US005853113A

United States Patent [19]

Small et al.

[11] **Patent Number: 5,853,113**

[45] **Date of Patent: *Dec. 29, 1998**

[54] **TELESCOPING COLUMN PIPE ASSEMBLY FOR FUEL DISPENSING PUMPING SYSTEMS**

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[*] Notice: The term of this patent shall not extend beyond the expiration date of Pat. No. 5,799,834.

[21] Appl. No.: **735,202**

[22] Filed: **Oct. 21, 1996**

[51] **Int. Cl.**[6] **B67D 5/50**

[52] **U.S. Cl.** **222/379**; 222/385; 222/464.5

[58] **Field of Search** 222/148, 379, 222/382, 385, 464.5; 288/302

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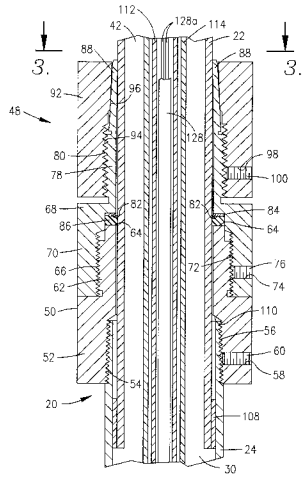
[57] **ABSTRACT**

An adjustable length column pipe for connecting a submersible electric pump in a fuel storage tank with a distribution head that distributes the fuel to dispenser units. Two telescoping column pipes can be telescopically adjusted to the desired length and then locked together by a locking mechanism. An adapter bushing is threaded onto the end of the larger diameter pipe and has a projecting sleeve. A fitting is threaded onto the sleeve and tightened to compress a seal ring which seals the lock assembly to the pipe. Projecting fingers on the fitting are wedged against the smaller telescoping pipe by a nut which is threaded onto the fitting and has a tapered surface to provide progressive wedging action. Electrical wiring for operating the pump is contained within a telescoping conduit assembly which extends inside of the column pipes and is isolated from the fuel passageway by a seal arrangement.

