GRIPPING DEVICE FOR TUBES OF HEAT-EXCHANGE APPARATUS

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5 Claims.

My present invention relates generally to tools, and has particular reference to a gripping device for externally engaging a tube of a heat-exchange apparatus.

It is a general object of my invention to provide an improved tool whose employment facilitates and speeds up the removal of tubes from a heat-exchange apparatus, during the process of overhauling the latter.

For the purpose of explaining the nature and purposes of my present invention, I will point out that a surface condenser is a typical example of the kind of heat-exchange apparatus whose servicing is simplified by means of the present tool. It is well known that a surface condenser comprises a series of tubes arranged in a parallel group and supported at their ends by two tube sheets, each of which forms the inner wall of a chamber. Water is usually directed into the bottom of one chamber, passing thence through certain of the tubes to the other chamber, and thence back through other tubes to the first chamber, and out. After a certain period of use, the tubes are likely to become worn and corroded and have to be replaced. It is not unusual for the tubes to be as much as twenty feet long, and sometimes longer; and many thousand tubes are customarily arranged in close proximity in a single heat-exchange apparatus.

In my Patent Number 1,717,487, issued June 18, 1929, I have described a tube-pulling tool which may be applied to one end of a tube of the character mentioned to grip the tube from within and thereupon to impart a forceful yank to the tube to displace the same from the tube sheets.

In employing a pulling device of this character, the initial yank is usually sufficient to permit a single workman thereafter to pull the tube by hand lengthwise out of its position. It frequently happens, however, that the tube resists easy withdrawal, by virtue either of burring at the remote end of the tube, or because of the passage of the tube through certain intermediate supporting plates, or for other reasons. Furthermore, it is frequently impossible to continue the use of the patented tube-pulling tool because of lack of space.

The specific object of my present invention is to provide an improved gripping device which may be applied externally over a tube of the character mentioned, after the same has been initially displaced from the tube sheet in which it is mounted, the present gripping device permitting the application of mechanical or pneumatic force to permit the gripped and stubborn tube to be fully withdrawn from the heat-exchange apparatus.

My present tool is characterized by a complete absence of moving parts, by its extreme simplicity of structure and operation, and by its high efficiency in firmly and reliably engaging the tube that is to be gripped and pulled.

Briefly, the present tool consists of a pair of jaws which are shaped and spaced to permit passage between them of the tube to be gripped, the jaws being mounted in a carriage which is provided with a portion adapted to receive a pulling force applied in a direction substantially parallel to but offset from the axis of the gripped tube.

A feature of my invention lies in the provision of parallel carrier arms which engage the jaws between them, together with releasable means for retaining the jaws and said arms in fixed relationship. Another feature lies in having readily adjustable the jaws individually relative to the carriage, thereby permitting renewal of the gripping surfaces which are presented toward each other.

A characterizing feature of the invention lies in constructing each jaw in the form of a member having substantially the shape of a hyperboloid.

The present tool may be said to be, in essence, of the "come-along" variety, since it may be shifted from place to place along the tube during the movement of the latter.

I achieve the foregoing objects, and such other objects as may hereinafter appear or be pointed out, in the manner illustratively exemplified in the accompanying drawings, wherein—

Figure 1 is a view, partly in cross-section, showing the manner in which the present tool is applied to a tube which is to be removed from a heat-exchange apparatus; Figure 2 is a cross-sectional view taken substantially along the line 2—2 of Figure 1; and Figure 3 is a perspective view of the present tool by itself.

In Figure 1, I have indicated at 10 a typical tube sheet within which a multiplicity of tubes 11 are mounted. I have illustratively shown a portion of a heat-exchange apparatus in which the tubes are "balled" at their outer ends to secure them in fixed relationship to the tube sheet. In the upper portion of Figure 1, I show a tube 11 in its normal disposition within the tube sheet 10. In the lower portion of Figure 1, I have shown a tube 11 which has been initially yanked out of the tube sheet, preferably with the aid of a tube-pulling device of the character illustrated.
and described in my aforementioned Patent Number 1,717,487. The initial displacement of the tube from the tube sheet positions the end of the tube about three to six inches beyond the surface of the tube sheet. While, ordinarily, such a displaced tube may be withdrawn endwise, by purely manual effort, it frequently happens that a greater force is required to withdraw the tube from the tube sheet. In such an event, the gripping device of the present type may be applied over the end of the tube, as shown most clearly in Figure 1.

Referring for the moment to Figure 3, the present device consists of a pair of jaws 12 and 13, each of which preferably consists of a member having substantially the shape of a hyperboloid. The curved hyperboloidal surfaces are roughened, so that the jaws present toward each other two concavo-convex gripping surfaces adapted to accommodate the tube between them, as shown most clearly in Figure 2.

