EXPENDABLE MOLD AND METHOD FOR SEALING JOINTS IN GAS MAINS

Filed March 27, 1963 4 Sheets-Sheet 1

Fig. 1.

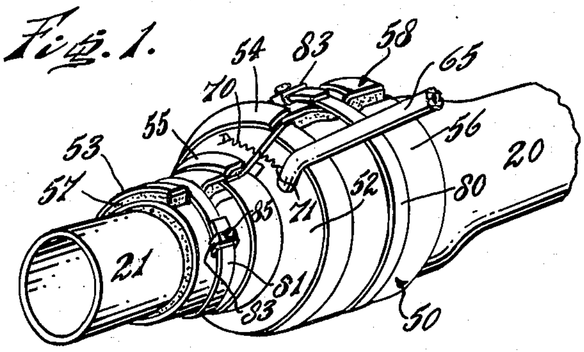


Fig. 2.

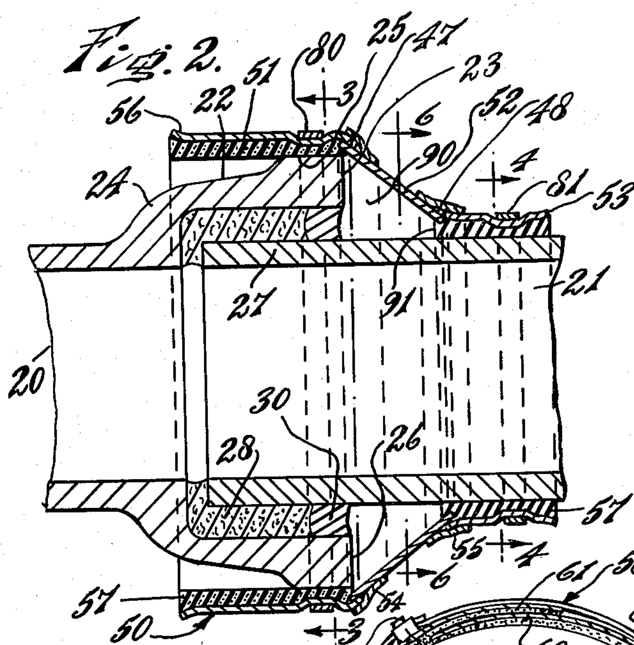


Fig. 4.

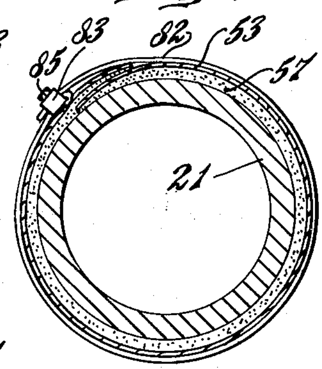
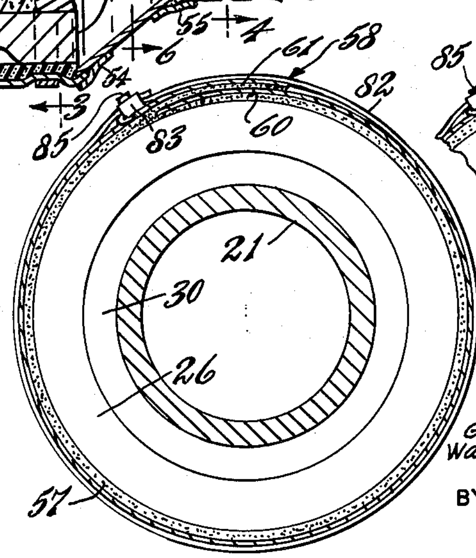


Fig. 3.



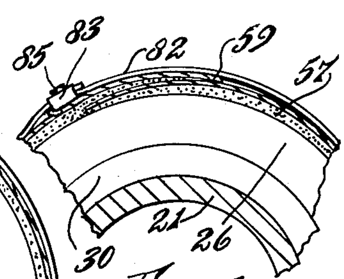


Fig. 5.

