Feb. 28, 1956 H. MAIMAN 2,736,541

SPARK ARRESTER

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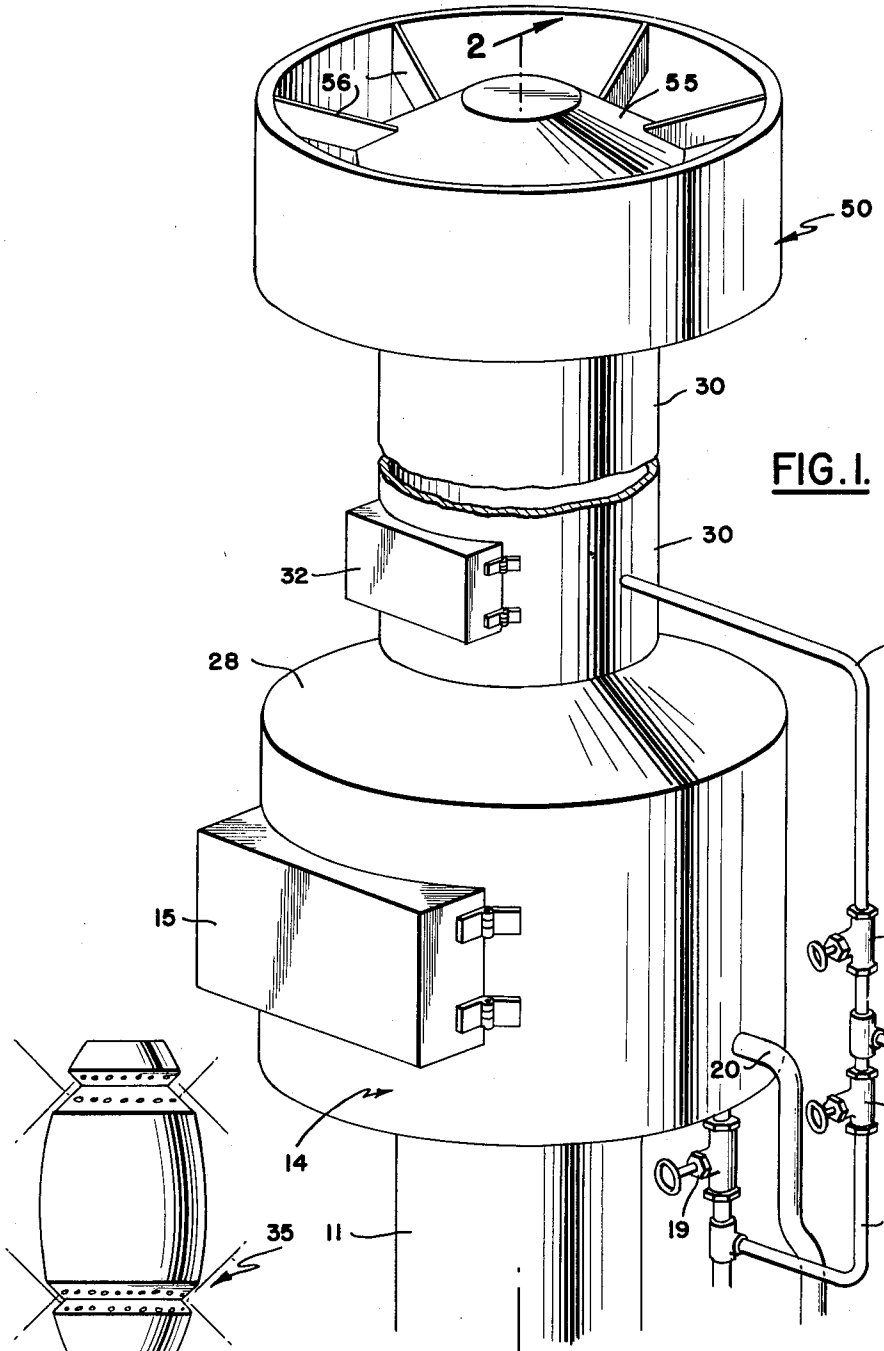

FIG. 1.

FIG. 3.