15 Claims, 4 Drawing Sheets



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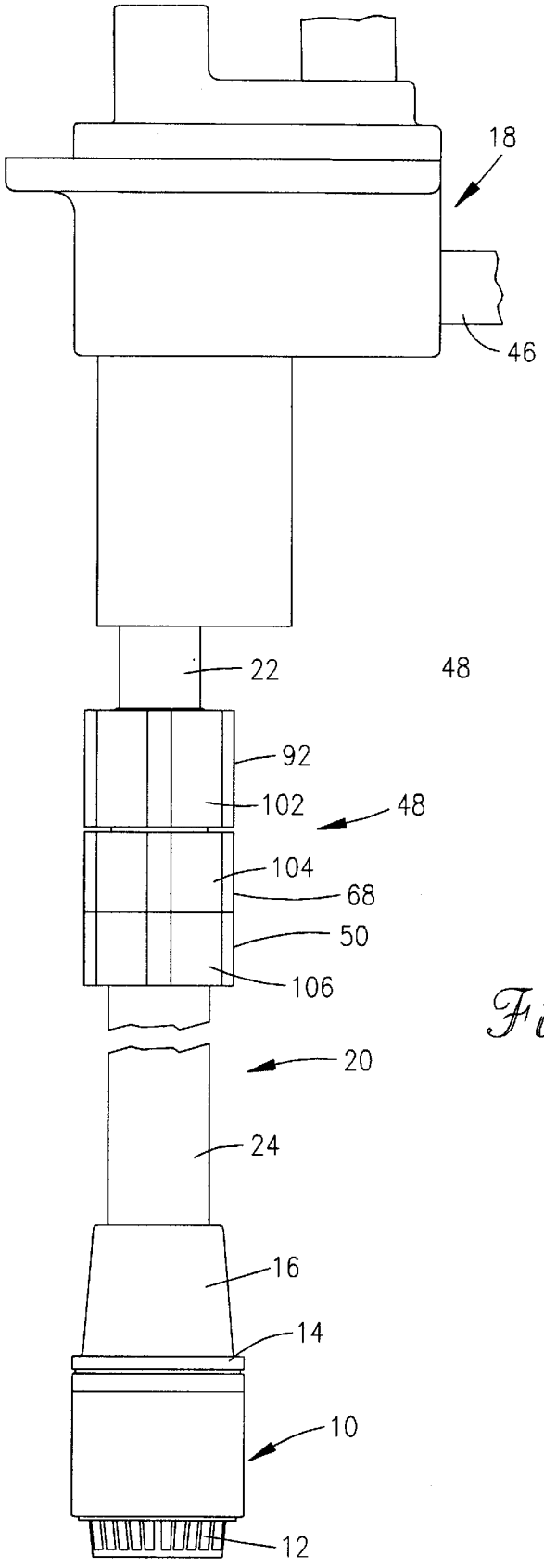
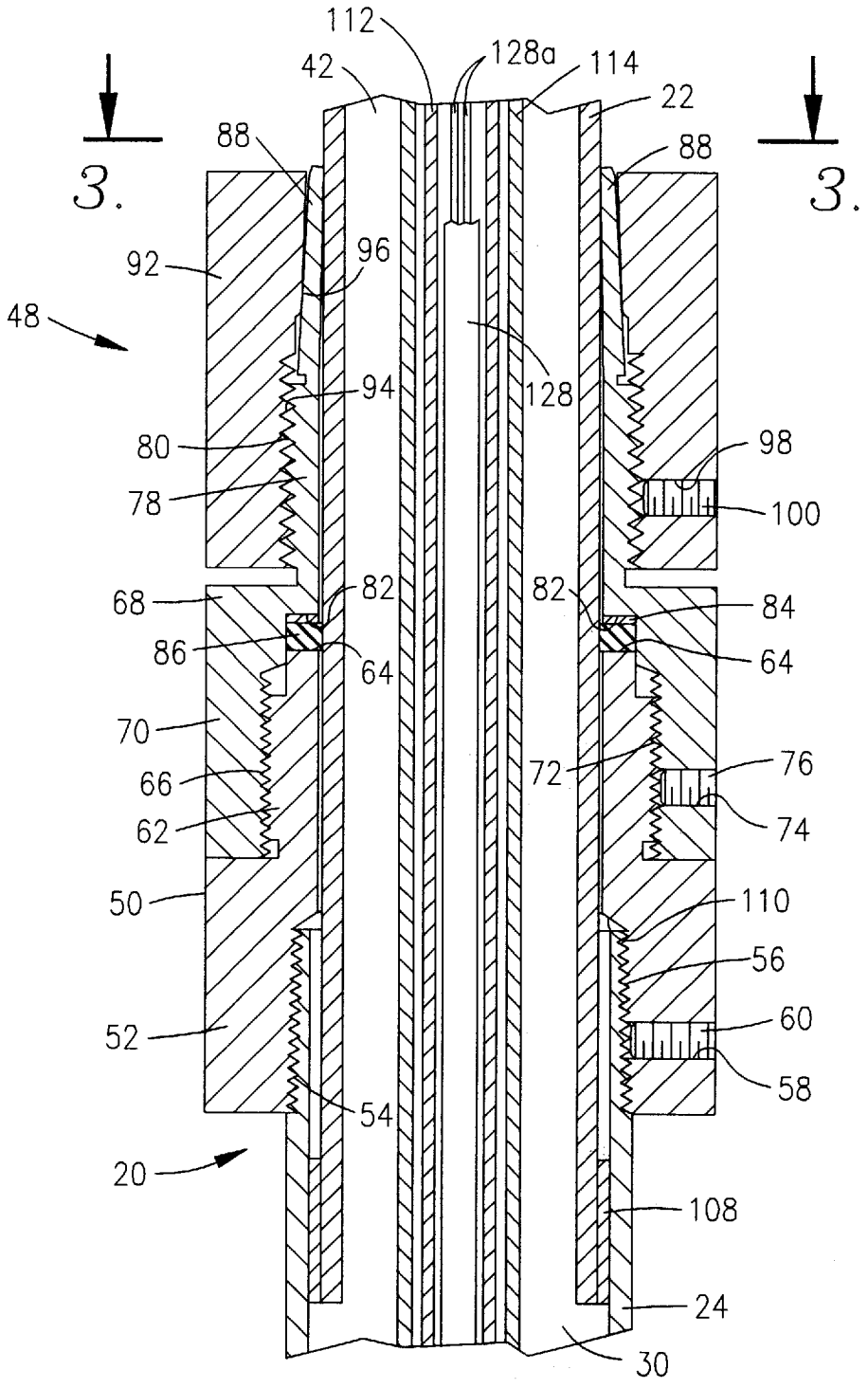


Fig. 1.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20
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24
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Fig. 2.

