

Aug. 29, 1967

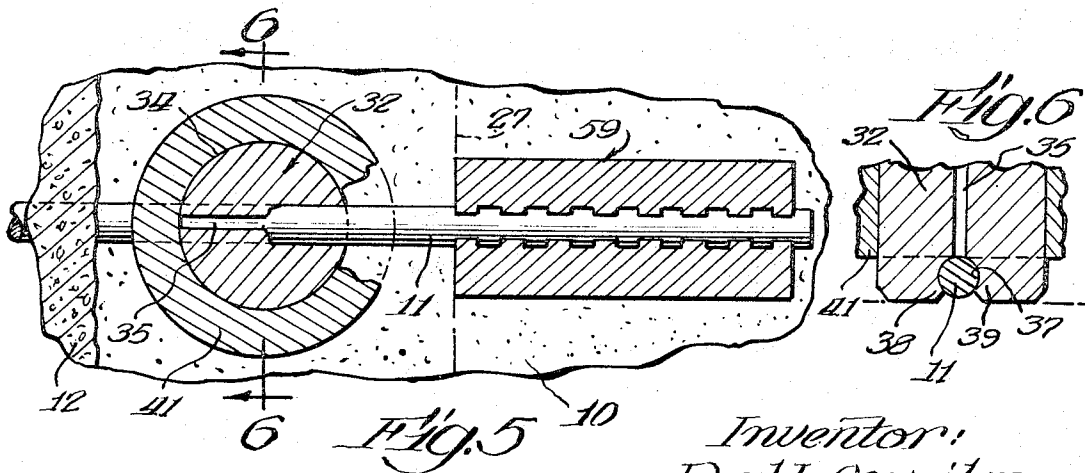
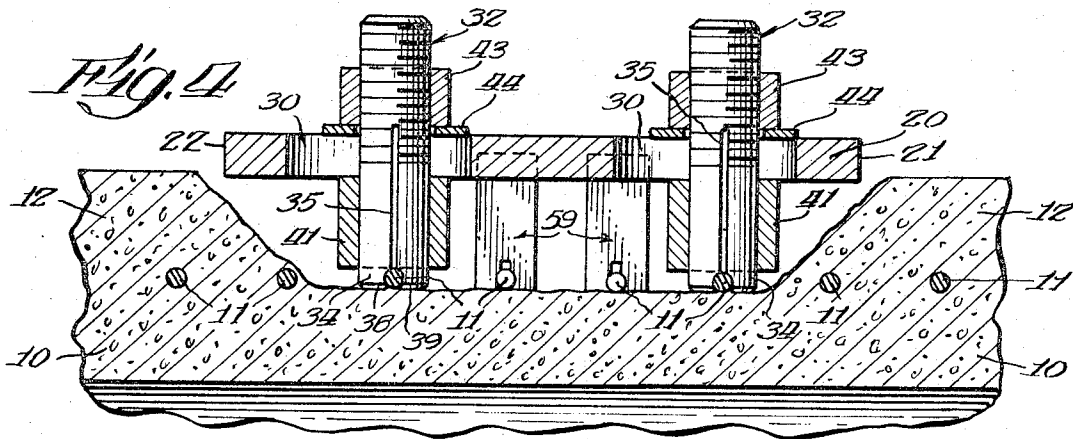
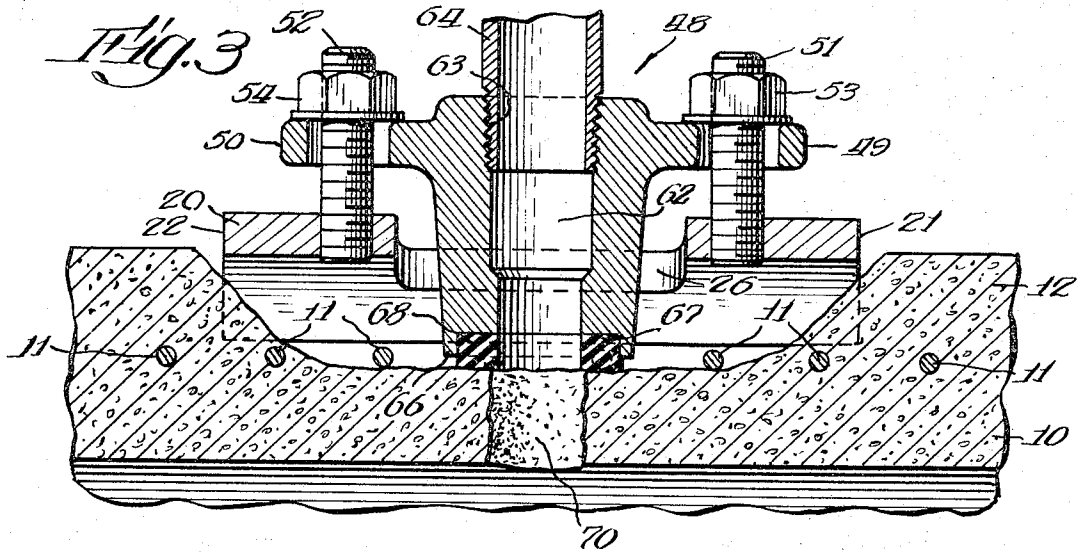
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3,338,601

