Nov. 11, 1947. F. M. PAXSON 2,430,733

DEVICE FOR REMOVING TUBES FROM HEAT EXCHANGE ASSEMBLIES

Filed Feb. 7, 1944

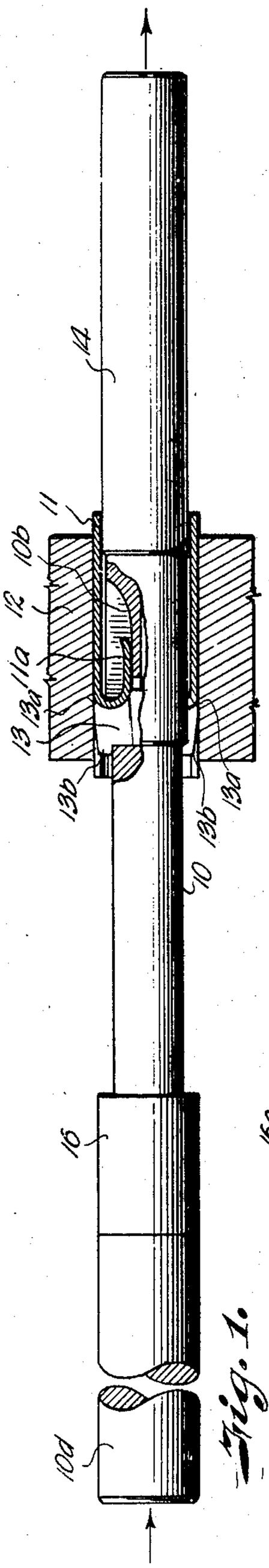

Fig. 1.

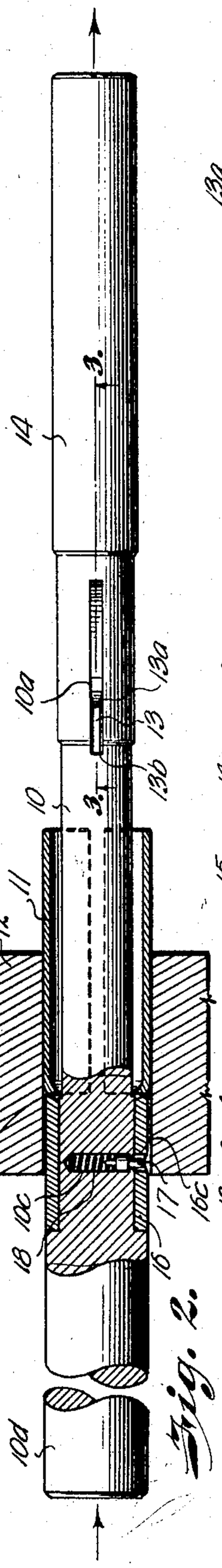

Fig. 2.

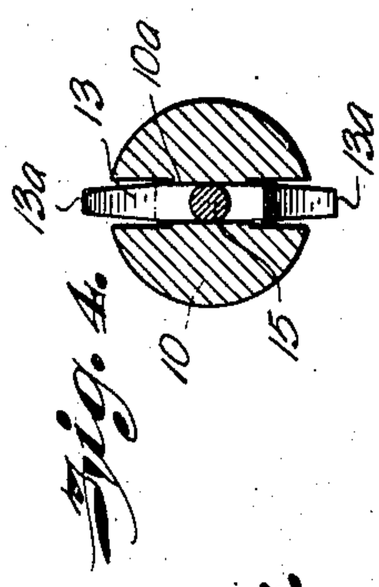

Fig. 4.

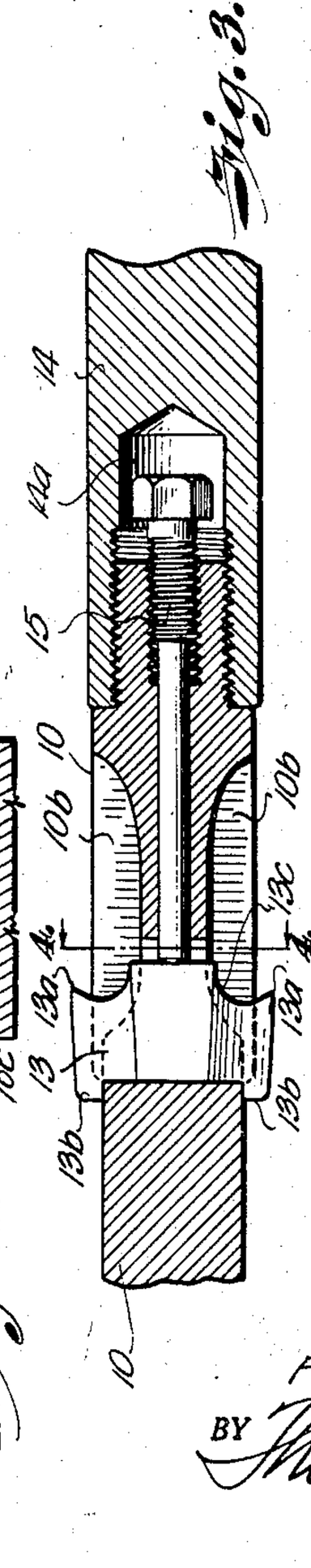

Fig. 3.

