pivoting of the arm about a horizontal axis transverse to the length of the arm, a plurality of microphones equal in number to the arms and mounted on the outer ends thereof, one microphone to an arm, and a plurality of clamps, one to an arm, mounted adjacent the outer ends of the arms, each clamp holding a post and being releasably fixable with respect to the arm so as in one position to cause the post when inoperative to extend along the arm and when operative to extend transversely of the arm into engagement with the ground, the post being longitudinally adjustable with respect to the clamp.

5. The assembly specified in claim **4,** each arm comprising spaced side portions between which the associated clamp is positioned, each clamp having a split, the assembly further comprising a plurality of bolts, one to an arm, each bolt having a head at the outside of one side portion and extending through said one side portion, the associated clamp at the split, and the other side portion, and a plurality of nuts, one to a bolt, each nut being threaded on the associated bolt at the outside of the other side portion.

6. An assembly comprising a multilegged support, a plurality of arms distributed about the support and extending radially outwardly of the support, means connecting the inner end of each arm with the support for pivoting of the arm about a horizontal axis transverse to the length of the arm, a plurality of microphones equal in number to the arms and mounted on the outer ends thereof, one microphone to an arm, a sighting device, and a removable carrier therefor having a plurality of feet, each foot engaging the sides of two adjacent arms adjacent their inner ends and fitting the space between said two adjacent arms for enabling the sighting device to orient the microphones.

7. The assembly specified in claim 6, the arms being four in number, two arms being aligned and extending in opposite directions from their inner ends, the remaining two arms being aligned, extending in opposite directions from their inner ends and being spaced 90° from the first-mentioned two arms, the feet on the carrier being four in number, the sighting device being aligned with two oppositely extending arms.

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