United States Patent [19]

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[11] **3,893,504**

[45] **July 8, 1975**

[54] METHOD FOR TRANSFERRING HEAT

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[22] Filed: **Dec. 7, 1973**

[21] Appl. No.: **422,780**

Related U.S. Application Data

[62] Division of Ser. No. 199.989, Nov. 18, 1971.

[52] **U.S. Cl.** **165/1**; 165/145; 165/163; 236/74

[51] **Int. Cl.²** **F28F 9/22**; G05D 15/00

[58] **Field of Search** 165/145, 163, 144, 146, 165/147, 1; 62/826; 236/74

[56] **References Cited**

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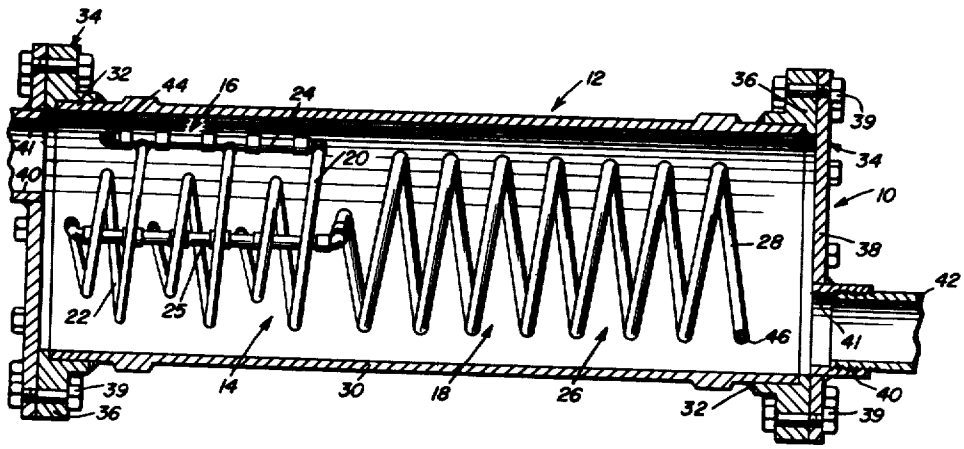
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Attorney, Agent, or Firm—Clarence A. O'Brien; Harvey B. Jacobson

[57] **ABSTRACT**

A medium passed from a high temperature system is cooled by the steps of retarding the normal rapid expansion of the medium while maintaining a relatively high velocity thereof while cooling same; passing medium cooled by the first step through a coil section for further cooling same, and performing the first two steps in the presence of a cooling medium. A heat exchanger for carrying out the method has a shell providing a flow path for a cooling medium, and a coil arranged within the shell and including a first coil section which controls expansion of the medium to be cooled and maintains the velocity high enough to maintain any condensate formed in the coil to be rapidly moved along the coil in front of the expanding medium to be cooled thus preventing hammering by preventing spaced areas or slugs of liquid condensate from moving rapidly toward each other as gaseous pockets therebetween are condensed which normally cause reduced pressure areas therebetween, and a second coil section connected to the first coil section to receive the medium to be cooled for further cooling same. The first coil section has a pair of headers and a plurality of helical loops connected between the headers. The second coil section is formed by a plurality of helical loops connected.

