Sept. 4, 1951 G. H. CALHOUN ET AL 2,567,009

EQUIPMENT FOR INSERTING SMALL FLEXIBLE TUBING INTO HIGH-PRESSURE WELLS

Filed June 24, 1948 5 Sheets-Sheet 1

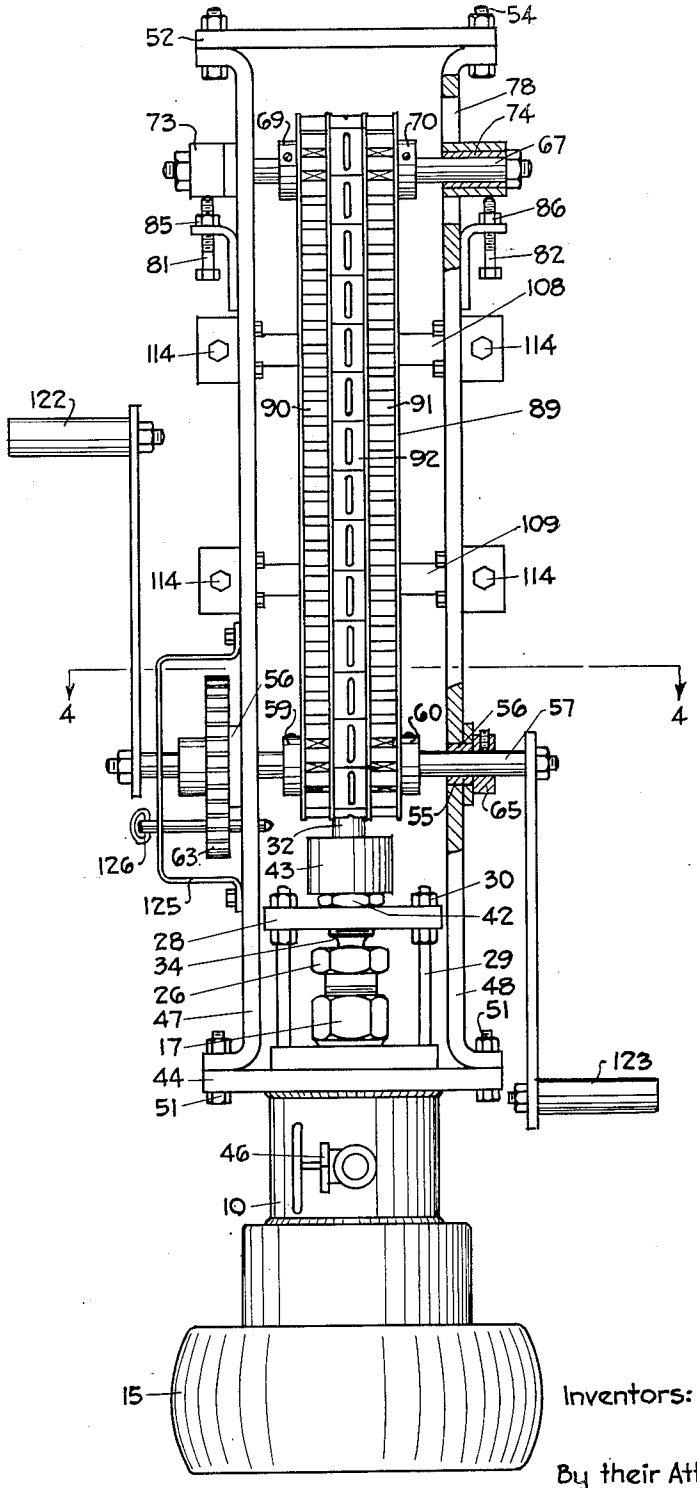


Fig. 1

Inventors: George H. Calhoun
Herbert Allen

By their Attorney: [illegible]

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Filed June 24, 1948 5 Sheets-Sheet 2