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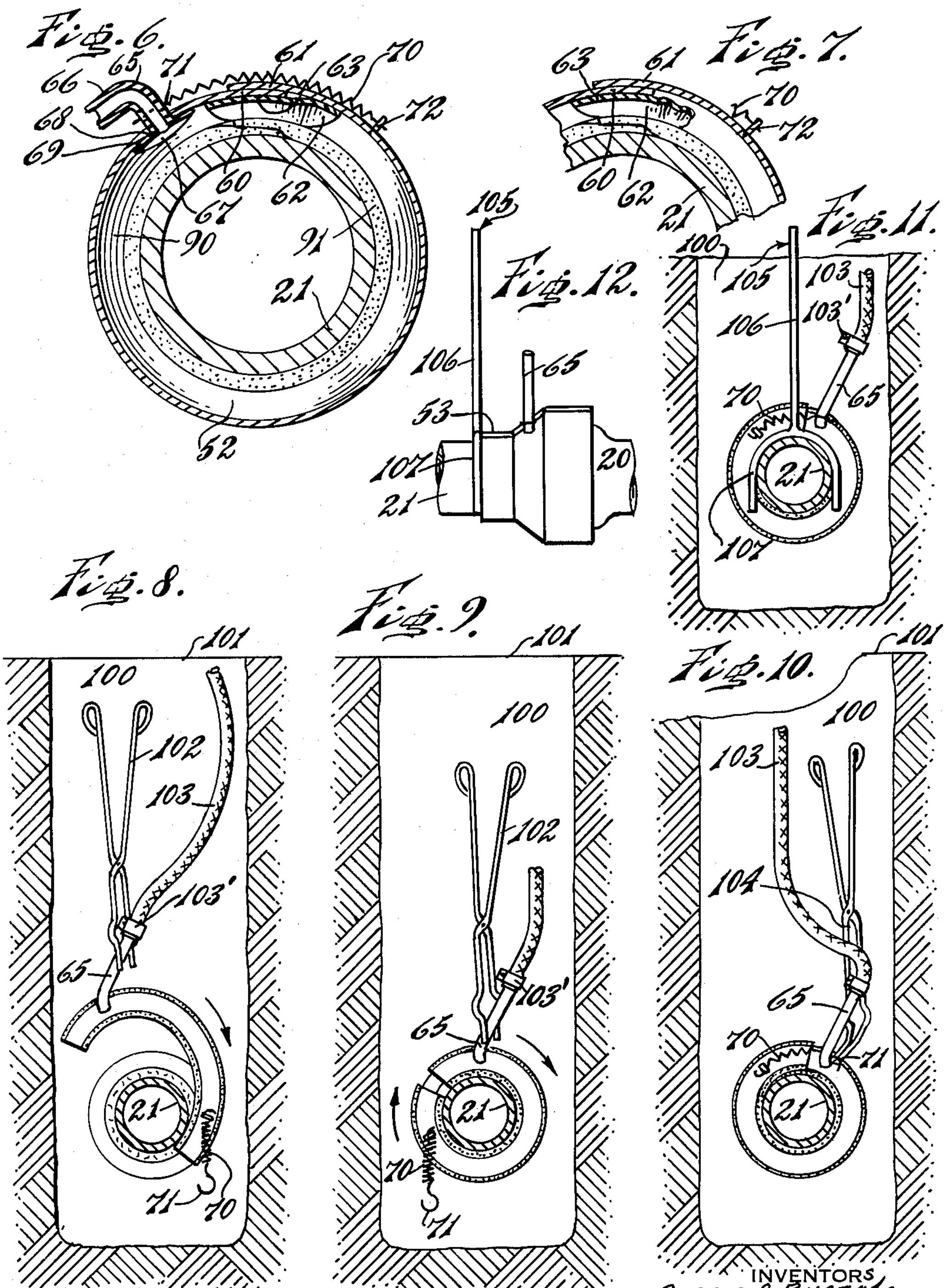

