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SONIC PRESSURE WAVE GENERATOR

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Fig. 1.

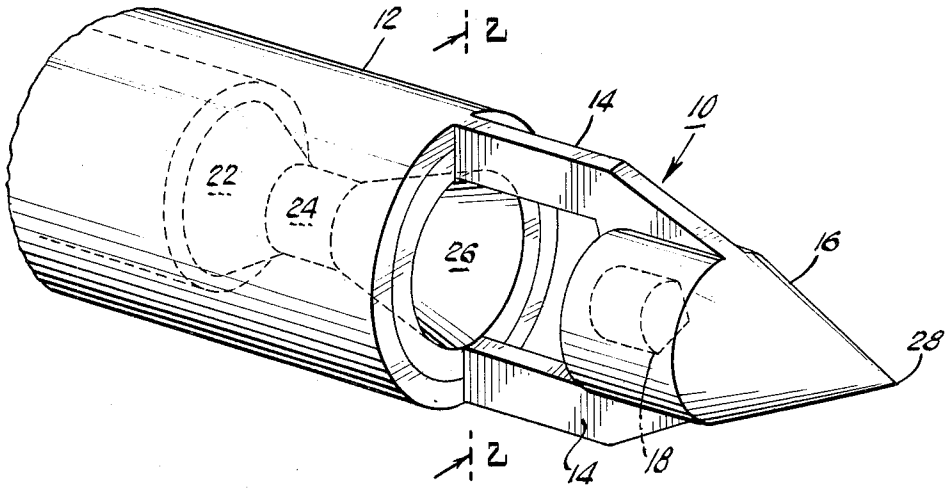
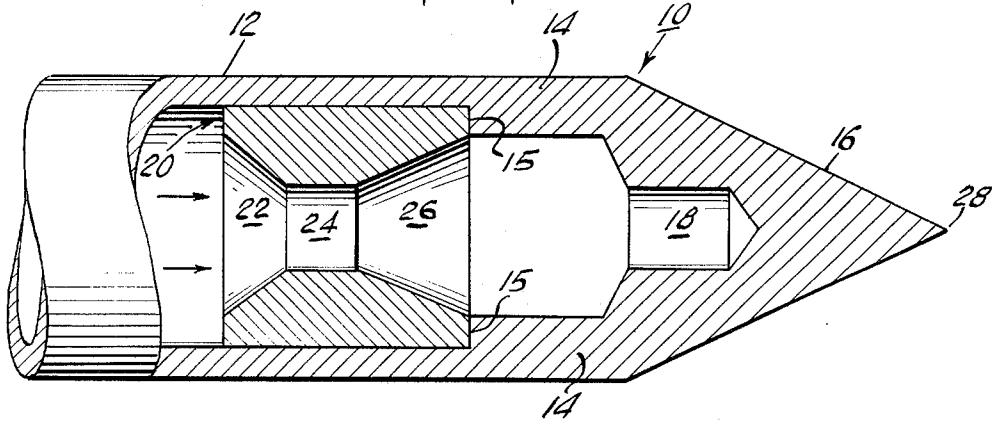


Fig. 2.



INVENTOR.
NATHANIEL HUGHES

BY

Curtis Morris & Safford
ATTORNEYS

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SONIC PRESSURE WAVE GENERATOR

Nathaniel Hughes, Bronx, N.Y., assignor to Sonic Development Corporation of America, Yonkers, N.Y.

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1 Claim. (Cl. 116—137)

This invention relates to apparatus for generating pressure waves in fluids; and, more particularly, to improved apparatus utilizing the flow of gases to generate "sonic" pressure waves in gaseous media.

The sonic pressure wave generator of the present invention constitutes an improvement over the inventions disclosed in my co-pending applications for United States Patent Serial Nos. 239,236, filed on November 21, 1962, and 247,221, filed on December 26, 1962, which applications are hereby incorporated in and made an integral part of this description.

Broadly, sonic generators in accordance with the above-mentioned co-pending applications utilize a pressurized-gas-supplied nozzle having a diverging exit region to create a high-speed, low-pressure, gas jet which is directed into a cavity pulsator to create a sonic pressure wave output. Although the performance of such generators is substantially greater than that of generators previously available, the generator of the present invention provides even further improved performance.

Accordingly, an object of this invention is to provide a novel and improved gas-operated sonic pressure wave generator which produces more sonic pressure wave power output with a given pressurized gas input than previous sonic generators.

A further object of this invention is to provide such a generator which is inexpensive to manufacture, operate and maintain.

The drawings and description that follow describe the invention and indicate some of its uses and advantages.

In the drawings:

FIGURE 1 is a perspective view of a sonic pressure wave generator embodying the present invention; and

FIGURE 2 is a vertical section view of this generator taken along line 2—2 of FIGURE 1, in the direction of the arrows.

Referring to FIGURES 1 and 2 of the drawings, the sonic generator shown includes a nozzle housing member, generally indicated at **10**, which comprises a tubular-shaped section **12** connected to a pair of leg-like members **14** terminating in a pointed, conically-shaped end portion **16** containing a pulsator cavity **18** with its open end facing toward tubular member **12**.