TAPPING SADDLE FOR PRESTRESSED CONCRETE PIPE

Filed Jan. 13, 1965

2 Sheets-Sheet 2



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3,338,601 TAPPING SADDLE FOR PRESTRESSED CONCRETE PIPE

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Filed Jan. 13, 1965, Ser. No. 425,160
9 Claims. (Cl. 285—197)

ABSTRACT OF THE DISCLOSURE

Conventional pipe, having tensioned, spaced steel wire coils, may be tapped at any available pipe area. A tapping saddle is secured against the tap region by tension members extending between the pipe steel and saddle. The saddle provides a window area cleared of tensioned coil wire and supports a tap pipe.

This invention relates to a tapping saddle for prestressed concrete pipe and is applicable to prestressed pipe entirely of concrete or steel cylinder pipe wherein the prestressing means comprises tensioned steel strand or wire. The tapping saddle forming the subject matter of the present invention is useful where a large pipe, usually of the order of 16 inches or more, requires a small pipe tapped off therefrom.

As is well known, prestressed pipe has steel wire tensioned wound around either the concrete core or steel and concrete core to provide a tensioned helical steel reinforcement for imparting greater strength to such a pipe to withstand high pressures within the pipe. Even in the case of steel cylinder pipe, it is customary to provide a concrete layer inside or around the steel cylinder and thereafter wind tensioned steel wire about the pipe. A protective layer of concrete of the order of about one inch in thickness is disposed around the outside of the tensioned wire for the purpose of protecting such wire against corrosion. In all cases, below the tensioned wire, there will be concrete ranging in thickness from about one inch for cylinder pipe or concrete pipe having a relatively small diameter up to as much as six or eight inches of concrete in large diameter pipe.

In all prestressed concrete pipe, it has been found expedient to use high tensile strength steel wire and tension the same to a sufficiently high value so that the prestressing wire can be wound as a helix having a separation between adjacent turns of the order of about $\frac{3}{4}$ " and even greater. In all prestressed pipe the prestressing coils are spaced generally as pointed out above. The spacing between adjacent coils is quite a bit larger than the wire diameter. Such a comparatively coarse pitch makes for efficient use of such wire.

In connection with taking a tap off such a pipe, it has been the practice to provide a saddle maintained in position by two metal straps around the entire circumference of the prestressed pipe. This requirement can be quite costly in case a tap is to be made into a pipe which has been buried in a trench. This invention provides a simple and highly effective means for attaching a saddle on a prestressed concrete pipe and dispenses with circumferential straps.

The invention to be described not only provides means for firmly anchoring a saddle to a pipe, but also includes means in association with the saddle for tightly anchoring the ends of one or more prestressing wire coils so that the cutting through the pipe wall can be effected without regard to maintaining the prestressing coil or coils intact at that particular region.

The invention in general contemplates a saddle which is preferably curved to the particular curvature of the exterior of a prestressed concrete pipe to which the saddle is applied. The saddle itself is maintained tightly against

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the exterior of the concrete pipe by special bolts and sleeves which cooperate with portions of the prestressing wire to anchor the saddle thereto. As a result, the saddle is firmly anchored to the pipe without the necessity of any circumferential strap or holding means going around the exterior of the prestressed pipe to be tapped. In addition thereto, the saddle has means for accommodating a wire grip or anchor of a construction all fully disclosed and claimed in the copending application of Warner Smith, Ser. No. 190,191, filed Apr. 16, 1962 now Patent No. 3,206,851 granted Sept. 21, 1965. The particular wire anchor which is briefly described here and which is more fully disclosed in the aforementioned patent makes it possible to hammer two wire grips over two longitudinally spaced exposed coil portions, after which the portions of the coil between the two wire grips may be removed or cut leaving the wire grips to cooperate with the saddle for maintaining the severed prestressing coils in tension as before. As a result, an opening through a prestressed pipe wall can be made larger than the spacing between adjacent wire turns without in any way endangering the prestressing tension and without reducing the tension of the prestressing material.

