A method for peening a portion of the inside of a small diameter heat exchanger tube by inserting a rotating shaft having a peening strip affixed thereto, orbiting and reciprocating the shaft as it rotates, and maintaining this operation for a predetermined length of time to relieve residual tensile stresses in a portion of a tube installed in a heat exchanger.

7 Claims, 1 Drawing Figure
METHOD OF PEENING THE INSIDE OF A SMALL DIAMETER TUBE

BACKGROUND OF THE INVENTION

This invention relates to heat exchangers and more particularly to a method for peening a portion of the inside of a small diameter heat exchanger tube to relieve stresses. Heat exchanger tubes are assembled in heat exchanges and then are held in place by light rolling of the tube in the tubesheet holes. The tubes then have their ends seal welded to the tubesheet and are expanded into engagement with the tubesheet the full depth of the tubesheet. All of these operations are carried out in a manner which minimizes residual tensile stresses. However, such stresses become locked in the tubes when there are severe surface irregularities in the holes, in the tubesheet, or if the tubes are inadvertently deformed in any of the above-mentioned installation procedures. These residual stresses cause premature failure of the tubes unless they are relieved or lowered.

SUMMARY OF THE INVENTION

In general a method for peening the inside of a small diameter tube when performed in accordance with this invention comprises the steps of inserting a shaft having a peening strip affixed thereto in the tube, rotating the shaft at a high speed, orbiting the shaft at a relatively slow speed as it rotates, maintaining a predetermined minimum clearance between the orbiting shaft and the tube, reciprocating the shaft over a predetermined distance at a slow rate, and continuing the above-mentioned steps for a predetermined period to relieve stresses in a portion of the tube.

BRIEF DESCRIPTION OF THE DRAWING

The objects and advantages of this invention will become more apparent from reading the following detailed description in conjunction with the accompanying drawing, in which:

The sole FIGURE is a partial sectional view of a tube and a peening device made in accordance with this invention.

DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring now to the sole FIGURE in detail there is shown apparatus utilized in a method for stress relieving a portion of a small diameter heat exchanger tube disposed in a tubesheet, the apparatus comprises a rotating shaft having affixed thereto a peening strip formed from a phenolic ribbon with spherical tungsten carbide shot by way of the peening strip permanently attached thereto adjacent the distal margins of the ribbon, the radial distance from the axis of the shaft to the shot being greater than the inside diameter of the tube. The shaft is rotatably and eccentrically disposed in a generally cylindrical housing which fits into the tube. The housing has indicia disposed thereon to reference the location of the peening strip with respect to the end of the tube. A variable speed motor is connected to one end of the shaft, the end opposite the end having the peening strip affixed thereto. An orbiting drive is provided for orbiting shaft in the tube. The orbiting drive includes a motor which is attached to the one end of the housing to rotate the housing between 30 and 100 revolutions per minute causing the shaft to orbit at the same rate.

The method for peening the inside of a small diameter tube comprises the steps of:

1. Manually inserting the shaft having a peening strip affixed thereto into the tube a depth indicated by the indicia which places the peening strip adjacent a portion of the tube which is to be stress relieved;
2. Rotating the shaft at high speed generally between 2000 and 4000 revolutions per minute to provide the proper peening action;
3. Orbiting the shaft as it rotates at a speed of about 30 to 100 revolutions per minute;
4. Maintaining a predetermined minimum clearance between the rotating shaft and the tube by inserting the housing in the tube and holding the housing in the tube so that peening occurs in the area diametrically opposite the location of the shaft as well as the area adjacent thereto;
5. Rotating said shaft at high speed;
6. Orbiting said shaft at a relatively slow speed as it rotates; and continuing the above-mentioned steps for a predetermined period to relieve residual stresses in a portion of the tube.
7. The method as set forth in claim 1, wherein the shaft is rotated generally between 2000 and 4000 revolutions per minute.
8. The method as set forth in claim 1, wherein the shaft is orbiting at the rate of about 30 to 100 revolutions per minute.
9. The method as set forth in claim 1, wherein the minimum clearance between the orbiting shaft and the
tube is generally maintained between 45 and 50 thousandths of an inch.

6. The method in claim 1, wherein the shaft is generally reciprocated at a rate of about one reciprocation per minute.

7. The method as set forth in claim 1, wherein the peening generally continues for a period of about four minutes.