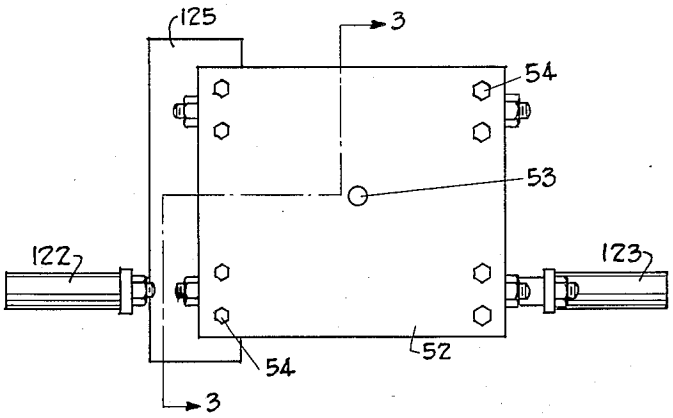


Fig. 2

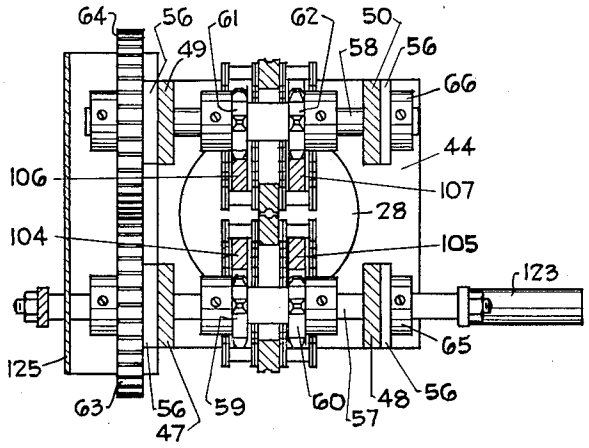


Fig. 4

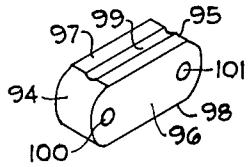


Fig. 5

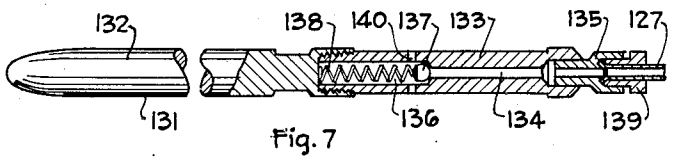


Fig. 7

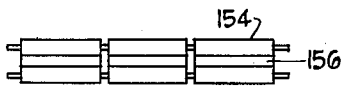


Fig. 9

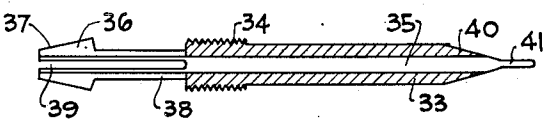


Fig. 11

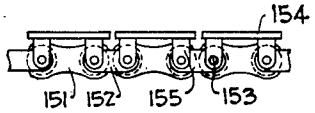


Fig. 10

Inventors: George H. Calhoun
Herbert Allen

By their Attorney: H. Alexander

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EQUIPMENT FOR INSERTING SMALL FLEXIBLE TUBING INTO HIGH-PRESSURE WELLS

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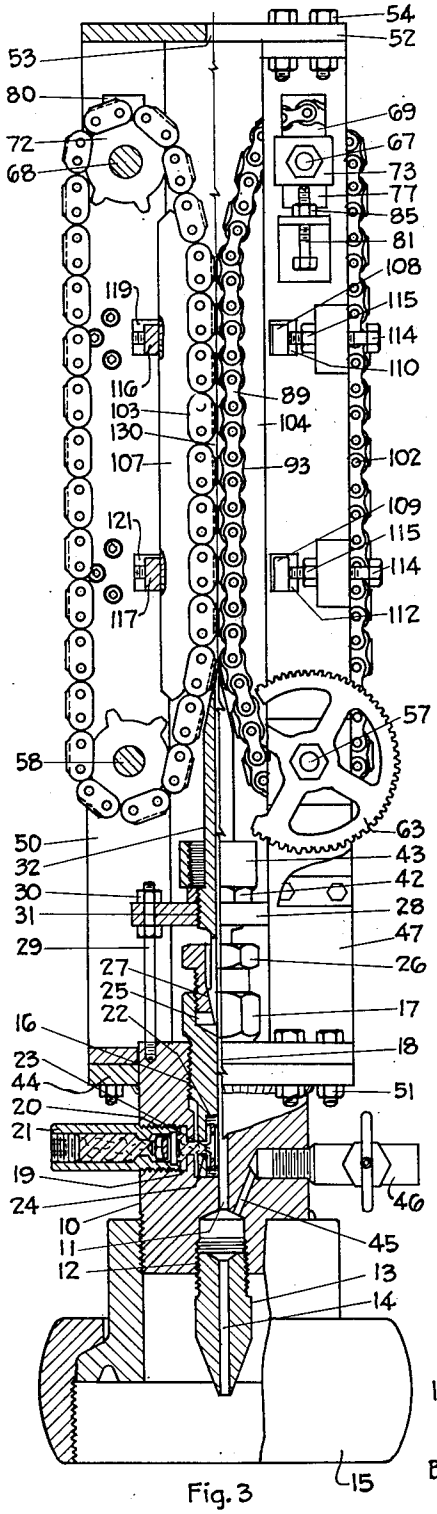


Fig. 3

Inventors: George H. Calhoun
Herbert Allen

By their Attorney: [signature]

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EQUIPMENT FOR INSERTING SMALL FLEXIBLE TUBING INTO HIGH-PRESSURE WELLS

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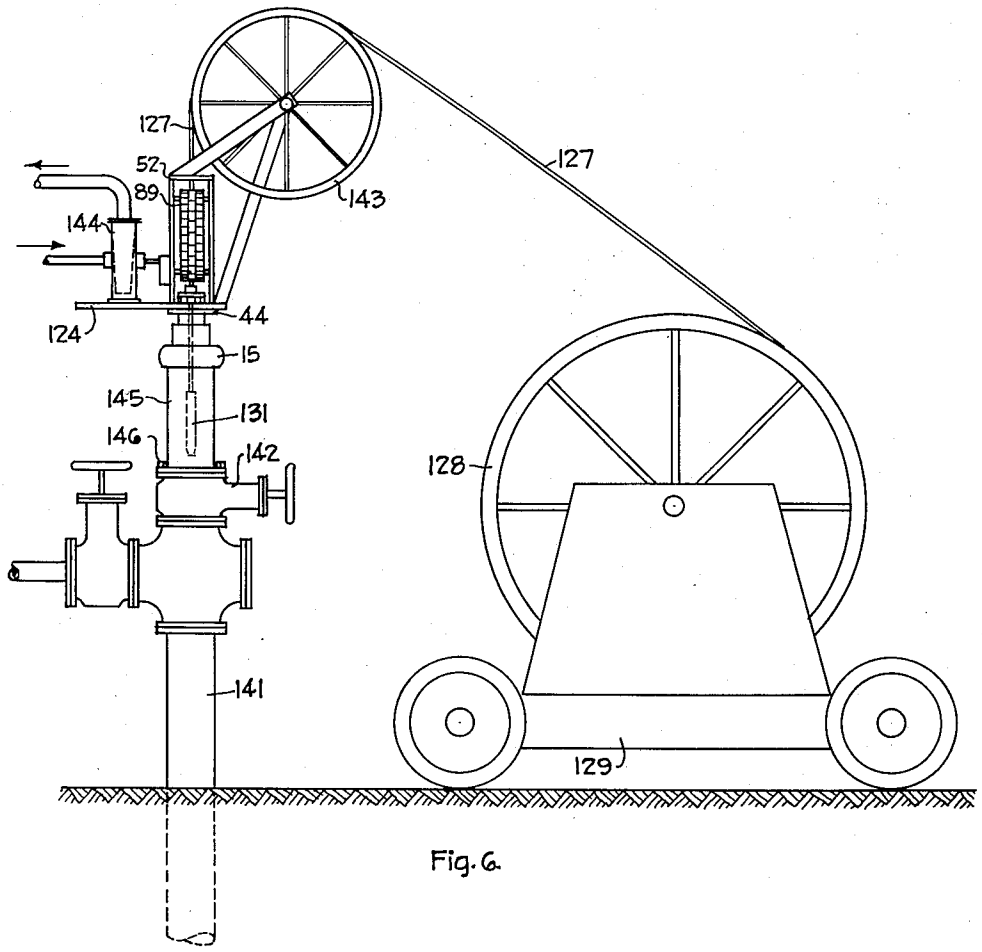


