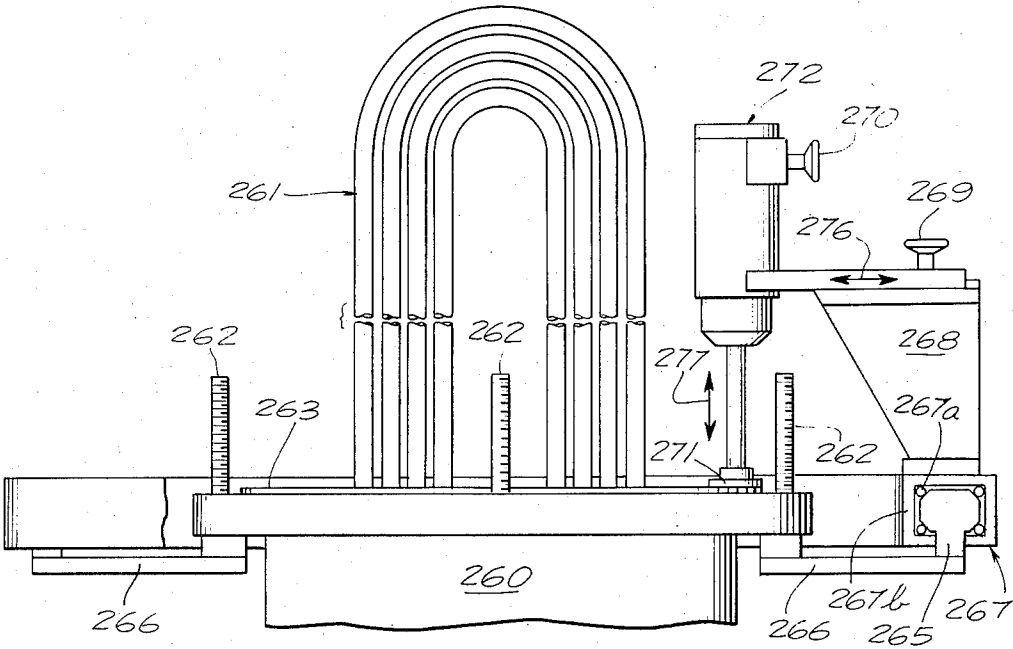


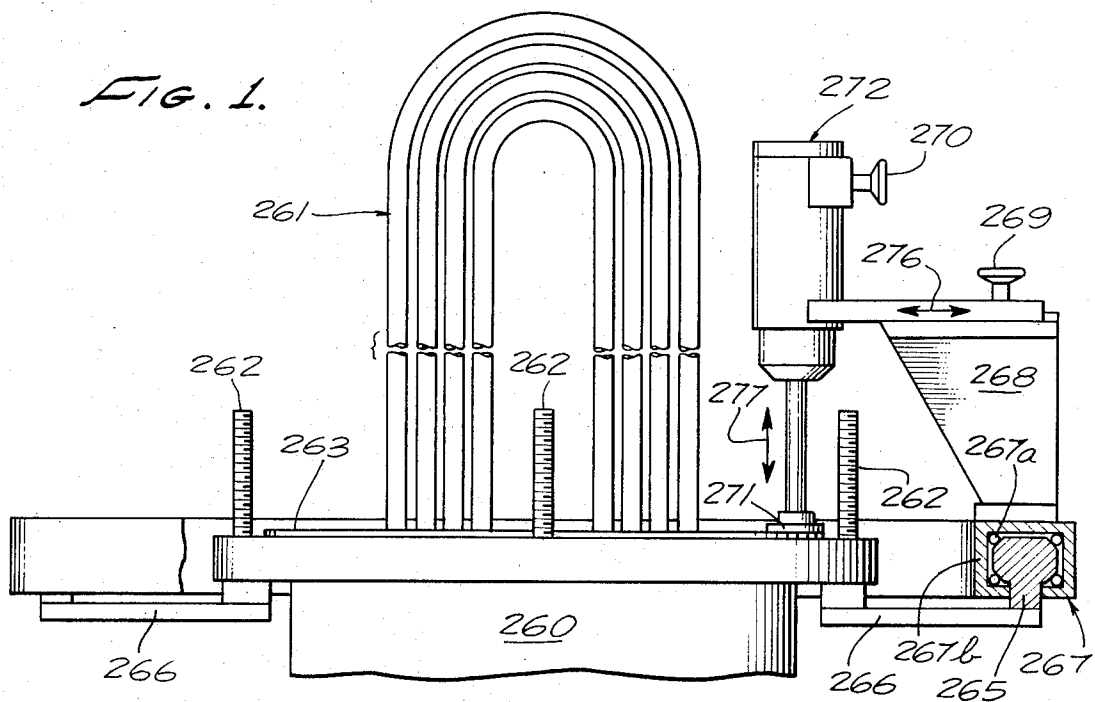
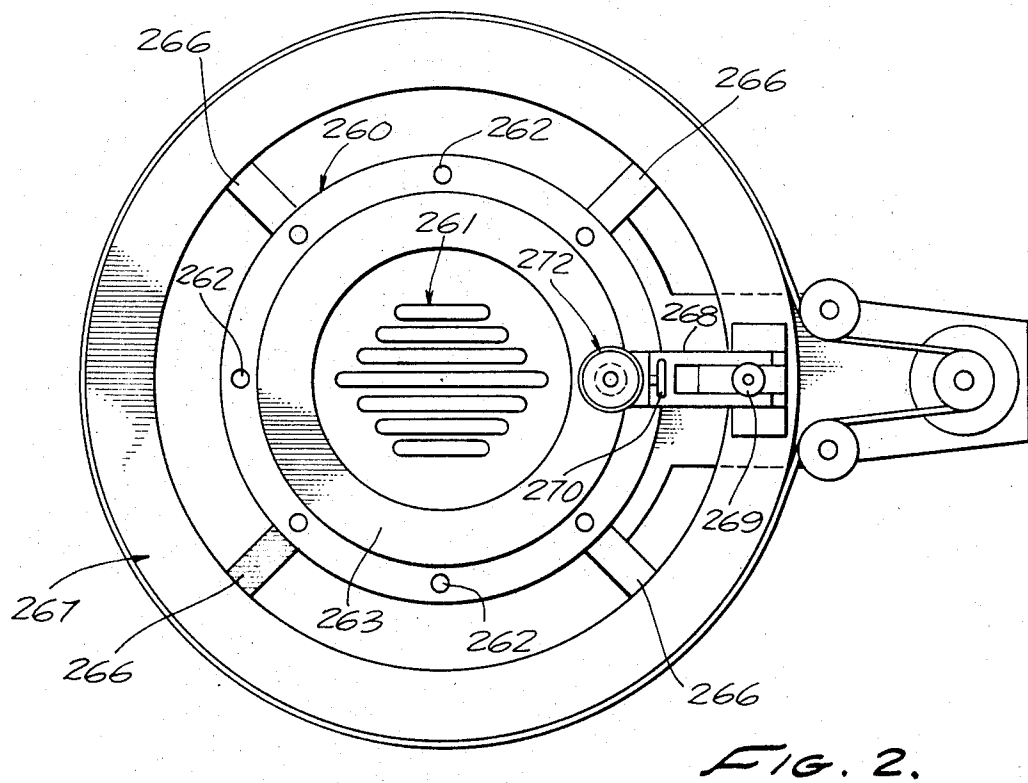
- [54] **METHOD OF RECONDITIONING A HEAT EXCHANGER**
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- [51] Int. Cl. **B24b 19/26**
- [58] Field of Search **29/157.3 R, 157.4, 401; 51/241 R, 241 S, 241 B, 281 SF; 90/11 C, 12 R; 144/144 R, 150**
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- [57] **ABSTRACT**
- A method of reconditioning an annular sealing surface on the header of a heat exchanger, in which a tool for finishing the sealing surface is supported on a ring, with suitable feed adjustments for the tool relative to the ring, and the ring in turn is rotatably supported upon a circular track that is attached around the header in a properly aligned position.
- 6 Claims, 2 Drawing Figures**





METHOD OF RECONDITIONING A HEAT EXCHANGER

RELATED APPLICATIONS

The present invention is an improvement over the invention disclosed and claimed in my U.S. Pat. application Ser. No. 229,055, filed Feb. 24, 1972, now U.S. Pat. No. 3,758,994 and entitled "Portable Power Driven Surface Finishing Device."

BACKGROUND OF THE INVENTION

In oil refineries, in particular, there is an increasing usage of large heat exchangers which include a return tube bundle as part of the construction thereof. The return tube bundle may typically be thirty or forty feet in length, and each tube passes through a circular header and traverses the length of the bundle and is then curved and returns the full length of the bundle and traverses back through the same header. With this type of construction a fluid product returns through the same end of the heat exchanger where it enters. A more specific advantage of this type of structure is that, in reconditioning the heat exchanger, it is only necessary to remove one header from one end of the heat exchanger vessel.

