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DEVICE FOR FLUID CLEANING OF HEAT EXCHANGER TUBES

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Fig. 2

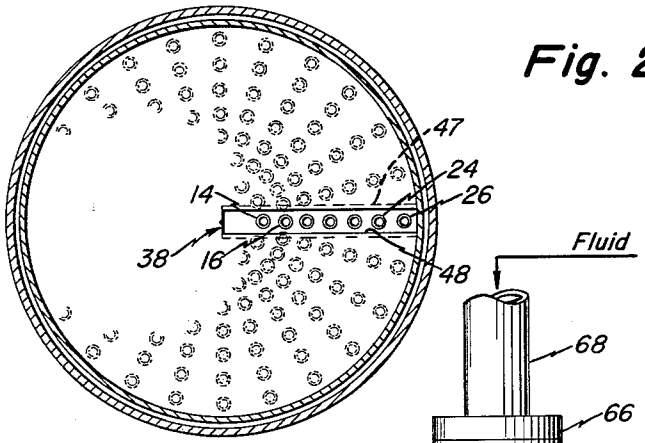


Fig. 1

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DEVICE FOR FLUID CLEANING OF HEAT EXCHANGER TUBES

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This invention relates to the cleaning of heat exchanger tubes and more particularly to a device for the selective cleaning of heat exchanger tubes using a pressurized fluid.

Deposits are built up in exchanger tubes during their operation. These deposits restrict flow and seriously decrease the heat transfer efficiencies of the exchangers. Periodic cleaning of the exchangers is required to remove these deposits. Conventionally these deposits are removed by one of the following methods: reverse fluid flow through the tubes; which is unsatisfactory because large pumping facilities are required to obtain the necessary velocities for proper cleaning of the tubes. In another procedure the deposits are removed by forcing fluid through one tube at a time; examples of suitable fluids are liquid, steam and air. Where the deposits are more difficult to remove, sand may be used in the cleaning process or some other abrasive solvent.

Reverse flow is ineffective because of the low pressures obtained with existing facilities. Cleaning of individual tubes is time-consuming, although the velocities required for proper cleaning are obtained.

One object of the invention is to provide a means for cleaning heat exchanger tubes which is less time-consuming than individual tube cleaning, yet providing reasonably effective cleaning. Another object is to provide a means for cleaning heat exchanger tubes which is more effective than the reverse fluid flow procedure yet does not require additional pumping facilities during the cleaning procedure. Still another object is to provide an inexpensive, simple device for use in pressurized fluid cleaning of heat exchanger tubes. Other objects of the invention will become apparent in connection with the detailed description of the invention.

Broadly, the invention herein comprises a rotatable distributor means for directing a pressurized fluid through a selected number of tubes in a tube sheet of a heat exchanger. Rotation of the distributor means permits the sequential cleaning of all of the heat exchanger tubes in the tube sheet.

Having thus indicated the general nature of the invention, reference is made to the accompanying drawings forming a part of this specification and showing one illustrative embodiment of the invention, wherein:

FIG. 1 is a cross-sectional view of a particular device of the invention.

FIG. 2 is a sectional view along the plane 2—2 showing a slot exposing a portion of the tubes on the tube sheet.

In FIG. 1 the device of the invention numbered 10 is shown positioned ready for cleaning of the tubes of heat exchanger 12. The device 10 is positioned to direct fluid through tubes 14, 16, 18, 20, 22, 24 and 26. The remaining tubes of the bundle are not numbered. The ends of the tubes are affixed in tube sheet 28 which is supported by backing ring 30. As is customary, the tube ends extend a short distance beyond the surface 32 of tube sheet 28. It is to be understood that only the portions of heat exchanger 12 which are pertinent to the description of the invention are shown in FIG. 1.

Device 10 includes a distributor means which in this embodiment comprises drum 34. Drum 34 comprises a flat surface 36 positioned in spaced relation to surface 32 of tube sheet 28 and surface 36 is provided with a radial slot 38. Surface 36 is spaced away from surface 32 by about the distance of the tube extensions. Surface 36 extends a distance substantially that of tube sheet 28 in order to encompass all the tube ends. Drum 34 includes a second flat surface 40 which is provided with a centrally located opening 42. In this embodiment a conduit connecting means 44 is affixed to surface 40 about opening 42 and extends into the interior of drum 34. Surfaces 36 and 40 of drum 34 are joined by cylindrical wall 46.

Radial slot 38 is positioned over and exposes tubes 14–26 in order to direct the fluid through these tubes only to obtain the necessary high fluid velocities for cleaning. A resilient member 47 is positioned around the edges 48 of slot 38. Resilient member 47 is adapted to fit against surface 32 of tube sheet 28 in a sealing relation. Member 47 is constructed of a resilient material such as rubber in order to slide over the ends of the tubes when device 10 is rotated. The sealing relation of resilient member 47 to surface 32 is not necessarily 100% and as the resilient member 47 is worn in use it will be substantially less than 100%.