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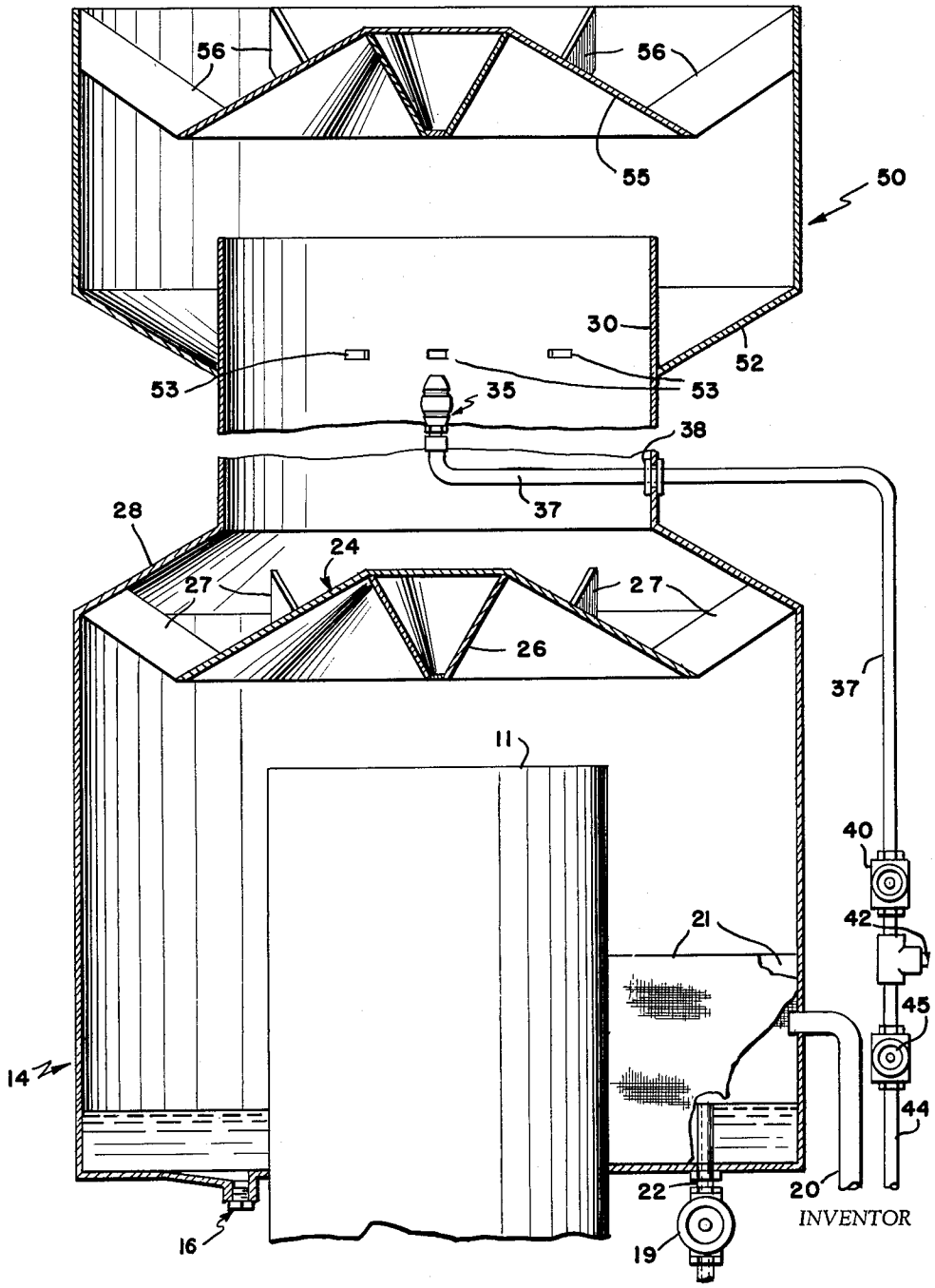
FIG. 2.



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SPARK ARRESTER

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1 Claim. (Cl. 261—126)

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

The present invention relates to spark arresters and more particularly to spark arresters for use on vessels.

Garbage and refuse disposal on combatant vessels operating in enemy waters has presented numerous security problems. If garbage and refuse is dumped in the ocean, it remains afloat for long periods of time and attracts seagulls, both of which provide visible evidence of the presence of a ship. If it is burned, it produces a dense black smoke and numerous burning particles so as to be visible by day or by night for many miles in clear weather. In an effort to reduce the sparks produced, screens have been used, but the screens break up large particles into small pieces which may pass through the screen, and are therefore ineffective. Similarly, water sprays in stacks have been employed to extinguish burning particles. However, if sufficient water was employed to extinguish large particles it entered the incinerator and interfered with combustion of the refuse and produced rapid corrosion of the metal surfaces. The several difficulties outlined above were effectively overcome by the spark arrester herein described, without detrimental effects on combustion or on the useful life of equipment.

