June 18, 1929. R. ARMSTRONG 1,717,487

TUBE PULLING DEVICE

Filed Aug. 4, 1927

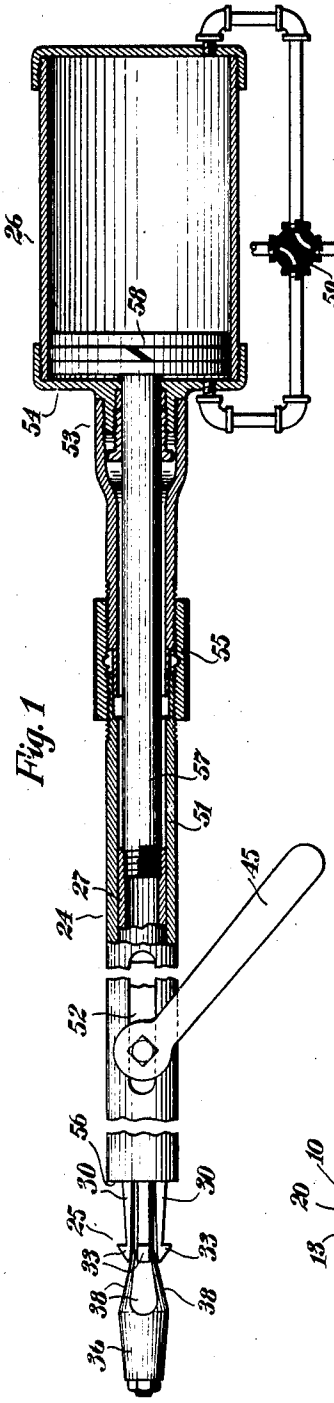


Fig. 1

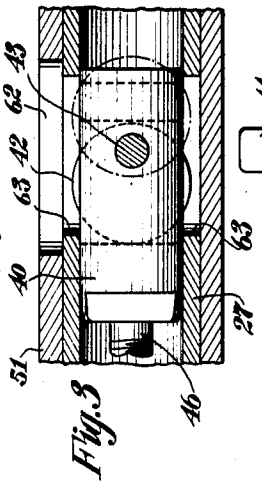


Fig. 3

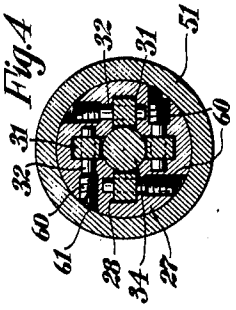


Fig. 4

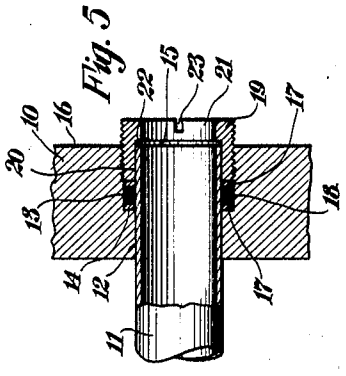


Fig. 5

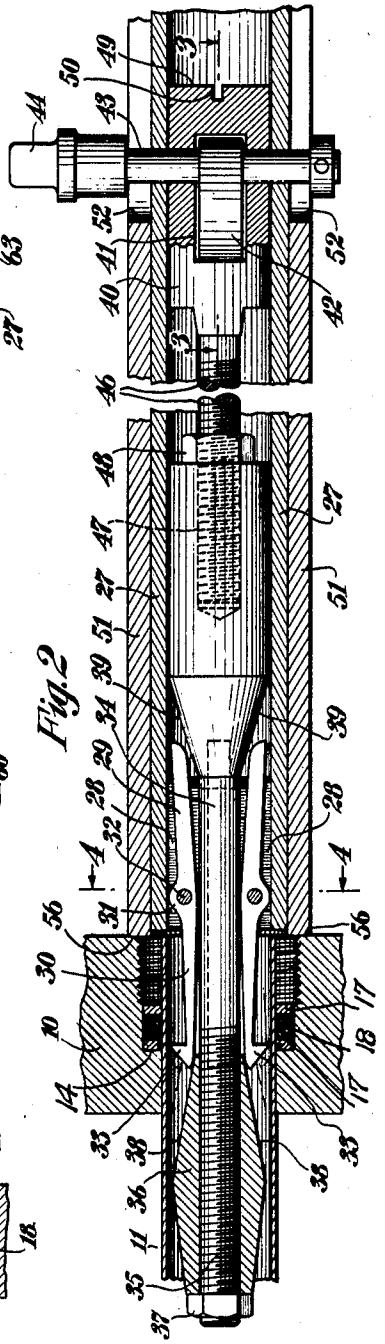


Fig. 2

INVENTOR

Robert Armstrong,

BY

Frederick Breitenfeld

ATTORNEY

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UNITED STATES PATENT OFFICE.

ROBERT ARMSTRONG, OF RIDGEFIELD, NEW JERSEY, ASSIGNOR OF ONE-TENTH TO FREDERICK BREITENFELD, OF NEW YORK, N. Y.

TUBE-PULLING DEVICE.

Application filed August 4, 1927. Serial No. 210,544.

My present invention relates generally to tools, and has particular reference to a tool or device for pulling tubes from a tube sheet.

Although I have illustrated and shall hereinafter describe a device which is primarily designed for the removal of tubes from a surface condenser, nevertheless it will be understood that as to certain phases of my invention a specific application of this character is not essential.

Before proceeding to describe my invention in detail, I will premise that a surface condenser comprises a series of tubes arranged in a parallel group, these tubes being supported at their ends by two tube sheets, each of which forms the inner wall of a chamber. Water is directed into the bottom of one chamber, thence through certain of the tubes to the other chamber, and thence back to other tubes to the first chamber and out. Steam is admitted, generally from above, into the main chamber which encloses the tubes, the steam being condensed by contact with the tubes and the condensed steam being generally led off from the bottom. It is of course essential that the steam chamber and the water chambers be securely sealed from each other, and accordingly, the mounting of the tubes between the two sheets necessitates the employment of suitable packing.