1 Claim, 3 Drawing Figures



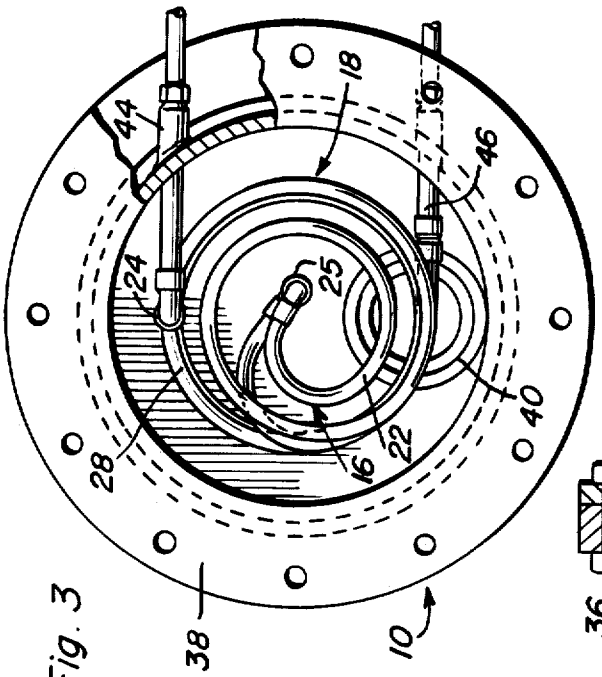


Fig. 3

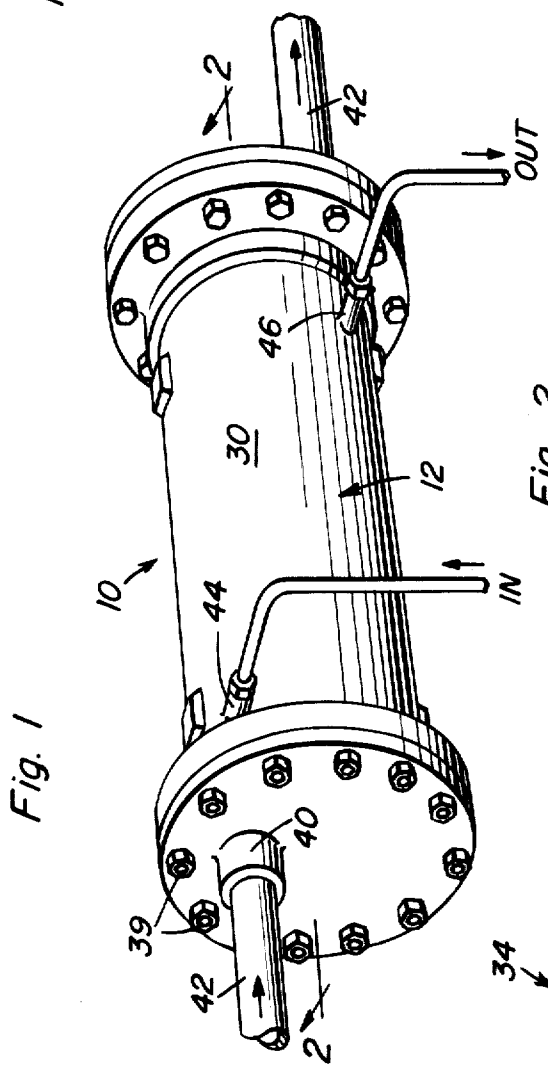


Fig. 1

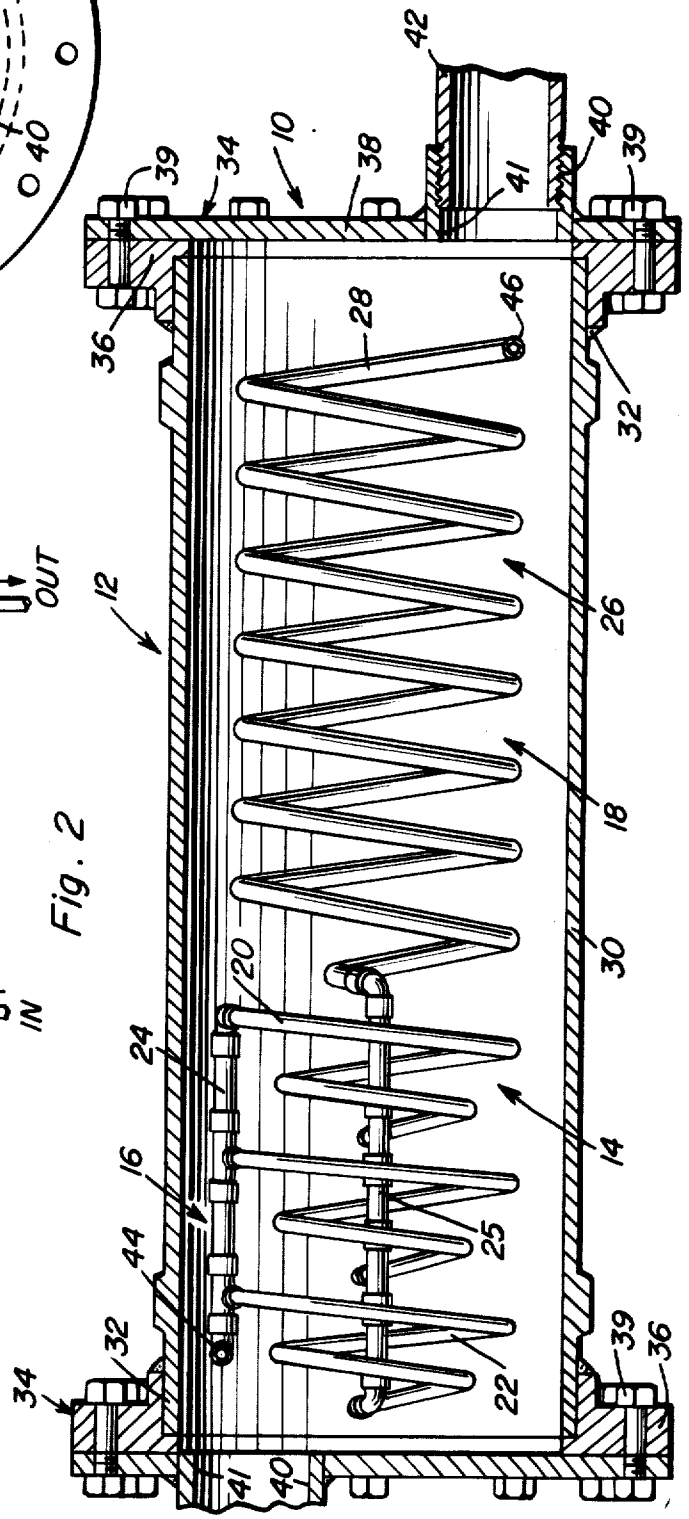


Fig. 2

METHOD FOR TRANSFERRING HEAT

This is a division of application Ser. No. 199,989, filed Nov. 18, 1971.

BACKGROUND OF THE INVENTION

1. Field of the Invention

This invention relates to a method for transferring heat. In particular, this invention relates to a heat exchanger which will receive condensate from a high temperature system such as a high pressure steam system, and cool this condensate without hammer or other adverse affects, so as to permit the condensate to be discharged into low temperature systems.

2. Description of the Prior Art

High temperature systems, such as high pressure steam systems, are commonly used in which a medium such as a fluid, is passed therefrom at a very high temperature and pressure. This is particularly true in passing a condensate from a high pressure steam system. Because of the high pressure, the condensate is very hot. When attempting to cool this hot condensate so that it can be discharged into low temperature systems, the use of conventional heat exchangers has resulted in water hammer, or noise in the coils due to unsteady flow, the cooling medium itself flashing to steam, and other adverse affects.

SUMMARY OF THE INVENTION

It is an object of the present invention to provide a method for cooling a medium passed from a high temperature system in a heat exchanger which will eliminate water hammer and other adverse affects.

These and other objects are achieved according to the present invention by providing a method for cooling a condensate passed from a high temperature steam system, and having the steps of retarding expansion of the condensate into steam while maintaining a relatively high flow velocity of the medium to be cooled for cooling same, passing medium cooled by the first step through a coil section for further cooling the medium, and performing the first two steps in the presence of a cooling medium.

A heat exchanger is provided for performing the method according to the present invention, and has a shell providing a flow path for a cooling medium, a coil arranged in said shell, and including means for retarding expansion of a medium to be cooled for cooling same and means connected to the expanding means for receiving the medium to be cooled from the expanding means for further cooling same.

In a preferred embodiment of the expanding means, a first coil section is provided which has a plurality of helical loops connected in parallel between a pair of headers. One of the headers is connected to the further cooling means and the other is adapted to be connected to a source of a medium to be cooled.

