Dec. 7, 1965 L. H. MORSE 3,221,758

METHOD AND APPARATUS FOR SEALING A PIPE LINE

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Fig. 1.

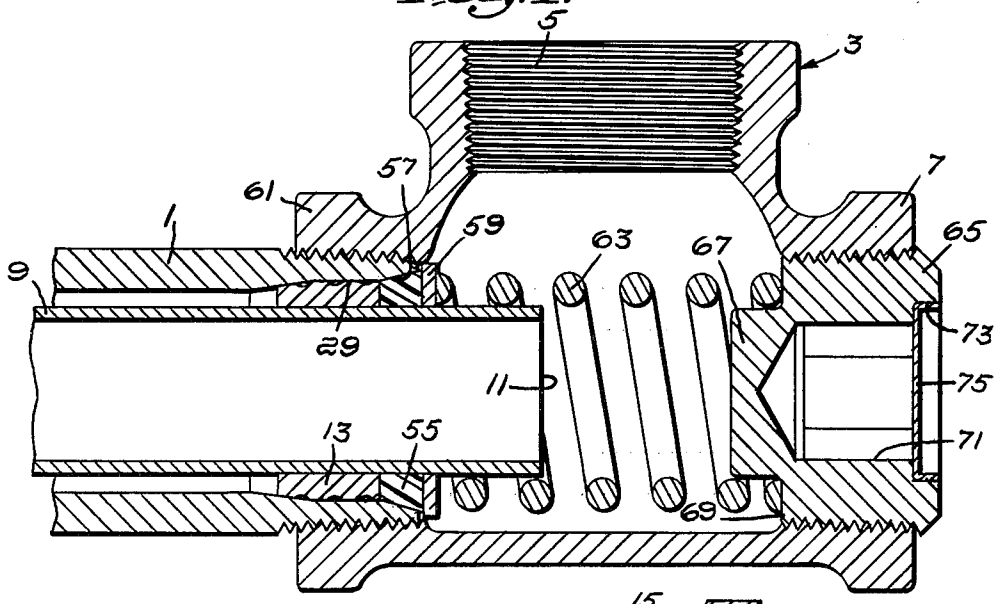


Fig. 2.

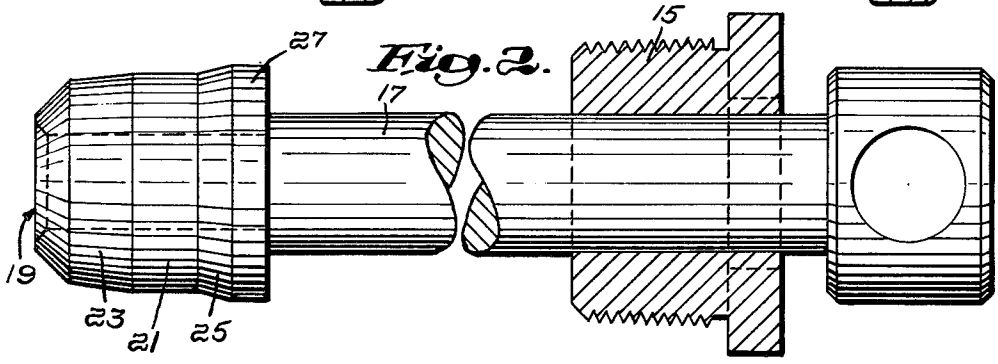
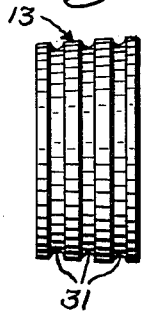


Fig. 4.



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Fig. 3.