The tubes corrode and become otherwise worn out after a certain period of use, and the replacement thereof by new tubes has heretofore been beset with many great difficulties, principally due to the packing arranged at each end of each tube. This packing generally becomes hardened, it adheres to the tube and to the walls of the opening through which the tube extends, and it renders the withdrawal of the tube extremely difficult. Where the removal of a tube has been attempted by driving the tube, obvious difficulties have arisen because of the burring produced upon the tube end by the driving. This difficulty is aggravated by the fact that worn-out tubes are generally of greatly reduced thickness, the walls being sometimes extremely thin and the tube end presenting an almost razorlike edge. On the other hand, where the withdrawal of a tube has been attempted by a purely pulling or drawing action, difficulties have arisen in securely grasping the tube from the inside, and in effecting a prompt withdrawal of the obstinate hardened packing.

The difficulty last mentioned is perhaps the greatest. Although the tube may be securely engaged from the inside, it is frequently necessary to withdraw the tube for a distance of anywhere from six to eighteen feet before the packing itself yields. An entire gang of men is frequently necessary to effect the withdrawal of a single tube in this manner, although after the packing has yielded, a single workman can draw the entire length of tube (approximately twenty-five feet) out with great ease.

It is an object of my present invention to provide a tube-pulling device which will enable a single operator to initiate the withdrawal of the tubes in rapid succession without encountering any of the difficulties heretofore met with in practice and illustratively set forth above. More particularly, it is an object of my invention to provide a device which forcibly and positively withdraws the obstinate packing in a simple and efficient manner accompanied by an initial withdrawing of the tube for a distance as slight as approximately one foot. Once this initial withdrawal has been effected, a workman following in the path of the operator may withdraw the tube by hand with relative ease.

Another object of my invention is to provide a device which engages the tube and the packing in the positive manner mentioned and which is at the same time easily withdrawable itself from the tube after its function has been achieved.

