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ELECTRO-MECHANICAL MEANS OF GENERATING
SUBSONIC ENERGY
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FIG. 1

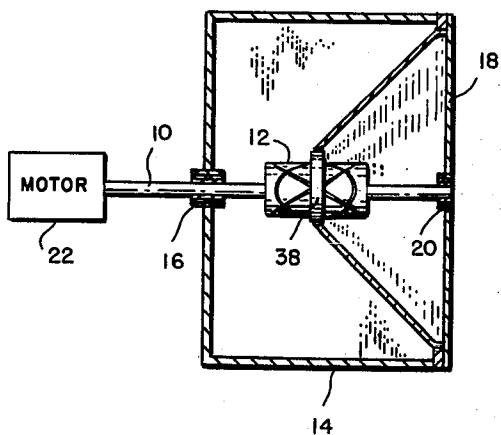


FIG. 2

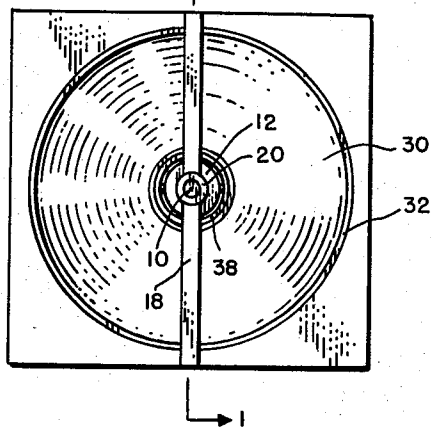


FIG. 3

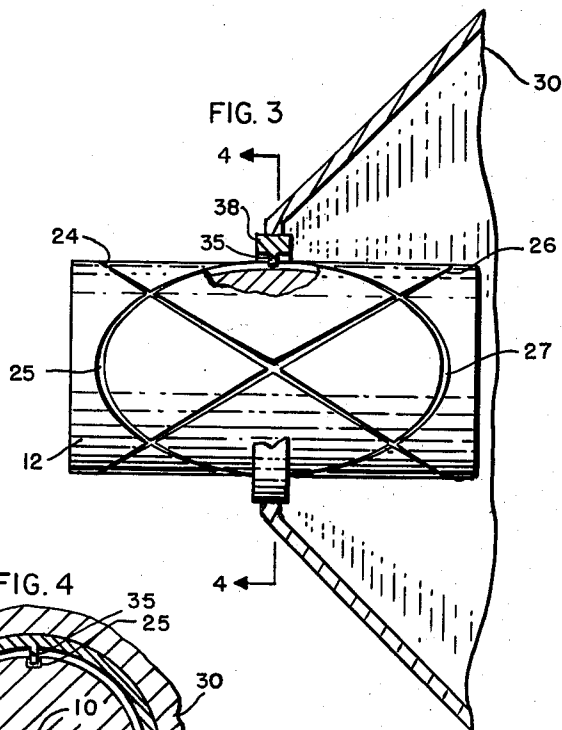
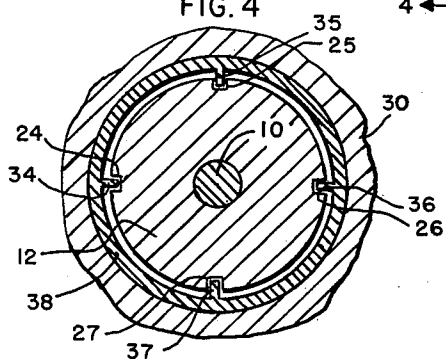


FIG. 4



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2 Claims. (Cl. 181—.5)

(Granted under Title 35, U. S. Code (1952), sec. 266)

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

The invention relates to a novel apparatus for the generation of compressional waves at subsonic frequencies and is intended to overcome some of the defects inherent in previous apparatus used for this purpose.

Previously, subsonic compressional waves have been generated by means of a relatively stiff mass which was made to travel in a sinusoidal pattern by means of a heavily weighted eccentric drive. The use of such an eccentric drive produced a satisfactory movement of the compressional wave producing mass but was accompanied by several undesirable defects. The large unbalanced weight of the eccentric drive gave rise to severe vibrations which tended to injure the housing and mount for the apparatus. The vibrations also caused undesired mechanical noise within the audio range. The presence of such defects obviously renders the prior art wave generators unsatisfactory for many uses.

It is a principal object of the present invention to provide a compressional wave generator which is not subject to mechanical vibrations.

It is a further object of the present invention to provide a compressional wave generator capable of operation at subsonic frequencies without the production of mechanical noise.

It is a still further object of the invention to provide a subsonic compressional wave generator of simple construction and with a minimum number of moving parts.

Further objects and many attendant advantages of the invention will be readily apparent as the same becomes better understood from the following detailed description and the accompanying drawings wherein:

Fig. 1 is a side view partially in section of a preferred embodiment of the invention,

Fig. 2 is a front view of the embodiment of Fig. 1,

Fig. 3 is a detail view of a cylindrical cam structure and ring cam follower which are used in the embodiment of Fig. 1,

Fig. 4 is a cross section of Fig. 3.

