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J. E. LONGLEY ET AL

2,911,859

METHOD FOR TAPPING PIPE

Filed April 22, 1955

4 Sheets-Sheet 1

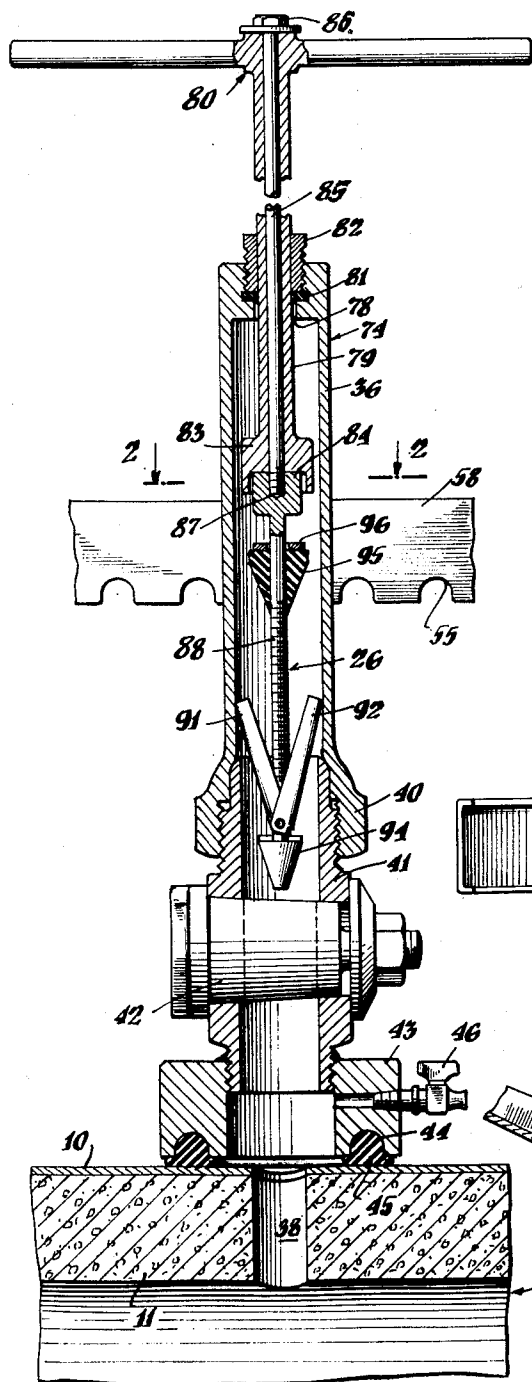


Fig. 1

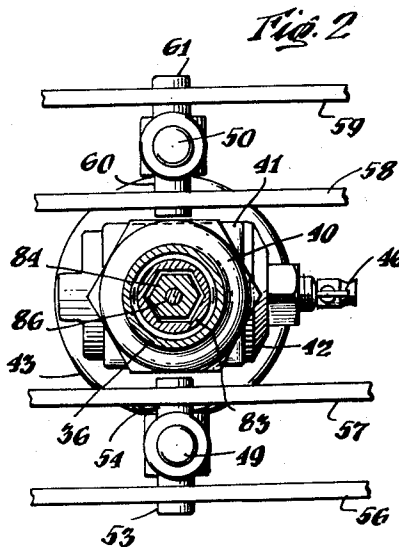


Fig. 2