One feature of my invention lies in providing tube-engaging means which is arranged and constructed to bite positively outwardly through the tube and into the encircling packing.

Another feature lies in providing means for limiting the initial insertion of the tube-engaging means to a predetermined extent, thereby rendering it possible to bite through successive tubes at exactly the right points to achieve the desired result.

Another feature of my invention lies in providing means for forcibly withdrawing the engaged tube and packing, and more particularly, by effecting this forcible with-

drawal by means which braces itself between the tube sheet itself and the tube being pulled.

A preferred form of construction provides the tube-engaging means in the form of radially reciprocable teeth, and it is a feature of my invention to provide exteriorly operable mechanism for positively controlling the reciprocation, both outwardly and inwardly, of the teeth.

It is a further feature of my invention to provide means for adjusting the amount by which the teeth may be made to bite outwardly through the tube, thereby rendering my device usable with different tubes of differing widths and thicknesses.

Other features of my invention lie in the particular arrangement and construction of parts hereinafter more fully described whereby I am enabled to provide a device which is simple and inexpensive from a manufacturing standpoint, easy and efficient from an operating standpoint, and highly capable of achieving its contemplated functions in a reliable manner.

For the attainment of the foregoing objects and such other objects as may hereinafter appear or be pointed out, I have illustrated one embodiment of my invention in the accompanying drawings in which—

Fig. 1 is a longitudinal view of a device embodying the features of my invention, portions being shown in cross-section for the sake of clearness;

Fig. 2 is a similar view upon a greatly enlarged scale of the forward or operative portion of my device in actual engagement with a tube to be withdrawn;

Fig. 3 is a fragmentary plan view taken substantially along the line 3—3 of Figure 2;

Fig. 4 is a cross-sectional view taken substantially along the line 4—4 of Figure 2; and

Fig. 5 is a cross-sectional view showing the normal disposition of a tube end in a tube sheet, and indicating the function for which my device is designed.

Referring for the moment to Figure 5, wherein I have illustrated the normal association between a tube sheet 10 and a single tube 11, it will be noted that the tube sheet is provided with a stepped bore, the inner portion 12 thereof being designed to receive the tube snugly therethrough and the outer portion 13 thereof being of increased diameter and thereby providing a shoulder 14 against which suitable packing is designed to be forced.

The tube is generally made to extend to a position wherein its outer surface or edge 15 is in substantial alignment with the outer surface 16 of the tube sheet 10. The packing which is forced against the shoulder 14 when the tube is initially inserted into the tube sheet may comprise two spaced leather washers 17 or the like and coil packing material 18 between said washers. After said packing has been inserted, a ferrule 19 is applied. The latter is externally threaded and engages with threads provided in the enlarged portions 13 of the bore. It will be noted that the ferrule is bored, having an inner bore portion 20 adapted to fit snugly about the tube end and having a somewhat reduced bore portion 21 arranged to provide a shoulder 22 which does not necessarily bear against the tube end 15 but which prevents any possible withdrawal or accidental displacement of the tube with respect to the tube sheet. The ferrule is generally provided with a groove 23 adapted to receive an instrument like a screw driver to facilitate the withdrawal thereof.

The assembly illustrated in Figure 5 shows clearly how water passing through the tube 11 (and the other tubes which are arranged in a parallel group and similarly mounted) may pass outwardly through the bore 21 and hence into the water chamber or water box at the right of the tube sheet 10 of Figure 5. At the same time, it will be noted that the space surrounding the tube at the left of the tube sheet 10 is efficiently sealed from the water by means of the packing which encircles the tube end.

In the replacement of the tubes, whereof the tube 11 may be considered typical, the ferrule 19 is first removed and the tube is then in readiness for the application thereto of the present device.

I have found that frictionally engaging the tube internally and then drawing the tube outwardly is not satisfactory for the reason that extreme force must be applied continually until the packing 17—18 yields and comes out. On the other hand, if the packing is withdrawn, the tube may be pulled out by hand.

