

Oct. 9, 1962

S. O. LA FLEUR

3,057,631

TUBE EXTRACTOR

Filed Nov. 12, 1958

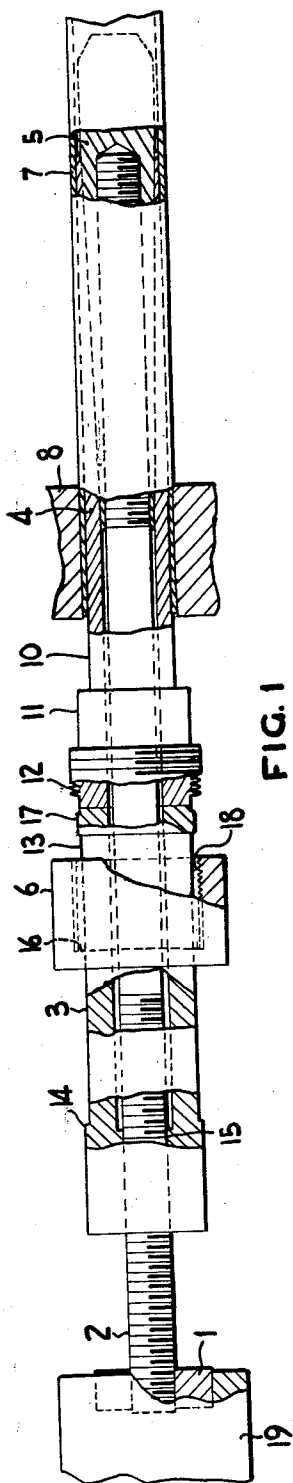


FIG. 1

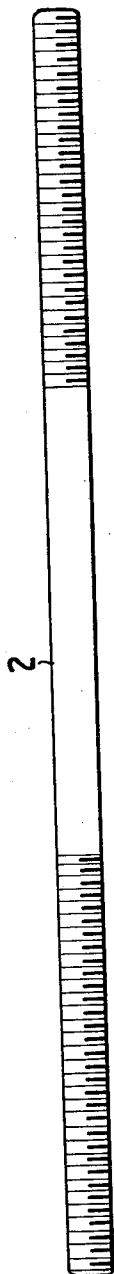


FIG. 2

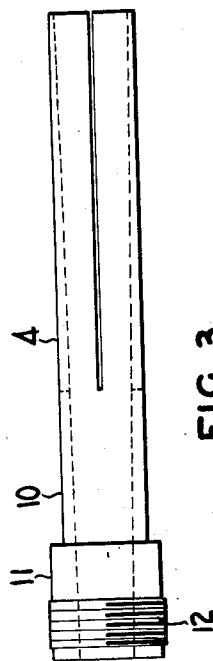


FIG. 3

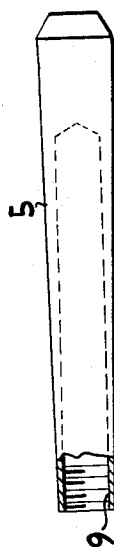


FIG. 5

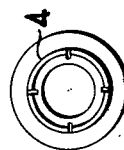


FIG. 4

INVENTOR.
SIDNEY O. LAFLEUR
BY
Oscar H. Spencer
ATTORNEY

1

3,057,631

TUBE EXTRACTOR

Sidney O. La Fleur, Sulphur, La., assignor, by mesne assignments, to Pittsburgh Plate Glass Company
Filed Nov. 12, 1958, Ser. No. 773,410
2 Claims. (Cl. 279-2)

The present invention relates to a new and useful tool for extracting tubes from condensers, boilers and the like. More particularly, the present invention relates to a tool which will extract tubes from condensers and/or boilers without damaging the tubes in any way.

During the operation of equipment such as surface condensers, boilers and other like structures quite frequently repair of iron baffles and tube sheets contained within such apparatus becomes necessary. During such shut-downs the condition of the tubes is often excellent. Thus, repair of the baffles or tube sheets or any other part of the equipment requiring removal of the tubes necessitates the removal of such tubes without any damage thereto. While many prior art devices have been constructed for the removal of tubes from such apparatus none have proved particularly effective in removing the great quantities of tubes contained in such apparatus without damage to the tubes occurring during removal.

According to the present invention a new and useful tool is provided which may be effectively employed in removing tubes from condensers, boilers and the like with no ensuing damage to the tubes removed occurring. Thus, it has been found in accordance with this invention that by utilizing a tube pulling device having an expandable tube engaging means having a substantially smooth external surface provided with a collar at one end thereof for engagement with a tube sheet and having means for expanding said end section to a predetermined degree and means for locking said expanding means when a desired degree of expansion has taken place it is possible to then exert sufficient force on the tube engaging means to move the tubes from the tube sheets and baffles with little or no damage ensuing.

