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STANDPIPE FOR UNDERWATER LAUNCHING SYSTEM

Filed April 15, 1965

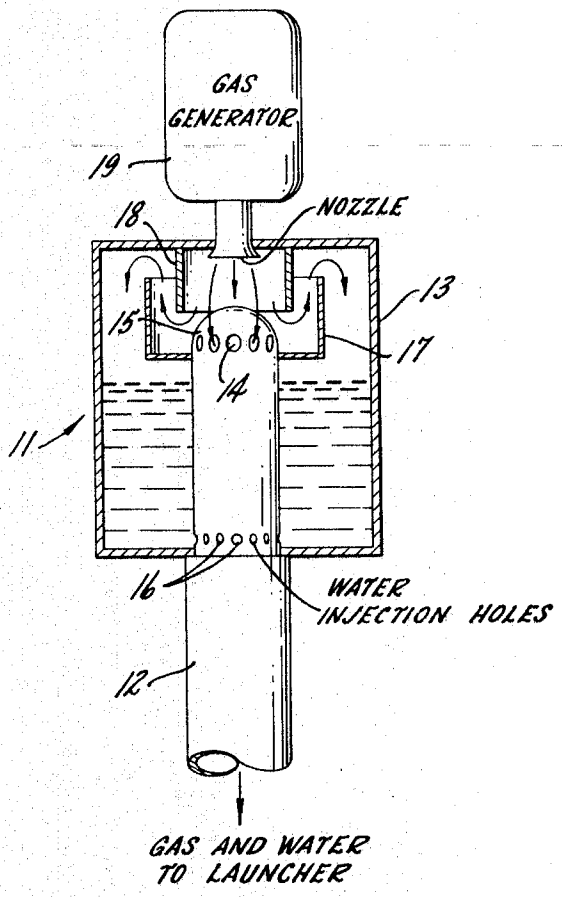


Fig. 1.
PRIOR ART

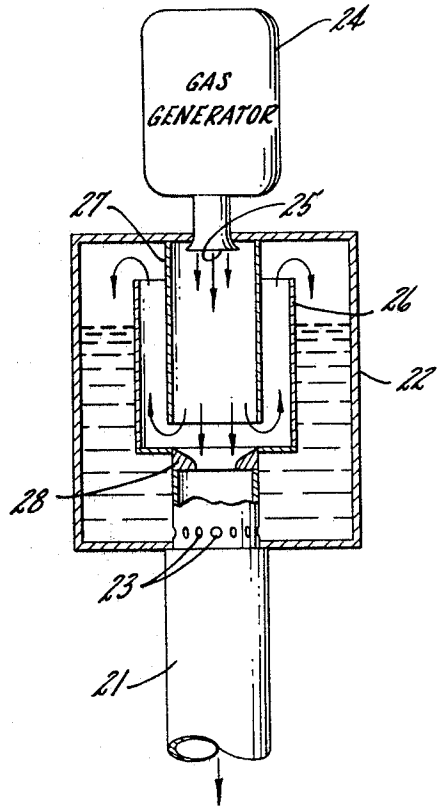


Fig. 2.

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STANDPIPE FOR UNDERWATER LAUNCHING SYSTEM

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1 Claim. (Cl. 89—1.8)

The present invention relates to an improved standpipe, and more particularly to an improved standpipe for use in an underwater launching device.

During submerged launching of a missile using the tube launch technique, wherein a missile is launched from a vertically oriented tube mounted within a submergible ship hull, it is necessary to provide means for ejecting the missile from the launch tube and for propelling the missile to the surface whereupon the motors are ignited to propel the missile to a target.

One system of ejecting a missile from a launching tube consists of using gas and water to propel the missile from the launching tube to the surface. In this system, a standpipe is used to mix the gas and the water.

One heretofore used standpipe, which is shown in U.S. Patent 3,182,554, and which issued to the present inventor on May 11, 1965, has a closed end pipe concentrically mounted within a water tank, and a gas generator is connected at the top of the water tank. The closed end pipe has a plurality of apertures near its closed end to permit the flow of gas from the generator into the inner diameter of the closed end pipe, and a second plurality of apertures are provided a further distance from the closed end for discharging water from the water tank into the closed end pipe. A first opened end cylinder is attached to the closed end pipe and a second opened end cylinder, smaller in diameter than the first opened end cylinder, is attached to the top of the water tank. The opened end of the second cylinder extends into the opened end of the first cylinder and a nozzle on the gas generator discharges into the second cylinder. The combination of the first and second cylinders provides a reverse-bent path for gas flowing from the nozzle into the water tank. In operation, a portion of the gas generator exhaust is deflected by the closed end of the pipe and is diverted through the baffle formed by the first and second cylinders. A portion of the gases pass through the upper holes and a large pressure drop is generated within the inner pipe. Water is then forced through the lower group of apertures by the pressure differential between the outside and the inside of the inner pipe.

While the above-described standpipe provides the necessary force for ejecting a missile from a launching tube, there is a major drawback to its use. The top of the inner pipe is subjected to hot exhaust gases and such severe erosion takes place that the standpipe has to be replaced after several launches.