In Figure 1 I have illustrated the principal elements of my completely assembled tube-pulling device. The device comprises an elongated portion 24, a forward operative or tube-engaging portion 25, and a piston and cylinder arrangement 26 at the opposite end. These elements will be presently described in greater detail, but I will mention at this point that the operative end 25 is designed to be inserted into the tube end, the tube-engaging means is then rendered operative, the piston is then forced to move in the cylinder, and the tube is thereby forcibly withdrawn by the amount of the piston travel, the packing encircling the tube being at the same time forcibly and positively engaged and withdrawn during this slight movement of withdrawal.

Referring now to Figure 2, I provide an elongated axially bored member 27 provided at its forward end with four radially dis-

posed recesses or grooves 28, these recesses being arranged at substantially 90° to each other and two opposite ones thereof being shown in Figure 2. These recesses extend radially outwardly from the forward portion of the axial bore to points short of the external periphery of the member 27.

Pivotally mounted in each recess is a rocker having a rear arm 29, a forward arm 30, and a medially pivoted portion 31. A suitable pivot pin 32 is made to extend transversely across the recess or groove within which the rocker is disposed.

The forward portion or arm 30 of the rocker extends outwardly beyond the forward end of the member 27. These forwardly extending portions or arms are clearly disclosed in Figure 1. At the forward end of each arm 30, I provide an outwardly disposed tooth 33 preferably pointed or wedge-shaped so that radially outward movement of the tooth will cause it to bite through whatever it encounters.

The teeth 33 are in this way designed for radial reciprocation, and I provide externally controllable mechanism for effecting this reciprocation in a positive manner in either direction. This mechanism comprises a longitudinally reciprocable rod 34 arranged in the bore of the member 27, the forward portion 35 being externally threaded and extending considerably beyond the teeth 33. Mounted upon this externally threaded portion 35 is an internally threaded adjustable wedge member 36 whose positional relationship upon the rod 34 is controllable and variable by simply screwing the member 36 upon the portion 35. A suitable lock nut 37 is provided at the forward end of the portion 35.

The rearwardly disposed surface 38 of the member 36 is substantially conical or, more accurately, pyramidal, it being contemplated that rearward movement of the rod 34 will cause the engagement of the surfaces 38 with the rear surface of the teeth 33 to move the latter radially outwardly.

Immediately behind the recesses 28, the bore in the member 27 enlarges, and the rod 34 also enlarges, to provide a conical or pyramidal surface or wedge portion 39 oppositely disposed with respect to the surface 38. It is contemplated that forward movement of the rod 34 will cause the engagement of the surface 39 with the rear surfaces of the arms 29 to pivot the rockers so as to move the teeth 33 radially inward.

In other words, the exteriorly controlled reciprocation of the rod 34 in either one or the other direction will cause the teeth 33 to be forcibly and positively moved either outwardly or inwardly. The positional adjustability of the wedge surface 38 permits the extent of this radial reciprocation of the teeth to be controlled. The nearer the wedge surface 38 is to the wedge surface 39 (assuming the reciprocable movement of the rod 34 is constant), the greater will be the radial reciprocation of the teeth.

To control this reciprocation of the rod 34, I provide a rear portion 40 of the rod 34 with a transverse slot 41 within which an actuating eccentric 42 is mounted. The longitudinal length of the slot 41 is substantially equal to the diameter of the eccentric 42. The latter is mounted upon a pivot pin 43 which extends transversely through the walls of the member 27 and whose rotation will obviously effect a reciprocal movement of the rod 34. This rotation is designed to be effected by manual means, and for this reason one end of the pin 43 is squared, as at 44 and is designed to receive a wrench 45 or similar tool.

For the sake of lightness and ease of manufacture and assembly, the portion 40 of the rod 34 is not integral with the forward portion thereof but is associated therewith by means of a reduced threaded portion 46 extending forwardly from the portion 40 and engaging within a suitable threaded bore 47 provided in the rearward portion of the rod 34. A lock nut 48 may also be provided, and the rear surface 49 of the portion 40 may advantageously be provided with a groove 50 for receiving a screw driver or the like in the initial assembly of the device.