One form of apparatus constructed in accordance with the principles of the invention is an improved generator of compressional waves employing a freely rotating shaft mounted on a housing frame and driven by a motor or other suitable driving means. A tracking path is attached or inscribed on a cylindrical surface of the shaft or a drum concentric to the shaft to form a cylindrical cam structure. This tracking path represents a motion along the axis of the shaft with respect to the rotation of the shaft. The tracking path forms a continuous loop, spiralling alternately up and down the cylindrical surface.

A ring cam follower or sliding member, having a fixed path parallel to the axis of the shaft is coupled to a key which rides in the tracking path as the shaft is rotated. The spiral of the tracking path in this device is cut to produce a sinusoidal motion in the sliding member parallel to the axis of the shaft for a constant angular velocity of

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the shaft. A mechano-acoustical device having a compressional surface or diaphragm pointing in a direction parallel to the axis of the shaft is connected to the sliding member. Thus, as the shaft is driven to rotate, the compressional face is driven backward and forward along a path parallel to the axis of the shaft. The compressional face is given a sinusoidal oscillation in its medium, thereby producing compressional waves.

Referring to Fig. 1, a shaft 10 fixedly bears a drum 12 and is freely mounted to a housing frame 14 by a bushing 16. The shaft 10 is further supported by being freely mounted to a support arm 18 of the housing frame 14 by a bushing 20. A motor 22 is connected to one end of the shaft 10. The drum 12 has spiral grooving forming a plurality of endless track paths 24-27 seen more clearly in Figs. 3 and 4.

Fig. 2 shows a front view of the device of Fig. 1, with the arm 18 supporting the bushing 20 which guides the shaft 10. The drum 12 is visible behind the support arm 18. A diaphragm or piston surface 30, is coupled to the forward edge of the housing frame 14 by a resilient annular gasket or mounting ring 32.

Fig. 3 shows in perspective the paths 24-27. This grooving provides the track paths for keys or lugs 34-37 projecting from a cylindrical sliding member 38 which rides freely, axially and circumferentially, along the surface of the drum 12. The sliding member 38 is rigidly coupled to the center part of the diaphragm 30 which is properly oriented to provide an acoustically efficient compressional surface in a direction parallel to the axis of the shaft 10.

Fig. 4 is a cross section of the portion of the device shown in Fig. 3, taken through the sliding member. The diaphragm 30 is seen coupled to the sliding member 38 whose inwardly projecting keys 34-37 engage corresponding grooves 24-27 in the drum 12 which is secured to the shaft 10. The sliding member rides freely on the drum.

The grooves 24-27 in the drum 12 are identical and are positioned in quadrature relationship to one another about the cylindrical surface of the drum. It is obvious, of course, that any number of grooves and corresponding keys may be provided as long as the sliding member will be driven satisfactorily.

Upon the rotation of shaft 10 and drum 12 by the operation of motor 22, the force applied to the keys 34-37 causes the sliding member 38 and the diaphragm 30 to oscillate forward and backward along the line of axis of shaft 10. The oscillation of the diaphragm 30 in its surrounding medium presents a compression surface and accordingly produces compressional waves. Assuming a constant speed of motor, shaft, and drum rotation, the grooves 24-27 are cut to produce a sinusoidal rate of progression of the keys parallel to the shaft which produces a corresponding sinusoidal compressional wave output.

Sinusoidal output of compressional waves may also be obtained by a linear rate of spiral ascension of tracking paths along the drum and a sinusoidal variation of rotational speed of the shaft and drum. A sinusoidal variation in the speed of rotation could be achieved, for example, by the use of an alternating current, direct-current series motor in place of the constant speed motor 22. If a supply voltage made up of a sinusoidal alternating current superposed on a direct current supply source is supplied, the rotational speed of motor, shaft and drum will vary at a corresponding sinusoidal rate. Proper values established for the direct current and the alternating current supply will effect the synchronization of the alternating current frequency and the frequency of oscillation of compressional surface in its medium.

A sinusoidal compressional wave output is generally preferable, but any other type of compressional wave may

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be produced by changing the curve of spiral ascension of the tracking paths along the drum or changing the function of the rotation variation of the shaft and drum, or by a combination of both.

It is to be understood, of course, that the use of grooves such as in tracking paths to provide the means for driving the sliding member to move the diaphragm is not an exclusive method. Tracking may be accomplished by similarly spiralling rails or threads or by any other tracking means known to the art with suitable attachments to drive the diaphragm.

While there has been described what is at present considered to be the preferred embodiment of this invention, it will be obvious to those skilled in the art that various changes and modifications may be made therein without departing from the invention.

Having thus described my invention, what is claimed is:

1. A compressional wave generator comprising a vibratable diaphragm having an aperture located therein, a rigid ring member fastened within said aperture, a rotatable shaft having a cylindrical drum thereon extending

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loosely within said ring, a plurality of identical, circumferentially-spaced, endless camming grooves upon the surface of said drum, each groove having a cyclic progression along the axis of said shaft with respect to its circumference, and a plurality of circumferentially-spaced cam-follower lugs extending inwardly from said ring and engaging said grooves, whereby upon rotation of said shaft said diaphragm is vibrated in accordance with the axial progression of said grooves to produce compressional waves.

2. A wave generator as set forth in claim 1, wherein said grooves are sinusoidally shaped to produce sinusoidal vibration of said diaphragm upon constant speed rotation of said shaft.

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