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EXPENDABLE MOLD AND METHOD FOR SEALING JOINTS IN GAS MAINS

Filed March 27, 1963 4 Sheets-Sheet 3

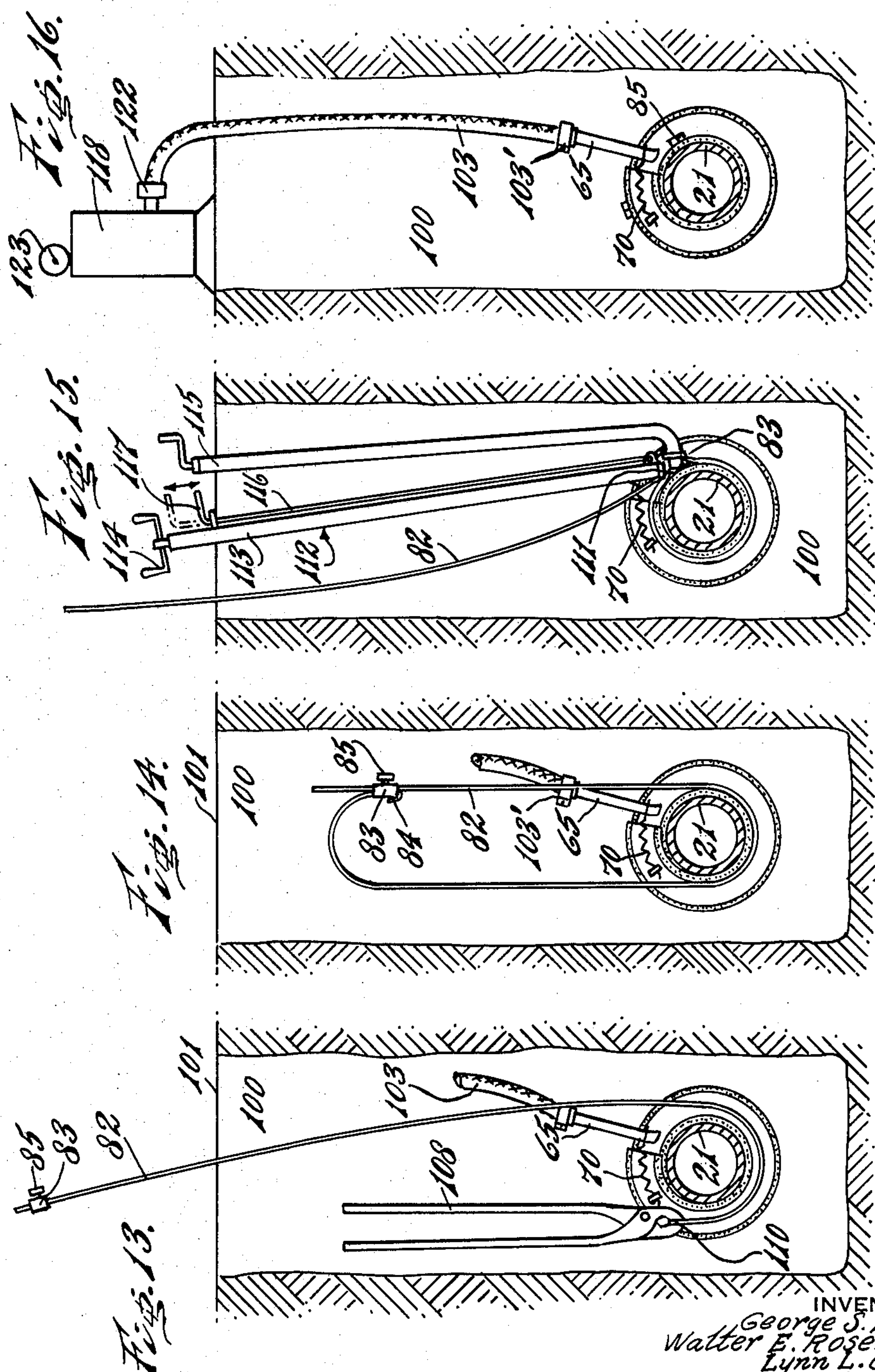

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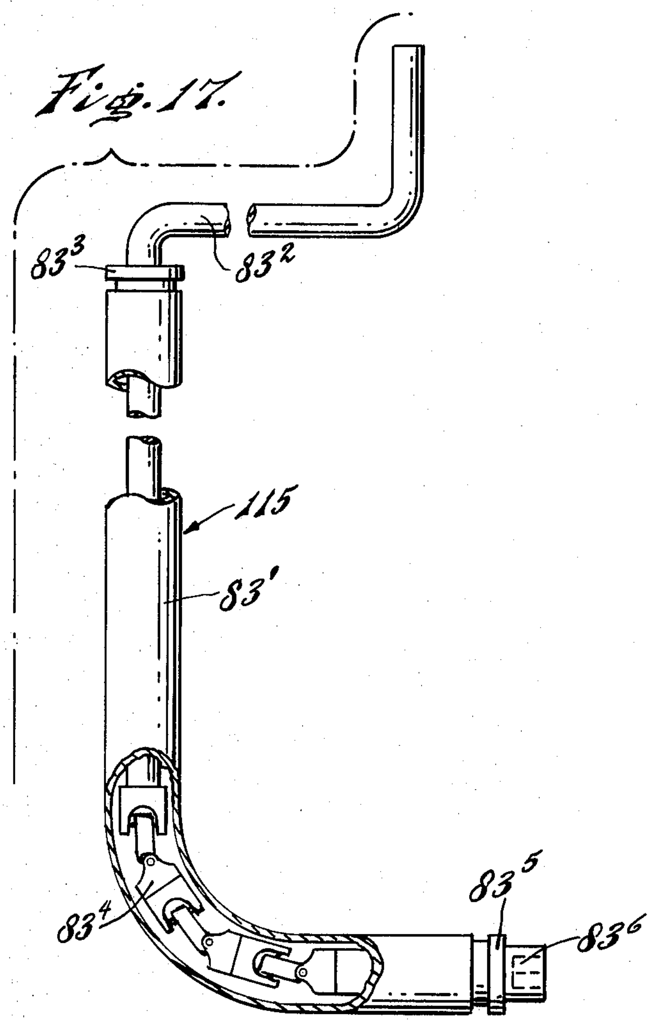
Fig. 17.



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United States Patent Office 3,260,280
Patented July 12, 1966

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EXPENDABLE MOLD AND METHOD FOR SEALING JOINTS IN GAS MAINS

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Filed Mar. 27, 1963, Ser. No. 268,388
16 Claims. (Cl. 138—97)

The present invention relates to a process and apparatus for sealing mains and particularly for sealing bell and spigot joints in existing mains carrying fluid such as fuel gas, water and other fluids.

A purpose of the present invention is to provide an expendable mold for receiving sealant for sealing leaks in bell and spigot joints.

A further purpose is to provide a mold which can be applied to a joint at the bottom of an excavation from a position at the surface of the excavation.

A further purpose is to be able to inject sealant into a mold at the bottom of an excavation from a position at the surface of the excavation.

A further purpose is to be able to backfill a hole immediately after the sealant has been injected into the mold.

A further purpose of the invention is to seal gas mains at the bell and spigot joints by means of a mold applied by an operator located at a point remote from the main.

A further purpose is to use commercially available steel banding for applying the mold on a joint.

A further purpose is to use a mold to create a cavity which extends outwardly from the joint packing space for the reception of a sealant.

A further purpose is to reduce the size of the hole necessary to gain access to the main to seal the joint.