The tube-engaging means which may be said broadly to include the member 27 and the various elements associated therewith and heretofore described, is designed to be forcibly withdrawn from the tube sheet 10 after the tube and encircling packing has been engaged by the teeth 33. I will now describe the means which I provide for accomplishing the dual purpose of (*a*) facilitating this withdrawal by cooperation with the tube sheet 10, and (*b*) rendering the extent of the initial insertion of the teeth and the tube end adjustably uniform for a given set of tubes.

A sheath or abutment member 51 encircles the entire member 27 and is provided with oppositely disposed longitudinal slots 52 for permitting passage therethrough of the pin 43. Reference to Figure 1 will show how the sheath 51 extends rearwardly into connection at 53 with the forward cylinder head 54 of the piston and cylinder arrangement 26. The sheath 51 is made in two longitudinal adjustable sections, the adjacent portions thereof being provided with left and right-hand threads respectively. An internally threaded adjusting collar 55 engages both of these adjacent ends, and it will be obvious that rotation of the collar 55 will draw the two sections toward each other or away from each other and thereby reduce or extend the total length of the sheath 51.

The forward end 56 of the sheath 51 is adapted to bear against the outer surface 16 of the tube sheet 10 and thereby form an abutment which limits the extent to which the teeth 33 may be initially inserted. By adjusting the total length of the sheath 51, the extent of insertion of the teeth 33 may be adjusted.

The rear end of the member 27 is suitably connected to a connecting rod or member 57 which extends rearwardly through the sheath 51 into connection with the piston 58. A valve 59 is adapted to control the reciprocal movement of the piston 58 in either one or the other direction.

When the device is employed, the wedge member 36 is first adjusted so that the outward movement of the teeth 33 will be sufficient to bite through the tube to be withdrawn, and not only bite completely through the latter but also to engage the encircling packing. The adjustment of the wedge member 36 is therefore designed to compensate for varying diameters and thicknesses of tubes being withdrawn. With the teeth in retractive position (with the rod 34 positioned forwardly to its full extent), the forward operative end of the device is inserted into the tube to be withdrawn. The extent of this insertion must be adjusted (by the adjustment of the length of sheath 51) so that the teeth will be substantially aligned with the shoulder 14 in the tube sheet 10. Inasmuch as these shoulders are uniformly positioned in any one tube sheet, an initial adjustment of the sheath 51 will render the device usable without further adjustment in the withdrawal of all the tubes from that particular tube sheet.

The operative end having been inserted to the proper extent, the tool 45 is applied to rotate the pivot pin 43 and thereby force the rod 34 rearwardly. When this occurs, the wedge surface 38 forces the teeth 33 radially outwardly, and the leverage afforded by the eccentric 42 and the tool 45 causes the teeth to bite entirely through the tube 11 and into the innermost portion of the encircling packing. If the sheath 51 is carefully adjusted, the teeth will bite almost exactly between the shoulder 14 and the adjacent packing thereby engaging the latter in a positive manner.

The valve 59 is then turned to admit compressed air, steam, or other working fluid, to the left-hand side of the piston 58, as the latter is shown in Figure 1. The pressure will force the piston 58 to the right, and the cylinder head 54 to the left, thereby forcibly withdrawing the tube and the engaged packing outwardly with respect to the tube sheet 10. In other words, the sheath 51 serves as an abutment member which braces itself against the tube sheet 10.

The valve 59 is then turned to return the piston 58 to its initial position, and the tool 45 is again manipulated to force the rod 34 to the left. The latter movement releases the teeth 33 in a positive manner from the engaged tube and packing, and the entire device may then be withdrawn with great ease from the tube end. Thereafter, a workman may withdraw the entire tube 11 by hand, inasmuch as the packing has been positively withdrawn.