Fig. 6.

Inventors: George H. Calhoun
Herbert Allen

By their Attorney: [signature]

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EQUIPMENT FOR INSERTING SMALL FLEXIBLE TUBING INTO HIGH-PRESSURE WELLS

Filed June 24, 1948 5 Sheets-Sheet 5

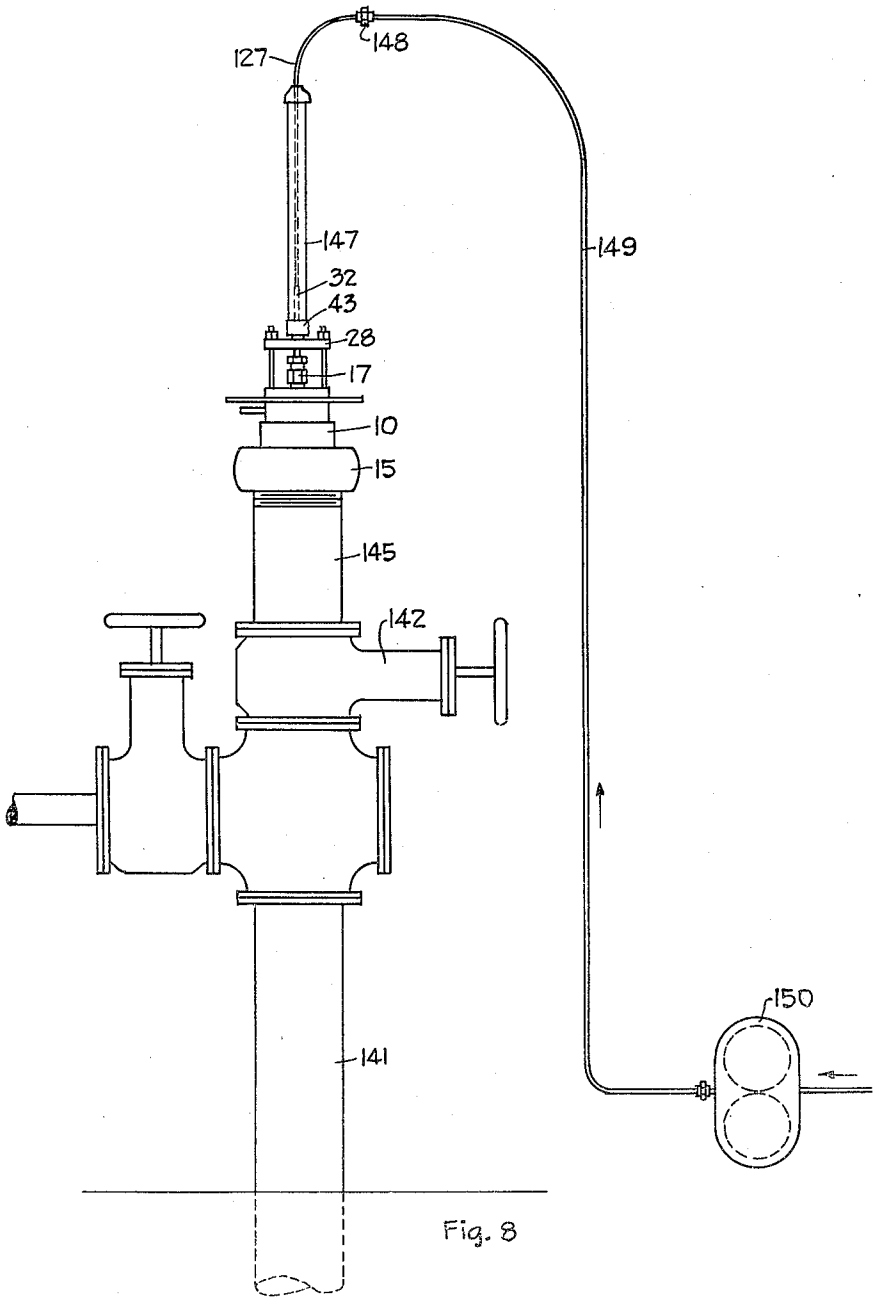


Fig. 8

Inventors: George H. Calhoun
Herbert Allen

By their Attorney: Alexander

Patented Sept. 4, 1951 2,567,009

# UNITED STATES PATENT OFFICE

2,567,009

## EQUIPMENT FOR INSERTING SMALL FLEXIBLE TUBING INTO HIGH-PRESSURE WELLS

George H. Calhoun and Herbert Allen, Houston, Tex., assignors to Shell Development Company, San Francisco, Calif., a corporation of Delaware

Application June 24, 1948, Serial No. 35,004

10 Claims. (Cl. 166—1)

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This invention relates to oil well tools and pertains more particularly to apparatus for inserting strings of elongated cylindrical or tubular elements, such as tubing, cables, etc., into a high-pressure well, suspending said strings therein, and subsequently removing them from the well.

