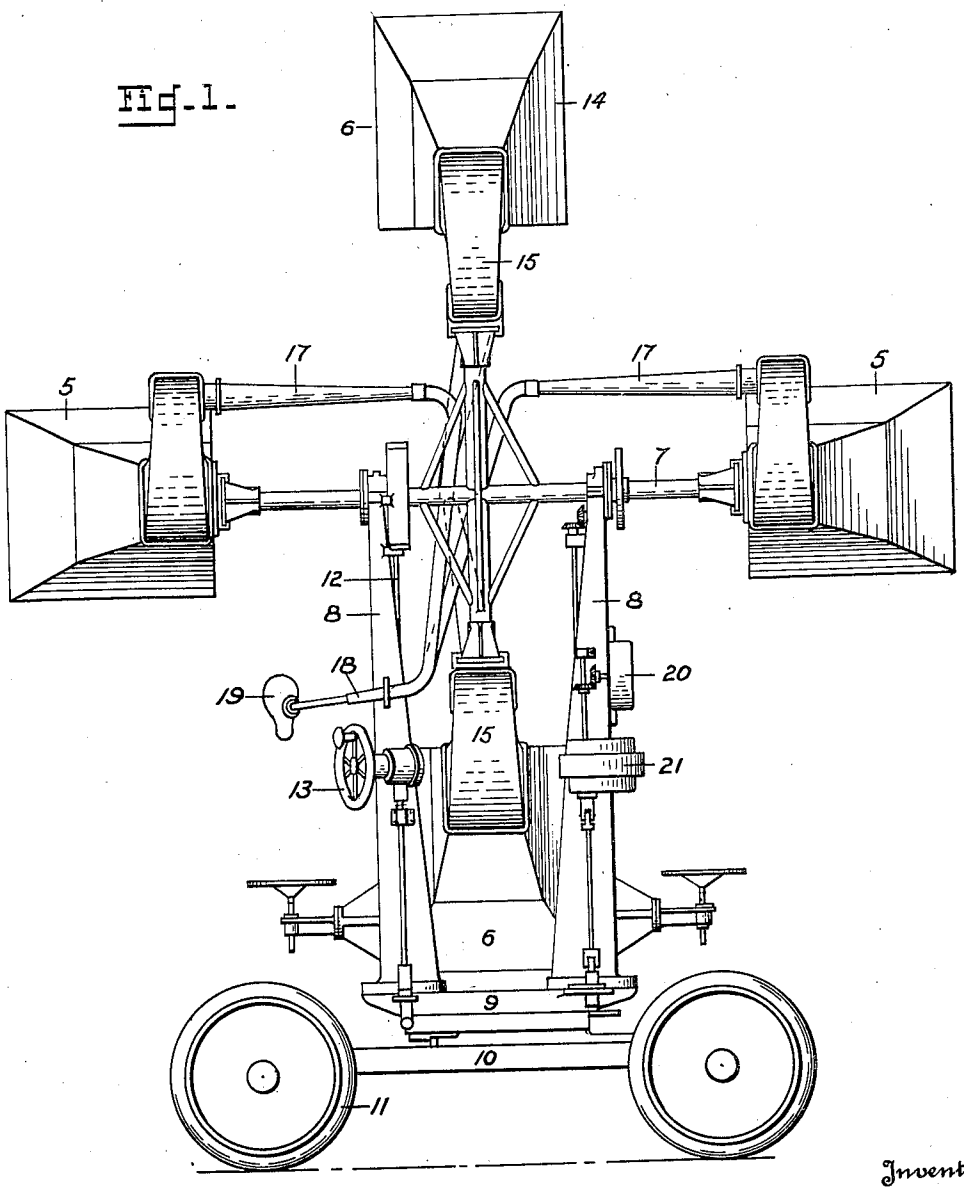
May 13, 1930. H. B. ELY 1,758,393

SOUND LOCATING APPARATUS

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Fig. 1.



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Fig. 2.