As to certain phases of my invention, the structural details are immaterial. In Figure 4 I have illustrated a preferred method of mounting the rockers in the recesses 28. Each pin 32 is provided with an externally threaded head 60, the latter being engageable with the internal threads 61 of a bore provided at the suitable point in the member 27. Each of the latter bores may be made to extend from the exterior surface of the member 27 to a point short of the opposite surface, each bore obviously extending along a chordal line. The heads 60 are so designed that they will countersink themselves within the bores 61 and thereby permit the member 27 to present only a smooth external surface.

In Figure 3 I have illustrated the preferable arrangement of a longitudinal slot 62 in the sheath 51, and the arrangement of a pair of slots 63 in the member 27, the slots 62 and 63 being aligned with the slot 41 and serving to permit the eccentric 42 to move between two positions shown in Figure 3. The slot 62 is provided in only one side of the sheath 51, and when the eccentric is moved, it is moved in the direction which passes it through the slot 62. The reason for this is that if a similar slot were provided in the opposite side of the sheath 51 it would be essential to maintain the eccentric 42 in the exact dead center position, otherwise the force of the piston might tend to dislodge it and thereby cause a release of the teeth 33. I prefer to swing the eccentric slightly beyond the dead center position in each case, i. e., toward the unslotted wall of the sheath 51, thereby preventing any dislodgement of the eccentric due to the instability of the dead center position.

By means of my device, I am enabled to effect the desired initial withdrawal of tubes and packing in extremely rapid succession. Only two men are therefore required to effect an efficient total withdrawal of all tubes. When it is considered that whole gangs of men where heretofore required to withdraw even one tube, and that the withdrawal of one tube has frequently necessitated a wholly unreasonable amount of time, the advantages of my device will be obvious.

It will be understood that the details herein described and illustrated for the purpose of explaining the nature of my invention may be changed by those skilled in the art

to suit varying requirements 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. In a device for pulling a tube from a tube sheet, tube-engaging means insertable into the tube, said means being arranged and constructed to bite outwardly through the tube and the encircling packing, exteriorly controllable mechanism for rendering said engaging means operative, and means for operatively interposing an expansible medium between the tube sheet and the engaging means for drawing the latter out with respect to the tube sheet.

2. In a device for pulling a tube from a tube sheet, tube-engaging means insertable into the tube, said means being arranged and constructed to bite outwardly through the tube and the encircling packing, exteriorly controllable mechanism for rendering said engaging means operative, means operatively interposed between the tube sheet and the engaging means for drawing the latter and hence the tube out with respect to the tube sheet, and adjustable means independent of said tube drawing means for limiting the insertion of the engaging means to a predetermined extent, whereby the entire packing may be positively engaged.

3. In a device for pulling a tube from a tube sheet, tube-engaging means insertable into the tube, said means being arranged and constructed to bite outwardly through the tube and the encircling packing, exteriorly controllable mechanism for rendering said engaging means operative, an adjustable member adapted to bear against the tube sheet, means operatively interposed between said member and the engaging means for drawing the latter and hence the tube out with respect to the tube sheet, and means independent of said tube drawing means for initially adjusting said member into predetermined relationship with respect to the engaging means, whereby the insertion of the latter may be predeterminedly limited in extent.

4. In a device for pulling a tube from a tube sheet, tube-engaging means insertable into the tube, said means being arranged and constructed to bite outwardly through the tube and the encircling packing, exteriorly controllable mechanism for rendering said engaging means operative, and means operatively interposed between the tube sheet and the engaging means for drawing the latter out with respect to the tube sheet, said last named means comprising a cylinder and piston, one thereof being braced against the tube sheet and the other being connected with the engaging means.

5. In a device for pulling a tube from a tube sheet, tube-engaging means insertable into the tube, said means being arranged and constructed to bite outwardly through the tube and the encircling packing, exteriorly controllable mechanism for rendering said engaging means operative, and means operatively interposed between the tube sheet and the engaging means for drawing the latter out with respect to the tube sheet; said last named means comprising a cylinder and piston, the latter being connected with the engaging means, and an abutment member adapted to bear against the tube sheet and connected with the cylinder.