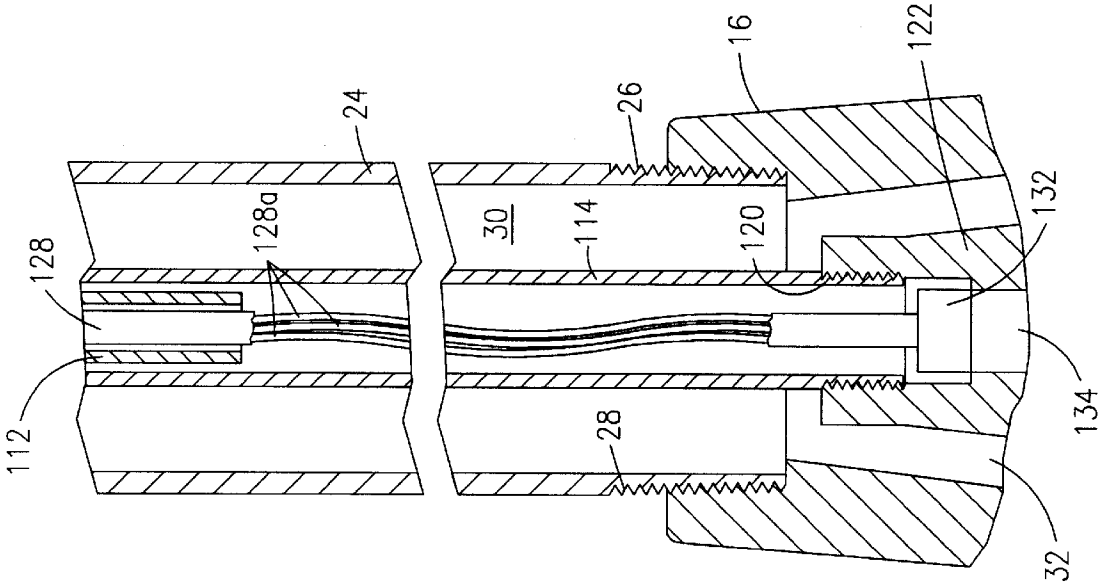

16
122
24
26
132
128a
30
114
120
128
112
134
28
32

Fig. 5.