A further purpose is to reduce the area of paving destroyed to gain access to seal the joint.

A further purpose is to keep the main in service while the joint is being sealed.

A further purpose is to provide an expendable mold which can compensate for variations from true roundness or lack of concentricity in the main or lack of angular alignment between the adjoining lengths of pipe.

Further purposes appear in the specification and in the claims.

In the drawings we have chosen to illustrate one embodiment only of the device for sealing the leak, choosing the form shown from the standpoints of convenience in illustration, satisfactory operation and clear demonstration of the principles involved.

FIGURE 1 is a perspective view of the mold of the invention applied to a pipe joint.

FIGURE 2 is an enlarged longitudinal vertical section of the mold of the invention applied to a bell and spigot joint.

FIGURE 3 is a section transverse to the axis of the pipe taken on the line 3—3 of FIGURE 2.

FIGURE 4 is a section transverse to the axis of the pipe taken on the line 4—4 of FIGURE 2.

FIGURE 5 is a fragmentary section transverse to the axis of the pipe similar to FIGURE 3 showing a variation in the overlap.

FIGURE 6 is a section transverse to the axis of the pipe taken on the line 6—6 of FIGURE 2 showing the inlet tubing.

FIGURE 7 is a fragmentary section transverse to the axis of the pipe similar to FIGURE 6 showing the sealing flap in the relaxed position.

FIGURES 8 through 16 show the application of the mold to a pipe joint.

FIGURE 8 is a transverse section with respect to the pipe showing the mold in elevation being lowered into the hole.

FIGURE 9 is a section transverse to the axis of the pipe showing the mold in elevation, the mold being rotatably adjusted about the joint.

FIGURE 10 is a section transverse to the axis of the pipe, showing the mold being closed by the use of hooked tongs to extend a spring.