For a full description of the invention, reference is now made to the drawings wherein:

FIGURE 1 is a top plan view of the new tapping saddle positioned on a prestressed pipe;

FIGURE 2 is a sectional detail on line 2—2 of FIGURE 1, certain parts being broken away, for illustrating the wire grip;

FIGURE 3 is a section on line 3—3 of FIGURE 1 and illustrates the tapping saddle installed and the tapping gland in place;

FIGURE 4 is a section on line 4—4 of FIGURE 2; FIGURE 5 is a section on line 5—5 of FIGURE 2; and FIGURE 6 is a sectional detail on line 6—6 of FIGURE 5.

The prestressed pipe to which the invention is applied includes pipe portion 10 about which there is disposed prestressed steel wire reinforcement 11, this being in the form of a helix, and the wire being covered with protective concrete layer 12. As has been pointed out, portion 10 of the pipe will generally have a thickness of at least about an inch, although this thickness may be somewhat variable due to manufacturing and design variations.

Outer concrete layer 12 will also have a thickness of the order of about an inch. Steel reinforcement 11 will generally be of suitable steel wire, generally solid, although stranded wire may be used, and will frequently be of a diameter corresponding to a No. 6 steel wire. The pitch of the wire reinforcement, which for all practical purposes is close to the distance between the adjacent wire turns, that is, the space between the adjacent wire turns, will also be at least about $\frac{3}{8}$ " and frequently will be larger. Some spacing between adjacent coils is essential for this invention, although above a certain minimum value, the amount of spacing insofar as this invention is concerned is not important.

In accordance with the present invention, saddle plate 20 of steel, cast iron or other strong material is provided. Plate 20 preferably will have a curvature which is generally the same as the curvature of the pipe to which the saddle plate is being applied. Equality of curvature is not necessary. In general, one size saddle plate, insofar as curvature is concerned, may be used for a number of different pipe diameters. Saddle plate 20, insofar as the shape is concerned, may have any desired shape and is here shown as a generally rectangular frame, with long sides 21 and 22 and transverse or short sides 23 and 24. The saddle plate provides window 26 having transverse end walls 27 and 28. Saddle plate 20 is provided with bolt clearance apertures 30 located at the corners of the saddle

plate. Inasmuch as the saddle plate attachment is the same at all of these apertures, only one will be described in detail.

Each bolt clearance aperture 30 is elongated transversely to the wire coils, this elongation being convenient to permit adjustment of the various anchoring bolts with respect to the saddle plate. Disposed in elongated aperture 30 is an assembly including bolt 32 having the exterior portion threaded in conventional fashion. Bolt 32 (see FIGURE 4) has wire gripping end 34 bifurcated by means of slot 35. Slot 35 extends longitudinally of the bolt body from end 34 of the bolt sufficiently to provide the wire gripping action as hereinafter explained. End portion 34 of bolt 32 has transverse wire accommodating passage or slot 37 cut therethrough. Transverse slot 37, as can be seen in FIGURE 4, has a generally circular transverse shape to permit jaw portions 38 and 39 of the slotted bolt to grip opposite sides of prestressing wire 11. Slot 35 extends far enough along the bolt length to permit jaws 38 and 39 of the bolt to open enough so that jaw portion 34 can be forced or snapped over wire 11.

Sleeve 41, of steel, is disposed over the body of slotted bolt 32 and is so dimensioned, that when forced down toward end portion 34 of the slotted bolt, jaw portions 38 and 39 of the bolt will be closed to grip wire 11. As can be seen from FIGURE 4, transverse slot 37 in the end of the bolt is so shaped and so located that when jaws 38 and 39 of the bolt are forced together toward each other, the wire will be caught in a tight grip.

Nut 43 cooperates with the bolt thread to force sleeve 41 toward the slotted end of the bolt.