A cylindrical nozzle member, generally indicated at **20**, is mounted inside nozzle housing member **10** with its forward end abutting under-cut portions **15** of the rear ends of legs **14** (see FIGURE 2). Nozzle member **20** has a converging inlet section **22**, a cylindrical middle or "stabilizing" section **24**, and a diverging outlet section **26**. A source of pressurized gas (not shown) is connected to tubular portion **12** of nozzle housing **10**. Pressurized gas flows from the supply through nozzle **20** and emerges in the form of a gas jet which is intercepted by pulsator cavity **18**. When thus energized, the unit develops a highly concentrated "core" of sonic pressure wave energy in the region between the exit of nozzle **20** and pulsator cavity **18** in the manner described in my above-mentioned co-pending patent applications. Powerful sonic pressure waves then spread outwardly from this intense core of energy.

When constructed and operated in accordance with the above-mentioned patent applications, the nozzle **20** produces a gas jet having a Mach number appreciably greater than 1.0 and preferably greater than 1.6. The nozzle also produces at its exit a pressure appreciably less than

the pressure of the ambient gas surrounding the nozzle and preferable less than 1 or 2 pounds per square inch absolute (p.s.i.a.). In order to attain these flow characteristics, the ratio of the cross-sectional area of the nozzle exit opening of divergent section **26** to the cross-sectional area of the stabilizing section **24** is made appreciably greater than 1 to 1 and preferably 1.5 to 1 or greater. The substantial difference between the pressure at the exit of the nozzle and the pressure at the exit of the nozzle and the pressure of the ambient gas causes the ambient gas to be drawn in or "imploded" into the intense sonic energy core produced in the region between the exit of nozzle **20** and the entrance of pulsator cavity **18**. As is more fully described in my above-mentioned patent applications, this implosion greatly enhances the power output and efficiency of the sonic generator.

The improvement added by the present invention comprises the provision of a tapered, pointed shape for end-portion **16** of nozzle housing **10**. End portion **16** is preferably given a conical shape with a pointed tip **28** which is directed away from nozzle member **20**. It has been found that, when end portion **16** is given such a shape and is so positioned, the generator produces more power for a given pressurized gas input pressure than produced by previous sonic generators, and, therefore, is more efficient and economical to use than previous generators.

It is believed that this improvement in performance is obtained because the tapered, pointed shape of end portion **16** of nozzle housing **10** increases the rate at which ambient gas is drawn or imploded into the core of sonic energy. It has been found that part of the imploding gas flows rearwardly, that is, in a direction opposite to the flow of the jet issuing from nozzle **20**. Thus, much of this rearwardly flowing gas passes over the surface of tapered end **16**. The pointed taper of this end portion **16** increases the velocity of the ambient gas flowing over it and, therefore, increases the rate at which it is delivered to the sonic energy core. In addition, the increased velocity of this gas lowers the pressure at the surface of tapered end **16** and draws inwardly toward tapered end **16** the gases flowing in a forward direction from the sonic energy core so that these gases flow more freely and do not interfere with the flow of the inrushing implosion gas into other regions of the core.

Although a specific preferred embodiment of the invention has been set forth in detail, it is desired to emphasize that this is not intended to be exhaustive or necessarily limitative; on the contrary, the showing herein is for the purpose of illustrating the invention and thus enabling those skilled in the art to adapt the invention in such ways as meet the requirements of particular applications, it being understood that various modifications may be made without departing from the scope of the invention.

I claim:

A gas-operated pressure wave generator, said generator comprising, in combination, a gas-accelerating nozzle comprising a body member forming a gas flow passageway, first, second and third longitudinal positions in said body member, said second position being spaced from said first position in the direction of flow of gas through said nozzle, and said third position being spaced from said second position in the direction of flow of gas through said nozzle, restrictor means reducing the cross-sectional area of said gas flow passageway and forming a reduced orifice at said first longitudinal position, stabilizing means in said gas flow passageway between said reduced orifice and said second longitudinal position, said stabilizing means providing a substantially constant cross-sectional area for said passageway between said reduced orifice and said second longitudinal position, said stabilizing means also providing another orifice at said second longi-

tudinal position, said other orifice having a cross-sectional area substantially equal to that of said reduced orifice, expansion means in said gas flow passageway between said other orifice and said third longitudinal position, said expansion means providing an increasing cross-sectional area for said passageway between said other orifice and said third longitudinal position in the direction of flow of gas through said nozzle, resonator means, and means for positioning said resonator means adjacent the exit opening of said gas flow passageway, said resonator means comprising a resonator member with a front surface, a resonator cavity in said front surface, and a rear external surface which is tapered to a point, said resonator member being positioned by said positioning means with said cavity facing said nozzle exit and the pointed end of said tapered rear surface extending away from said nozzle.

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LOUIS J. CAPOZI, *Primary Examiner.*