FIGURE 11 is a section transverse to the axis of the pipe showing a yoke being used to longitudinally tap the mold into position.

FIGURE 12 is a fragmentary longitudinal elevation showing the step illustrated in FIGURE 11.

FIGURE 13 is a section transverse to the axis of the pipe showing the insertion of a band around the joint.

FIGURE 14 is a view transverse to the axis of the pipe showing the closed band with the free end of the steel band hooked behind the buckle.

FIGURE 15 is a section transveres to the axis of the pipe showing the use of the extension tensor to tighten the band around the mold. This view also illustrates a special wrench for tightening the band.

FIGURE 16 is a view similar in position to FIGURE 15, but showing the insertion of the sealant into the mold.

FIGURE 17 is a fragmentary elevation partly in section of the special wrench of the character employed in FIGURE 15.

Describing in illustration but not in limitation and referring to the drawings:

In the distribution of gas for domestic, commercial and industrial use, a network of mains is employed to carry the gas from central points to points of usage. These mains in many instances have bell and spigot joints which are typically packed by jute and then usually leaded or cemented at the outside. When these joints were originally installed, many of the mains were distributing carbureted water gas or coke oven gas or other manufactured gas which contained a substantial content of moisture, tars and oils. These liquids had over a period of time saturated the packing materials to provide relatively leak-free joints.

In recent years there has been a shift over to natural gas which is of a comparatively dry nature. The natural gas has reduced by absorption the content of tars and oils which has been built up in the joints, thus drying out the joints. Furthermore, many of the textile packing materials tend to shrink when they dry. The result encountered in a widespread way has been a tendency of the packing to shrink, causing openings through the dried out packing which permit leakage of gas.

In other instances leaks have been caused in many areas of the country by active earth conditions which in certain localized areas has involved settling or movement of the earth in the order of a half inch or even one inch a year. This settling has caused a certain tendency for misalignment of the various pipe sections, both vertically and also horizontally and this has further increased the tendency toward leakage. This misalignment in some instances has caused a withdrawal to some extent of the pipe from the spigot causing additional leakage.

All of these factors have made it quite important to develop some technique for sealing the joints. One approach to the problem has been to cut out the line, and actually introduce a self-propelled plug, which cleans the line and locates the joint, sometimes electronically, and then to coat the inside with a suitable sealing compound.

This involves several complications, the worst of which is taking the line out of service and the need to provide an alternate temporary supply to the customer and also the need to operate on relatively straight pipe stretches and not on pronounced bends.

In order to overcome the disadvantages of sealing by a self-propelled crawler inside the line, extensive use has been made in some areas of external sealing techniques, which may be used without taking the line out of service. These usually involve digging an excavation at each joint large enough for a man to descend to the area around the bell or pipe and to fix a bolted clamp fitting around the joint. The fitting compresses a rubber gasket which seals against the outside of the bell and also against the adjoining straight pipe section of the spigot.

There is also another technique which in effect butters epoxy resin around the face of the bell in order to accomplish sealing. This method also requires extensive excavation.

The present invention, as in copending application Serial No. 192,817, for Process and Apparatus for Sealing Mains, filed May 7, 1962, permits the line to remain in service at normal pressure without any interruption of gas flow, and permits the line to be repaired with a minimum of excavation. The process and equipment can function using a slit about 18 inches in length and about 4 inches in width where it penetrates the sidewalk or other paving, and slightlly wider in the earth at the bottom where the pipe joint is located. Thus it will be evident that successful operation can be carried on through an opening which is less than 1 square foot in area and in many cases as small as ½ square foot in area at grade in the paving. In addition, in the present invention the excavation can be backfilled immediately after the repair is made so that a minimum of inconvenience is caused to the public.

The present invention as compared to any preformed gasket technique gives a greatly improved seal by providing a bond to the metal surface.

Principally due to the reduced amount of excavation, the speed of the operation is considerably increased compared to the other techniques. It is believed that the time is not more than one-half that of the best prior technique.

By virtue of the relatively small size of the opening in the paving, it is much less costly to repave after sealing the leak than it was in prior art methods. In addition, highway authorities have permitted openings of this size in paving to be repaired with a mere block of concrete rather than extensive cutback and repaving according to specification. This provides quite substantial savings. Also, it is usually possible to work around reinforcing rods in concrete paving, thus eliminating the necessity for replacing and/or tie-welding new rods with repaving. Furthermore, the repair to the paving can be made immediately.