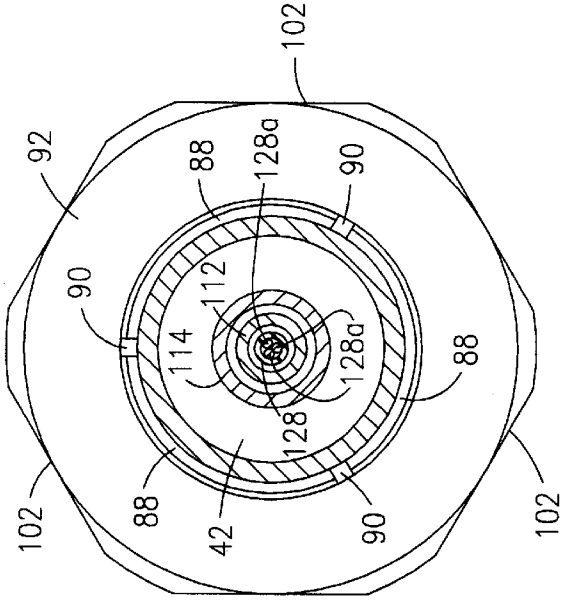
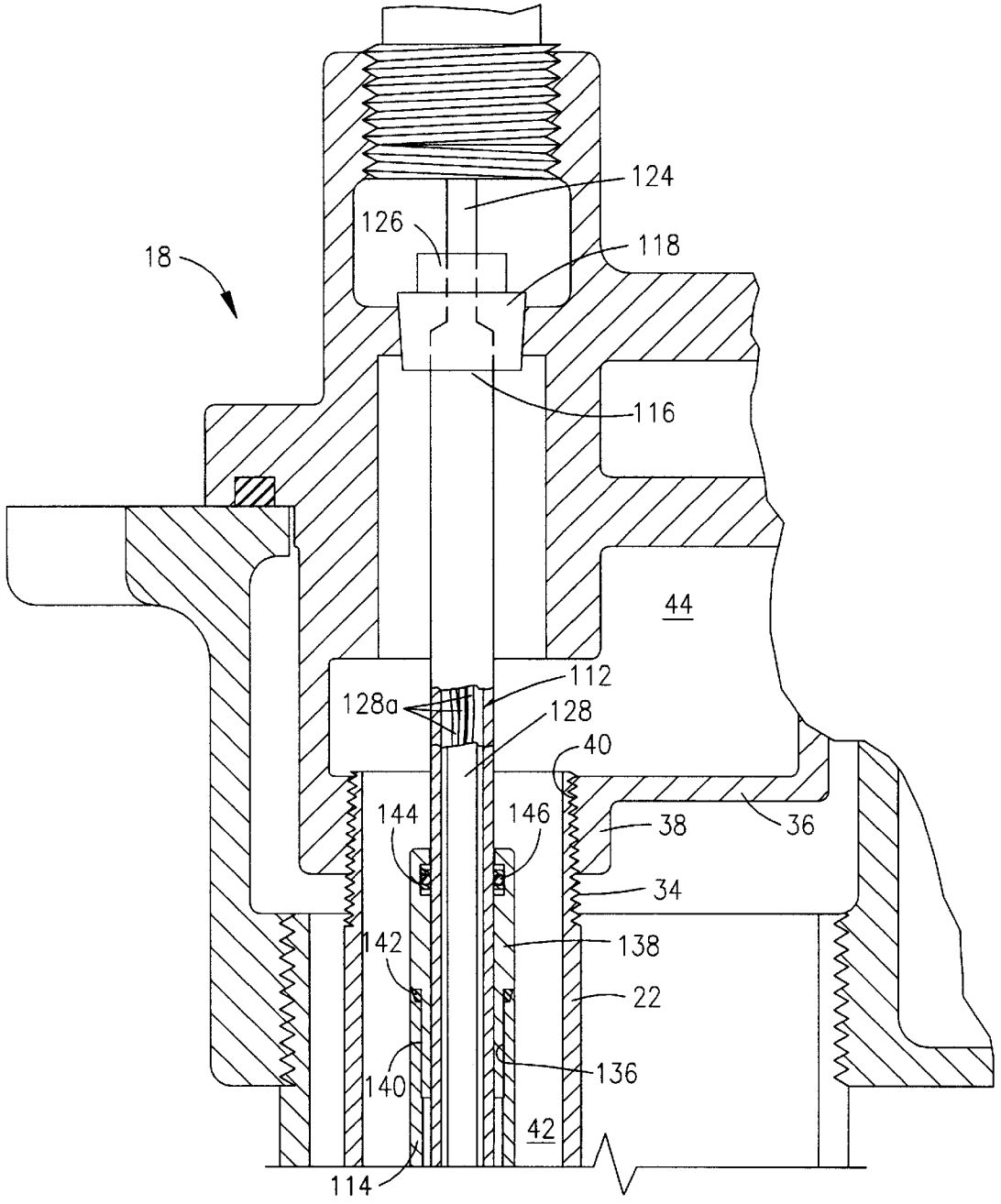

102
92
88
128a
90
90
112
114
128a
88
128
88
42
90
102
102

Fig. 3.


18
124
126
118
116
44
112
128a
128
40
144
146
38
36
34
142
138
22
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136
42
114

Fig. 4.

TELESCOPING COLUMN PIPE ASSEMBLY FOR FUEL DISPENSING PUMPING SYSTEMS

FIELD OF THE INVENTION

This invention relates generally to fuel dispensing systems such as the type commonly installed at gasoline service stations. More specifically, the invention is directed to an adjustable length column pipe which extends between a submersible electric pump in an underground fuel storage tank and a distribution head from which the fuel is distributed to one or more dispensing units.

BACKGROUND OF THE INVENTION

Gasoline service stations normally have underground storage tanks from which the fuel is pumped to dispensing units. A typical installation makes use of a submersible electric pump in the storage tank which operates to pump gasoline or another fuel to a distribution head located above the tank. From the distribution head, the fuel is supplied to the dispensers.