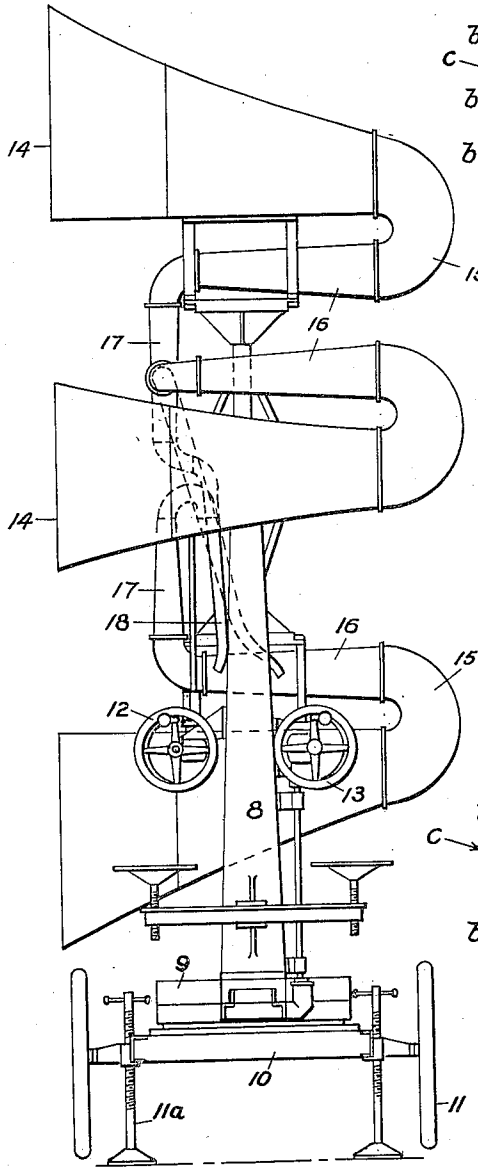
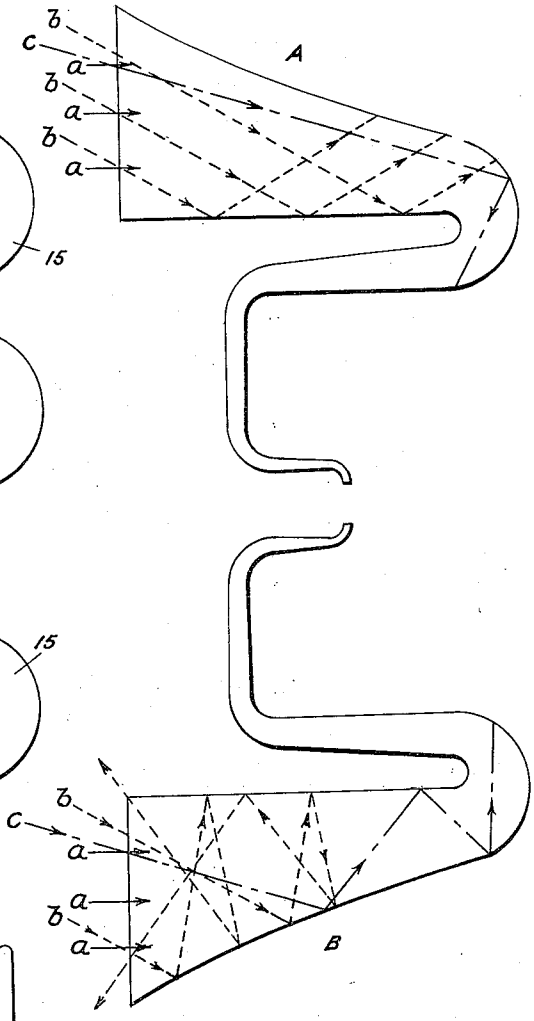


Fig. 3.



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UNITED STATES PATENT OFFICE

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SOUND-LOCATING APPARATUS

Application filed September 19, 1927. Serial No. 220,531.

(GRANTED UNDER THE ACT OF MARCH 3, 1883, AS AMENDED APRIL 30, 1928; 370 O. G. 757)

The invention described herein may be manufactured and used by or for the Government for governmental purposes without the payment to me of any royalty thereon.

The subject of this invention is a sound locating apparatus of the so-called "trumpet type," operating according to the system of binaural comparison in which the apparatus is directed at the source of sound, when the listener, having reduced the phase difference to zero will receive the sound impulse in phase.

In order that the apparatus may be more quickly oriented to determine the direction of sound it is proposed in the present invention to arrange asymmetrical horns of each set in reverse order so that sound waves approaching from a non-frontal direction will not be received by the far horn or if received will be transmitted with considerably diminished intensity.

Other objects and advantages reside in the structural details of the horns which are designed to reduce vibration and aid in assembly and dismounting and also in the details of the mount which provide for rapid maneuvering and the incorporation of an automatic mechanical corrector and automatic data transmitters.

With the foregoing and other objects in view, my invention resides in the novel arrangement and combination of parts and in the details of construction hereinafter described and claimed, it being understood that changes in the precise embodiment of the invention herein disclosed may be made within the scope of what is claimed without departing from the spirit of the invention.

A practical embodiment of the invention is illustrated in the accompanying drawings, wherein:

Fig. 1 is a view in rear elevation of sound locating apparatus constructed in accordance with the invention;

Fig. 2 is a view in side elevation of Fig. 1;

Fig. 3 is a diagrammatic view illustrating the reception of sound waves.

Referring to the drawings by numerals of reference:

The apparatus consists of four large horns rigidly interconnected in parallel and arranged in two combinations or intersecting base lines, one such combination comprising the horns 5—5 for determining azimuth and the other comprising the horns 6—6 for determining elevation. The horns are removably mounted on the extremities of a cross arm support 7, the fixed horizontal axis of which is trunnioned in a pair of standards 8—8 which are part of a top carriage 9 rotatably mounted on a base 10 forming part of the platform of a wheeled mount 11 which is provided with levelling jacks 11^a.