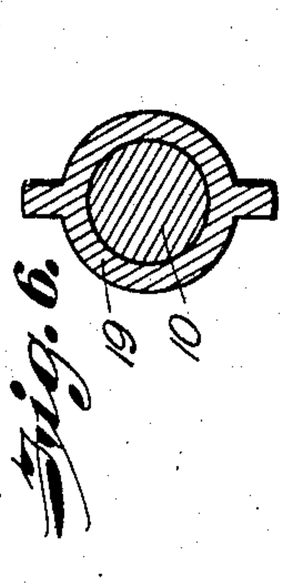

Fig. 6.

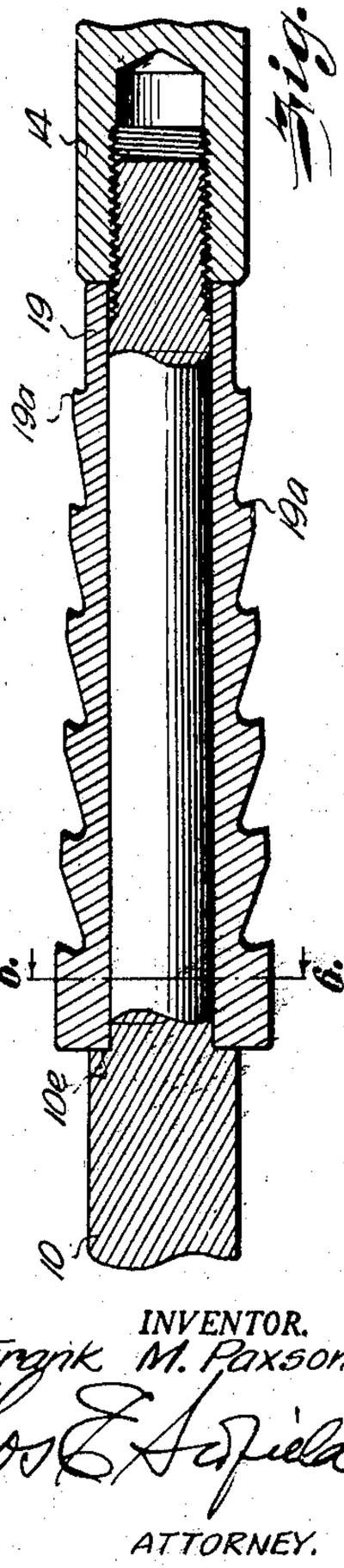

Fig. 5.

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DEVICE FOR REMOVING TUBES FROM HEAT EXCHANGE ASSEMBLIES

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1 Claim. (Cl. 7—14.1)

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My invention relates to new and useful improvements in tube extractors.

The tubes in heat exchange equipment rapidly become worn or corroded and require frequent replacement. However, their replacement is a tedious procedure since the ends of the tubes fit tightly in the tube sheets and are very difficult to remove.

The usual procedure is to cut the tubes transversely just outside of the tube sheets and then drive out each stub section of tubing with a suitable plug after the section has been weakened and loosened by manually splitting it with a gouge. However, this method is slow and tedious. Furthermore, it is inefficient since the tube sheets are frequently damaged by the gouge when the stub sections are split.

An important object of my invention is to provide a tool that will quickly and efficiently remove the stub sections of tubing from the tube sheets.

Another object of my invention is to provide a tool of the above mentioned character that will split the sections of tubing and drive them from the tube sheet in one continuous operation.

Still another object of my invention is to provide a tube extractor that will not cut or otherwise damage the tube sheet during removal of the tube sections.

Yet another object of my invention is to provide a tube extractor tool that is simple in construction and inexpensive to manufacture.

Other objects and advantages of my invention will be apparent during the course of the following description.

In the drawing forming a part of this specification and wherein like numerals are employed to designate like parts throughout the same,

Fig. 1 is a side elevation of a tube extractor tool embodying my invention and showing the manner in which a stub section of tubing is split longitudinally, parts of the tool being broken away and shown in section for clearness of illustration,

Fig. 2 is a side elevation of the tool showing the manner in which split sections of tubing are driven from the tube sheet, parts of the tool being broken away and shown in section,

Fig. 3 is a fragmentary longitudinal sectional view taken along the line 3—3 of Fig. 2,

Fig. 4 is a transverse sectional view taken on the line 4—4 of Fig. 3,

Fig. 5 is a longitudinal sectional view of a modified form of the invention, and

Fig. 6 is a transverse sectional view taken on the line 6—6 of Fig. 5.