Since the present invention is especially well suited for handling strings of small diameter flexible tubing, it will be described herein in its application to this particlular type of operations. It is, however, understood that the invention is in no way limited thereto, and that by suitably enlarging or modifying the various component parts of the present system, said system can be readily adapted, without departing from its principle, for the handling of any type of production tubing, as in snubbing operations, etc. The invention may also be used for inserting temperature and pressure bulbs, or similar instruments, into pressure vessels such, for example, as towers in oil refineries.

It is often desirable, during the operation of a well flowing under pressure, to introduce fluids, for example, liquid corrosion inhibitors, into the well flow stream far down the production tubing in the well. In order to discharge liquid inhibitors into the well flow stream at any desired location, it is necessary to conduct said inhibitor to the desired point through a conduit or tubing having a sufficient capacity to handle the flow of liquid inhibitor therethrough. Generally, only small quantities, for example, two gallons per hour, of an inhibitor are injected into the flow stream of the well so that the conduit carrying the fluid inhibitor may be sufficiently small to be insertable in a production tubing string. Thus, a suitable conduit from the standpoint of economy, capacity, ease of transporting and handling and length of life, is a flexible, corrosion-resistant tubing of small diameter.

Since small diameter flexible tubing has relatively thin walls, it is extremely difficult to insert it through a pressure packing without bending the tubing, which weakens its walls and makes it unsuitable for further use.

After a fluid inhibitor tubing has been inserted into a well, it is desirable to have it suspended therein by suitable clamp means, which are preferably independent or detachable from the inserting apparatus used, so as to allow said apparatus to be moved to and used at another well. Inserting apparatus of the type sometimes used to insert a cable into a high-pressure well has not proved successful for the purposes of the present invention. The gripping elements of such

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devices either do not have a sufficient gripping surface to grip smooth-surfaced tubing, or else they injure the thin-walled tubing by puncturing, bending or causing excessive wear. Also, cable inserting devices are not capable of maintaining the easily-bendable tubing in rigid alignment at substantially all points between the gripping elements and the seal or lubricator element through which the tubing is being forced, thus increasing the chances of bending said tubing.

It is therefore a primary object of this invention to provide apparatus for rapidly inserting small-diameter flexible tubing or equivalent elongated cylindrical elements into a high-pressure well and removing said tubing therefrom.

It is also an object of the present invention to provide a suspension and pack-off mechanism equipped with detachable clamping means for suspending a small-diameter flexible tubing in a well after the inserting mechanism has been removed.

A further object of this invention is to provide an inserting mechanism having gripping elements adapted to grip a smooth-surfaced, small-diameter, flexible tubing over a substantial portion of length thereof without injuring said tubing during insertion into or removal from a well.

Another object of the present invention is to provide a tubing inserting mechanism adapted to maintain the tubing in rigid alignment while inserting it into a well, thus preventing any bending or buckling of said tubing.

Still another object of this invention is to provide a tubing inserting apparatus having prime mover means for rapidly inserting a small-diameter flexible tubing into a high-pressure well, said prime mover means receiving its power from an outside source or from the pressure of the well where the tubing inserting apparatus is being used.

Other objects and advantages of the invention will become apparent from the following description taken with reference to the drawings wherein:

Figure 1 is a diagrammatic elevation view, partly in cross section, of an embodiment of the present tubing inserting mechanism.

Figure 2 is a top plan view of Figure 1.

Figure 3 is a cross-sectional view of the present device taken along the line 3—3 in Figure 2.

Figure 4 is a view in cross section taken along the line 4—4 in Figure 1.

Figure 5 is an isometric view of an intermediate link of the chain employed in the tubing inserting mechanism.

Figure 6 is a diagrammatic view of a motor-driven tubing inserting mechanism of the present invention mounted for operation at a well head.

Figure 7 is a view, partly in cross section, of a sinker bar.

Figure 8 is a diagrammatic view of casing closure means mounted on the well head with a tubing suspended therein, said tubing being connected to a pump.

Figures 9 and 10 are top and front views of another embodiment of a chain.

Figure 11 is a cross-sectional view of the tubing clamping means employed in the present invention.

Briefly, the apparatus of the present invention comprises casing closure means adapted to be mounted on and close a high pressure well casing, there being a vertical bore in said closure means through which a small-diameter flexible tubing may be introduced into said well casing, packing means in said casing closure means forming a fluidtight seal about a tubing passing through said axial bore, movable tubing gripping means detachably mounted directly above said vertical bore in the casing closure means for conveying said tubing through said bore, tubing alignment means mounted between said gripping means and said axial bore, and adjustable clamping means carried by said casing closure means for suspending tubing within the well casing.

Referring to Figures 1 and 3 of the drawing, the casing closure means, as shown, comprises a cylindrical body **10** having an axial bore **11** therethrough, which bore is enlarged at its lower end and threaded at **12** to receive and secure therein a stripper **13**. The stripper **13** has an axial bore **14** therethrough that is coaxial with the bore **11**. Secured to the lower end of said body **10**, in any desired manner as by screw-threads or welding, is a suitable means, such as a coupling **15**, for securing said casing closure means to a threaded section on the top of a well casing.