The elevating mechanism 12 geared to the support 7 and the traversing mechanism 13 geared to the base 10 are both carried on one of the standards.

The horns are substantially alike and are made of rigid units of four sections which are of cast metal for the purpose of reducing vibrations and facilitating manufacture and assembly. Each horn comprises a mouth section 14, a curved intermediate section 15, a reverse section 16 and an apical section 17 which is perpendicular to the reverse section so that it may terminate adjacent the center of the cross arm support.

The horns are each of exponential cross section, the rate of increase of cross sectional area being in the present case 6% for each three inches of length. The form of the equation used in determining the design of the horn is $A = Ao e^{mx}$ in which A is the cross sectional area at any point; Ao is the cross sectional area at a small end; x is the abscissa measured along the horn axis from the small end as an origin; m is a constant determined by the rate of flare desired and e is the base of the Naperian system of logarithms.

Attached to the apex of the horn is a flexible tube 18 leading to a head set 19 which also receives the tube from the companion horn of the particular set. The tube also follows the exponential form. It will be noted from Fig. 1 that the termination of the apical sections of the horns adjacent the center of the support will prevent entanglement of the flexible tubes as the support is moved in azimuth and elevation.

Referring especially to Fig. 1 the mouth section of the horn is rectangular in cross section, the inner side of each horn when arranged in group being constituted by a plane surface 22 and the remaining sides being flared to produce reflections that will aid in the location of sound. Of the three flared walls the one opposite the plane walls has a more pronounced curvature which acts in the off horn B of Fig. 3 either to baffle non-frontal sound waves indicated by the arrows *b*—*b* and by reflection cause them to pass out of the horns or as indicated by the sound waves *c*—*c* to effect their intensity and time or arrival. The same curvature serves in the near horn A of the illustration to increase its perception and augment the binaural phase effect. The sound waves *a*—*a* approaching the horns in a plane perpendicular to the frontal direction will enter both horns and be transmitted in phase.

Since the primary use of sound locating apparatus is to secure data as to the position of a distant object such as a target for guns and search lights and since the direct data obtained must be corrected for certain factors such as sound lag, wind, parallex and refraction, the mounting for the horns is arranged to reserve one of the standards 8 for the attachment of an automatic corrector 20 and two adjacent data transmitters 21, one for azimuth and one for elevation. Movements indicating the present values of azimuth and elevation are respectively introduced into the corrector 20 by shafting 23 and 24 adjacent the standard 8. The details of the corrector and transmitter units form no part of the present invention and their operation in connection with a comparator at the remote control station is sufficiently understood by those skilled in the art to appreciate the advantages accruing from the mounting provided.

While the invention is illustrated in connection with sound receiving apparatus it is evident that the principles set forth are applicable to sound sending apparatus.

I claim:

1. A sound apparatus embodying a base, spaced standards secured thereto, a cross arm support trunnioned in the standards, means carried by one standard for rotating the base and the support and means for conveying such movements to a selected position on the other standard whereby they may be introduced into a data corrector.

2. A sound apparatus embodying a rotatable top carriage, a cross arm support trunnioned therein, means for actuating said carriage and support and means for conveying such movements to a selected position on the top carriage whereby they may be introduced into a data corrector.

3. A sound apparatus embodying a rotatable top carriage, a cross arm support trunnioned therein, parallel horns, each mounted at an extremity of the support, said horns having inturned apical portions terminating adjacent the center of the support.

4. A sound apparatus embodying a support mounted for movement in azimuth and elevation, a group of parallel horns carried by the support and having inturned apical portions terminating adjacent the intersection of the axes of rotation of the support.

5. An accoustic device embodying a group of rigid horns, each horn composed of a mouth section, a reversely disposed section, an apical section perpendicular to the reverse section, a flexible tube attached to the apical section and said horn and tube having a uniform rate of change of cross sectional area.

6. An accoustic device embodying a group of rigid horns each horn composed of a mouth section, a reversely disposed section, and an apical section perpendicular to the reverse section.

7. In a sound apparatus, a pair of parallel spaced horns rectangular in cross section mounted for movement in unison and arranged to have a common field, the inner side of each being constituted by a plane surface and the other sides being flared.

8. In a sound apparatus, a pair of parallel spaced horns mounted for movement in unison, and arranged to have a common field, the inner side of each horn being constituted by a plane surface and the other sides being flared.

9. In a sound apparatus, a pair of parallel spaced horns mounted for movement in unison and arranged to have a common field, the inner side of each horn being constituted by a plane surface and the opposite sides being flared.

10. In a sound apparatus, a pair of horns mounted for movement in unison, said horns formed with means for individually baffling non-frontal sound waves.

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