Bolts 32 will be moved into position over the respective portions of the prestressing coils, after the outer layer of concrete has been removed to expose the prestressing coils, and prior to the application of the saddle plate.

Before a bolt is tightened by nut 43, the saddle plate will have been positioned over all the bolts. The bolts, prior to tightening, will be loose enough so that they may be positioned or worked through slots 30 in the saddle plate. Moderate tightening of nuts 43 and the use of washers 44 will cause the slotted bolts to grip the respective portions of the prestressing wires and anchor the saddle plate tightly into position.

Parts 32, which have been designated as bolts, do not have heads thereon, since heads generally are not necessary. However, under certain circumstances, it may be desirable to have heads on the outer ends of bolts 32 in the event that it is desired to turn nuts 43 down very tightly but avoid exerting any powerful turning forces on bolt 32. In such case, it would be possible to turn nut 43 in one direction and urge the head of bolt 32 in the opposite direction.

Bolt 32, in general, will have a diameter which is less than the spacing between adjacent coils of wire reinforcement, generally designated as 11. In practice, bolts 32 may have a diameter of about $\frac{3}{4}$ ". The bolt is so designed with reference to the length of slots 35 and the width of slots 37, together with the transverse dimension of transverse slot 37 at the end of the bolt, so that jaws 38 and 39 of the bolt will be spread to permit the ends of the bolt to open enough so that wire or strand 11 can enter between the two jaws. It is evident that the diameter of the bolt, which normally has a certain value, such as for example $\frac{3}{4}$ ", would be increased somewhat due to the spreading action of the jaws formed by the ends of the bolt after the bolt has been positioned over the wire. The spread or open position of the jaws of a bolt is sufficient so that the increase in diameter of the bolt at the slotted portion is great enough so that sleeve 41 should not be positioned until after the jaws are forced over the wire. The sleeve then may be forced down by the threaded means, which, in this instance, consists of nuts 43. It is preferred that the dimension of the various parts be so selected that with wire or strand 11 in position, as illustrated, for

example, in FIGURE 4, sleeve 41 when forced down near the bottom end of the bolt will cause the jaws of the bolt to grip the tension wire tightly. This tight grip is sufficient not only to anchor the bolt against transverse movement of the bolt with respect to tensioned wire 11, but will also provide a force to keep the bolt in position against sliding along the length of wire 11. This last function, however, need not necessarily be provided, since some degree of freedom of the bolt along the length of tensioned wire 11 may not be objectionable. Where tensioned coils are wound over concrete, the concrete below the bottom end of bolt 32 may be undercut so that the jaws of the bolt can extend below the strand as illustrated, for example, in FIGURE 6.

Instead of having a separate nut for forcing sleeve 41 down to close the bolt jaws after the bolt has been installed over the tensioned wire, it is possible to have nut 43 and sleeve 41 in one piece, or in other words, to thread the bolt so that the bottom portion of the bolt adjacent slot 35 will have threading. The inside of sleeve 41 may have threads either at the sleeve or at the upper portion thereof for cooperation with the threading of the bolt, whereby the sleeve cooperates with the bolt threads for moving the sleeve downwardly to force the jaws together. However, in general, a separate nut 43 is preferred, since the nut not only functions to drive the sleeve downwardly for jaw tightening, but can also be used to tighten the bolt against the saddle plate. In addition, having a separate nut and sleeve reduces the effort to tighten the bolt over the wire for the reason that the sleeve itself is only moved longitudinally of the bolt instead of circumferentially. However, either of the above arrangements can function. The illustrated arrangement may be cheaper, since the nuts and sleeves are cheap to obtain and the only special part of the entire attaching structure is the slotted bolt 32.

Since the tensioned wire in general is of hard, tough steel, it may be desirable to have bolt 32 also of hardened steel, or at least the jaws thereof, so that a tight grip on the wire can be obtained.

A gland fixture, generally indicated by 48, can now be easily applied. Gland fixture 48 has wings 49 and 50 transversely thereof which may be bolted to the saddle plate on opposite sides of window 26. The construction is simple, as illustrated in FIGURE 3, with bolts 51 and 52 engaging threaded recesses in the saddle plate and being themselves tightened down by nuts 53 and 54.

