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TUBE PULLER

Garland W. Hall, Port Neches, Tex., assignor to
The Pure Oil Company, Chicago, Ill., a corpora-
tion of Ohio

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This invention relates to a tool for gripping the interior of a tube to facilitate the handling thereof.

When a condenser or boiler tube develops a leak, it becomes important to remove it from the nest, for operation of an apparatus with plugged tubes leads to uneconomical inefficiencies. In the past, it has been customary to use a variety of schemes for extracting tubes from nests, one of which involves drilling a hole in the tube, passing a hook therethrough and thus applying sufficient force to the tube to extract it. The inadvisability of adopting such a procedure is quite obvious.

Accordingly, it is an object of this invention to provide a tube handling device which can be used conveniently and operate with a minimum amount of damage to the tube.

It is a second object of this invention to provide a tube handling tool which can be used for gripping the interiors of tubes to facilitate the handling thereof without causing material damage to the wall.

It is a further object of this invention to provide a tube puller adapted for extracting tubes from tube assemblies such that the force used in the extraction can be applied along the longitudinal axis of the tube.

Other objects and advantages of the invention will in part be obvious and in part appear hereinafter.

The invention comprises a tube gripping unit including, in combination, a central body portion having a tapered force-applying terminal member which consists of a plurality of wedge-shaped cams mounted on a supporting portion of the body portion, tapered wedges or cam followers maintained in surface-contacting relationship therewith, and a guide member, said tapered wedges having surface gripping outer sides by means of which force applied by the first-mentioned member is exerted against the inside of a tube, thereby to seize it, the guide member being employed to align the tool accurately along the longitudinal axis of the tube.

The nature of the device and the general scope of the invention will be more clearly understood by reference to the accompanying drawing showing the structure thereof in detail in which:

Figure 1 constitutes a general side elevation of the tube puller partially in section to show the relationship of the several parts thereof;

Figure 1a is a section along the line a-a of Figure 1;

Figure 2 constitutes a second side elevation

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thereof showing the body portion of the apparatus rotated through 90° from the position of Figure 1;

Figure 3 is a longitudinal section of a modification of the alignment member which is employed to place the wedge-shaped gripping members in operative position;

Figure 4 is a sketch illustrating the relationship of the parts when the tool is in use.

Referring now to the drawing comprising Figure 1, 10 represents generally the tube pulling device which has a ring 11 attached to a shank 12 integral with a tapered wedge-shaped cam-like force developing terminal 13, which has a collar 14 at one extremity thereof. Mating with the tapered cam-like force developing member are wedge-shaped cam follower jaw members 15 and 16, which together with member 13 have a cross section like that shown in Figure 1a. The outer surfaces of members 15 and 16 are serrated and arcuate to fit the inner surface of a tube, the serrations being oriented in the direction of the ring of the tool.

Members 15 and 16 are held in surface contacting relationship with the force developing member 13 by means of a bolt 18 joining the three members through counterbored holes 19 and slot 20 holding them in close relationship with each other by means of spring 21 which has a counterpart in member 16. Wedge members 15 and 16 are guided in longitudinal movement by pegs 22 running in slot 20' along the bottom face of wedge-shaped members 15 and 16 intermediate the ends thereof and its counterpart in member 16.

On the shank portion of the tool, there is aligning member 26 which consists of tapered collar 27, flange 28 and probes 29, 30.

When the device is to be used, it is inserted into a tube as indicated in the diagram comprising Figure 4 so that the serrations on the wedges 15 and 16 are within the end of the tube. Aligning member 26 is moved forward to hold wedges 15 and 16 in place and at the same time shank member 12 is withdrawn slightly from the tube. The effect of this movement is to spread the wedge members apart so that the serrations meet the inner surface of the tube, thereby to give a reasonable grip thereon. When a secure grip has been developed on the inside of the tube, aligning member 26 is given a quarter turn and probes 29 and 30 slid into the tube beside the shank member, moving tapered collar 27 up to the tube, thereby to provide a guide for alignment of the tool. If desired, probe members 29

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and 30 can be made adjustable in position on the flange 25 so that when they are slid in beside the wedge members, they will contact the inside of the tube lightly, thereby also helping to guide the movement of the tool. Once a reasonable grip has been developed, heavy force is applied to the handle of the tube puller, sufficient to extract the tube. For heavy duty, a hook is attached to ring 11 and a winch used to pull the tube.

Upon removal of the tube from a nest, removal of the tool from the tube is accomplished simply by pushing the shank member forward into the tube to release the hold of the wedge members on the inside of the tube. It will be noted from Figure 1 showing the serrations that the act of pushing shank member 12 forward will bring collar 14 into contact with the wedges 15 and 16 to dislodge them. When they are back in place on the shank member, the tool is withdrawn from the tube.

The apparatus is useful for gripping tubes having an inside diameter slightly larger than the outside diameter of the tool as set by the serrated wedges and tapered force applying member. Although it can be used on any tube of a diameter which will permit insertion of the tool and seizure of its inner surface, best operation is obtained on tubes which have inside diameters which do not require more expansion than that obtained by movement of member 13 over half of the length of wedges 15 and 16.