In a more specific embodiment of the present invention a tube pulling device is provided which contains a tapered wedge, an expandable tube engaging means, coupling means constructed to engage the wedge member, and so constructed and arranged to provide a controlled longitudinal movement of said wedge member when the wedge is inserted in a tube contained in a tube sheet and/or baffles. The wedge member is placed forward of the expandable tube engaging means so that when the coupling means is rotated the wedge member moves longitudinally into the expandable tube engaging means thereby expanding it. Locking means are provided on the coupling device to lock it in a definite position when the wedge member has moved and expanded the tube engaging means to the desired degree. Means are then provided for applying force to the tube engaging means for movement of the tube engaged by the tube engaging means to a predetermined degree. Utilizing a device of this nature it is a relatively easy matter to apply force to tubes contained within a tube sheet or baffle and move them 4 or 5 inches from their original position and from their new position they are easily removed by hand.

For a more complete understanding of the present invention reference is made to the accompanying drawing in which:

FIG. 1 represents a longitudinal cross section of a tube pulling device inserted in a tube contained within a tube sheet.

FIG. 2 represents a side view of a rod member which engages the wedge member of the tube pulling device.

FIG. 3 is a side view of the tube engaging means.

2

FIG. 4 is an end view of the tube engaging means of FIG. 3.

FIG. 5 is a side view of the wedge member employed. In FIG. 1 there is shown the tube pulling device of the instant invention inserted in a tube contained within a tube sheet. As shown therein, the tube pulling device is comprised of a wedge member 5 inserted in tube 7 contained within tube sheet 8. Wedge member 5 as shown more clearly in FIG. 5 is a wedge shaped member having its widest portion roughly approximating the inside diameter of the tube to be extracted and being gradually tapered from this wide portion to the other end. The tubular wedge as shown in FIG. 5 contains a tapped bore 9 therein which is threaded for engagement with another section of the tube pulling device as will be hereinafter further explained.

The embodiment shown in FIG. 1 illustrates the insertion of the wedge member 5 into the tube engaging means 4 contained within tube 7. Tube engaging means 4 as shown in FIGS. 1, 3 and 4 is comprised of an expandable end section which is inserted into the tube to be extracted. The other end of tube engaging means 4 is provided with a shaft 10, a collar 11, and externally disposed threads 12 affixed to the end portion of the collar 11.

Situated immediately behind the tube engaging means 4 is a supporting tube 3 which engages tube 7 at its end section and is provided with a shaft 13 and a collar 14. Both tube engaging means 4 and means 3 are provided with a central bore which has an internal diameter of such dimensions that rod member 2 may be inserted therethrough. The collar on means 3 is provided on its internal bore surface with internal thread members 15, constructed and arranged to engage external threads situated on one end of the wedge moving means 2.

Sections 3 and 4 are held together by the insertion of the wedge moving means 2 through the internal bore of 3 and 4 coupled with the threaded engagement encountered between the external threads on part 2 the internal threads on section 3. A coupling or locking means 6 is provided on the external surface of parts 3 and 4 for engagement with the external threads 12, of means 4. The locking mechanism is provided with internal threads 18 constructed and arranged to engage externally threaded members 12 of the tube expanding means 4.

Rod or wedge moving means 2 is in an elongated shaft or rod provided at either end with externally threaded members and is constructed and arranged to permit easy insertion into the tubular borings of section 3, tube engaging means 4 and wedge member 5. When in place on the assembled mechanism section 2 engages by its external threads the internally threaded bore of wedge means 5. On its other end the externally threaded members of the rod 2 engage the internal threaded members 15 on the collar 14 of part 3. At the end most portion of part 2 a cap is provided to cover the terminal of section 2 by a suitable engagement such as a threaded engagement, or some other means for firmly affixing cap 1 to part 2. The primary function of cap 1 is to allow the application of force to the entire instrument as shown.

The device is assembled for use as follows. The wedge engaging means 2 is inserted into the bore 9 of wedge member 5 and threadedly engaged therewith. This member is then inserted into the tube contained within a tube sheet that is to be removed. Section 4 is then placed over the wedge coupling means 2 and pushed forward until its end section engages the end section of the wedge member 5. Section 3, having locking means 6 connected thereto, is then slipped over the coupling means 2 until it engages the tube expanding means 4. The collar 1 is then affixed to the end of the rod 2 and the device is ready for use with a suitable means for applying force to cap or collar 1 such as by pneumatic ram 19.

In utilizing the device wedge member 5 is inserted in the tube to be extracted along with expansion means 4 of the tube pulling device. Usually insertion of the expanding means is conducted for a distance sufficient to provide firm engagement between the collar 11 of the tube expanding means 4 and the tube sheet 8 which contains the tube desired to be extracted. After the tube expanding means 4 has been placed in position section 3 of the instrument is rotated. The rotations of the internal threads of part 3 on the external threads of part 2 causes movement in a longitudinal direction of the wedge coupling means 2 so that the wedge 5 moves towards the tube sheet 8. Movement of the wedge member towards the tube sheet 8 causes expansion of the expandable end section of the tube engaging means 4. The construction and arrangement of the end section of part 4 is such that an even pressure is exerted on the internal surface of the tube 7 by the external surfaces of the end section of tube expanding means 4 caused by their expansion.