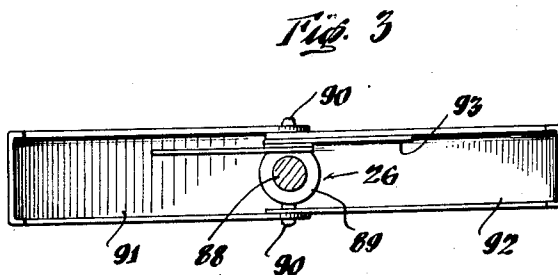


Fig. 3

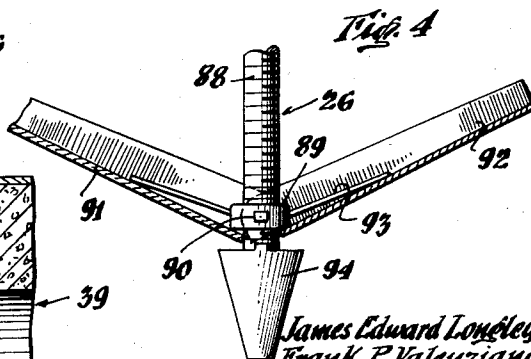


Fig. 4

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4 Sheets-Sheet 2

Fig. 5

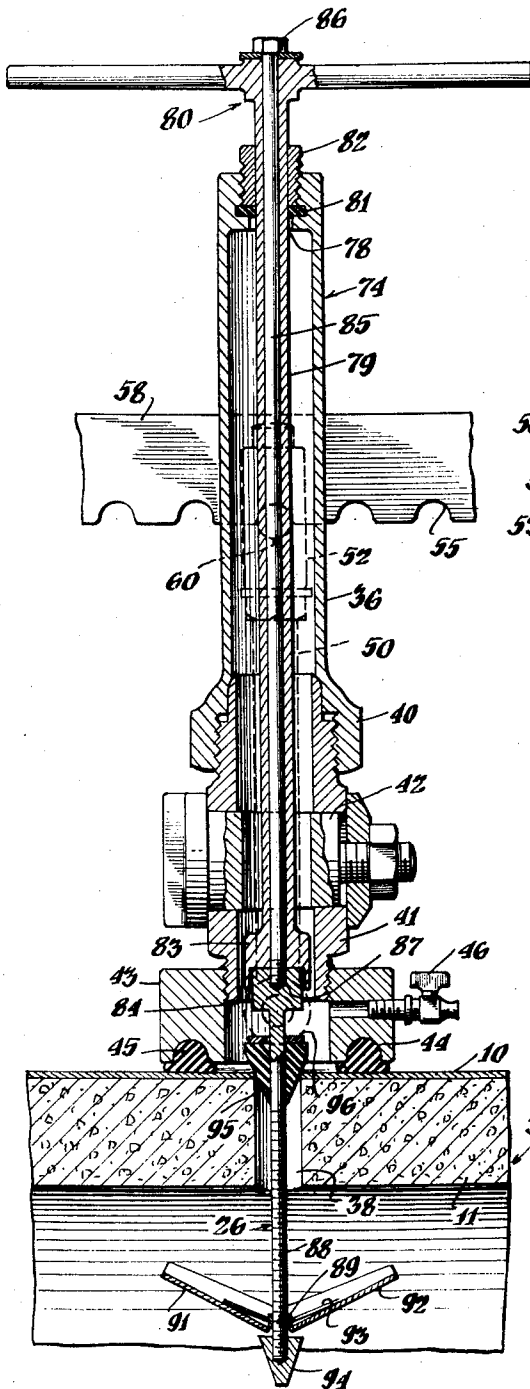
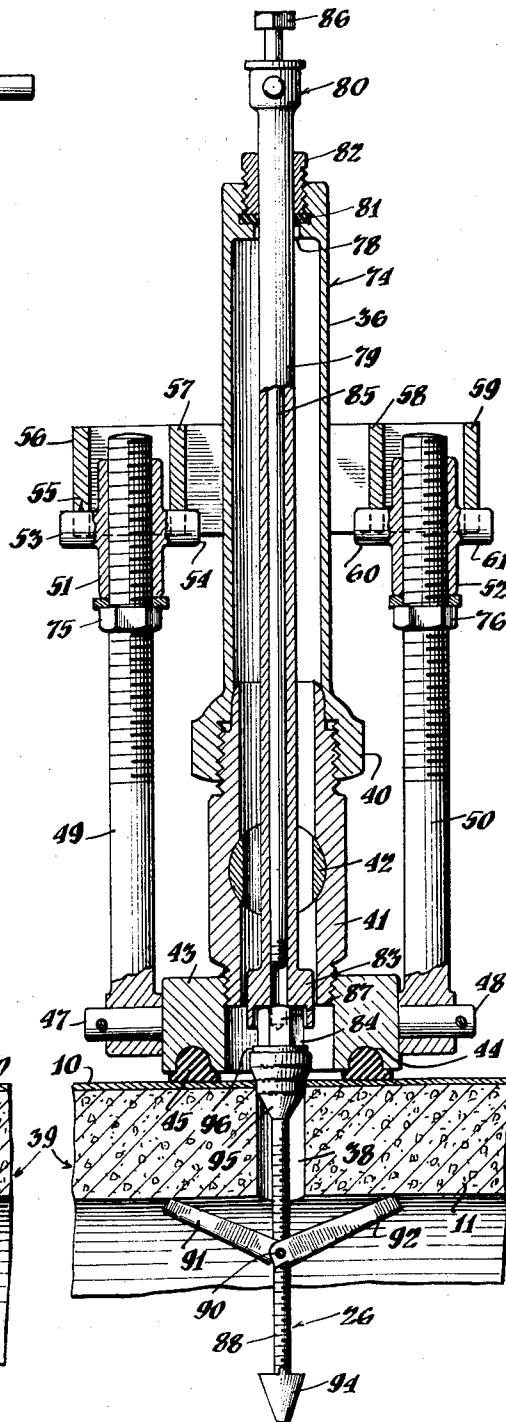