Since modified embodiments of the invention could be made without departing from the spirit or scope thereof, it is intended that all matter contained in the description or shown in the drawings shall be interpreted as illustrative and not in a limiting sense.

What is claimed is:

1. A hollow conduit pulling device which comprises an elongated structural body having a shank portion, a cams supporting portion mounted on one end of the shank portion integral and coaxial therewith, and a means affixed to the other end of the shank portion for applying a coaxial external force thereto, a plurality of longitudinally mounted, wedge-shaped cams affixed integrally to and projecting laterally from the said supporting portion, the operating faces of said cams being divergently inclined from the said shank portion, a plurality of wedge-shaped cam follower jaws slidably mounted on said cams supporting portion and cooperating therewith to engage frictionally the inner wall of a hollow conduit, a jaw positioning and centering element coaxially, reciprocatively and rotatably mounted on the said shank portion comprising a frustum-shaped base member having a minimum diameter which permits the insertion of the smaller diameter end of the base member into a hollow conduit to be pulled and having a maximum diameter which prevents the larger diameter end of said base member from being inserted into said conduit, a plurality of rigid, spaced probes independent of said jaws projecting from the smaller diameter face of said base member parallel with the axis of the said shank portion toward said cam follower jaws in a number at least equal to the number of said cam follower jaws, said probes being aligned on the said smaller face so that at least one probe registers simultaneously with each jaw to position said jaws within said conduit in perpendicular alignment with the longitudinal axis thereof.

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2. A device in accordance with claim 1 in which the jaw positioning and centering element comprises a frustum-shaped base member having a minimum diameter which permits the insertion of the smaller end of the base member into a hollow conduit to be pulled and having a maximum diameter which prevents the larger diameter end of said base member from being inserted into said conduit and a hollow cylindrical sleeve independent of said jaws projecting coaxially from the smaller diameter face of said base member toward said cam follower jaws, said sleeve having an outside diameter less than the inside diameter of said conduit and an inside diameter sufficient to clear said wedge-shaped cams at about their maximum deviation from the axis of said elongated body, said sleeve being aligned on the said smaller face to register with and position said jaws within said conduit in perpendicular alignment with the longitudinal axis thereof.

3. A hollow conduit pulling device which comprises an elongated structural body having a shank portion, a cams supporting portion mounted on one end of the shank portion integral and coaxial therewith, and a means affixed to the other end of the shank portion for applying a coaxial external force thereto, a pair of longitudinally and diametrically mounted, wedge-shaped cams affixed integrally to and projecting laterally from the said supporting portion, the operating faces of said cams being divergently inclined from the said shank portion, a pair of wedge-shaped cam follower jaws slidably mounted on said cams supporting portion and cooperating therewith to engage frictionally the inner wall of a hollow conduit, a jaw positioning and centering element coaxially, reciprocatively and rotatably mounted on the said shank portion comprising a frustum-shaped base member having a minimum diameter which permits the insertion of the smaller diameter end of the base member into a hollow conduit to be pulled and having a maximum diameter which prevents the larger diameter end of said base member from being inserted into said conduit, rigid, spaced probes independent of said jaws projecting from the smaller diameter face of said base member parallel with the axis of the said shank portion toward said cam follower jaws, said probes being aligned on the said smaller face so that at least one probe registers simultaneously to position said jaws within said conduit in perpendicular alignment with the longitudinal axis thereof.

4. A hollow conduit pulling device which comprises an elongated structural body having a shank portion, a cams supporting portion mounted on one end of the shank portion integral and coaxial therewith and a means affixed to the other end of the shank portion for applying a coaxial external force thereto, a pair of longitudinally and diametrically mounted wedge-shaped cams affixed integrally to and projecting laterally from the said supporting portion, the operating faces of said cams being divergently inclined from the said shank portion, a coregistering, longitudinally symmetrical transverse slot disposed in said cams supporting portion and said cams, said slot terminating at a point short of the terminal extremity of said cams and said cams supporting portion, a stud disposed in the face of each of said cams in longitudinal alignment with said slot and intermediate the terminal extremity of said cams and terminal extremity of said slot adjacent thereto, a pair of

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wedge-shaped cam follower jaws slidably mounted on said cams and cooperating with said cams to engage frictionally the inner wall of a hollow conduit, said jaws being provided with longitudinal grooves in their respective cam following faces which respectively register with said studs, a link pin extending transversely through said slot and terminating within the bodies of said jaws, resilient means mounted on the terminal ends of said link pin to retain said cam follower jaws in coextensive engagement with the operating faces of said wedge-shaped cams, a jaw positioning and centering element comprising a frustum-shaped base member having a minimum diameter which permits the insertion of the smaller diameter end of the base member into a hollow conduit to be pulled and having a maximum diameter which prevents the larger diameter end of said base member from being inserted into said conduit, a pair of rigid, spaced probes independent of said jaws diametrically mounted on and projecting from the smaller di-

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ameter face of said base member parallel with the axis of the said shank portion toward said cam follower jaws, said probes being aligned on the said smaller face to register with and position said jaws within said conduit in perpendicular alignment with the longitudinal axis thereof.

GARLAND W. HALL.

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