The present invention eliminates the undesirable feature of having hot exhaust gases impinge on the end of the inner pipe by providing a different method of generating a pressure differential. The end of the inner pipe is open and a second nozzle is provided downstream on the centerline of the gas stream from a first nozzle. The pressure beyond the second nozzle, in the entry pipe, is very low, and the second nozzle is above the critical pressure ratio and has sonic flow at the throat. The ratio of the second nozzle area to the first nozzle area determines the stagnation pressure loss between the first and second nozzle, and establishes a high pressure immediately in front of the second nozzle. Gas for pressurizing the water tank is taken off at the high pressure point immediately in front of the second nozzle, and water is injected into the low pressure area below the second nozzle.

It is therefore a general object of the present invention to provide an improved standpipe for use in launching a missile.

Another object of the present invention is to provide an improved means for establishing a pressure differential in a standpipe.

Other objects and advantages of the present invention will be readily appreciated as the same becomes better understood by reference to the following detailed description when considered in connection with the accompanying drawing wherein:

FIGURE 1 is a diagrammatic view showing a prior art standpipe design, and

FIGURE 2 is a diagrammatic view showing a preferred embodiment of the present invention.

Referring now to FIGURE 1 of the drawing, there is shown a standpipe design of the prior art which is generally designated by the numeral **11**. A center pipe **12** is concentrically mounted within a water tank **13**, and pipe **12** is provided with a first plurality of holes **14** near its closed end **15** and a second plurality of holes **16** are provided a further distance from closed end **15**. A pair of cylinders **17** and **18** are provided near the top of water tank **13** to serve as baffles for diverting a portion of a gas stream from a generator **19** to the area between the inner pipe **12** and the sides of the water tank **13**. The portion of the gas stream that is not diverted enters holes **14** and flows within pipe **12** thereby causing a pressure differential between the inside and outside of that portion of inner pipe **12** that is within water tank **13**. Water within tank **13** is forced through the holes **16** into pipe **12** and the mixture of gas and water is used to launch a missile. It can be readily seen that the hot exhaust gases from generator **19** impinge on end **15** of pipe **12** causing erosion thereby requiring replacement of pipe **12** after several launches.

Referring now to FIGURE 2 of the drawing, which shows a preferred embodiment of the present invention, a pipe **21** is connected to a water tank **22** with a portion of pipe **21** extending within tank **22**. A plurality of water injection holes **23** are placed radially through pipe **21** near the bottom of tank **22**. A gas generator **24** is attached to the top of water tank **22** and an exhaust nozzle **25** discharges within tank **22**. A pair of cylinders **26** and **27** are provided to serve as baffles for diverting a portion of the flow of the gas stream from nozzle **25**.

A second nozzle **28** is placed on the center line of the gas stream that is exhausting from the first nozzle **25**. The second nozzle **28** must be placed downstream far enough (approximately 8 diameters) so that the second nozzle does not interfere with the expansion wave pattern from the first nozzle **25**. Also the inner diameter of cylinder **27** must be large enough so that the shock waves causing the stagnation pressure loss can not be "swallowed" through the second nozzle **28**.

In operation, gases from generator **24** flow through cylinder **27**, whereupon a portion of the gases pass between the walls of cylinders **26** and **27**, and the remainder of the gases flow through nozzle **28**. The pressure beyond the second nozzle **28**, in the entry pipe **21**, is very low, and the pressure immediately in front of nozzle **28** is high. It can be seen by reference to FIGURE 2 of the drawing that gas for pressuring the water tank **22** is taken off at a high pressure point and that the water injection holes **23** are located at a low pressure area below the second nozzle. Thus, in operation, there is a rapid discharge of water from tank **22** into pipe **21**.

It can thus be seen that the present invention provides an improved standpipe for use in missile launching by

eliminating from the prior art design the impingement of hot exhaust gases on a closed end of a discharge pipe. The improvement is accomplished by changing the principle used to generate the pressure differential for water injection.

Obviously many modifications and variations of the present invention are possible in the light of the above teachings. It is therefore to be understood, that within the scope of the appended claim, the invention may be practiced otherwise than as specifically described.

What is claimed is:

A standpipe device for a missile launching system comprising:

a tank for holding a quantity of water,

a discharge pipe connected to the bottom of said tank and having a portion thereof extending into said tank, said portion of said discharge pipe having a plurality of water injection holes therein located near the bottom of said tank,

a gas generator having an exhaust nozzle extending into the top of said tank for applying gas to said tank,

a discharge nozzle attached to the end of said portion of said discharge pipe extending into said tank, said discharge nozzle being displaced from said exhaust nozzle a distance equal to about eight times the inner diameter of said discharge nozzle, and

baffle means for diverting a portion of said gas thereby applying pressure to said water while permitting a portion of said gas to pass directly through said discharge nozzle whereby a pressure differential is created between the inside of said discharge pipe and the inside of said tank for rapidly expelling water from said water tank through said water injection holes into said discharge pipe, said baffle means including first and second cylinders, said first cylinder having one end attached to and closed by the top of said tank with said exhaust nozzle extending into said first cylinder and said second cylinder being concentrically mounted around said first cylinder and being opened at the top and partially closed at the bottom and having an aperture communicating with said discharge nozzle.

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