Fig. 6



Nov. 10, 1959

J. E. LONGLEY ET AL
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Filed April 22, 1955

4 Sheets-Sheet 3

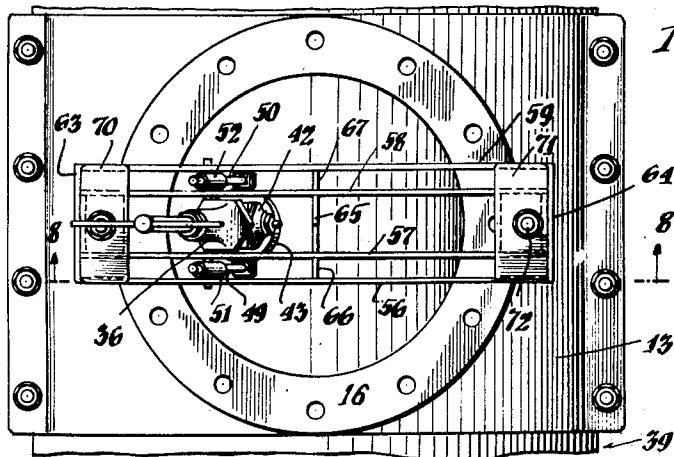


Fig. 7

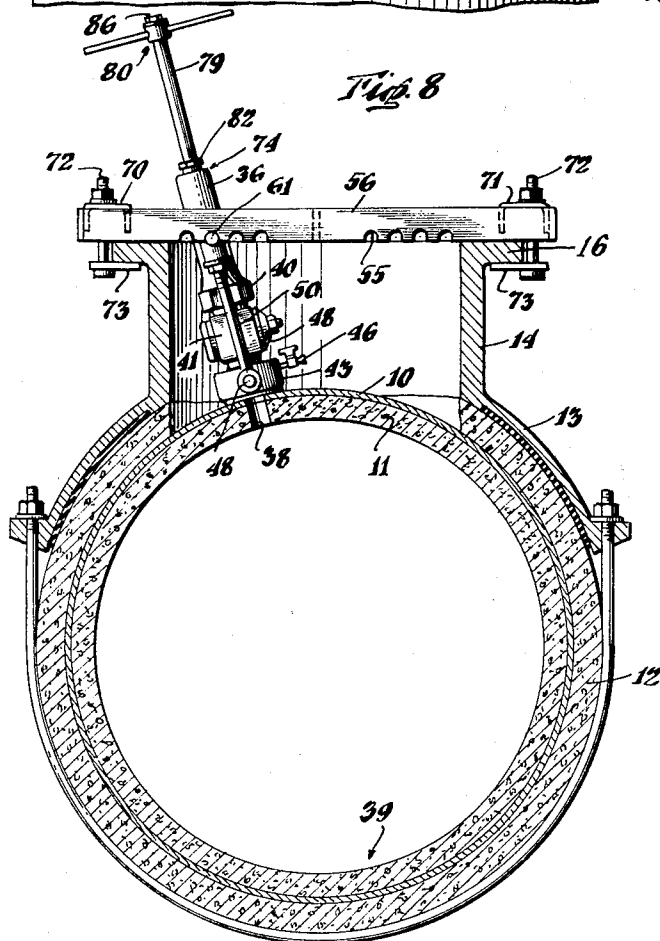