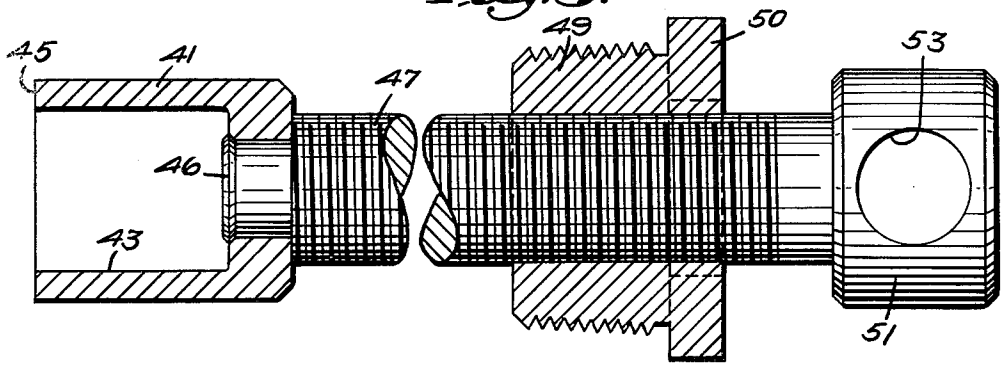
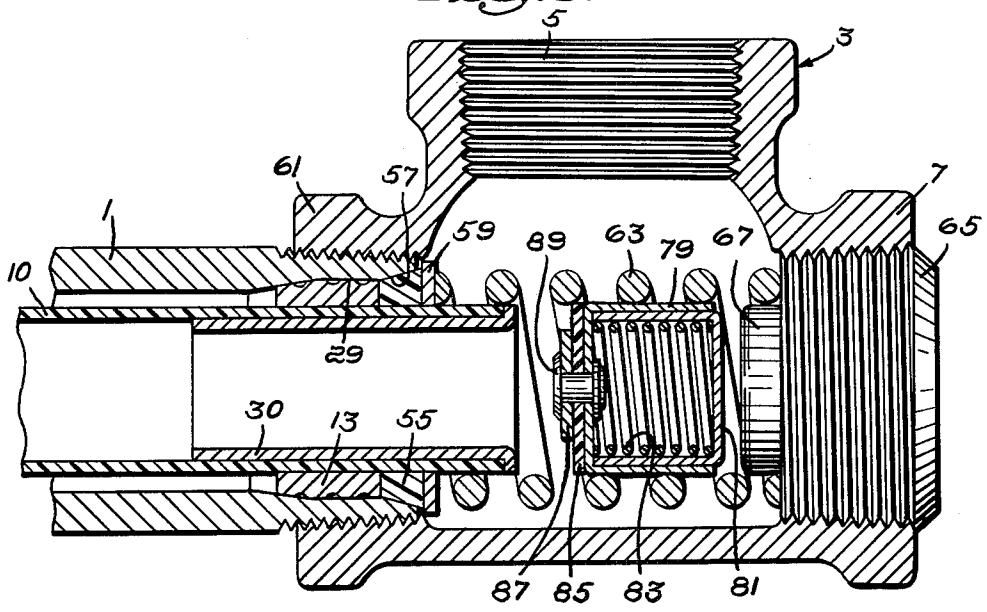


Fig. 5.



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METHOD AND APPARATUS FOR SEALING A PIPE LINE

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8 Claims. (Cl. 137—15)

This invention relates to the repair or replacement of existing pipe lines which require renewal because of leakage, aging, or other reasons.

A common problem of renewing the buried iron supply pipe line which delivers natural or manufactured gas from the public utility company's mains under the street to the building or house where it is consumed, is frequently solved in practical manner by running a continuous length of soft copper tubing or of plastic tubing through the existing iron supply pipe from a point adjacent the gas meter in the building clear to the main in the street. This saves the heavy cost and delay of digging up the old pipe line, removing and replacing it, and reburying it. All that remains to be done is to connect one end of the copper or plastic tubing to the main after cutting off a short length of the iron pipe to give room for the connection, and joining the other end of the tubing to the meter connection.

Requirements of safety dictate that the entire gas line within the building from the point of entry to the meter be composed of rigid iron pipe, and so the joining of the tubing to the meter connection must be made within the iron pipe or the iron fittings thereon. Various ways have been proposed for sealing the delivery end of the tubing to the interior of the iron pipe or fittings. Such provision is necessary to prevent back-flow of gas through the space between the interior wall of the old iron pipe and the exterior of the tubing within it, with eventual escape at the cut-off end of the iron pipe adjacent but short of the main, or at leaks in between the building and the main or elsewhere. But all with which I am acquainted have been so cumbrous or so relatively expensive as to leave room for improvement.

The present invention thus aims to provide a means of sealing the flexible tubing to the rigid iron pipe, and a method and apparatus for applying and installing such means, that will be cheaper, easier, and quicker to install, safer, and practically proof against failure.

To these ends, the invention basically lies in a novel composite seal comprising a metal taper collar to be wedged into the indoor end of the iron supply pipe and fixed compressively about the tubing, an annular preferably non-metallic elastic radially-expansible packing ring bearing against the collar and the iron pipe and the tubing, and a spring continuously pressing the packing ring against the metal collar and expanding this ring radially outward against the iron pipe's interior wall and radially inward against the outside wall of the tubing.