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In brief, the tool embodying my invention is formed at one end with an elongated cylindrical guide portion which snugly fits within the tube section to be removed. The guide is inserted in the tube section to properly center and locate cutting blades which project radially from the body. At its other end the tool is adapted to connect with a pneumatic hammer which is operated to drive the cutting blades through the tube and split it longitudinally. During the splitting operation the guide centers the tool and prevents the blades from cutting or otherwise damaging the tube sheet. After the section of tubing has been split it is easily collapsed and driven from the sheet by an annular shoulder formed on the tool behind the cutting blades.

Referring now to the form of the invention shown in Figs. 1 through 4, the numeral 10 designates a tubular body of sufficiently small diameter to pass through a tube section 11 to be removed from the tube sheet 12.

A cutting blade 13 is removably mounted in a diametric slot 10*a* at substantially the middle of the body 10. The width of the blade is substantially equal to the outside diameter of the tubing 11 and its projecting ends are formed with cutting edges 13*a* which slice longitudinal strips from the tubing when the tool is driven therethrough. Formed on the blade are rearwardly projecting arms 13*b* which embrace body 10 holding the blade properly centered in slot 10*a* and preventing the blade from shifting laterally within the slot and cutting into the tube sheet. Bolt 15 extending longitudinally through the forward end of the body presses against blade 13, and holds it securely within the slot. The tool, itself, is centered within the tubing during the cutting operation by a cylindrical guide 14 threaded on the forward end of body 10 and adapted to fit snugly but slidably within the tubing 11. As best shown in Fig. 3, guide 14 is formed at its inner end with a socket 14*a* which accommodates the projecting head portion of bolt 15.

As the tool is driven through tubing 11, the cutting edges of blade 13 split the tube longitudinally. The narrow strips of metal 11*a* cut from the tubing are accommodated with cavities or recesses 10*b* formed in the body in advance of the cutting blade. As best shown in Fig. 3 the lower edges of the projecting cutters are arcuately curved, as at 13*c*, to direct strips 11*a* into the recesses.

After the tube section has been longitudinally split it can be easily collapsed and driven from tube sheet 12. This is done by a driving sleeve 16 removably mounted on body 10 behind blade

13. Sleeve 16 is preferably made of hardened metal and is formed with a concave forward end 16*a* which seats against the tube section 11 and drives it from the tube sheet. Driving sleeve 16 is preferably located a sufficient distance behind the cutting blade so that the cutting operation is completed before the sleeve engages the tube section. The driving sleeve is removably retained on the body by a detent 17 mounted in a socket 10*c* formed in the body behind the sleeve. A spring 18 normally urges the detent into a registering opening 16*c* in sleeve 16.

The tool can be driven to remove the tube section in any suitable manner; however, I prefer that the end 10*d* of the body be shaped to accommodate a pneumatic hammer.

The body 10 should be of lesser diameter than the smallest size tube for which the tool is to be used. However, cutting blade 13, guide 14 and driving sleeve 16 must be accurately dimensioned with respect to the particular tube to be removed. Guide 14 must snugly fit within the tube section to properly center the tool and prevent the blade 13 from cutting into the tube sheet. Blade 13 must accurately fit the outside diameter of the tube. The strips cut from the tube must be substantially its full thickness so that it can be properly collapsed and driven from the tube sheet by sleeve 16. Obviously, sleeve 16 must accurately fit the tube if it is to efficiently drive it from the sheet. Accordingly, I have made parts 14, 13 and 16 removable so that elements can be attached to the body which properly fit the particular tube section to be removed.

Referring now to the form of the invention illustrated in Figs. 5 and 6. I have here shown the cutting blade 13 and retaining bolt 15 replaced by a sleeve 19 formed with diametrically opposed radial cutting blades 19*a*. As best shown in Fig. 5 the blades gradually increase in width toward the rearward or upper end of the sleeve. The sleeve 19 is retained between an annular shoulder 10*e* formed on the body and the adjacent end of guide 14.

The latter form of the invention operates in the same manner as the first form. Blades 19*a* cut thin strips from the tube section as the tool is driven therethrough. After the blades have passed through the tube section it is collapsed by the driving sleeve 16 and driven from the tube sheet.

It may thus be seen that I have achieved the objects of my invention. I have provided a tube extractor that will rapidly and efficiently remove tube sections from a tube sheet in a single continuous operation and without cutting or otherwise damaging the tube sheet.

It is to be understoqd that the forms of the invention herewith shown and described are to be taken as preferred examples of the same and that various changes in the size, shape and arrangement of parts may be resorted to without departing from the spirit of my invention or the scope of the appended claim.

Having thus described my invention, I claim:

A tube extractor for removing tube sections from a tube sheet comprising a body adapted to pass through the tube to be extracted, a cutting blade of a width equal to the outer diameter of said tube carried by said body and extending radially therefrom whereby such tube is axially divided as said body is driven therethrough, an extension of reduced diameter rearwardly of said body, and a tube engaging shoulder on said extension spaced axially from said blade by a distance substantially greater than the thickness of the usual tube sheet, said shoulder being of a diameter to substantially fit said tube sheet so that said shoulder will engage the forward end of the tube operated upon after said blade has passed through such tube.

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