A preferred embodiment of the further cooling means has a second coil section formed by a plurality of helical loops connected together in series.

The shell of the heat exchanger according to the present invention preferably has a cylinder with spaced end portions, and means for enclosing the end portions and for connecting the shell to a cooling medium flow system. The first coil section may have a pipe arranged transversely with respect to the cylinder and passing therethrough, and connected to the other of the headers for connecting same to a source of a medium to be cooled. Another pipe may be arranged transversely with respect to the cylinder and passing therethrough and connected to the second coil section for passing cooled medium from the heat exchanger.

These together with other objects and advantages which will become subsequently apparent reside in the details of construction and operation as more fully hereinafter described and claimed, reference being had to the accompanying drawings forming a part hereof, wherein like numerals refer to like parts throughout.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** is a perspective view showing a heat exchanger according to the present invention.

FIG. **2** is a sectional view taken generally along the line **2—2** of FIG. **1.**

FIG. **3** is an end view, partly cut away and in section, of the heat exchanger according to FIGS. **1** and **2.**

DESCRIPTION OF THE PREFERRED EMBODIMENTS

Referring to the drawings, a heat exchanger **10** according to the present invention has a shell **12** providing a flow path for a cooling medium (not shown), and a coil **14** arranged within shell **12.** Coil **14** has means **16** controllably expanding a medium to be cooled for cooling same, and a means **18** connected to means **16** for receiving the medium to be cooled therefrom for further cooling the medium to be cooled.

Means **16** has a first coil section **20** with a plurality of helical loops **22.** Coil section **20** has also a pair of headers **24, 25.** Header **24** is adapted to be connected to a source of a medium to be cooled and header **25** is connected to means **18.** The source is not shown in the drawings. Helical loops **22** are connected in parallel between headers **24, 25.**

Means **18** has a second coil section **26** which is formed by a plurality of helical loops **28** connected together in series. It is to be understood that coil section **26** may be constructed from a length of tubing which is coiled in a known manner.