The upper part of the axial bore **11** is enlarged and threaded at **16** to accommodate a threaded gland member **17** therein. An axial bore **18** in said gland member **17** is coaxial with the bore **11**. A radially extending passageway **19** in the cylindrical body **10**, between the outside thereof and the axial bore **11**, is threaded at **20** to secure therein a packing injection assembly **21**, through which any suitable packing material may be introduced. If desired, the lower end of the gland member **17** may, as in this embodiment, be recessed at its lower end to accommodate sealing rings **22** and a gland spacer **23** therebetween. The lower end of said gland member **17** has a plurality of radial openings **24** therein so that one of them is substantially in register with passageway **19** in the body **10** whereby packing material may be introduced into said body **10** and gland member **17** and distributed about the axial bore **18** therein to form a fluidtight seal about the tubing to be positioned in said bore.

A coaxial recess **25** is drilled and tapped in the top of the gland member **17**. A threaded nut **26** having a tapered axial bore **27** therethrough is secured in the gland recess **25**. Mounted above said gland member **17** and nut **26** is a plate member **28** that is secured to said body **10** by any suitable means as by stud bolts **29** and nuts **30**. A hole **31** through this plate member **28** is threaded to receive the threaded portion of an



auxiliary alignment and clamping means, such as a collet **32**.

As shown in Figure 11, the collet **32** comprises a cylindrical body member **33** having a threaded portion **34** and an axial bore **35** therethrough of a dimension slightly greater than the diameter of a tubing, cable, or wire to be run therethrough, as will be later described. The lower end **36** of the collet **32** is tapered at **37**, to substantially the same angle as the tapered bore **27** of the nut **26** (Figure 3). Adjacent the tapered portion **37**, the collet **32** is machined, as at **38**, to reduce the thickness of the collet wall and to make it more flexible. Thus, when a longitudinal slot **39** is cut or formed in the tapered and machined lower end **36** of the collet, a tubing clamping means is formed. The upper end **40** of the collet **32** is also tapered and if desired may have flats **41** formed at the point of the taper to serve as additional tubing alignment means.

The collet is threadedly secured in the center of the plate member **28** with its tapered lower end **36** in the tapered axial bore **27** of the nut **26** (Figure 3). The position of the collet **32** is fixed by any suitable means as by a lock nut **42**. A small pipe coupling **43** is positioned about the collet **32** above the plate member **28**, said coupling being fixedly secured to said plate member **28** or said nut **42** in any suitable manner as by welding. Flange means **44** are secured, as by welding, to the cylindrical body **10** of the casing closure means. A conduit **45** may also be formed in said body in communication between the axial bore therethrough and the space outside thereof, said conduit **45** being normally closed by a valve **46**.

As shown in Figures 1 and 3, the movable tubing gripping and conveying means, for inserting a small-diameter flexible element such as tubing through the previously-described casing closure means, has a framework comprising two pair of vertical frame members **47**, **48**, **49** and **50** adapted to be removably attached to flange member **44** of the casing closure means in any suitable manner as by bolts **51**. A top plate member **52**, having a centrally located hole **53** therethrough (Figure 2), joins the frame members **47**, **48**, **49** and **50**, being fastened thereto by bolts **54**.

Holes **55** (Figure 1) are drilled through the lower portion of each of the frame members **47**, **48**, **49** and **50**, each of said holes being in alignment with the hole in the opposite frame member and being fitted with a bearing **56**. Rotatably mounted in bearings **56** are parallel shafts **57** and **58** as shown in Figure 4. Fixedly positioned on said shafts **57** and **58**, between the bearings **56**, are two pairs of identical spaced sprocket wheels **59** and **60**, **61** and **62**, respectively. Secured to the corresponding ends of said shafts **57** and **58** are meshing drive gears **63** and **64**. Collars **65** and **66** are affixed at the other ends of said shafts **57** and **58** adjacent the bearings **56**.

A second set of shafts **67** and **68**, having spaced sprocket wheels **69**, **70**, **71** and **72** affixed thereto, are rotatably mounted in bearings **73**, **74**, **75** and **76** in the upper portion of the framework as shown in Figures 1 and 3. However, these bearings **73**, **74**, **75** and **76** are slidably movable in vertical slots **77**, **78**, **79** and **80** in the frame members **47**, **48**, **49** and **50**, being positioned therein at any desired point by adjusting screws **81**, **82**, **83** and **84** having lock nuts **85**, **86**, **87** and **88**.

Mounted between lower sprocket wheels **59** and

60 and upper sprocket wheels 69 and 70 is an endless chain 89 which is preferably three links wide. The outer links 90 and 91 of said chain are conventional roller links while the intermediate links 92 are of special design embodying a gripping surface on its outer face. Each roller link 90 and 91 has an arcuate inner edge 93 to substantially conform with the edges of the sprocket wheels 59, 60, 69 and 70, this relation being clearly shown in Figure 3.

Each intermediate link 92 (Figure 5) is preferably block-shaped, having curved ends 94 and 95, flat sides 96, top face 97 and bottom face 98. Formed or cut in the top face 97 of said link is a longitudinal semi-circular groove 99, preferably having a radius equal to the outside radius of the tubing or other element to be put through this apparatus. Two horizontal holes 100 and 101 drilled through said link serve to accommodate connecting pins. The intermediate links 92 are identical in shape and size and preferably have a greater height than the roller links so that the top or contact faces 97 of said intermediate links 92 extend forward of the roller links 90 and 91 when the endless chain is in a vertical position as shown in Figure 3. These links 92 are preferably made of steel but may be made of any other metal, composition material, rubber, or the like. In assembling the endless chain 89 the outer roller links 90 and 91 and the intermediate links 92 are fastened with their flat sides together by means of link pins 102 (Figure 3) which extend through the three links 90, 91 and 92.