When the desired amount of pressure has been applied by movement of the wedge member 5 into the internal bore of the tube engaging means 4 the locking member 6 is placed over the external threads 12 of the tube engaging means 4 and the external surface of the end of the member 3 which is in engagement with the tube 4. A small collar 17 is positioned at the end section of member 3 and is constructed and arranged to engage a shoulder 16 provided at one end of the locking member 6 to prevent disengagement of the locking member from the member 3. When the locking member 6 has been placed in and set in a fixed position an external force is applied to the firmly attached collar 1 at the end of a coupling means 2. The application of force to part 1 either in the form of a pull or a forward thrust will cause movement of the tube 7 by virtue of its connection through the tube engaging means 4 to the rod member 2. Once the tube has been moved a few inches either inwardly or outwardly it is a relatively simple matter to extract the tube from the sheet by hand.

The tube engaging member of the device as shown in accompanying drawings, especially in FIG. 4, is characterized by having an end or tube engaging section split into 4 equal, expandable parts. While this is a preferred embodiment of the instant invention, it is of course understood that tube engaging means 4 may be divided into more or less sections as desired for a particular application. So long as the splitting is such that an equal force may be applied when a wedge member is inserted into the end of tube engaging means 4 the particular arrangement has no significance.

Any means of applying force to the collar 1 and rod 2 of the tube pulling device or tool may be employed without in any way interfering with its operation. Thus, if desired hammers may be employed, pneumatic or hydraulic rams, or any other means of force capable of supplying energy sufficient to move the tubes engaged by the tube puller. The arrangement of elements as shown herein permits the application of force to cap 1 and the application of such force is transmitted through the wedge coupling means 2 to the tube engaging means 4. The locking mechanism is so constructed that irrespective of the amount of force applied to part 1 no movement of the wedge member 5 will take place during the application of force to cap 1 and the coupling member 2, since the entire amount of force will be transmitted through member 2 to the tube engaging means 4. Thus, tube damage is held to a minimum.

The following example illustrates effectively the application of the instant invention to a specific tube removing problem.

Example

A surface condenser containing 1,760 $\frac{3}{4}$ inch in diameter 20 foot, 70-30 cupro-nickel tubes contained within wrought iron baffles and tube sheets was in need of repair. The condenser had not been in use for long and the tubes contained therein were in excellent condition. An examination of the condenser showed that the centermost baffles inside the condenser which supported the tubes were out of alignment therefore the condenser was bowed in the middle making it extremely difficult to remove the tubes therefrom. Utilizing the device of the instant invention in the manner herein above described and applying force to the cap 1 affixed to the wedge engaging member 2, by means of a hydraulic ram utilizing 6,000 pounds of force as a pull on cap 1, all tubes in the condenser were removed effectively and efficiently without damage to any tube contained within the condenser.

While the above invention has been described with reference to certain specific embodiments it is of course understood that many modifications may be made within the skill of the art without departing from the spirit and scope of the invention except insofar as appears in the accompanying claims.

I claim:

1. A tube pulling device comprising a tapered wedge having a centrally threaded bore therein, expandable tube engaging means provided with a central bore and having a smooth external surface, a coupling means having external threading on both ends thereof and constructed and arranged to engage the internally threaded bore of said wedge, a sleeve member having a central bore and constructed and arranged to engage said tube engaging means on one end bore being provided with means for engaging said coupling means on the other end of said sleeve, locking means for said sleeve member and said tube engaging means for preventing rotation of said coupling means.

2. Tube engaging means comprising in combination a wedge member having a threaded internal bore, a rod member externally threaded at both ends and constructed to engage said internal bore of said wedge member at one end thereof, tube engaging means provided with a central bore and having a split end section having a substantially smooth external surface and provided on its external surface at the other end thereof with a collar having affixed thereon external thread members, a sleeve member having a central bore and provided with internal threading at one end thereof constructed and arranged to engage the external threads of the other end of the rod member, said sleeve having a collar on the external surface of the other end thereof, locking means for engaging the external threads of said tube engaging means and provided with a shoulder for engagement with the collar on said sleeve member.

References Cited in the file of this patent

UNITED STATES PATENTS

718,066	McWilliams	Jan. 6, 1903
736,991	Matthews	Aug. 25, 1903
1,372,363	Mueller	Mar. 22, 1921
1,694,953	Smooth	Dec. 11, 1928
1,813,567	Delorme	July 7, 1931
1,897,561	Mannucci	Feb. 14, 1933
2,380,068	Patton	July 10, 1945
2,687,324	Grunsky	Aug. 24, 1954
2,699,354	Kok	Jan. 11, 1955
2,868,548	Lappin	Jan. 13, 1959
2,883,740	Derby	Apr. 28, 1959
2,914,330	Wheeler	Nov. 14, 1959