Shell **12** has a cylinder **30** with spaced end portions **32.** A means **34** is provided for enclosing end portions **32,** and for connecting shell **12** to a cooling medium flow system. Means **34** has a flange ring **36** connected to end portions **32** in a suitable, known manner, such as by welding or brazing, and a cover plate **38** attached to flange ring **36** as by, for example, bolt and nut assemblies **39.** Each cover plate **38** is provided with a flange **40** arranged about an opening **41** also provided in each cover plate **38.** The orientation of inlet pipe in relation to the coil sections and outlet pipe may be varied by selective angulation of the end plates **38** and the heat exchanges may be vertically oriented if desired. Pipes **42** may be attached to flanges **40** as by screw threads or welding for connecting heat exchanger **10** to a cooling medium flow system. Such a system is conventional, and has not been shown in the drawings.

Coil section **20** has a pipe **44** arranged transversely with respect to cylinder **30** and passing therethrough. Pipe **44** is connected to header **24** for connecting header **24** to a source of a medium to be cooled. A pipe **46** is also arranged transversely with respect to cylinder **30** and passing therethrough, and is connected to the end of coil section **26** opposite the end connected to

header **25** for passing cooled medium from the heat exchanger.

Heat exchanger **10** can be mounted directly into pipes **42** of the cooling or low temperature medium. It is then connected to a source of a medium passed from a high temperature system which may be a condensate from a high pressure steam system. Thus, header **24** will receive a condensate at high pressure and high temperature from the steam trap of a high temperature steam system. By means of a widely-spaced first coil section **20** and the larger second coil section **26,** the temperature of the condensate will be reduced without noise or hammer in the coils which is caused by the condensate flashing to steam as it expands and forming spaced areas of liquid and steam which upon further cooling are condensed and form reduced pressure areas that then cause the areas of liquid to move rapidly towards each other and resulting in a hammering noise. By retarding the expansion and maintaining a high velocity through the coil, the liquid condensate will move at a velocity sufficient to maintain the liquid in the form of a wall or continuous column as it is cooled thereby elimininating the hammering noise.

The header-type system used for coil section **20** has its plurality of small diameter coils of small size pipe dimensioned to retard expansion of the high temperature condensate and cool same. The spacing and sizing of loops **22** is such that the cooling medium surrounding coil section **20** will not rise in temperature so rapidly as to cause the cooling medium itself to be flashed to steam. After the temperature is reduced sufficiently in coil section **20,** the condensate is then run through the larger diameter, series-type coil section **26,** which is constructed of larger diameter pipe size to further cool the condensate and completely reduce the condensate temperature to that of the cooling medium. This condensate can then be either discharged into the cooling medium or connected to any external discharge point.

By mouting the coil sections **20,26,** on pipes **44, 46,** respectively, complete freedom of movement required for rapid expansion and contraction of coil sections **20,** 26, in response to rapid temperature changes is realized.

The various elements of heat exchanger **10** may be constructed in a known manner from suitable, known materials. Material selection is determined by the specific requirements dictated by varying operating conditions involving the parameters of temperature, pressure, corrosiveness, and the like. The particular dimensions of a heat exchanger **10** are determined by the flow rates and temperatures of the cooling medium and the medium being cooled.

Although a condensate has been used as an example of a fluid passed through heat exchanger **10,** it is to be understood that any suitable fluid may be cooled in a heat exchanger **10.**

The foregoing is considered as illustrative only of the principles of the invention. Further, since numerous modifications and changes will readily occur to those skilled in the art, it is not desired to limit the invention to the exact construction and operation shown and described, and accordingly all suitable modifications and equivalents may be resorted to, falling within the scope of the invention.

What is claimed as new is as follows:

1. A method for cooling a medium passed from a high temperature system, comprising the steps of:

a. providing a flow path for a liquid cooling medium;

b. retarding expansion of a medium to be cooled while passing same through the flow path of the cooling medium, the retarding step (b) including the steps of:

i. passing the medium to be cooled into a first header;

ii. passing the medium to be cooled from the first header to a second header through a plurality of loops of smaller diameter than coils of the coil section of step (b) and connected in parallel between the first header and the second header; and

iii. passing the medium to be cooled from the second header to the coil section of step (b);

c. limiting cooling of step (b) to an amount sufficient for preventing evaporation of the cooling medium;

d. passing medium retarded by step (b) through a coil section for further cooling the medium in the presence of the cooling medium; and

e. providing the coil section of step (d) with size sufficient to completely reduce the temperature of the medium being cooled to that of the cooling medium.

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