Gland body 48 may require an opening through the pipe wall which is larger than the space between adjacent prestressing wire coils. Accordingly, the concrete covering the prestressing coils lying below window 26 is removed to expose the wires. Wire grips, generally indicated by 59, are applied to each individual wire coil. The wire grips are disposed in position on the wire prestressing coils so that the wire grips are wedged against window walls 27 and 28 of the saddle plate. This is possible by the desirable properties of the wire grip.

As illustrated in FIGURE 5, the wire grip is so constructed as to cut transverse slots in the tensioned wire. It is not essential for the operation of the grip that the wire be tensioned. However, the wire grip may be positioned in place and hammered down to grip the wire while the wire is in tension, all of this being accomplished without loss of tension.

Such wire grips are available from the assignee of the present invention and are used for anchoring prestressed wire. As more fully disclosed and claimed in the patent previously identified, the wire grip has slots and teeth in the sides thereof and functions as a slot cutting device for engaging hard steel wire. After the wire grips are in place, these being long enough to grip the wire. The portions of the tensioned wire between longitudinally spaced wire anchors may be cut without loss of tension in the prestressing wire. Thereafter, any desired hole through the entire concrete wall, and steel

cylinder if necessary, of the pipe may be provided for the gland.

The wire grip or anchor is designed so that the teeth will substantially hold the tensioned wire. The requirements for tooth design are set forth in said Smith patent.

Insofar as the gland is concerned, a wide variety of structures may be used. The particular gland structure illustrated here is one example of a suitable structure. Gland body 48 is provided with passage 62. Body 48 has a portion of the passage wall tapped at 63 for accommodating the threaded end of tap 64. Gland body 48 has end 66 which is the inner end of the gland body recessed at 67 to accommodate gasket 68 of rubber or other suitable material. Gasket 68 provides a tight seal between the end of the gland body and the concrete surrounding tap passage 70 extending through the wall of the pipe. It is understood that passage 62 of the gland body is disposed to register with passage 70 through the pipe wall.

It is evident that the transverse dimensions of opening 70 through the pipe wall and passage 62 of the gland body can be greater than the separation of the adjacent wire coils. It is only necessary that the saddle plate be sufficiently large to permit mounting in the fashion disclosed. The wire anchors themselves will generally be small enough transversely to the length of the tensioned wire so that there is no problem in disposing wire anchors over certain wires and clearing adjacent wire coils. The wire anchor disclosed in the Smith patent is particularly desirable for use in the saddle combination disclosed here due to the ease with which a wire anchor may be positioned over a tensioned wire without loss of tension. The bearing surfaces provided at the window of the saddle plate for the wire anchors is adequate. It is understood that the saddle plate itself will be sufficiently strong to withstand the forces acting on the sides of the window in the saddle plate due to the tension of the coils after the intervening parts of the anchored coils have been severed.

It is understood that wherever necessary, the outer layer of concrete will be removed generally as illustrated in the drawings.

It is immaterial whether wire anchors 59 are applied to the wire coil portions prior to or after gland body 48 is attached to the saddle plate frame. In all instances the space between wire anchors, making up a cooperative pair of anchors, aligned along a wire coil, must be great enough to clear gland body 48. The slotted bolts constitute tension resisting members, each one of which is adapted to grip a tensioned exposed coil wire and be secured to the saddle plate. The saddle plate has a tap pipe rigidly secured thereto. Thus tap pipe stresses are communicated to the saddle plate, thence to tensioned wire coils for distribution about the concrete pipe circumference.

After the entire tapping assembly and pipe tap have been provided, it will be desirable to cover the entire assembly with concrete to protect the wire and metal against corrosion.

I claim:

1. An assembly for connecting a tap pipe at any time into a prestressed pipe having a wall about which are disposed in one layer tensioned steel wire coils spaced along the pipe length and provided with an outer protective layer to cover the steel, said assembly including a saddle plate conforming generally to the pipe where a tap is to be provided and having a frame surrounding a window area where the tensioned wire must be exposed for tap installation, said frame having opposed window end walls to be parallel to the pipe length, a plurality of metallic means for securing said frame at spaced frame regions to tensioned coils at selected wire areas below the frame and beyond the frame window boundaries, each said metallic securing means including a tension resisting member having one end thereof shaped to grip