The flow path for the fuel includes a vertical column pipe which extends from the pump to the distribution head. In order to supply electrical power to the pump, the distribution head has electrical connections which are suitably connected with a power source. A conduit extending through the column pipe contains lead wires which supply power to the pump from the electrical connections of the distribution head.

Industry regulations and general safety considerations require that the electrical system meet prescribed standards. It is critical that the electrical system be completely isolated from the fuel in order to prevent fires or explosions that could result from an electrical spark or other electrical problem. It is also necessary to prevent undue leakage of fuel from the column pipe to the surrounding environment. Any field assembly of the components that is necessary must be carried out in a manner to assure compliance with all applicable safety and environmental requirements.

The storage tanks vary in capacity and also vary as to the depth at which they are buried. Consequently, the length of the column pipe assembly can vary considerably between different installations. For this reason, there is a need for a column pipe assembly that can be adjusted in length while maintaining compliance with applicable safety and environmental regulations.

SUMMARY OF THE INVENTION

The present invention is directed to a column pipe assembly that is adjustable in length in the field to accommodate different tank installations. It is a particular feature of the invention that the column pipe assembly may be quickly and easily adjusted in length without impairing the integrity of the electrical system or the pipe containment system, and without creating possible fuel leakage into the electrical system. Another object of the invention is to provide a column pipe assembly which can be adjusted throughout a wide range of possible lengths.

In accordance with the invention, two telescoping column pipes can be extended to the desired length and then locked together by means of a special locking assembly. The locking components include an adapter bushing which is threaded onto the end of the larger column pipe. A sleeve on the adapter bushing surrounds the smaller diameter column pipe and is externally threaded to receive the base of a special fitting. The fitting has a projecting sleeve which carries a plurality of fingers. The sleeve of the fitting is externally threaded so that it can receive a locking nut. The nut has a tapered surface which acts against the fingers to provide a wedging effect that forces the fingers inwardly to grip against the smaller column pipe as the nut is progressively tightened on the fitting. When the nut is fully tightened, the two column pipes are securely locked together to provide the column pipe assembly with the desired overall length.

A seal ring is fitted around the smaller column pipe between the end of the bushing sleeve and a shoulder formed on the fitting. When the fitting is threaded on the bushing, the seal ring is squeezed against the pipe to provide an effective seal against its outside surface.

Inside of the column pipes, two telescoping electrical conduits contain the wiring which supplies electrical power to the pump. The conduits are sealed together by a dynamic seal arrangement which accommodates their telescopic extension and retraction as the column pipes are extended or retracted. At the same time, the conduits are effectively sealed to prevent the fuel from leaking into the electrical system.

BRIEF DESCRIPTION OF THE DRAWINGS

In the accompanying drawings which form a part of the specification and are to be read in conjunction therewith and in which like reference numerals are used to indicate like parts in the various views:

FIG. **1** is an elevational view showing a column pipe assembly constructed according to a preferred embodiment of the present invention installed to extend between a submersible electric pump and a distribution head, with the break lines indicating continuous length;

FIG. **2** is a fragmentary sectional view on an enlarged scale taken on a vertical plane through the locking mechanism which locks the column pipe assembly at the desired length;

FIG. **3** is a sectional view taken generally along line **3**—**3** of FIG. **2** in the direction of the arrows;

FIG. **4** is a fragmentary sectional view taken on a vertical plane through the distribution head and the upper portion of the column pipe assembly; and

FIG. **5** is a fragmentary sectional view taken on a vertical plane through the lower portion of the column pipe assembly, with the break lines indicating continuous length.

DETAILED DESCRIPTION OF THE INVENTION

Referring now to the drawings in more detail and initially to FIG. **1**, numeral **10** generally designates a submersible electric pump which is used in a pumping system of the type that operates to pump flammable fuels such as gasoline from an underground storage tank to one or more above-ground dispensing units. This type of pumping system is commonly found in gasoline service stations. The pump **10** is submerged in the fuel contained within the storage tank (not shown) and includes an intake **12** which draws the fuel into the pump when the pump is in operation. The pump **10** is bolted or otherwise secured to a flange **14** formed on the lower end of a discharge head **16**. The discharge head **16** has a spool type configuration.