Further features of the invention are the method and apparatus provided to prepare for and install the parts of the novel seal. Thus, the cast-iron T initially present, or one installed, on the building end of the iron supply pipe where it emerges from the foundation and the line turns to the meter or regulator, is used as the body and anchorage of a jig for successively reaming the old supply pipe end and thereafter seating the taper collar in sealing position.

An additional feature of the invention is the facility it offers for the installation of a heat-responsive automatic gas shut-off, called a fire valve for short. The spring which loads the elastic packing ring is of helical expanding type, mounted coaxially with the tubing on the end of the latter, and thus can be and is used as a guide for a cylindrical axially expandible cell having a valve

member on its end to seat upon and close the adjacent end of the tubing in case of fire near the meter and the entry point of the supply line.

Other objects of the invention, and the manner of their attainment, are as set forth hereinafter.

An illustrative embodiment of the invention is shown in the accompanying drawings, in which

FIG. 1 shows a portion of the delivery end of an iron gas supply pipe and a T applied thereto, with the tubing sealed in place by the novel seal, all parts being shown in vertical axial section.

FIG. 2 shows mainly in side elevation a reamer to be inserted in the T and used for preparing a seat in the iron pipe's end for the taper collar, the cutting flutes being omitted.

FIG. 3 shows mainly in side elevation a tool to be inserted in the T to seat the metal taper collar in the iron pipe and about the tubing.

FIG. 4 is a side elevation of the metal taper collar.

FIG. 5 is a view similar to FIG. 1 showing the fire valve in place, and a reinforcing sleeve used inside the tubing when the latter is of plastic.

In the drawings, the iron supply pipe is indicated at **1**, with the usual cast-iron T **3** screwed onto its delivery end within the building. The hub **5** receives the pipe which conducts the gas to the meter or reducing valve. The hub **7** in line with pipe **1** is conventionally closed by a common pipe plug (not shown), and serves to admit cleaning implements. It also serves to permit the introduction of the continuous length of soft copper or plastic tubing **9** or **10**, of sufficiently less outside diameter than the internal diameter of the iron pipe **1** to enable it to be drawn through pipe **1** for the latter's full length by a steel wire or electrician's "snake."

In accordance with the invention, in preparation for the insertion of the tubing **9** into the iron pipe **1**, the clean-out plug is removed from hub **7** and replaced by the screw-threaded and hexagon-headed plug **15**, FIG. 2, through which extends the round shank **17** of a reamer **19** having a cylindrical portion **21** at mid-length which is approximately .030 inch larger than the standard internal diameter of the particular iron pipe **1** in use, another zone **23** nearer its end having a 5° or more straight taper, and a third zone **25** farther from its end and having a straight taper of from 15° to 30°, the portion **27** of maximum diameter being substantially .100″ greater than the standard internal diameter of the pipe **1**. Upon insertion of this reamer into the end of pipe **1** and rotation by suitable means applied to its shank **17** outside the guide plug **15**, a taper seat **29** having zones complementary to the described zones of the reamer is formed in the end of the iron pipe. The reamer cuts deeply enough to eliminate all rust, pits, and scale otherwise present in the corresponding end portion of the pipe. After reaming the seat **29** in the end of the iron pipe to a smooth surface, the reamer and its guide plug **15** are removed, and the flexible tubing **9** is drawn through the old pipe **1** until it reaches the main in the street, whereupon the tubing is severed smoothly as indicated at **11** while still outside the T **3**, and then the tubing is drawn forward until its end **11** is located ¼″ or so out from the end of iron pipe **1**, as shown.

Next, in accordance with the invention, an annular member in the form of a collar **13**, FIGS. 1, 4 and 5, of relatively soft and deformable metal, preferably brass, having a cylindrical interior bore of sufficiently greater diameter than the outside diameter of the tubing to slide over it easily, and preferably an exterior which is part cylindrical and part taper (about half and half) is fitted over the end of tubing **9** and press-fitted into seat **29** of the pipe **1**, being wedged thereinto so tightly as to contract upon and compressibly grip the tubing **9** it

encircles. When plastic tubing **10** is used, a metal reinforcing sleeve **30** with a terminal flange is slipped inside the tubing to support it against the inward pressure of collar **13**, as shown in FIG. 5. The cylindrical portion of the taper collar **13** exceeds the diameter of the cylindrical portion, the mid-section, of seats **29** in pipe **1** by .010" to .015", the tapered inward end portion of the collar having a diameter of approximately .040" less than the cylindrical portion. While these dimensions of reamer and collar are adapted for use in inserting a nominally ½" I.D. tubing in the conventional ¾" I.D. iron pipe, they are illustrative only, the basic principle being that the taper collar is of the proper dimensions and ductility to be swaged by the seat formed in the iron pipe acting as a die, and thus compressed radially like a gland into tight gripping relation about the tubing **9**. The taper collar is accordingly provided with a plurality of peripheral grooves **31** to provide voids into which the metal of the collar can flow under the distortion incident to swaging and wedging it into its seat **29** in pipe **1**.