The spark arrester, while highly effective on shipboard incinerators, is also useful for arresting sparks on equipment of other types, such as city incinerators, locomotive, and saw mill boiler stacks. The unit effectively traps and extinguishes large burning particles in an enlarged compartment having a water-filled lower section and a baffle which reverses the direction of flow within the chamber. The gases and small particles leaving the chamber are subjected to an atomized spray of water which extinguishes any remaining particles. A second chamber at the exhaust end of the stack materially prevents the escape of the water spray and reduces the quantity of water required by the spark arrester.

It is an object of the present invention to provide a spark arrester which will eliminate flying sparks and not detrimentally affect the operation of the combustion equipment.

It is also an object of the present invention to provide a spark arrester which requires small quantities of water for its operation.

It is a further object of the present invention to provide a spark arrested which extinguishes burning particles by separating them from the exhaust gases.

It is a still further object of the present invention to provide a spark arrester which extinguishes burning particles by separation from the larger particles from the exhaust gases and extinguishing the smaller particles by means of a fine water spray.

Other objects and advantages of the present invention will be made apparent by reference to the following description and to the appended drawings in which—

Fig. 1 is a perspective view of the apparatus;

Fig. 2 is a section view taken on line 2—2 of Fig. 1; and

Fig. 3 is a detail view of the nozzle of the present invention.

Referring now to Fig. 1, the stack **11** from the incinerator (not shown) carries the smoke and suspended particles produced in burning garbage and refuse into the chamber **14**. The stack **11** may be inclined if desired or may be horizontal, but should terminate in a vertical direction within the chamber. The vertical direction of the stack **11** in the drawings is illustrative of one type of installation, although it will be apparent that the direction of the stack may be readily changed to suit a particular installation.

The chamber **14** is provided with an access door **15** to facilitate cleaning and inspection of the unit. The door **15** may be hinged to the chamber as shown or may be made sliding or removable as desired. At the upper end, the chamber **14** is reduced in diameter to connect through plate **28** with a tube **30** having a diameter approximately equal to that of the stack **11**. The tube **30** is equipped with an access door **32** which is attached in a manner similar to the door **15**, and extends upward from the chamber **14** for a distance sufficient to rise above surrounding structures so as to provide an adequate draft and provide a compartment where smoke and suspended particles may intermix with the water spray.

The upper end of the tube **30** is expanded into the cap **50** which has a diameter substantially equal to that of the chamber **14** and is provided with a baffle **55** having a diameter larger than that of the tube **30** to prevent the entrance of rain and prevent the escape of an excessive amount of water spray.

The stack **11** extends into the chamber **14** for a considerable distance as shown in Fig. 2, and the junction between the chamber and the stack is sealed by a suitable means, such as welding, to be water-tight. A drain pipe **22** extends above the bottom and into the chamber **14** a sufficient distance to maintain a desired water level and an emergency overflow pipe **20** is provided in the event the drain pipe **22** becomes clogged. A screen **21** of wire mesh or expanded metal is wastened between the outer wall of the stack **11** and the inner wall of the chamber **14** to prevent trash from entering the drain pipe **22** and the overflow pipe **20** and clogging them and an additional screw plug **16** is also provided to drain the water from the chamber **14** when cleaning the residue from the bottom of the chamber. The bottom of the chamber **14** is kept filled with water emitted from the nozzle **35** and the water supply pipe **37**.

A baffle **24** including a downward projection **26** at its center and having a diameter considerably smaller than the chamber **14** and considerably larger than the stack **11** is coaxially secured in the upper part of the chamber so as to cause the products of combustion to reverse their direction of travel. The design of the baffle **24** is largely a matter of choice and may be composed of a double involute surface or a double conical surface as shown. The baffle **24** may be secured within the chamber **14** by any convenient means, such as the struts **27** welded to the wall of chamber **14** and the baffle **24**.

The upper end of the chamber **14** is sealed to the lower end of the tube **30** by means of the conical section **28**. The nozzle **35** is mounted approximately coaxially with the tube **30** and adjacent the door **32**, and contains a number of very small holes which form sprays intersecting each other. The nozzle **35** is similar to the fog nozzle used in firefighting equipment, and produces very finely divided particles which effectively cover a considerable volume with a small amount of water, and is shown in Fig. 3 of the drawings.