Cap-like member 50 encloses drum 34. In this embodiment cap-like member 50 includes flat plate 52 having an opening 54 co-axial with opening 42. Cylindrical wall 56 extends from flat plate 52 to tube sheet 28. Wall 56 abuts in a fluid sealing relation against tube sheet 28. Bar 58 extends across plate 52 and is bolted to backing ring 30 by bolts 60 and 62. The purpose of bar 58 and bolts 60 and 62 is to hold cap-like member 50 in sealing relation with tube sheet 28 and to position the device 10 on the end of the heat exchanger.

Conduit means 64 is provided to introduce fluid into the interior of drum 34. Conduit means 64 passes through openings 54 and 42 and extends into conduit connecting means 44. Swivel joint 66 is connected to the outer end of conduit means 64. Hose 68 is connected to swivel joint 66 to bring pressurized fluid into conduit means 64.

A means is provided for the rotation of slot 38 to different positions over tube sheet 28. In this embodiment the rotation is obtained by the rotation of conduit means 64.

Stuffing box 70 is positioned around conduit means 64 and exterior to cap-like member 50. In this embodiment a sleeve bearing 72 is positioned immediately adjacent to the outer surface 74 of conduit means 64. Packing gland 76 is provided to insure the position of sleeve bearing 72 and packing 78. The purpose of stuffing box 70 is to retard the flow of fluid from within cap-like member 50 by way of the outer surface 74 of conduit means 64; this fluid comes from leakage beneath resilient member 47.

The spaced relationship between surface 36 and surface 32 is adjustable by means of mechanism 80. Mechanism 80 is composed of slotted disc 82 attached around the exterior of stuffing box 70, which disc 82 is provided with rotatable member 84. An elongated member 86 is attached to conduit means 64 above stuffing box 70. Threaded rods 88 and 90 join member 86 to rotatable member 84, permitting an adjustment of the relative positions of member 86 and member 84. In this embodiment the rotation of conduit means 64 is obtained by means of handle 92 which is affixed to elongated member 86.

The cleaning operation permitted by the device of this invention is as follows: a heat exchanger which requires cleaning is prepared by opening both ends of the exchanger exposing the open ends of the tubes. Device 10 is bolted to backing ring 30 by means of bolts 60 and 62 and cap-like member 50 is abutted against tube sheet 28 by tightening up the bolts. Resilient member 47 is positioned in sealing relation with surface 32 by means of adjusting the spaced relation of members 84 and 86 by

means of threaded rods 88 and 90. Of course, radial slot 38 was first positioned over the ends of tubes 14–26. Hose 68 is connected to conduit means 64 by means of swivel joint 66. Hose 68 is connected to a source of cleaning fluid of the desired pressure, which source is not shown.

Supply valve (not shown) is opened and the cleaning fluid passes through conduit means 64 into drum 34 and through slot 38 into the tubes being cleaned; the cleaning fluid is passed through such tubes until the tubes are cleaned. Then handle 92 is moved to bring slot 38 over the next group of tubes to be cleaned. This sequential cleaning is continued until all of the tubes on tube sheet 28 are cleaned by 360° rotation of slot 38. During this operation packing gland 76 may have to be tightened to provide against loss of fluid through stuffing box 70. It may be necessary to adjust the spaced relation of members 84 and 86 during the cleaning operation in order to compensate for the wear on resilient member 47 to improve the sealing relation of member 47 with surface 32.

It can be seen from the above description that by means of a relatively simple device of the invention it is possible to clean all the tubes of the heat exchanger using fluid velocities far in excess of those obtainable without the selective arrangement of the radial slot described and a great deal more rapidly than is possible with procedures cleaning one tube at a time.

It is to be understood that the embodiment described above is merely one of numerous variations which can be devised on the broad concept by those of ordinary skill in the art and the claims which are appended hereto are not limited to the specific embodiment described.

Thus having described the invention, what is claimed is:

1. A device for the selective cleaning of heat exchanger tubes by directing pressurized fluid therethrough, which device comprises:

a drum having a diameter adapted to be substantially that of the tube sheet and having a first flat surface adapted to be positioned in immediate spaced relation to said tube sheet, said flat surface having a radial slot and said slot being sized and adapted to expose a minor number of the tubes on said tube sheet and said drum having a second flat surface provided with a centrally located opening;

a resilient member positioned around the edges of said slot and adapted to be in a sealing relation with said tube sheet;

a cap-like member, enclosing and in spaced relation with said drum, having a flat plate provided with an opening, co-axial with said opening in said drum, and having a cylindrical wall adapted to be abutting against and in fluid sealing relation with said tube sheet;

a conduit means for introducing fluid into the interior of said drum, said conduit means passing through said co-axial opening in said flat plate and being affixed around said co-axial opening in said second flat surface of said drum;

a stuffing box member to retard the flow of fluid from within said cap-like member by way of the outer surface of said conduit means; and

means for rotating said drum to expose other numbers of said tubes.

2. The device of claim 1 wherein the rotation of said drum is obtained by the rotation of said conduit means.

3. The device of claim 1 wherein an adjustment means is operatively connected to said drum and provided in order to improve the sealing efficiency of said resilient member by adjusting the position of said drum in relation to said tube sheet.

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