The invention provides the means for applying the heavy pressure desired and needed to swage the taper collar **13** thus into place, by supplying a tool, FIG. 3, which converts the T **3** into a screw-press which seats the collar **13** in the manner desired. This tool comprises a cup-shaped presser **41** whose recess **43** fits easily over the end of the tubing **9** and whose rim **45** is adapted to engage the big end of collar **13** after the latter has been installed on the tubing **9** and in the flaring outermost portion **57** of seat **29**, as by using long-nosed pliers or other means. The presser **41** is mounted rotatably on the end **46** of a screw-threaded shaft or shank **47** which is threaded through a guide plug **49** with hexagonal head **50** which is screwed in the hub **7** of the T **3** temporarily while the tool is in use. The head **51** of shank **47** is provided with a transverse hole **53** in which a bar may be inserted to rotate the screw shank **47** and thus impel the presser **41** against taper collar **13** with the force required to swage the latter into place. The tool is thereupon removed.

The collar **13** installed in the iron pipe **1** thus functions as a mechanically tight seal connecting and centering the iron pipe and the tubing, and may or may not be in gas-tight relation. But its main purpose is to provide a seat or stop against which to press a second annular member in the form of a non-metallic elastic packing ring **55** which under axial pressure is expandible both radially inward and radially outward, and comprises the actual essential gas-tight seal. Herein, this packing ring is made of neoprene, preferably having a taper roughly matching the slope of the reamed taper **57** at the mouth of the seat formed in the end of pipe **1**. This ring is slid over the end of tubing **9** or **10**, followed by one or more metallic washers **59** slightly less than the diameter of the hub **61** into which the iron pipe **1** is screwed. Then a stiff expanding coil spring **63**, fitting closely on the outside of tubing **9** or **10**, is placed over the end of tubing **9** or **10** to bear against the washer **59**.

The pressure of spring **63** when stressed, and delivered to the ring **55** through the washer **59**, is of such intensity as to compress the ring **55** axially and thus expand it radially into gas-tight sealing relation to the outer wall of tubing **9** or **10** and the inner wall of pipe **1**, specifically at the bevel **57** therein.

To load the spring, a special plug **65**, permanently replacing the original clean-out plug, now discarded, is provided and installed in the hub **7**. This plug has a coaxial boss **67** which enters and centers the spring **63** in axial alignment with the pipe **1** and tubing **9** or **10**, while the adjacent annular shoulder or inward face **69** of plug **65** compresses the spring and causes it to load the washer **59** and thus press and hold the neoprene packing ring **55** permanently in gas-tight sealing relation

with the tubing **9** and the pipe **1**. A suitable polygonal socket **71** is formed in the outer end of the plug **65** for the reception of a correspondingly shaped wrench whereby to insert and remove the plug. Where still greater pressure on packing ring **55** is needed, or other adjustment of the spring tension is wanted, additional steel washers **59** are interposed between the ring and the spring.

Preferably this socket **71** and matching wrench will have an odd number or shape of facets, to reduce the possibility of unauthorized removal of the plug. To the same end, the socket is preferably counterbored as shown at **73** for the reception of a press-fitted sheet-metal seal **75** with or without identifying insignia of the public utility company.

The spring **63** being of open wind opposes no obstacle to the free flow of gas from tubing **9** or **10** through the T to the pipe (not shown) applied to hub **5** and leading to the meter or regulator.

The economy of the present invention will be obvious, as it involves no replacement of pipe or fittings or openings of joints in the original pipe line, even in the case of the smallest supply pipe sizes used in standard installations. Beyond the substitution of the special plug **65**, of essentially inexpensive construction, all that is needed to complete the structure are the three simple annular components **13**, **55** and **59**, and the spring **63**. Once the reaming of iron pipe **1** and the installation of the flexible tubing **9** or **10** are completed, it is only a matter of a few minutes' work to install the improved seal in permanent working relation.