Fig. 8

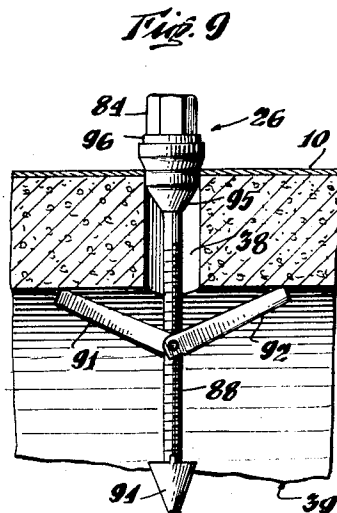


Fig. 9

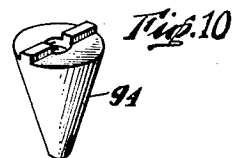


Fig. 10

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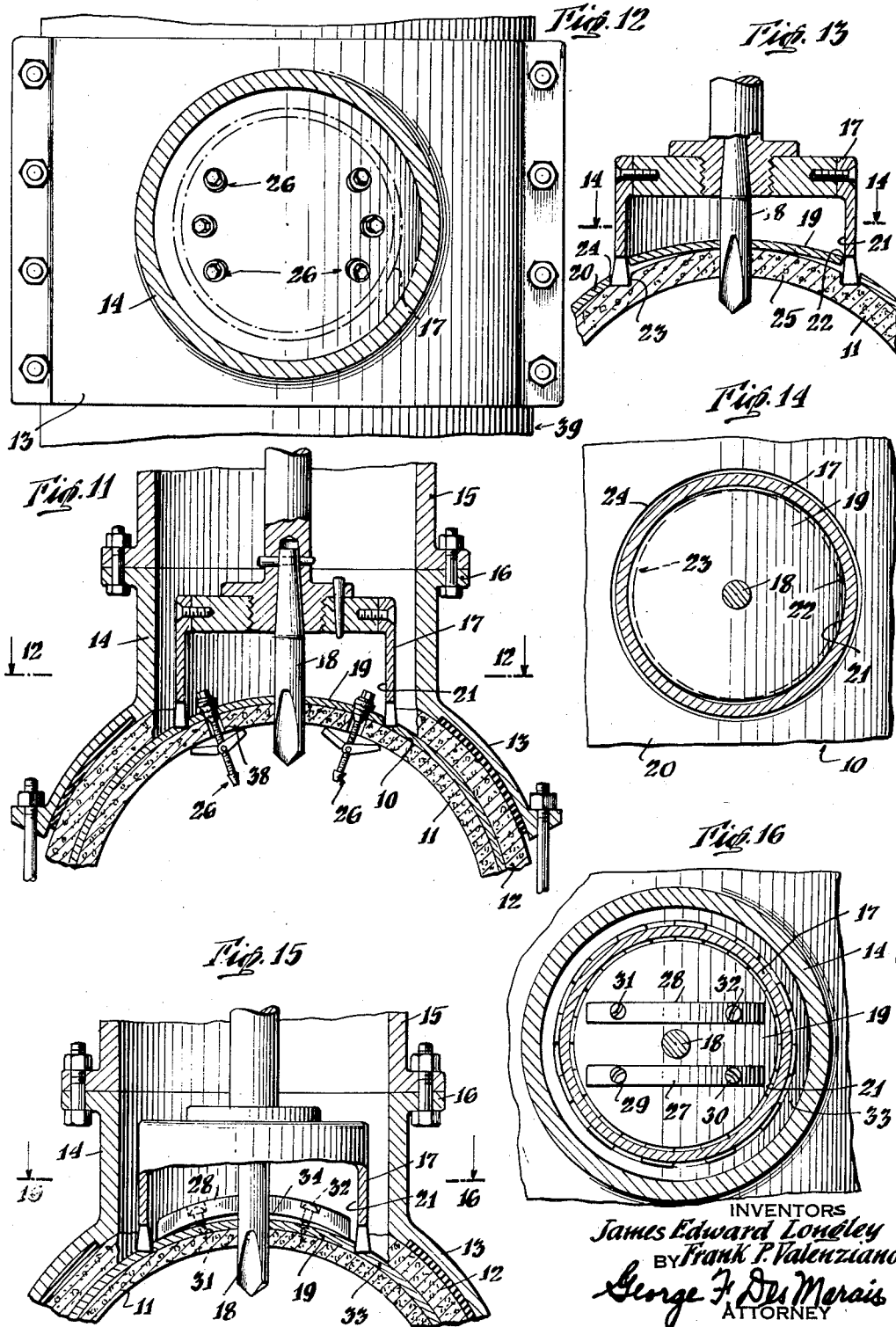
J. E. LONGLEY ET AL