A second triple-width endless chain 103, identical to the above-described chain 89, is mounted between the other pair of upper and lower sprocket wheels 71 and 72, 61 and 62, respectively. With the two chains 89 and 103 mounted face to face, the grooves 99 in the faces of the intermediate links 92 of each chain are in the same vertical plane. When the oppositely faced links 99 are brought in face to face contact, the semi-circular grooves 99 form a substantially cylindrical opening having a diameter equal to, but preferably slightly less than, the outside diameter of the tubing to be inserted into the well casing.

Spacing means, for governing the position of the two chains 89 and 103 and hence the position of the opposing intermediate blocks 92 with regard to each other, are supplied by two pairs of vertical bar members or press-up blocks 104 and 105, 106 and 107 as shown in Figures 3 and 4.

One pair of vertical bar members 104 and 105 are affixed, in any suitable manner, as by welding, to a pair of horizontal bar members 108 and 109 (Figures 1 and 3) which in turn are mounted, for sliding movement in a horizontal plane, in openings 110, 111, 112 and 113 in the vertical frame members 47 and 48. Bar positioning means, such as positioning screws 114 having lock nuts 115, are fixedly secured to the vertical frame members 47 and 48 so as to contact the horizontal bar members 108 and 109.

The vertical bar members 104 and 105 have a length less than the distance between the upper and lower pairs of sprocket wheels 69 and 70, 59 and 60 and preferably a width slightly less than the width of the rollers in the links 90 or 91. The vertical bar members 104 and 105 are positioned inside the endless chain 89 so that each bar member is in contact with the rear face of said chain 89 on the side that is adjacent the other chain 103. Preferably, the distance between the vertical bar members 104 and 105 is equal to the distance between the roller links 90 and 91 so that only the links 90 and 91 of the chain 89 are in contact with said bar members.



The second pair of vertical bar members 106 and 107 (Fig. 3) are identically arranged on a pair of horizontal bar members 116 and 117 movably mounted in slots 118, 119, 120, and 121 in the vertical frame members 49 and 50, said horizontal bar members 116 and 117 being positioned in said slots by positioning screws 114. Thus, by adjustment of the positioning screws 114, an accurate alignment of the intermediate links 92 over the collet 32 may be secured. Also, when a tubing is being conveyed between said chains 89 and 103 into a well, the gripping pressure exerted on said tubing by the grooved intermediate links 92 of both chains may be regulated, as desired, by adjustment of said positioning screws 114.

Since the drive gears 63 and 64 attached to the shafts 57 and 58 are in mesh, movement of either shaft causes both chain belts 89 and 103 to rotate simultaneously in opposite directions so that oppositely facing links move upward or downward at the same time. The belts 89 and 103 may be rotated manually by handle means 122 and 123 (Figure 1) secured to the ends of shaft 57. If desired, any suitable mechanical, electrical or hydraulic prime mover means may be secured to one of the shafts 57 or 58 to drive the attached chain belts 89 and 103 as diagrammatically shown in Figure 6. Both the prime mover means 144 and the tubing-inserting apparatus may be mounted on a common platform 124 adapted to be secured to the flange means 44 of the casing closure means. The prime mover means may be an air or gas operated reversible engine which may be powered from any desired source such, for example, as the well itself. A suitable safety shield 125 (Figure 1) may cover the drive gears 63 and 64, being secured to the vertical frame members 47 and 50. The two chain belts 89 and 103, and the element being gripped thereby, may be temporarily maintained at any position by inserting a holding pin 126 through suitable holes or openings in said shield 125, drive gear 63 and vertical frame member 47.

For illustrative purposes, an application of the present invention will be described with regard to the insertion or withdrawal of small-diameter flexible tubing into high pressure wells, which may be done for various purposes, such as the measurement of well potentials or the injection of corrosion-inhibiting compounds. When the main purpose of inserting a small-diameter flexible tubing 127 (Figure 6) into a high pressure well is to allow a corrosion inhibitor to be discharged into said casing at some predetermined depth, say 5000 feet, the size and type of tubing used must necessarily be determined by the amount of inhibitor (gallons per hour) to be introduced into the well and the conditions encountered therein. A relatively flexible tubing is preferred in order to facilitate its storage and transportation in a reasonably convenient manner, as on a reel 128 mounted on a small trailer 129 (Figure 6). The tubing may be made of any suitable metal or plastic material having the desired relatively high structural strength and corrosion resistance. Short sections of metal tubing may be joined together to form a single length of tubing in any suitable manner, as by silver soldering, welding, or the like. Sections of plastic tubing may be bonded together with suitable

cements. It is preferred that sections of metallic tubing be joined together so as to give a flush joint that is readily accommodated in the grooved link faces of the inserting chains 89 and 103. However, small couplings may be used to connect sections of tubing if the intermediate links 92 of the chains 89 and 103 are made of, or faced with, a resilient material, such as synthetic rubber. Couplings, if used, may also be arranged to move and fit in the spaces 130 between the adjacent links 92 of the chains.

To facilitate the insertion of tubing into a well casing and to prevent plugging of the tubing during said operation, a valve-equipped sinker bar 131 may be attached to the lower end of the tubing. As shown in Figure 7, the sinker bar 131 comprises a weighted lower end 132, a valve body 133 having an axial bore 134 therethrough which is enlarged and tapped at one end to receive a nipple 135 and is enlarged at the other end to form a valve chamber 136 accommodating a ball-type check valve 137 and its actuating spring 138. A nipple 139 that is secured to the lower end of the tubing 127 in any suitable manner, as by welding, serves as means for connecting said tubing to said sinker bar. Fluid outlet means 140 through the walls of said valve body 133 are normally closed by said spring-loaded non-return valve 137.