6. In a device for pulling a tube from a tube sheet, tube-engaging means insertable into the tube, said means being arranged and constructed to bite outwardly through the tube and the encircling packing, exteriorly controllable mechanism for rendering said engaging means operative, and means operatively interposed between the tube sheet and the engaging means for drawing the latter out with respect to the tube sheet; said last named means comprising a cylinder and piston, the latter being connected with the engaging means, and an adjustable abutment member adapted to bear against the tube sheet and connected with the cylinder; and means for initially adjusting the abutment member with respect to the engaging means so as to predeterminedly limit the insertion of the latter.

7. In a device for pulling a tube from a tube sheet, tube-engaging means insertable into the tube, said means being arranged and constructed to be radially reciprocable and to bite outwardly through the tube, and exteriorly operable mechanism for controlling the reciprocation in both directions of said engaging means.

8. In a device for pulling a tube from a tube sheet, tube-engaging means insertable into the tube, said means being arranged and constructed to be radially reciprocable and to bite outwardly through the tube, and exteriorly operable mechanism for controlling the reciprocation in both directions of said engaging means, said mechanism including a pair of oppositely arranged substantially conical wedges mounted so as to be axially adjustable into and out of concentric relationship to said means.

9. In a device for pulling a tube from a tube sheet, tube-engaging means insertable into the tube, said means being arranged and constructed to be radially reciprocable and to bite outwardly through the tube, and exteriorly operable mechanism for con-

trolling the reciprocation in both directions of said engaging means, said mechanism comprising a pair of longitudinally reciprocable substantially conical wedges, and means for reciprocating the latter.

10. In a device for pulling a tube from a tube sheet, tube-engaging means insertable into the tube and comprising a set of radially reciprocable teeth arranged and constructed to bite through the tube and the encircling packing, and means for positively controlling the reciprocation in either direction of said teeth.

11. In a device for pulling a tube from a tube sheet, tube-engaging means insertable into the tube and comprising a set of radially reciprocable teeth arranged and constructed to bite through the tube and the encircling packing, and mechanism for positively controlling the reciprocation of said teeth, said mechanism including a pair of substantially conical wedges mounted for longitudinal axial reciprocation and engageable with said teeth when reciprocated.

12. In a device for pulling a tube from a tube sheet, tube-engaging means insertable into the tube and comprising a set of radially reciprocable teeth arranged and constructed to bite through the tube and the encircling packing, mechanism for positively controlling the reciprocation of said teeth, said mechanism including a substantially conical wedge mounted for longitudinal axial reciprocation and engageable with said teeth when it is reciprocated, and means for limiting the extent of reciprocation of said wedge so as to control the extent of outward movement of the teeth.

13. In a device for pulling a tube from a tube sheet, an elongated member, a set of radially reciprocable teeth carried at the end of said member and insertable into the tube, and remotely controlled means for reciprocating said teeth in either direction so as to cause them either to bite outwardly through the tube or to retract into compact relation within the tube.

14. In a device for pulling a tube from a tube sheet, an elongated member, a set of radially reciprocable teeth carried at the end of said member and insertable into the tube, and means for reciprocating said teeth to cause them either to bite outwardly through the tube or to retract into compact relation within the tube; said means comprising a set of rockers pivotally mounted in said end and carrying said teeth, and mechanism for pivoting said rockers.

15. In a device for pulling a tube from a tube sheet, an elongated member, a set of radially reciprocable teeth carried at the end of said member and insertable into the tube, and means for reciprocating said teeth to cause them either to bite outwardly through the tube or to retract into compact relation within the tube; said means comprising a set of rockers pivotally mounted in said end and carrying said teeth, and mechanism for pivoting said rockers; said mechanism comprising a longitudinally reciprocable rod having wedge portions adapted to encounter said rockers when the rod is reciprocated.

