April 27, 1965 W. T. CUNEO 3,180,449

NOISE ABATEMENT SNUBBER FOR VACUUM PUMP SYSTEM

Filed Jan. 28, 1963

2 Sheets-Sheet 1

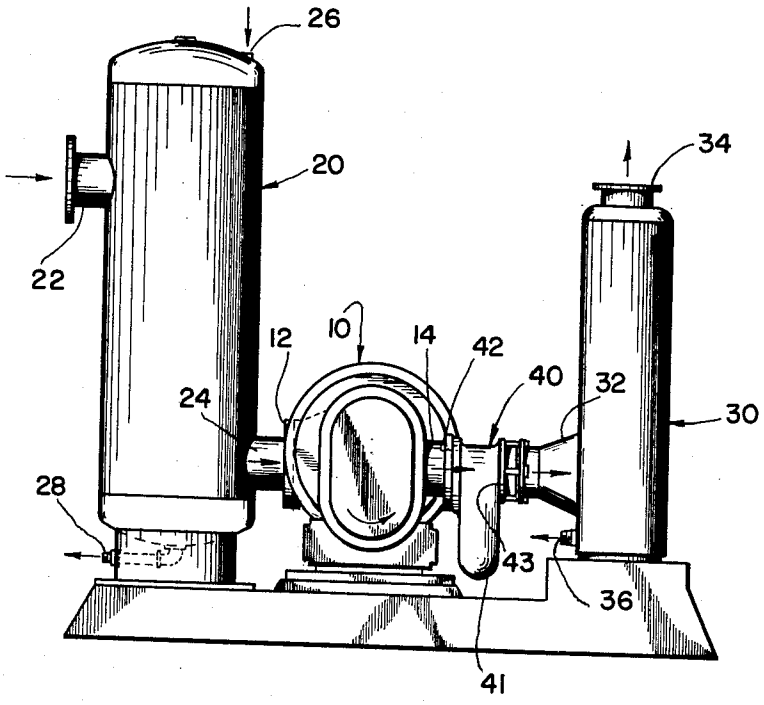

FIG. 1

INVENTOR.
WILLIAM T. CUNEO
BY Charles J. Worth
AGENT

April 27, 1965 W. T. CUNEO 3,180,449

NOISE ABATEMENT SNUBBER FOR VACUUM PUMP SYSTEM

Filed Jan. 28, 1963 2 Sheets-Sheet 2

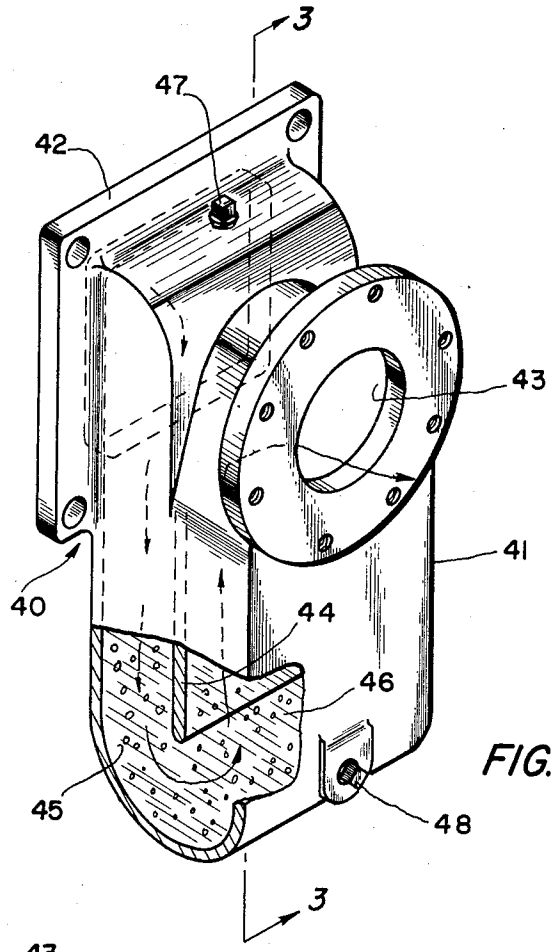

FIG. 2

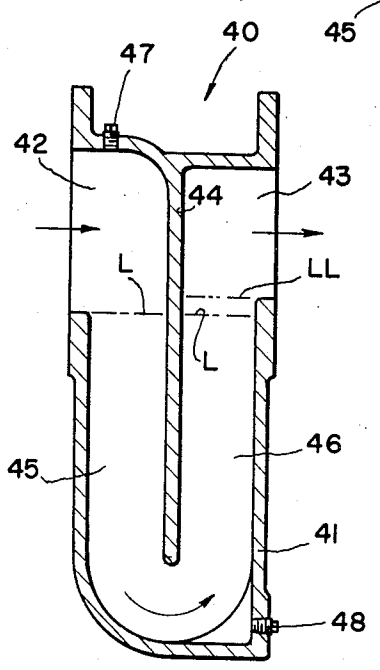

FIG. 3

INVENTOR
WILLIAM T. CUNEO
BY Charles J. Worth
AGENT

United States Patent Office 3,180,449 Patented Apr. 27, 1965

3,180,449

NOISE ABATEMENT SNUBBER FOR VACUUM PUMP SYSTEM

William T. Cuneo, Tioga, Pa., assignor to Ingersoll-Rand Company, New York, N.Y., a corporation of New Jersey

Filed Jan. 28, 1963, Ser. No. 254,119
3 Claims. (Cl. 181—52)

This invention relates generally to noise abatement and more particularly to noise abatement means for pump discharge in a fluid handling system.