The jaws are made of any suitable material, preferably tool steel, and they are mounted in a jaw carrier which consists of the spaced parallel arms 14 and 15. These arms have one set of ends 16 and 17 bent into contiguous relationship and shaped, preferably, to form a loop or ring 18. This loop portion of the carrier is adapted to receive a pulling force, and I have illustratively shown the manner in which a cable 19 may be engaged within the loop 18. This cable may extend from any suitable source of power, either mechanical, pneumatic, or otherwise, and it has not illustrated the power source because it forms no part of the present invention. It will be understood, however, that the pulling force is applied to the present tool in a direction substantially parallel to, but offset from, the axis of the tube which is gripped. The application of this force positions the present tool in the oblique relationship shown in Figure 1, thereby insuring a firm engagement of the tube. As a matter of fact, the firmness of engagement of the tube increases with the increase of force in the direction of the arrow 20 of Figure 1.

In accordance with my invention, means are provided for permitting adjustment of the jaws relative to the carrier to permit renewal of the operative gripping surfaces from time to time. In the preferred embodiment, the jaw 13 carries at each end a lug 21 which is of equilateral polygonal cross-section. I have illustratively shown a square lug in each case. The carrier arms 14 and 15 are each provided with a correspondingly shaped aperture into which the lugs 21 snugly fit. The jaw 12 is similarly provided with lugs 22. Of similar or equivalent shape, these lugs sitting into apertures purposefully provided in the carrier arms 14 and 15.

To hold the parts in fixed assembled relationship, the lugs 21 carry threaded bolt portions 23, adapted to receive tightening nuts 24.

The manner of use of the present tool will be obvious to those skilled in the art. The tool is applied endwise over the projecting end of the tube, the space between the jaws being sufficient to permit passage over the belled end of the tube, or over any packing or other projecting material. An external force is then applied to the force-receiving portion 18, and this causes a firm engagement of the tube 14 between the gripping surfaces of the jaws, as shown in Figures 1 and 2. If, during the withdrawal of the tube, it is necessary to shift the position of the present tool, it is a relatively simple matter to discontinue the pulling force momentarily and to shift the tool bodily along the tube which it has been gripping. Ultimately, the withdrawal of the present tool from either one or the other end of the tube 5 is a relatively simple matter.

In the event that it is desired to renew one or both of the operative gripping surfaces of the jaws, or in case the jaws need complete replacement, it is merely necessary to remove the nuts 24. This permits the two carrier arms to be separated from the other, and the two jaws are then easily removable. If they are merely to be rotatively adjusted, the polygonal cross-section of the lugs 24 and 23 permits this adjustment to 15 be effected with facility.

In general, it will be obvious that changes in the details, herein described and illustrated for the purpose of explaining the nature of my invention, may be made by those skilled in the art without departing from the spirit and scope of the invention as expressed in the appended claims. It is, therefore, intended that these details be interpreted as illustrative, and not in a limiting sense.

Having thus described my invention, and illustrated its use, what I claim as new and desire to secure by Letters Patent is:

1. A gripping device for externally engaging a tube of a heat-exchange apparatus, comprising a pair of jaws shaped and spaced to permit passage between them of the tube to be gripped, and a jaw carrier provided with a portion adapted to receive a pulling force applied in a direction substantially parallel to but offset from the axis of the gripped tube, each jaw consisting of a member having substantially the shape of a hyperboloid.

2. A gripping device for externally engaging a tube of a heat-exchange apparatus, comprising a pair of jaws shaped and spaced to permit passage between them of the tube to be gripped, and a jaw carrier provided with a portion adapted to receive a pulling force applied in a direction substantially parallel to but offset from the axis of the gripped tube, each jaw consisting of a member having substantially the shape of a hyperboloid, the hyperboloidal surfaces being roughened so that the tube is firmly gripped between the two opposed gripping surfaces.

3. A gripping device for externally engaging a tube of a heat-exchange apparatus, comprising a pair of jaws shaped and spaced to permit passage between them of the tube to be gripped, a jaw carrier provided with a portion adapted to receive a pulling force applied in a direction substantially parallel to but offset from the axis of the gripped tube, each jaw consisting of a member having substantially the shape of a hyperboloid, and means for adjusting the jaws to present different portions of their surfaces toward each other.

4. A gripping device for externally engaging a tube of a heat-exchange apparatus, comprising a pair of jaws shaped and spaced to permit passage between them of the tube to be gripped, a jaw carrier provided with a portion adapted to receive a pulling force applied in a direction substantially parallel to but offset from the axis of the gripped tube, each jaw consisting of a member having substantially the shape of a hyperboloid, and means for adjusting the jaws to present different portions of their surfaces toward each other, said means comprising spaced parallel carrier arms having apertures of equilateral polygonal shape, and each jaw having a lug of corre-
sponding cross-sectional shape for engagement in one of said apertures.

5. A gripping device for externally engaging a tube of a heat-exchange apparatus, comprising a pair of jaws shaped and spaced to permit passage between them of the tube to be gripped, a jaw carrier comprising spaced parallel arms adapted to engage the jaws between them, said carrier having a portion adapted to receive a pulling force applied in a direction substantially parallel to but offset from the axis of the gripped tube, each jaw consisting of a member having substantially the shape of a hyperboloid, and means for adjusting the jaws relative to the carrier to permit renewal of the gripping surfaces which are presented toward each other, said means comprising a lug on each jaw of equilateral polygonal cross-section, an aperture of corresponding shape in one of said carrier arms, and releasable means for holding the carrier arms and the jaws together.

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