16. In a device for pulling a tube from a tube sheet, an elongated member, a set of radially reciprocable teeth carried at the end of said member and insertable into the tube, and means for reciprocating said teeth to cause them either to bite outwardly through the tube or to retract into compact relation within the tube; said means comprising a longitudinally reciprocable rod having wedge portions engageable with the teeth when the rod is reciprocated; and means for positionally adjusting said wedge portions to control the amount of tooth reciprocation.

17. In a device for pulling a tube from a tube sheet, an elongated member, a set of radially reciprocable teeth carried at the end of said member and insertable into the tube, and means for reciprocating said teeth to cause them either to bite outwardly through the tube or to retract into compact relation within the tube; said means comprising a set of rockers pivotally mounted in said end and carrying said teeth, and mechanism for pivoting said rockers; said mechanism comprising a longitudinally reciprocable rod having wedge portions adapted to encounter said rockers when the rod is reciprocated; and means for positionally adjusting said wedge portions to control the amount of tooth reciprocation.

18. In a device for pulling a tube from a tube sheet, an axially bored elongated member, a set of radially reciprocable teeth carried at the end thereof and insertable into the tube, a set of rockers pivotally mounted in said end and carrying said teeth, each rocker being arranged to pivot in a radial plane about a midportion thereof, a longitudinally reciprocable rod in said bore, and wedge portions on said rod and arranged to encounter and pivot said rockers when the rod is reciprocated, one of said wedge portions being adjustably mounted on the rod to permit positional adjustment thereof and thereby control the amount of tooth reciprocation.

19. In a device for pulling a tube from a tube sheet, an axially bored elongated member, a set of radially reciprocable teeth carried at the end thereof and insertable into the tube, a set of rockers pivotally mounted in said end and carrying said teeth, each rocker being arranged to pivot in a radial plane about a midportion thereof, a longitudinally reciprocable rod in said bore, means carried by said rod for engaging and

pivoting the rockers when the rod is reciprocated, and exteriorly controllable mechanism for reciprocating said rod; said mechanism comprising an eccentric mounted on a transverse axis in said elongated member and engageable with the rod to reciprocate the latter when the eccentric is rotated.

20. In a device for pulling a tube from a tube sheet, tube-engaging means comprising an elongated member having a set of longitudinal recesses arranged in the exterior of one end thereof, a set of rockers pivotally mounted in said recesses respectively, each rocker having an end extending beyond the end of said member and provided with an outwardly disposed tooth at said end; and means for pivoting said rockers to move the teeth radially outwardly or inwardly.

21. In a device for pulling a tube from a tube sheet, tube-engaging means comprising an axially bored elongated member having a set of longitudinal recesses arranged in the exterior of one end thereof, a set of rockers pivotally mounted in said recesses respectively, each rocker being pivoted at a midportion thereof and provided with an outwardly disposed tooth at its outermost end; and means for pivoting said rockers so as to move the teeth in radial directions either outwardly or inwardly; said means comprising a rod reciprocably mounted in said bore and provided with spaced and oppositely arranged wedge portions which engage opposite ends of said rockers respectively when the rod is reciprocated.

22. In a device for pulling a tube from a tube sheet, a tube-engaging means insertable into the tube and including an axially bored elongated member; and mechanism for controlling the operation of said means, said mechanism comprising a slotted rod reciprocably mounted in said bore and arranged to operate said means when reciprocated, and exteriorly controllable mechanism engaging said slot for reciprocating said rod.

23. In a device for pulling a tube from a tube sheet, tube-engaging means insertable into the tube and including an axially bored elongated member; and mechanism for controlling the operation of said means, said mechanism comprising a slotted rod reciprocably mounted in said bore and arranged to operate said means when reciprocated, a pivot pin mounted in the elongated member at right angles to the slot, and an eccentric on said pin and in said slot and so arranged that rotation of the pin will cause the eccentric to engage the end walls of the slot to reciprocate said rod.

In witness whereof I have signed and sealed this specification this 27th day of July, 1927.

ROBERT ARMSTRONG.