2,911,859

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Filed April 22, 1955

4 Sheets-Sheet 4



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2,911,859

METHOD FOR TAPPING PIPE

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3 Claims. (Cl. 77-42)

This invention relates to the tapping of pipes and, more particularly, to a method and means for removing a core from a pipe wall comprising a metal sleeve and a lining of an inflexible material such as concrete or other hardened cementitious material. The principal purpose of the present invention is to cut through the wall of such a pipe without having the lining material within the area of the tap drop into the pipe.

The walls of certain types of pressure pipe used in water distribution systems contain steel sleeves which are lined with concrete. The sleeve is formed by rolling a sheet or strip of metal and fastening its adjacent edges to complete the sleeve. Owing to strains induced in the metal during the rolling operation, a rolled sheet unfurls or opens up from its fully rolled state unless it is restrained.

In using a circular cutter to tap an opening in the wall of a pipe having a steel sleeve surrounding an inner tube, a circular piece of steel is severed from the main body of the sleeve before the inner tube is cut through, and the severed piece of steel springs open from its original curvature. Upon the happening of this, the severed piece of steel becomes firmly engaged to the inside wall of the cutter, but its rotation with the cutter is repressed because of the underlying material of the inner tube which is fast in place, so that the completion of the cutting operation is seriously interfered with.

The severed piece of steel is held in a bowed condition at a radius greater than its original radius. As the cutter rotates it tends to carry the piece of steel with it and there ensues considerable reaction between the severed piece and the stationary inner tube or lining of solid material which has yet to be severed from the pipe wall. Whenever the lining material is relatively thin, or the metal sleeve is relatively thick, and in any case, when tapping holes of large diameters, the forces acting between the severed piece of the sleeve and the lining material frequently cause the lining material within the area of the tap to fail and fall into the pipe. The present method facilitates the cutting operation and prevents this from happening.

The steel sleeve and the lining material within the area of the hole to be made in the pipe are tied or clamped together in such a manner as to prevent any appreciable change in the original curvature of the severed piece of steel so that the advancing cutter proceeds through the wall of the pipe without undue interference and the severed piece of the sleeve and the underlying portion of the lining are recoverable as in one piece at the conclusion of the cutting operation.

It is also an object of the invention to provide means for placing a fastening bolt in a hole in a wall of a pipe containing fluid under pressure.

Other and more detailed objects will be referred to hereinafter in the accompanying specification and in the drawings in which the best mode contemplated for carrying out the invention is disclosed.

In the drawings:

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Fig. 1 is a sectional view through the axis of a machine for placing a fastening bolt in a hole in the wall of a pipe containing fluid under pressure;

Fig. 2 is a section on line 2-2 of Fig. 1;

5 Figs. 3 and 4 are details of the stem end of a toggle bolt;

Fig. 5 is a sectional view similar to that shown in Fig. 1 but with parts of the machine displaced;

Fig. 6 is a sectional view of the machine at right angles to the views shown in Figs. 1 and 5;

10 Fig. 7 illustrates the bolt-placing machine mounted on a pipe;

Fig. 8 is a section on line 8-8 of Fig. 7;

15 Fig. 9 shows a toggle bolt in seizing relationship with the metal and concrete;

Fig. 10 shows a guide for the stem end of a toggle bolt;

Fig. 11 is a section taken through the axis of a cutter of a cutting machine in a plane crosswise of a pipe;

Fig. 12 is a view on line 12-12 of Fig. 11;

20 Fig. 13 is a section through the axis of a cutter of a cutting machine and shows diagrammatically how a loose sleeve portion of core flexes to bind with the cutter;

Fig. 14 is a section on line 14-14 of Fig. 13 illustrating the projected area of the sleeve portion of the core shown in Fig. 13;

25 Fig. 15 shows a manner of preventing the increase of the radius of curvature of the freed sleeve portion of the core; and

Fig. 16 is a view on line 16-16 of Fig. 15.