the coil wire at the selected wire area, said tension member having its other end provided with means for attachment to the saddle plate, a pair of wire gripping anchors for each tensioned wire coil to be exposed at the frame window and to be mutilated, each wire anchor being of the type which is movable laterally of a coil wire into wire gripping position thereon without loss of wire tension, the saddle plate window length, perpendicular to the pipe length, being great enough so that a sufficient length of wire per coil at the window can accommodate two longitudinally aligned anchors abutting the frame end walls with clearance between opposed anchor ends to permit a tap pipe to extend generally radially of the prestressed pipe through the saddle plate window area after removal of coil wire between wire anchors, said saddle plate frame functioning to brace wire anchors at the window end walls for tension maintenance and means on said saddle plate for rigidly supporting a tap pipe whereby the prestressed pipe area to be worked on when installing a tap pipe is small in comparison to the pipe circumference and pipe length, said prestressed pipe requiring a passage through the pipe wall aligned with the tap pipe and, after installation, the stresses incident to the presence of the tap pipe being transmitted directly to tensioned steel wire and distributed along a circumferential band of the prestressed pipe.

2. The assembly according to claim 1 wherein said tension resisting member comprises a bolt having its one end slotted to provide wire gripping jaws, and means cooperating with the bolt thread and movable along the bolt for closing the bolt jaws about a wire after such jaws, when open, have been positioned about a wire.

3. The assembly according to claim 2 wherein said frame has clearance apertures for said bolts, each bolt having its other end extending through a clearance aperture and wherein a nut is provided for attaching the bolt to said frame.

4. The assembly according to claim 1 wherein said wire anchor comprises a steel block having a slot for receiving the wire, said slot having rectangular cutting teeth to cut transverse slots in said wire for interlocking action.

5. In combination, a prestressed pipe having a wall about which are disposed in one layer tensioned steel wire coils spaced along the pipe length and provided with an outer protective layer to cover the steel, said combination including a saddle plate conforming generally to the pipe area containing a tap, said saddle plate having a saddle frame surrounding a window area where the original pipe protective layer had been removed, said frame having opposed window end walls parallel to the pipe length, a plurality of metallic means for securing said frame at spaced frame regions to tensioned coils at selected wire areas below the frame and beyond the frame window boundaries, each said metallic securing means including a tension resisting member having one end thereof shaped to grip a coil wire, said tension member having its other end attached to the saddle plate, a pair of wire gripping anchors for each tensioned wire coil which originally had been at the frame window, each wire anchor being of the type which can be put into final wire gripping position thereon without loss of wire tension, the saddle plate window length, perpendicular to the pipe length, being great enough so that two longitudinally aligned anchors abutting the frame end walls have sufficient space therebetween for a tap pipe, the window area containing the wire coil portions between the opposed separated ends of each pair of installed wire anchors having been cleared and tap pipe means extending generally radially of the prestressed pipe through the coil free saddle plate window area and having a fluid flow channel aligned with an aperture through the pipe wall, said combination being susceptible to assembly of the prestressed pipe and accessory parts at any time after said prestressed pipe has been manufactured and/or in-

stalled and requiring a limited area of said pipe for access during installation.

6. The combination according to claim 5 wherein said tension resisting member comprises a bolt having its one end slotted to provide wire gripping jaws and means co-operating with the bolt thread and movable along the bolt for closing the bolt jaws on a wire after such jaws, when open, have been positioned over a wire.

7. The combination according to claim 5 wherein said frame has a clearance aperture for each bolt, each bolt having its other end extending through such clearance aperture and a nut for attaching the bolt to said frame.

8. The combination according to claim 5 wherein each wire anchor comprises a steel block having a slot for receiving the wire, said slot having rectangular cutting teeth to cut transverse slots in said wire when said wire is forced into said anchor slot for interlocking action.

9. The method of tapping a conventional prestressed pipe having longitudinally spaced tensioned steel coils around it, said method comprising removing from a limited pipe area, where a tap is to be made, the protective layer of concrete to expose tensioned coil portions, positioning a saddle plate over said exposed coil portions, said saddle plate having a window therethrough giving

access to exposed coil portions, securing the saddle plate to exposed coil portions at various locations beyond the saddle plate window without damage to the coil wire, bracing individual coils exposed in the window area against saddle plate parts to maintain tension independently of coil continuity in the window area, removing from between braced coils portions at the saddle plate window unnecessary coil wire to create a wire free tapping region, providing an aperture through the pipe wall at such cleared region and securing a tap gland to the saddle plate to register with the pipe wall aperture.

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