Disposed well above the pump **10** and above the fuel storage tank is a distribution head generally identified by numeral **18**. The distribution head is also referred to in the

industry as a packer. As will be explained more fully, the distribution head **18** is provided with electrical connections for the electrical system which powers the pump **10**. The distribution head **18** also receives the fuel which is delivered to it by the pump **10**, and it directs the fuel to one or more above ground dispensing units (not shown).

In accordance with the present invention, a telescoping column pipe assembly which is generally identified by numeral **20** connects the pump **10** with the distribution head **18**. The column pipe assembly **20** includes an upper column pipe **22** and a larger diameter lower column pipe **24** which telescopically receives the upper pipe **22**.

As best shown in FIG. **5**, the bottom end of the lower pipe **24** is externally threaded at **26**. The top end of the discharge head **16** is internally threaded at **28** to mate with the threads **26** of pipe **24**. The discharge head **16** is thus mounted on the bottom end of pipe **24** by means of the threaded connection provided by the threads **26** and **28**. The interior of the lower column pipe **24** serves as a flow passage **30** for the fuel which is pumped by the pump **10**. The discharge head **16** also has an interior passage **32** which connects with the discharge side of the pump **10** in order to receive the fuel and direct it into the flow passage **30**.

With particular reference to FIG. **4**, the top end of the upper column pipe **22** is externally threaded at **34**. The distribution head **18** includes a packer block **36** having a neck **38** on its lower end which is internally threaded at **40**. A threaded connection is established between the column pipe **22** and the block **36** by the mating threads **38** and **40**. This mounts the column pipe assembly **20** to the distribution head **18**. The interior of column pipe **22** serves as a flow passage **42** which receives the fuel and directs it into a flow chamber **44** provided by the packer block **36**. The chamber **44** in turn connects with a distribution pipe **46** (see FIG. **1**) which leads to one or more of the dispensing units in order to deliver the fuel to those dispensing units.

The telescoping pipes **22** and **24** may be locked together by a locking mechanism which is generally identified by numeral **48** and which is best shown in detail in FIG. **2**. The upper pipe **22** fits inside of the larger diameter lower pipe **24** and may be telescopically extended and retracted therein. The locking mechanism **48** includes an adapter bushing **50** having a relatively large base portion **52** which is internally threaded at **54**. The upper end portion of the pipe **24** is externally threaded at **56** so that the base portion **52** of the adapter bushing can be threaded onto the threads **56** to mount the bushing on pipe **24**. The base **52** is provided on one side with an internally threaded passage **58** which receives a set screw **60**. The set screw **60** may be tightened against the pipe **24** in order to securely lock the adapter bushing **50** in place on the end of pipe **24**.

The adapter bushing **50** has a barrel or sleeve portion **62** which is cylindrical and extends upwardly from the base portion **52**. The inside surface of the sleeve **52** fits around the outside surface of the upper column pipe **22** and is spaced slightly outwardly therefrom. The sleeve **62** terminates at its top end in a flat end surface **64** which is annular and which faces upwardly. The sleeve **62** is externally threaded at **66**. The sleeve **62** is located beyond the end of the lower column pipe **24**.

The locking mechanism **48** includes a special fitting **68** which may be connected with the adapter bushing **50**. The fitting **68** has a base portion **70** which is internally threaded as indicated at **72**. The threads **72** mate with the threads **66** on sleeve **62** in order to establish a threaded connection of the fitting **68** with the bushing **50**. One side of the base **70** is provided with a threaded passage **74** which receives a set screw **76**. The set screw **76** may be threaded into passage **74** and tightened against the sleeve **62** in order to lock the fitting **68** to the adapter bushing **50**.

The fitting **68** has a sleeve portion **78** which is generally cylindrical and extends upwardly from the base **70**. The sleeve **78** extends around pipe **22** and is spaced slightly outwardly therefrom. The sleeve **78** has external threads **80**.

A flat internal shoulder **82** is provided on the fitting **68** at a location near the intersection between the base **70** and sleeve **78**. The shoulder **82** is annular and is spaced from and faces toward the end surface **64**. The shoulder **82** and end surface **64** are approximately equal in surface area. A flat backup ring **84** is seated on the shoulder **82**. A seal ring **86** which may be constructed of an elastomeric material is located between the shoulder **82** and the end surface **64** of sleeve **62**. When the fitting **68** is tightened on the adapter bushing **50**, the seal ring **86** is squeezed between the backup ring **84** and the end surface **64**. This squeezing of ring **86** compresses it radially and forces it against the outside surface of the upper column pipe **22**, thereby providing a fluid tight seal between the column pipe, the bushing **50** and the fitting **68**.