30 The invention is useful for tapping practically any type of a pipe which has a wall including a metal sleeve outside of a tube or of a lining of a solid material from which a circumscribed piece of the sleeve may be separated, and therefore the following description is not intended to limit the application of the invention to any particular type of pipe.

35 In Figs. 7 and 8 there is illustrated a portion of a pressure pipe which includes a steel sleeve or cylinder 10 and a tube of solid material 11, such as hardened concrete within the sleeve. The sleeve 10 is formed by rolling a rectangular sheet of steel into cylindrical form and butt-welding its longitudinal edges. The concrete may have been placed against the inner surface of the sleeve in any suitable manner as by the use of a centrifuging machine.

40 The pipe which is illustrated has a protective covering of mortar 12 outside of the steel sleeve. When a branch connection is to be made a saddle 13 is fastened to the pipe and the mortar covering 12 is chipped away within the saddle opening defined by the neck 14 of the saddle.

45 For tapping a hole in a pipe a cutting machine having a connecting member 15, Fig. 11, is attached to the flange 16 at the free end of the saddle-neck and a circular cutter 17 is rotated as it is advanced through the wall of the pipe. The cutter is centered by a drill 18.

50 In cutting a hole in pipes having solid walls, such as a monolithic wall of concrete or a wall composed entirely of steel, it is possible to cut through the wall and then remove the severed core in one piece upon retracting the cutter through the neck of the saddle, but when the pipe wall includes a rolled sleeve of a resilient metal outside of an inner tube, the completing of a cut presents a greater problem. This is because the steel portion of the core to be removed opens up upon being severed from the sleeve.

55 As diagrammatically illustrated in Fig. 13, the severed piece of steel 19 is sprung open to a radius greater than the radius of the steel sleeve 20, and the extremities of the arc are shown in contact with the inside surface 21 of the cutter 17. In a plane normal to the axis of the cutter, as shown in Fig. 14, the portions of the edge of the severed piece of steel engage the inner wall of the cutter at the ends of the major axis of an ellipse 22, of which the minor axis is equal to the diameter of the cutting

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circle 23 which is indicated by a broken line. The kerf of the cut is between the circles 23 and 24.

The severed piece of steel has seized upon the inner surface of the cutter, and the rotation of the cutter is resisted by the engagement of the piece with the stationary tube as the axis of curvature of the piece becomes angularly displaced from the plane containing the axis of the tube and the center of the cutter. In rotating, the severed piece of steel would press against the underlying portion of the tube with considerable force and interfere with the cutting operation.

In accordance with the present invention, seizure between the severed piece of steel and the inside of the cutter is avoided by retaining as close as possible the original curvature of the portion of the steel sleeve located within the cutter. This may be accomplished by tying this portion of the sleeve to the concrete lining 25 by tying or fastening devices such as bolts 26 placed through the wall of the pipe within the area defined by the perimeter of the core which is to be removed, as generally illustrated in Figs. 11 and 12.

Another manner of preventing a change of curvature of the steel circumscribed by the cutter is illustrated in Figs. 15 and 16. This includes attaching a pair of pre-shaped and rigid bracing bars 27 and 28 by means of thread-cutting screws 29, 30, 31 and 32 which are screwed into the steel sleeve 33 within the area circumscribed by the cutter 17. Each bar has an inside curvature 34 whose radius is less than that of the outside surface of the steel sleeve 33 so that the ends of the bars bear tightly against the outside of the sleeve. The anchored bars retain the original curvature of the steel portion of the core when the sleeve is cut through. Whatsoever means are employed to prevent the opening of the severed portion of the sleeve, the cutter will proceed smoothly through the wall of the pipe. The entire core consisting of cut-out portions of the steel sleeve and of the concrete lining may then be removed as the cutter is withdrawn through the neck of the saddle.