The water supply pipe **37** may be used to secure the nozzle **35** within the tube **30**, or other mounting methods may be employed. As illustrated herein, the water supply pipe is fastened to the tube **30** by means of the collar

38 or by means of welding. The water supply pipe **37** is bent to support the nozzle **35** in its correct position and to clear the chamber **14**. The water supply to the nozzle is controlled by means of the valve **40** between the water main **42** and the water supply pipe **37**.

The pipe **44** is connected to the drain pipe **22** and through the valve **45** to the water main **42** to permit the operator to flush, after closing the valve **19**, the drain pipe obstructed by residue.

The tube **30** extends into the cap **50** and the cap is fastened to the tube by means of the conical funnel **52**. A plurality of openings **53** are provided in the tube **30** adjacent the funnel **52** to allow water and particles to escape therethrough. The baffle **55** is similar to the baffle **24** and reverses the direction of flow of the gases so as to remove moisture and particles remaining in the gases by separating them into the cavity between the cap **50** and the tube **30**. After passing the baffle **55**, the gases which are now free from burning particles escape into the atmosphere.

The baffle **55** may be mounted in the cap by any convenient means, the struts **56** being merely illustrative.

The operation of the spark arrester is as follows: The products of combustion from an incinerator or boiler move up the stack **11** into the chamber **14** and strike the baffle **24** which reverses their direction. At the same time, the velocity of the gases project most of the solid matter carried by the gases into the lower portion of the chamber where they remain. Because the bottom of the chamber is covered with water, the solid particles are wetted, retained and any fire is extinguished.

The gases which pass around the baffle **24** are subjected to the fog spray from the nozzle **35** in the tube **30** which extinguishes any remaining burning particles in the gases. Such particles must be small and light to be carried by the gases through the chamber **14**, and are therefore easily extinguished with a moderate amount of water.

The cap **50** separates most of the remaining solid particles and droplets of water from the gases, after which they pass out into the atmosphere. It will be apparent that the smoke will be considerably less dense because the suspended particles are removed and the gases are considerably washed by the water spray. Furthermore, no burning particles remain in the smoke.

To operate the spark arrester, the operator opens the drain valve **19** and then opens valve **40** to admit water to the nozzle. Water collecting on the inside of the tube **30** is conducted to the chamber **14** but is prevented from entering the stack **11** by the baffle **24**, and fills the lower portion of the chamber **14** up to the opening of the drain pipe **20** and overflows through the drain pipe **20**.

After the combustion has been completed, the operator closes valve **40**. The inside of the chamber **14** need not be cleaned after each use, but should be cleaned frequently. Cleaning the chamber is accomplished by opening the door **15** and scraping out the residue. Also, in the event that the drain pipe **22** becomes clogged, closing valve **19** and opening valve **45** will force the clogged matter free.

It will be readily apparent that many changes and modifications of the device herein described are possible. The stack **11** may be horizontal rather than vertical, and the shape of the baffles may be changed. The proportions of the structure may be changed to suit the operating conditions of the installation.

The device herein described may be manufactured and used by or for the Government of the United States for Governmental purposes without the payment of any royalty therefore or thereon.

What is claimed is:

In a spark arrester for exhaust gases and particles from a smokestack, a tubular chamber having a diameter considerably larger than the diameter of said stack surrounding the end of said stack and in water-tight contact therewith, said stack extending into said chamber, a conical baffle having an inverted downwardly projecting tip mounted within said chamber coaxially with and above the end of said stack to present a continuous surface to the gases and particles emerging from said stack thereby to reverse the direction of movement of said exhaust gases and particles entering said chamber, means for maintaining water in the lower section of said chamber about the extension of said stack at a predetermined level thereby to separate and quench the larger solid particles which strike the surface of said water, a vertical exhaust tube having a diameter considerably smaller than said chamber extending from the end of said chamber housing the baffle, said exhaust tube having a series of slots on the extended end thereof, means including a fog spray nozzle mounted coaxially of said exhaust tube for spraying a finely divided spray of water therein to extinguish smaller particles, said water and smaller particles falling about said baffle into the water in the lower section of said chamber, a cap having a diameter considerably larger than said exhaust tube mounted on the slotted end of said exhaust tube, said exhaust tube extending into said cap, and a second conical baffle having an inverted downwardly projecting tip mounted in said cap coaxially with and above the end of said exhaust tube to prevent rain or other atmospheric condensate from falling into said exhaust tube other than through the slots in said exhaust tube, said exhaust gases passing about said baffle into said atmosphere.

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