Before running a small diameter flexible tubing into a well against pressure, the assembled tubing inserting mechanism and its related equipment is moved into position adjacent a well head and the former is mounted at the top of the well casing 141 above the master control valve 142 as shown in Figure 6. A guide sheave 143 is temporarily secured in any suitable manner, as by bolting, to the top of the apparatus. This sheave 143 acts as a guide between the tubing reel 128 and the inserting chains 89 and 103.

The end of the tubing 127 is unwound from the reel 128 and passed over the sheave 143 (Figure 6) and through the hole 53 (Figures 2 and 3) in the center of the top plate 52. The tubing is then run between the chains 89 and 103 in the grooves 99 of the intermediate blocks of said chains and then through the coaxial bores of the collet 32, gland member 17, cylinder body 10 and stripper 13 so that the end of the tubing 127 projects out of the stripper 13. The nipple 139 (Figure 7) is then fixedly secured to the end of the tubing and the sinker bar 131 is attached to said nipple and allowed to hang just below the stripper 13.

The completely assembled apparatus is now mounted by means of its threaded coupling 15 to the top of a short extension pipe 145 (Figure 6) that is in turn fixedly secured in fluidtight manner to the top of the master valve 142 of the well. The extension pipe 145 is of sufficient length to receive the sinker bar 131 and is threaded at one end to mate with coupling 15 while the other end is adapted to be removably secured to the master control valve 142 in any suitable manner as, for example, by bolts 146. The tubing 127 in the axial bore 11 (Figure 3) of the body 10 of the casing closure means is packed off in a fluidtight manner by introducing a suitable packing through the packing injection screw 21. Any other suitable sealing or packing-off means may be used, said means being located in or mounted on the body member 10. For example, a rubber pack-off element may be mounted on the top of the body 10 about tubing 127.

With the top of the well casing 141 now sealed off in a fluidtight manner, the master control valve 142 is opened to allow the sinker bar 131 and attached tubing to pass through into the well casing below. The motor 144 is then started in the proper direction to drive the chains 89 and 103, causing the grooved intermediate links 92 to grip the outer surface of the tubing and force it into the well. It will be noted from Figure 3 that a substantial portion of each chain 89 and 103 contacts and grips a substantial area of the tubing that is run between them, thus maintaining sufficient pressure, and therefore friction, against tubing to force it through the seal of said casing closure means. While gripping and inserting the tubing, the chains also maintain it in perfect alignment over said collet 32, thus preventing any bending or buckling of said tubing.

A particularly important feature of the present invention is the fact that the tubing inserting mechanism is detachable from the casing closure means. At the end of a downward run of tubing into a well, the tubing is clamped securely in position by tightening nut 26 (Figure 3) against the split, tapered, lower end 36 of the collet 32 causing it to clamp the tubing 127 and thus preventing further downward or upward movement of said tubing. The tubing is then cut off at some point above the inserting mechanism and the sheave 143 and tubing inserting mechanism may be removed for use on another well. Cutting off the tubing above the apparatus leaves a sufficient length for the inserting mechanism to grip when said mechanism is later again installed to remove said tubing from the well. A short section of pipe 147 (Figure 8) may be inserted over the projecting tubing 127 to protect it, said pipe being threadedly connected to coupling 43 surrounding the collet 32. A suitable coupling 148 may be affixed to the end of the tubing 127 whereby a pump tubing 149, leading from the outlet of a chemical injection pump 150 may be coupled thereto. Chemical corrosion inhibitor fluid may then be pumped down the well casing through said tubing 127 and be discharged under pressure through the check valve in the sinker bar 131.

To reverse the operation and pull the flexible tubing 127 and sinker bar 131 from the well, the pump tubing 149 is disconnected and the short section of pipe 147 is removed. The assembled tubing inserting mechanism, prime mover 144 and sheave 143 are mounted on the flange 44 below the collet 32. The tubing 127 is inserted between chains 89 and 103 and the direction of the prime mover 144 is reversed. Starting the prime mover 144 in the reverse direction causes the portion of the chains 89 and 103 facing each other to rotate upward pulling the flexible tubing 127 out of the well. When all of the tubing 127 is out of the well the sinker bar 131 is positioned in the short pipe section 145. The wellhead master control valve 142 is then closed and the tubing inserting mechanism and the casing closure means may be removed as a single unit either by disconnecting the coupling 15 or by unbolting the short pipe section 145 from the valve 142. The apparatus may then be readily moved to another wellhead.

It is understood that although the preferred embodiment of the present invention has been described above as having a tubing inserting mechanism comprising a pair of triple width endless chains having grooved intermediate links, it is clear that single width chains could be employed instead if the faces of the chains that are in substantial contact with each other possess longitu-

dinal grooved portions capable of gripping a tubing. A section of one embodiment of such a chain is shown in Figures 9 and 10, wherein said chain comprises a series of roller links 151 connected together by side bars 152 and pins 153. Mounted on the top of each link 151 is a plate member 154 having downwardly extending arms 155 secured to the pins 153. Each plate member 154 has a longitudinal groove 156 in its face adapted to fit against a tubing. While the use of roller link chains is preferred, any other type of belt means may be used, such as for example, any ordinary drive belt made of rubber, cord, wire and the like having sufficient thickness to have a groove cut or formed in its outer surface. Such a belt would be run between a pair of sheaves instead of sprocket wheels.