In Fig. 1 there is illustrated a machine for inserting a bolt in a hole within a pipe wall and for securing the bolt firmly in place. The machine includes a member 36 in the form of an elongated hollow body dimensioned for containing a fastening bolt 26 to be inserted in the hole 38 in the wall 39 of a pipe. The member 36 is open at one end and has a threaded coupling 40 for engaging one end of a corporation cock or tubular member 41 which carries a valve 42. The other end of the tubular member is threaded into a gland base block 43 to which it is braised. The block has an opening therethrough and a circular groove 44 for containing a gasket 45 which seals between the outer surface of the pipe and the block. The block is provided with a cock 46 which is used to determine whether or not the hole 38 is completely sealed after the bolt 26 has been placed therein.

The gland base block 43 has a pair of pins 47 and 48 extending from opposite sides thereof, Fig. 6, and which engage eyes in a pair of bolts 49 and 50 by which the block is held firmly in sealing relationship with the outside of the pipe 39. The bolts 49 and 50 extend through sleeves 51 and 52, respectively. The pins 53 and 54 extend from opposite sides of the sleeve 51 and are engaged in notches 55 at the under sides of the bars 56 and 57. Another pair of notched bars 58 and 59 are engaged by the pins 60 and 61 of the sleeve 52. As best seen in Fig. 7, these four bars are connected at their ends by cross-bars 63 and 64 and by bracing bars 65, 66 and 67 at their mid lengths. All of these bars are welded together at their points of intersection and constitute a rigid bridge which is of such length as to span the outermost dimensions of the flange 16 on the neck 14, as shown in Figs. 7 and 8.

The cross-members 70 and 71 of the bridge have legs extending downwardly between the bars 57 and 58 which prevent the endwise movement of the cross-members 70

and 71 but allow for the positioning of these members lengthwise of the bridge. Each cross-member carries a bolt 72 which engages a dog 73 for engaging the under side of the flange 16 to fasten the bridge to the flange.

It will be appreciated that this construction permits the placing of the bridge in any position across the open end of the neck 14 for locating the bolt-inserting machine 74 in line with predetermined locations of holes for receiving a bolt. The block 43 is pressed into sealing engagement with the outside of the pipe when the nuts 75 and 76 are brought into tight engagement with the ends of the sleeves 51 and 52.

Referring particularly to Figs. 1, 5 and 6, the end of the elongated hollow body member 36 which is opposite from the coupling member 40 is closed except for a bore 78 through which the shaft 79 of a wrench 80 extends. The shaft 79 is slidable within a packing ring 81 which is held in place by a follower 82. The lower end of the shaft 79 is provided with a coupling member 83 which has a socket for engaging the flat sides of the head 84 of a fastening bolt, whereby the bolt may be rotated by the wrench.

The wrench shaft 79 is bored along its axis to provide a passage for the shank 85 of a bolt 86. The threaded end of the bolt 86 is engageable in a tapped hole 87 in the head of the fastening bolt 26, whereby the fastening bolt may be secured to the wrench and moved lengthwise of the hollow body member 36.

The corporation cock and the block 43 may be used to attach a drilling machine by which the hole 38 is drilled through the wall of a pipe containing fluid under pressure. After the hole is drilled, the valve 42 is closed and the drilling machine is replaced by the hollow member 36.

Before the hollow member 36 is attached to the valve body 41 a fastening bolt is attached by the bolt 86 to the wrench and drawn into the hollow body 36. The assembled hollow body 36, tubular member 41 and base block 43 provide a continuous passageway aligned with the hole 38 in the wall of the pipe when the valve 42 is in open position. With the bolt-inserting machine firmly supported against the pipe and readied for use, the valve 42 is opened and the fastening bolt is advanced through the valve and into the hole in the wall of the pipe to a position as shown in Fig. 5.