In order to recondition such a vessel the method currently in use has been to cut off the return tube bundle, refinish the inner surface of the header, and then replace the return tube bundle. In my prior copending application, Ser. No. 229,055 filed Feb. 24, 1972 I have disclosed an apparatus which is capable of refinishing the header surface without removal of the tube bundle.

An even greater problem sometimes arises, however, where the header of the heat exchanger is equipped with a plurality of studs which project from its outer circumference in a direction parallel to the tube bundle. To remove these studs in order to recondition or refinish the sealing surface of the header is a very time consuming and expensive process. It would be desirable to be able to refinish the sealing surface without removal of either the tube bundle or the studs.

Accordingly, the primary object and purpose of the present invention is to provide a method of reconditioning the header of a heat exchanger, which has a return tube bundle protruding from the center of the header and a plurality of studs protruding from its outer circumference.

DRAWING SUMMARY

FIG. 1 is an elevation view of apparatus used in carrying out the novel method of the present invention; and

FIG. 2 is a plan view of the inner surface of the header and also showing the apparatus used in accordance with the present invention.

PREFERRED EMBODIMENT

In the drawings a generally circular header 260 is a device which normally closes one end of a heat exchanger vessel (the vessel itself being not shown). A return tube bundle 261 of heat exchanger tubes extend through the header, out a considerable distance perpendicular to the header, and then are curved around and extend back to and through the header. It will be

seen that the return tube bundle is attached only in the central portion of the circular header 260.

On the outer circumference of the header 260 there are a plurality of studs 262. It will be noted that the length of the studs 262 is a great deal less than the length of the return tube bundle. More specifically, the length of the return tube bundle may typically be as much as 30 or 40 feet whereas the length of the studs 262 would be about a foot, or somewhat more, or somewhat less. Intermediate to the return tube bundle 261 and studs 262 there is an annular sealing surface 263. In the assembled condition of the heat exchanger (not shown) there is usually a circular gasket which engages the sealing surface 263, providing the means for a secure sealing action with the end of the heat exchanger vessel.

In accordance with the present invention it is desired to refinish the sealing surface 263, but without removing or damaging either the return tube bundle 261 or the studs 262. Accordingly, suitable apparatus for that purpose is shown in the drawing. The illustrated apparatus is, in general, similar to the apparatus illustrated in my prior application, Ser. No. 229,055, filed Feb. 24, 1972.

In order to carry out the method of the present invention the first step is to place a circular rail about the header 260 and concentric to the annular sealing surface 263 and aligned parallel to the sealing surface. As shown in the drawing a circular rail 265 having a T-shaped transverse cross-section may be used for this purpose. A rail support frame 266 is also required in order to support the rail 265 in its desired position.

The rail support frame 266 also extends about the header 260, and is removably attached to the header. The rail support frame 266 is also attached to the rail 265. The plane of the rail 265 should be parallel to the plane of the annular sealing surface 263, but in event that the sealing surface is unevenly worn or is misaligned then the rail should be aligned parallel to the finish level that is desired for the sealing surface (in case the same is not parallel to the existing level of that surface). It is therefore necessary to make some adjustments of the rail support frame 266 in three dimensions, and this may conveniently be done by moving the rail support frame rather slight amounts relative to the header 260, or by inserting appropriate spacers or shims between the rail support frame 266 and the rail 265, or both. It is therefore possible to align rail 265 so that its plane is precisely parallel to the desired finish level of the sealing surface 263.

The next step of the method of the present invention is to place a ring in retentive engagement with the rail and rotatable thereon. The drawing illustrates a ring 267 which is suitable for this purpose. Roller bearings 267a are preferably utilized between the ring 267 and rail 265 in order to secure easy rotation of the ring. Also, it is preferred to utilize flanges 267b which are attached to the ring 267 and which extend down and underneath the sides of the track 265 so as to retain the ring on the track. It is then possible for the ring to rotate freely upon the rail or track, and being securely retained in place while doing so.

The next step of the method is to select a surface finishing tool such as the tool 271, having a tool support such as the tool support 268. It is necessary that the tool also has a feed adjustment which is adjustable in two dimensions relative to the tool support. After the

tool with its accompanying tool support and feed adjustment has been selected, it is then attached to the ring 267.