It is also understood that although this invention has been described for illustration purposes chiefly with regard to the insertion into wells of small diameter flexible tubing, it can equally well be applied for the insertion of any other elements of substantial length, particularly when said elements are of such nature as to be easily damaged during insertion, as for example in the case of insulated conductor cables.

As used in the foregoing description and in the claims appended thereto, the term "string element" refers to any tubing, electrical conductor cable, wire line, or the like which may be employed in a high-pressure well installation.

We claim as our invention:

1. An apparatus adapted to be mounted on a well head for inserting an elongated semi-rigid string element into a high pressure well casing, said apparatus comprising casing closure means mounted on the well head and having a vertical bore therethrough through which said string element may be inserted, said bore having a diameter slightly greater than the outside diameter of said string element, means carried by said closure means adapted to seal the vertical bore of said casing closure means in a fluidtight manner about the string element positioned therein, a gripping and feeding mechanism positioned directly adjacent said casing closure means for gripping and feeding said string element through said vertical bore and sealing means, and adjustable clamping means carried by said casing closure through which said string element passes for anchoring the string element in the well casing.

2. In an apparatus for inserting an elongated semi-rigid string element into a pressure wellhead and casing, a closure member for said wellhead having a vertical bore therethrough through which said string element may be inserted, packing means carried by said closure member adapted to seal said vertical bore against loss of well pressure when said string element is inserted therein, clamping means carried by said closure member for anchoring the string element therein, a gripping and feeding mechanism positioned above the wellhead, said gripping and feeding mechanism comprising at least two pairs of wheel elements mounted symmetrically with regard to said vertical bore, one wheel element in each of said pairs being mounted above the other in the same vertical plane, two endless belts each mounted on each of said pairs of wheel elements, said two belts having gripping elements thereon with vertically extending gripping surfaces substantially adjoining each other along the center line of said vertical bore, and means for rotating said wheel elements so as to cause said adjoining gripping elements to move together in the same direction, whereby a string element inserted into said vertical bore is frictionally engaged by said gripping elements and driven along a vertical line through said vertical bore and the packing means therein.

3. In an apparatus for inserting a cylindrical semi-rigid string element into a pressure wellhead and casing, a closure member for said wellhead having an axial bore therethrough through which said string element may be inserted, packing means within said closure member adapted to seal the space between the walls of said axial bore and said string element when said string element is inserted therein, clamping means carried by said closure member for anchoring the string element therein, a gripping and feeding mechanism removably positioned above the wellhead, said gripping and feeding mechanism comprising at least two parts of wheel elements mounted symmetrically with regard to said axial bore, one wheel element in each of said pairs being mounted vertically above the other and separated therefrom by a distance greater than the diameter of said wheel elements, two endless belts each mounted on each of said pairs of wheel elements, said two belts having gripping elements thereon with vertically extending gripping surfaces substantially adjoining each other along the center line of said axial bore, and means for rotating said wheel elements so as to cause said adjoining gripping elements to move together in the same direction whereby a string element inserted into said axial bore is frictionally engaged by said gripping elements and driven along a vertical line through said axial bore and the packing means therein.

4. In an apparatus for inserting a cylindrical semi-rigid string element into a pressure wellhead and casing, a closure member for said wellhead having an axial bore therethrough through which said string element may be inserted, packing means within said closure member adapted to seal the space between the walls of said axial bore and said string element when said string element is inserted therein, clamping means carried by said closure member for anchoring the string element therein, a gripping and feeding mechanism removably positioned above the wellhead, said gripping mechanism comprising two endless belts having gripping elements thereon with vertically extending gripping surfaces substantially adjoining each other along the center line of said axial bore, and means for driving said belts with said adjoining gripping elements traveling in the same direction, whereby a string element inserted into said axial bore is frictionally engaged by said gripping elements and driven along a vertical line through said axial bore and the packing means therein.

5. The apparatus of claim 1, having an elongated tubular guide affixed to said closure member and extending thereabove at least to the level of the lower wheel elements, said guide having an axial bore in register with the bore of the closure member, whereby each successive increment of a string element being moved downward by said gripping belt elements enters said guide bore substantially as it is released by said gripping elements and is thus protected from buckling.

6. The apparatus of claim 1, wherein said adjustable clamping means comprises a guide element with a resilient wall portion and gland means in screw-threaded engagement between said closure member and said resilient wall portion, whereby a circumferential pressure can be

applied to said guide portion by an adjustment of said gland means to cause said guide element to grip said string element to suspend it in the well after the completion of the lowering operation.

7. The apparatus of claim 3 including means carried by said gripping mechanism for adjusting the spacing of the substantially adjoining gripping elements of said belts to accommodate said cylindrical string element between them and to maintain pressure in a transverse direction against said string element.

8. The apparatus of claim 3 wherein said endless belts have longitudinally grooved gripping elements, said grooves having a radius substantially equal to radius of said cylindrical string element.

9. The apparatus of claim 3 wherein said wheel elements consist of sprocket wheels and said endless belts consist of roller chains, each of said chains being mounted between a pair of sprocket wheels and comprising a plurality of links, connecting pins securing said links together, and grooved plate elements secured on the outer face of said links, said plate elements being adapted to grip said string element.

10. The apparatus of claim 3 wherein each of



said endless belts consists of a triple-width endless chain comprising three single width chains with connecting pins fastening said three single chains in side-by-side relationship, the outer chains consisting of roller links and the intermediate chain consisting of plate links having longitudinal grooves in the top surfaces, and wherein said wheel elements consist of a pair of spaced sprocket wheels on which said outer roller chains are mounted.

GEORGE H. CALHOUN.
HERBERT ALLEN.


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