In accordance with the present invention, a cleaning technique is employed, which may conveniently be sand blasting but could be grit blasting, wheat blasting or refractory blasting. Alternatively the joint could be cleaned by wire brushing, scraping or by solvent. After the cleaning has been completed, a mold is introduced about the joint more or less by remote control since the operator is at ground level. A suitable sealing material is introduced under pressure into the mold space. The mold is left in position about the pipe or joint, the sealing material inlet tube extension is disconnected from the mold and the excavation is immediately backfilled.

The preferred sand blasing device and technique is set forth in copending application Serial No. 192,817 referred to above. This device and technique consist essentially of a rotating element having a nozzle adapted to sand blast the pipe, the rotating element being manipulated remotely from the main by means of a handle.

The present invention is adapted to be used on a joint of the type comprising lengths of pipe **20** and **21**. Pipe **20** has a bell **22** having a flange **23**, a web **24**, a longitudinally and circumferentially extending surface **25** and a radially and transversely extending face **26**. The spigot **27** is in effect an integral extension of pipe **21** having the

same inside and outside diameter. The outer circumference of the spigot **27** and the inner circumference of the bell **22** form a space having a circumferentially extending portion and a radially extending portion. Jute packing **28** occupies the radially extending portion and a part of the circumferentially extending portion and a lead packing **30** extends circumferentially at the remaining part of the space not occupied by the jute.

Considering now the mold itself as shown in FIGURES 1 through 7, a girdle **50** has a circumferential longitudinally extending spigot portion **53**, a circumferential longitudinally inclined cavity-forming portion **52**, and a circumferential longitudinally extending bell portion **51**. The girdle portions **51**, **52** and **53** are permissibly integral but as shown are desirably of separate elements cemented or sewn together at longitudinal overlap positions **47** and **48**, and further connected by circumferentially extending reinforcing cemented rubber tapes **54** and **55**. The girdle portions **51** and **53** are composed suitably of an outer layer of rubberized fabric **56** laminated to an inner layer of foam rubber **57**. The diagonal or intermediate portion **52** is of a rubberized fabric of the type employed at **56**.

The mold **50** in a relaxed position conforms to the diameter and shape of the bell and spigot joint to which it is to be applied.

The mold is separated longitudinally at overlap **58** with an inner lap **60** and an outer lap **61**. In FIGURE 3, the outside lap **61** has the foam rubber **57** terminating at the end of lap **61**. In an alternative shown in FIGURE 5, the foam rubber **57** terminates short of the overlap **61** to permit a closer engagement as at **59**.

The inner lap **60** of girdle portion **52** has a thin flexible plastic or fabric film flap **62** adhesively connected at **63** as best seen in FIGURES 6 and 7. The flap **62** tends to remain smooth against the stiffer material of girdle portion **52** when subjected to internal pressure. The inner lap **60** extends between flap **62** and outer lap **61** as seen in FIGURES 6 and 7.

In FIGURE 6, the flap **62** is shown in a stressed position, and in FIGURE 7, the flap **62** is shown in an unstressed position.

A fill tube **65** as best seen in FIGURE 6 is composed of a tube portion **66** and a flange portion **67**. The tube portion **66** fits through a circular opening **68** in the intermediate portion **52** of the girdle and is held in place by flange **67** which is suitably cemented to portion **52** at **69**.

A helically wound tension spring **70** having a hooked end **71** is anchored to a D-ring cemented or otherwise secured to girdle portion **52** at **72**.

The girdle **50** will be held in position over the joint by steep straps **80** and **81** which extend over the bell portion **51** and the spigot portion **53** of the girdle **50**. These straps **80** and **81** are of a well known commercial type consisting of a band **82** and a buckle **83**. One end of band **82** is secured in buckle **83** by a bend **84** and the opposite end of band **82** is held in buckle **83** by a bolt **85**.

It will be noted that the band of strap **80** is placed over the bell portion of the girdle **51** over circumferentially extending surface **25** of the bell **22**. This is best seen in FIGURE 2. Likewise steel strap **81** extends around girdle portion **53** to secure the portion to spigot **27**.

As seen in FIGURE 2, the joint and girdle form a cavity **90** which is annular and which is of a generally triangular longitudinal cross section. The cavity **90** is defined by bell transverse face **26**, lead packing **30**, spigot **27**, and by the girdle portion **52**. A small portion of the foam rubber at **91** completes the cavity definition.