The tool support 268 is attached to the ring 267 in a fixed circumferential position on the ring. The alignment of the tool support and its accompanying tool 271 is such that the tool support projects beyond the studs 262, and also projects radially inward over the studs 262. The tool is then located above the sealing surface 263 and intermediate the return tube bundle 261 and studs 262. As a result of the alignment of the tool support and tool the workings of the feed adjustment are such that the tool may be adjusted axially of the ring (as shown by arrow 277) or may be adjusted radially of the ring as shown by arrow 276.

The capacity of the tool adjustment must be such that the axial movement of the tool (arrow 277) is sufficient for the tool to engage the annular sealing surface 263 and cut it to a desired depth. A feed control or handle 270 is shown for controlling the axial feed. The mechanism of the feed control may be any one of several well known types.

It is also necessary that the feed adjustment in the radial direction (arrow 276) is sufficient for the tool to sweep a full radial width of the annular sealing surface 263. A radial feed control 269 shown as a manually operated handle is utilized for this purpose, and its accompanying mechanism may, again, be any of several well known types.

After the tool 271 is set at its initial position the finishing operation is ready to be commenced. It is then necessary to concurrently rotate ring 267 on the rail or track 265, operate the tool 271 by supplying energy to its tool motor 272, and vary one or both of the feed adjustments so as to finish the sealing surface. It will be seen that the tool support 268 clears the ends of the studs 262 by sufficient distance so that it is unnecessary to remove the studs from the header. At the same time the firm grip achieved by the ring 267 upon its supporting rail or track 265 is such as to securely support the tool in its aligned position and thereby provide a precise machining action so as to produce a true surface as the end result of the refinishing process.

As will be understood by those skilled in the art, what has been described are preferred embodiments in which modifications and changes may be made without departing from the spirit and scope of the accompanying claims.

I claim:

1. The method of reconditioning a generally circular header for a heat exchanger, which has a return tube bundle protruding from the center thereof and a plurality of studs protruding from the outer circumference thereof and projecting parallel to the tubes, by finishing an annular sealing surface which lies intermediate to said tubes and said studs, comprising the steps of:

placing a circular rail about said header and concentric to said annular sealing surface and aligned parallel thereto;

placing a ring in retentive engagement with said rail and rotatable thereon;

selecting a surface finishing tool having a tool support and having a feed adjustment which is adjustable in two dimensions relative to said support;

attaching said tool support to said ring in a fixed circumferential position thereon such that said tool support projects beyond and over said studs, and said tool may be adjusted axially of said ring so as to engage the annular sealing surface and cut same to a desired depth, and said tool may also be adjusted radially of said ring so as to sweep the full radial width of the annular sealing surface; and concurrently rotating said ring on said track, operating said tool, and varying said feed adjustment so as to finish the sealing surface.

2. The method of claim 1 wherein a rail support frame is placed about said header and removably attached thereto, is attached to said rail, and is adjusted so as to align said rail parallel to the desired finish level of said annular sealing surface.

3. The method of claim 1 wherein said ring is placed upon said track, and flanges are attached to said ring which extend down and underneath the sides of said track so as to retain said ring on said track.

4. The method of reconditioning a generally circular header for a heat exchanger, which has a return tube bundle protruding from the center thereof, by finishing an annular sealing surface surrounding said return tube bundle, comprising the steps of:

placing a circular rail about said header and concentric to said annular sealing surface and aligned parallel thereto;

placing a ring in retentive engagement with said rail and rotatable thereon;

selecting a surface finishing tool having a tool support and having a feed adjustment which is adjustable in two dimensions relative to said support;

attaching said tool support to said ring in a fixed circumferential position thereon such that said tool may be adjusted axially of said ring so as to engage the annular sealing surface and cut same to a desired depth, and said tool may also be adjusted radially of said ring so as to sweep the full radial width of the annular sealing surface; and

concurrently rotating said ring on said track, operating said tool, and varying said feed adjustment so as to finish the sealing surface.

5. The method of claim 4 wherein a rail support frame is placed about said header and removably attached thereto, is attached to said rail, and is adjusted so as to align said rail parallel to the desired finish level of said annular sealing surface.

6. The method of claim 4 wherein said ring is placed upon said track, and flanges are attached to said ring which extend down and underneath the sides of said track so as to retain said ring on said track.

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