Exhaust noise in fluid transmission is usually connected to high pressure fluid at high critical flow rates in which forces or energies thereof are in audible ranges. It has, however, been found that an axial type compressor provided as a pump in a vacuum system discharges relatively low pressure fluid which is attended by a substantial amount of noise. Such noise appears to be caused by carried waves resulting from pulses, and a siren effect created by the type of construction of such pumping means.

It is, therefore, common practice to pass discharge fluid from such pumping means, of the aforementioned systems, through conventional industrial silencers. Such silencers are primarily resonance chambers, with or without fibrous insulation, which provide a tortuous expansion path. These industrial silencers have but a limited effectiveness.

It is also common practice to pass fluid in such systems through a separator when the fluid carries liquid vapor. Using a cold liquid spray injection in such a separator, a determined amount of vapor condensation may be effected before the fluid enters the pumping means; the condensate being drawn off separately from a sump area. Under these conditions, industrial silencers are constructed with condensate traps. However, with the two aforementioned devices, only limited condensation of carried liquid vapor is effected while the life of the silencer-separator is limited by the deleterious effects of the vapor and condensate, and compacting of the insulation.

Accordingly, an object of the present invention is to provide a ruggedly constructed, relatively inexpensive sound abatement device for a pump discharge in a fluid transmission system which has an extensive useable life span and is substantially unaffected by deleterious effects of condensate and vibration.

Another object of this invention is to provide the aforementioned sound abatement device which has no moving parts to malfunction nor loose energy absorbing material to mat.

Still another object of this invention is to provide a sound abatement device for vacuum systems which uses condensate from a gaseous carrier to absorb sound vibration energy from such carrier.

And still another object of this invention is to provide the aforementioned device which is also capable of causing a degree of condensation.

This invention contemplates a sound abatement device comprising a hollow casing with an inlet at one end and an outlet at the opposite end, and at least one baffle member disposed in said casing to divide the area within said casing into a retroverted flow path from the inlet to the outlet capable of maintaining a liquid for absorbing vibration energy as a fluid vibration carrier is passed therethrough.

The foregoing and other objects and advantages will appear more fully hereinafter from a consideration of the detailed description which follows, taken together with the accompanying drawings wherein one embodiment of the invention is illustrated by way of example. It is to be expressly understood, however, that the drawings are for

illustration purposes only and are not to be construed as defining the limits of the invention.

FIGURE 1 is an elevational view of part of an illustrative vacuum system including a sound abatement device made in accodance with this invention,

FIGURE 2 is an enlarged perspective view, with a portion of the casing removed, of the novel sound abatement device of FIGURE 1, and

FIGURE 3 is a sectional view of the novel device taken on line 3—3 of FIGURE 2.

Referring now to the drawings, and particularly to FIGURE 1, a pump **10** creates a suction at its inlet **12** to draw fluid from a source (not shown) such as a condenser, the fluid being discharged at the pump outlet **14**. As an example, pump **10** may be a two stage axial device as shown, described and claimed in copending U.S. application, Serial No. 86,164, filed by G. D. Fraser on January 31, 1961, and assigned to the same assignee as the present application.

To trap slugs of liquid which could be ruinous to pump **10** and to provide condensation means for vapor in the fluid, an accumulator **20** is provided which has an inlet **22** to be connected to the source (not shown) for receiving vacuated fluid, in this instance being a gas which carries liquid vapor. A second inlet **26** is provided at the top of accumulator **20** for cold liquid which is sprayed into the fluid which travels a baffled course to reduce temperature and cause condensation of carried liquid vapor. At the same time, passage of liquid slugs is blocked by accumulator baffles. Accumulator **20** also has a pair of outlets **24** and **28** at its base, outlet **24** being connected to the pump inlet **12** for presenting dehydrated fluid while outlet **28** provides a discharge path for liquid slugs and condensate from accumulator sump area (not shown).

A conventional separator-silencer **30** has an inlet **32** connected to the pump outlet **14**, by a novel sound abatement device **40** made in accordance with the present invention, to receive discharge fluid from pump **10**. The pump discharge fluid travels through separator-silencer **30** which provides terminal condensation and muffling; the exhausting gas leaving through a top outlet **34** and the condensate being collected in a sump (not shown) which discharges through a bottom outlet **36**.