Any suitable form of fastening bolt may be employed to tie together the separable pieces of the core. A toggle bolt having a nut with an expandable device has proved satisfactory. The toggle bolt illustrated in the drawing has a multi-sided head 84 for engagement by a wrench and a threaded stem 88 which is engaged by a nut 89. The nut carries a pair of pins 90 extending in opposite directions and on which are pivotally mounted a pair of wings 91 and 92 and a spring 93 which is biased to spread the wings. These wings are folded towards the stem 88 until they have passed through the hole 38. A pilot member 94 with a conical surface is screwed onto the end of the stem 88 to serve as a guide for entry into the hole in the pipe.

After the toggle bolt has been advanced into a hole a sufficient distance to permit the wings of the bolt to spread (Fig. 5), the wrench 80 is retracted until the wings are engaged with the inside of the pipe. The wrench is then rotated to seat and tension the bolt firmly in place. The stem of the bolt 26 is threaded through a hole at the axis of a conically-shaped rubber stopper 95 which is self-centering and provides sufficient material to partially enter and to completely seal the outer end of the hole 38 when the wings 91 and 92 are firmly engaged against the interior surface of the pipe wall. An ordinary washer 96 between the stopper and the head 84 of the bolt protects the stopper as the bolt is tightened into final position.

When the toggle bolt has been tightened, the bolt 86 is unscrewed from engagement with the toggle bolt (Fig.

6) and the attaching machine may then be removed and used for placing another toggle bolt.

In making taps of large diameter more than two symmetrically positioned fastening devices may be used. As shown in Fig. 12, six toggle bolts have been placed. The bridge and its fastenings are so devised that the bridge can be fastened to the flange of the neck 14 in any desired position across the neck.

The invention is particularly useful in making taps exceeding twelve inches in diameter. Whenever a lining is thin, or is in poor condition and the metal of a sleeve is thick, the use of both fastening devices and bracing members is usually required to retract the entire core, but in general, when the lining is relatively thick and the metal of the sleeve is relatively thin, the fastening devices will suffice for that purpose, and when both the lining and the metal of the sleeve are thick the bracing members may be used alone. When there is some doubt as to the condition of the lining or thickness of the metal of the sleeve, it is advisable to use both fastening and bracing devices for a single tapping operation.

The best mode contemplated for carrying out the invention has been described but it is to be understood that it may be embodied in other constructions and that some of the various features and elements described may be altered without affecting the usefulness and scope of the invention set forth in the appended claims.

What is claimed is:

1. In a method for removing a circular core from a pipe wall comprising a metal sleeve lined with a hard cementitious material which method includes cutting through the pipe wall in a circular path circumscribing the circular core to be removed, the steps comprising bracing the portion of the metal sleeve within the area of the circular core to be removed to restrain increase of the original radius of said portion of the sleeve as it is severed from the main body of the sleeve, then completing the circular cut through the sleeve and the lining material, and in one operation simultaneously withdrawing the portions of the sleeve and lining material circumscribed by the cut from their original positions in the wall of the pipe.

2. In a method for removing a circular core from a pipe wall comprising a metal sleeve lined with a hard cementitious material which method includes cutting through the pipe wall in a circle circumscribing the circular core to be removed, the steps comprising tying together the metal sleeve and concrete lining within the perimeter of the circular core to be removed, then completing the circular cut through the sleeve and the lining material, and in one operation simultaneously withdrawing the portions of the sleeve and lining material circumscribed by the cut from their original positions in the wall of the pipe.

3. In a method for tapping a pressure pipe which contains a metal sleeve outside of a tube of inflexible material, the steps comprising circumscribing an area of the sleeve within which an opening is to be made through the wall of the pipe, then prior to the severance of the metal from the sleeve upon cutting into the wall of the pipe to form said opening, restraining subsequent deflection of the metal to be removed from the sleeve by bracing the metal within the area of said opening to retain its original curvature and avoid its unfurling away from the underlying tube of inflexible material when said area of metal is freed from the sleeve, then forming said opening by cutting through the metal sleeve and tube to free from the wall of the pipe a core consisting of a piece of the sleeve and a piece of the tube, and simultaneously withdrawing outwardly from the pipe wall the severed piece of metal and the severed piece of the tube and thereby leaving the desired opening.

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