In operation, a hole is excavated about the joint by the use of long handled tools from the surface. This excavation can be of approximately 18 inches in length and about 4 inches in width at the surface where it penetrates the sidewalk or other paving. The excavation is made slightly larger at the base in the area of the joint so that the mold can be properly manipulated.

Referring to FIGURE 8, the girdle **50** is lowered into excavation **100** from surface **101** by grasping the fill tube **65** with a pair of straight tongs **102**. It will be evident that prior to the insertion of the mold into the excavation, a hose **103** has been connected to the fill tube **65** as by a suitable clamp **103'**. The mold will extend in a slightly curved fashion so an operator can manipulate the hose around the joint until the girdle assumes the position shown in FIGURE 9.

As shown in FIGURE 9, the tongs **102** are used to slide the mold around the joint. Because of the mold's resilience it will stay in almost a closed position around the joint. The hook **71** of spring **70** is then grasped by the offset tongs **104** and hooked around the fill tube **65** as shown in FIGURE 10. The spring **70** keeps the mold circumferentially positioned about the joint.

Using a long handled yoke **105** having a straight handle **106** and a yoke portion **107**, the mold is tapped longitudinally at the spigot portion **53** to insure that the mold is up against the bell **22**, as shown in FIGURES 11 and 12. The mold is now in position for application of the steel straps **80** and **81**.

A buckle **83** is applied to the steel band **82** which is played out from a coiled roll (not shown). The buckle **83** is tightened along the band **82** by bolt **85** and secured lightly thereto so that it does not slip down. The strap **82** is then placed along one side of the spigot portion **53** of the girdle **50** until it curls around the spigot portion **53** and comes up on the other side as shown in FIGURE 13. The band **82** is manipulated from the excavation surface **101**. Straight nosed tongs or pliers **108** are used to grasp the free end of the band at **110** and the free end is brought to the surface **101**. The free end **110** is threaded through buckle **83** and bent back on itself at **84** as in the normal banding fashion. The buckle **83** is then pused down along the band **82** as far as can be reached by hand from the surface **101** as shown in FIGURE 14.

The side slot of the tensor head **111** of a conventional band tensor **112** having an elongated handle **113** extends from the hole. The tensor head **111** is pushed down against the buckle **83** and the strap is pulled up snugly as in FIGURE 15.

The conventional handle **114** at the top of the tensor **112** is rotated to tighten up the band **82** about the spigot **27**. When the band is sufficiently tight a special wrench **115** with three universal joints is used to engage and tighten the bolt **85** on the buckle **83** as shown in FIGURE 15. The special wrench includes a tube **83'** suitably bent to 90 degrees, having at one end a crank handle $\mathbf{83^2}$, suitably journalled on a bearing $\mathbf{83^3}$, which connects to a series of suitably three universal joints $\mathbf{83^4}$ connected end to end in the bend of tube **83'** and at the output end suitably journalled in a bearing $\mathbf{83^5}$ and connecting to a socket wrench $\mathbf{83^6}$. Thus it will be evident that torsional force applied at the crank end is made effective at right angles in the socket wrench.

When the nut **85** on the buckle **83** has been tightenend, the steel band **82** is cut adjacent to buckle **83** by operating the conventional cut-off lever **116** of the band tensor **112** by forcing handle **117** downward.

The same procedure is followed for placing strap **80** on the bell portion **51** of the mold.

After both bands have been placed and properly secured the mold is ready for injection of the sealant. The sealant is preferably of a type which will partially harden but which will remain flexible throughout its life.

In FIGURE 16 there is shown the step of injecting the sealant into the mold by the use of a fluid pump **118** of any well known type which connects through inlet hose **103** to fill tube **65**.

The flap **62** acts as a valve which permits the air being displaced by the sealant entering the cavity **90** to escape through the overlap **58** of a girdle portion **52** but prevents similar escape of the highly viscid sealant.

The sealant is of a material of such viscosity that it will

not leak out through the mold even though the mold would not be tight to water.

A gauge **123** or other technique, such as observing difficulty in further operation of the pump **118** or, for instance, a grease gun, is used to indicate when the cavity **90** is completely filled with sealant.