The construction facilitates the installations of a heat-responsive automatic shut-off or fire valve, as shown in FIG. 5. An improved form of the latter comprises a cell made of two telescoped cups **79**, **81**, sweated together by low-temperature fusible metal having a melting point in the range between 165° and 250° F., which hold under compression a coil spring **83** initially several times their length. A washer **85** of diameter equal to that of tubing **9** or **10** and of suitable flexible, gas-impervious, and heat-resisting material such as "Neobestos," overlain by a smaller metal washer **87**, is affixed to the end of the cell adjacent the tubing **9** by a rivet **89**. This fire valve fits loosely and slidably within the heavy coil springs **63**, which thus also performs the function of guiding the cup **79** accurately toward the end **11** of tubing **9** or of the sleeve **30** until the valve material **85** is seated correctly and tightly against and closing the tubing, when the fusible metal lets go under its rise in temperature in case of fire.

While I have illustrated and described a certain form in which the invention may be embodied, I am aware that many modifications may be made therein by any person skilled in the art, without departing from the scope of the invention as expressed in the claims. Therefore, I do not wish to be limited to the particular form shown, or to the details of construction thereof, but

What I do claim is:

1. Sealing means for a pipe line having in combination a relatively rigid pipe having a tapered seat in one end, a relatively flexible pipe within the rigid pipe and at least coextensive therewith, a deformable metallic collar compressively surrounding the flexible pipe and having a tapered exterior surface wedged in the seat, and a non-metallic packing ring between the inner and outer pipes and in gas-tight relation with the two pipes and the collar.

2. The combination according to claim **1** in which resilient means is provided ever pressing the packing ring inward into the rigid pipe.

3. Sealing means for a pipe line having in combination a relatively rigid pipe, a T on an end thereof, a relatively flexible pipe within the rigid pipe, a deformable metallic collar wedged inside the end portion of the rigid pipe and gripping the flexible pipe, a non-metallic packing ring wedged in the rigid pipe and bearing against the flexible

pipe, a helical spring within the T and pressing the packing ring against the collar, and screw means in the T loading the spring.

4. Sealing means for a pipe line having in combination a T, a relatively rigid pipe fixed in one end of the T, a relatively flexible pipe extending throughout the rigid pipe and having one end within the T, a deformable metallic collar wedged into the fixed end of the rigid pipe and compressively gripping and surrounding the flexible pipe, a non-metallic radially expansible packing ring in the mouth of the rigid pipe, a helical spring encircling the end of the flexible pipe within the T and pressing the packing ring into sealing contact with the collar and the two pipes, and a plug in the T in line with the pipes and loading the spring.

5. Sealing means for a pipe line having in combination a T having two coaxial hubs, a pipe having one end fixed in one hub, a plug in the other hub, a coil spring in coaxial relation with the pipe and located between the pipe and the plug, a cylindrical axially expandible heat-responsive element coaxially and slidably disposed in the coil spring and movable independently of the latter, and closure means for the pipe on the end of the element confronting the end of the pipe.

6. Sealing means for a pipe line having in combination a rigid metallic pipe, a plastic pipe within the rigid pipe and at least coextensive therewith, a rigid metallic sleeve within the plastic pipe, a metallic collar around the plastic pipe and wedged in the rigid pipe and compressing the plastic pipe against the sleeve therein, and a non-metallic packing ring wedged between the two pipes and seated on the metallic collar and in gas-tight contact with the two pipes and the collar.

7. The method of sealing a pipe line composed of a T, a pipe having one end screwed into the T, and a second pipe within the first pipe, which method comprises forming a taper seat in the end of the outer pipe, inserting the second pipe into the outer pipe, placing a collar around the end portion of the inner pipe and within the taper seat, swaging and deforming the collar into wedging relation with both pipes by pressure means reacting against the T, thereafter placing a flexible packing ring about the end portion of the inner pipe and within the taper seat, and holding the packing ring pressed against the collar and the adjacent surfaces of the two pipes by pressure means confined within and reacting against the T.

8. The method of sealing a pipe line which includes a rigid pipe, a T on the end of such pipe having hubs in line with the pipe, and a flexible pipe within the rigid pipe and the T, comprising the steps of using one hub of the T as a guide for a tool used to form a seat in the rigid pipe, then using the hub as an abutment in press-fitting a stop member in the seat in the rigid pipe, and thereafter using the hub as an abutment to load spring means holding a packing element against the stop.

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