The novel device **40** is shown in detail in FIGURES 2 and 3 as a liquid snubber and provides a penultimate silencing and dehydration of the gaseous carrier in the illustrative system of FIGURE 1. Snubber **40** is comprised of an elongated hollow casing **41** that is vertically disposed and has an inlet **42** axially alined with an outlet **43** in the horizontal, at the top thereof. A vertically disposed baffle **44** extends from side to side of casing **41**, depends from the top, and is spaced from the bottom of such casing to provide a pair of interconnected vertically disposed passageways **45** and **46** of substantially equal cross-sectional area. Passage **45** communicates with inlet **42** while passage **46** communicates with outlet **43**, and together provide a retroverted path connecting the outlet **14** of pump **10** to the inlet **32** of separator-silencer **30**. Thus, snubber **40** has the form of a trap and is filled with liquid, to a static level L even with the lowermost surface of inlet **42**, which forms the sound absorbent material. The liquid in snubber **40** may be derived from condensate during initial rundown of the illustrative system or may be filled through an opening provided in the top of casing **40** normally closed by a plug **47**. A drain opening is provided at the bottom of casing **41** and is normally closed by a plug **48**.

Under operating conditions, discharging pressure fluid from pump **10** causes the liquid level L in passage **46** to rise to a new maximum level LL determined by the lowermost surface of outlet **43** while additional condensate maintains the level L in passage **45**.

Considering the operation of pump 10, fully described in the copending application, pockets of its rotors sequentially pass its discharge port to release pressure fluid which enters snubber 40 as pulses. Further, such communication of each of the pockets with the pump outlet port is initially severely restricted which progressively reduces to provide full communication. Such communication then becomes progressively restricted to cut off causing a siren effect. The alternating increasing and decreasing forces of pulsation and the siren effects of the pump discharge provide carried forces in audible ranges that act on the liquid column of snubber 40 thus dissipating as the pressure fluid courses passages 45 and 46 from inlet 42 to outlet 43. The flow forces associated with the pump discharge are expended as the fluid is forced downwardly in the liquid of passage 45 against its natural buoyancy which causes it to rise in the liquid of passage 46. Simultaneously, the fluid expands thus its pressure drops as the compression forces are expanded moving liquid. Any remaining forces which might cause noise is then damped in the silencer-separator 30.

Thus, the present invention is described in a preferred form wherein a novel snubber is connected to the exhaust of a pump means and provides a tortuous flow path including a liquid column, such liquid being a flow medium acted on by the fluid for force expension to prevent pump exhaust noise.

Although but a single embodiment of the invention has been illustrated and described in detail, it is to be expressly understood that the invention is not limited thereto. Various changes may be made in the design and arrangement of the parts without departing from the spirit and scope of the invention as the same will now be understood by those skilled in the art.

I claim:

1. A sound abatement device comprising:
(*a*) a casing defining a chamber therein having an inlet to receive pressure fluid with noise energy and an outlet for such pressure fluid;
(*b*) baffle means disposed in the casing dividing the chamber into a tortuous flow path from the inlet to the outlet;
(*c*) said inlet and outlet both being disposed adjacent the top of the casing with the lowermost portion of the outlet being of greater vertical distance from the lowermost portion of the flow path than the lowermost portion of the inlet; and

(*d*) a flowable material substantially filling the flow path between the inlet and outlet providing an elongated vertical column of such material to be acted on by pressure fluid as such pressure fluid passes therethrough from the inlet to the outlet.

2. A sound abatement device comprising:
(*a*) a casing having a pair of spaced walls and defining a chamber therein;
(*b*) each of said spaced walls having an opening therethrough adjacent the top of the casing to provide an inlet at one end of the casing for receiving pressure with noise energy to be damped and vapor to be condensed, and to provide an outlet at the other end of the casing for such fluid;
(*c*) a vertical baffle disposed in the casing, depending from the top thereof and spaced from the bottom thereof to divide the chamber into a retroverted flow path from the inlet to the outlet;
(*d*) the lowermost portion of the outlet being of greater vertical distance from the lowermost portion of the flow path than is the lowermost portion of the inlet; and
(*e*) a liquid substantially filling the flow path between the inlet and outlet providing an elongated vertical liquid column on each side of the baffle to be acted on by pressure fluid as such pressure fluid passes therethrough from the inlet to the outlet.

3. The sound abatement device in accordance with claim 2, wherein:
(*a*) said inlet and outlet are axially alined horizontally and the inlet is larger than the outlet.

References Cited by the Examiner

UNITED STATES PATENTS

714,080	11/02	Whitson	181—36
1,641,394	9/27	Martin.	
1,892,853	1/33	Rustin et al.	55—276
1,897,199	2/33	Kenney	230—232
2,692,653	10/54	Diez	181—52

FOREIGN PATENTS

1,004,132	11/51	France.
534,600	9/31	Germany.

LEO SMILOW, *Primary Examiner.*