After the sealant has been injected into the mold and the inlet hose **103** secured against leakage as, for instance, by bending the hose **103** into a kink and tying the hose, the hose is disconnected from the pump at **122** and allowed to drop into the hole. The hole can be immediately backfilled.

In view of our invention and disclosure, variations and modifications to meet the individual whim or particular need will doubtless become evident to others skilled in the art, to obtain all or part of the benefits of our invention without copying the structure and process shown, and we, therefore claim all such insofar as they fall within the reasonable spirit and scope of our claims.

Having thus described our invention what we claim as new and desire to secure by Letters Patent is:

1. A one piece collar for enclosing the periphery of a cylindrical object such as a conduit or the like which comprises an elongated flexible body portion having an axial lap joint, said body portion being of one piece and adapted to extend 360 degrees around a conduit, means for clamping said collar to and around the conduit in spaced relation at each side of the portion of the conduit to be sealed, and an inlet in the collar, for introducing a sealing compound around the conduit in said portion to be sealed.

2. A collar in accordance with claim **1** having check means for preventing backflow of the sealing compound through the inlet.

3. A collar in accordance with claim **1** having a smaller diameter portion, a larger diameter portion, and a tapered connection between said portions.

4. A collar in accordance with claim **1** formed of flexible fabric, and a resilient sponge-like collar secured inside and around each end of said fabric.

5. A collar assembly in accordance with claim **1** having means for initially holding the lap joint in place during the positioning of the clamp means.

6. A collar for sealing the joint of an underground conduit and the like comprising a flexible body member capable of being twisted into a strand-like condition, a flap at one end of said body member adapted to underlie the opposite end of the body member when pushed around a cylindrical conduit, a puckered area in said flap, an inlet tube providing access to the inside of the collar, said inlet tube being located less than 180° from the puckered portion of the flap, means associated with said inlet tube for preventing backflow of the sealing compound introduced through the tube under pressure, and means for clamping the overlapped collar around the periphery of the conduit at axially spaced distances from the area on the conduit to be sealed.

7. A collar in accordance with claim **6** having a large diameter portion for clamping around the bell of the conduit and a smaller diameter portion for clamping around the body of an adjacent conduit section.

8. A collar in accordance with claim **6** having means for retaining the lap joint in position around the conduit prior to and during the installation of the clamping means.

9. The method of sealing an area in an underground conduit which comprises the steps of excavating a relatively narrow shaft above an area in the conduit to be sealed, twisting a flexible collar into a strand-like condition, threading said twisted collar into the excavation around the portion of the conduit to be seaed, untwisting the collar, positioning the collar to form a lap joint around the conduit, applying a temporary holding member for retaining the collar in said overlapped position, clamping the collar to the conduit in positions axially spaced from each other and enclosing the area to be sealed, and introducing a sealing compound between the outer periphery of the conduit and the collar.

10. The method in accordance with claim 9 including the step of introducing a thermosetting sealing compound into the collar.

11. The method of claim 9 including the step of preventing backflow of the sealing compound.

12. A collar for sealing the joint of an underground conduit and the like comprising a flexible body member, a flap at one end of said body member adapted to underlie the opposite end of the body member when pushed around a cylindrical conduit, a puckered area in said flap, an inlet tube providing access to the inside of the collar, said inlet tube being located less than 180° from the puckered portion of the flap, means associated with said inlet tube for preventing backflow of the sealing compound introduced through the tube under pressure, and means for clamping the overlapped collar around the periphery of the conduit at axially spaced distances from the area on the conduit to be sealed.

13. A collar in accordance with claim 12, having a large diameter portion for clamping around the bell of the conduit and a smaller diameter portion for clamping around the body of an adjacent conduit section.

14. A collar in accordance with claim 12 having means for retaining the lap joint in position around the conduit prior to and during the installation of the clamping means.

15. The method of sealing an area in an underground conduit which comprises the steps of excavating a relatively narrow shaft above an area in the conduit to be sealed, threading a collar into the excavation around the portion of the conduit to be sealed, releasing the collar to conform to the conduit, positioning the collar to form a lap joint around the conduit, applying a temporary holding member for retaining the collar in said overlapped position, clamping the collar to the conduit in positions axially spaced from each other and enclosing the area to be sealed, and introducing a sealing compound between the outer periphery of the conduit and the collar.

16. A method of claim 15 including the step of preventing backflow of the sealing compound.

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