Carried on the upper end of the sleeve portion **78** of fitting **68** are a plurality of relatively flexible prongs or fingers **88**. As best shown in FIG. **3**, the fingers **88** are arcuate, and it may be convenient to provide three of them (although a different number may be provided) . The fingers **88** are separated circumferentially from one another by small gaps **90**. The fingers **88** cooperate to extend around substantially the entire circumference of pipe **22**, except for the small gaps **90**. The fingers **88** are flexible enough that they can flex in and out about their lower ends where they connect with the sleeve **88**.

The final component of the locking assembly **48** is a nut **92** having a bore which is internally threaded at **94** to mate with the threads **80** on the sleeve **78**. The threads **94** do not extend the entire height of the bore of nut **92**. Beyond the threads **94**, the upper portion of the bore of nut **92** presents an unthreaded surface **96** which tapers inwardly from bottom to top. The tapered surface **96** acts against the outside surfaces of the fingers **88** and presses the fingers inwardly toward pipe **22** as the nut **92** is progressively tightened on the fitting **68**. One side of the nut **92** is provided with an internally threaded passage **98** which receives a set screw **100**. The set screw **100** may be tightened against sleeve **78** in order to securely lock the nut **92** on the fitting **68**.

The set screws **60**, **76** and **100** may be eliminated and replaced by self locking threads of the type commercially available as SPIRALOCK threads. All NPT threaded joints are secured with a permanent self locking thread sealant.

The nut **92** has wrench flats **102** (see FIGS. **1** and **3**) on its outside surface in order to facilitate application and removal of the nut with a wrench or similar tool. Likewise, the base **70** of fitting **68** is provided with wrench flats **104** (FIG. **1**), as is the base **52** of the adapter bushing **50** (as indicated at **106** in FIG. **1**).

When the locking mechanism **48** is released, the pipes **22** and **24** can be telescopically extended or retracted relative to one another to adjust the column pipe assembly **20** to the desired overall length. As shown in FIG. **2**, the bottom of the upper pipe **22** is flared outwardly at **108** or otherwise extended outwardly. The flare **108** fits closely inside of the lower column pipe **24**. When the column pipe assembly **20** is fully extended, the edge of the flare **108** butts against a shoulder surface **110** formed interiorly of the adapter bush-

ing **50**. The engagement between the flare **108** and shoulder **110** prevents pipe **22** from being extended far enough to separate from the other pipe **24**. In this fashion, the flare **108** provides a stop that prevents separation of the column pipes.

Extending concentrically within the column pipe assembly **20** is an electrical conduit assembly which includes an upper conduit **112** and a lower conduit **114**. The upper conduit **112** is smaller in diameter than the lower conduit **114** and has a telescopic fit in the lower conduit.

As best shown in FIG. **4**, the upper conduit **112** has a press fit top end **116** which is secured to a fitting **118** mounted to the packer block **36**. As shown in FIG. **5**, the lower conduit **114** has a threaded bottom end **120** which is threaded into a gland **122** forming part of the discharge head **16**.

With reference again to FIG. **4**, three electrical cables **128** extend from a source of electrical power through an upper portion **126** of the block **118** in the distribution head **18**. The electrical cables extend through block **118** and through the telescoping conduit assembly so that they can provide electrical power to operate the submersible pump **10**. The cables **128** extend through the upper conduit **112** and also through the lower conduit **114**. The cable assembly includes three individually insulated electrical wires conductors designed **128**a in FIG. **3**.

The electrical cables can be cut in the field to the proper length. Alternatively, the lower portions of the cables **128** located within the conduit **114** may be coiled in a spiral fashion so that the cord can extend and retract as the conduit assembly is extended and retracted. The lower ends of the cables extend to an electrical connector **132** that mates with another electrical connector **134** carried by the gland **122** of the discharge head **16**. The connector **134** provides an electrical connection for the pump **10**.

Referring particularly to FIG. **4**, the top end of the lower conduit **114** is machined at **136**. A sleeve **138** has its lower portion machined at **140** to provide a press fit connection for mounting of the sleeve **138** on the top end of conduit **114**. A seal ring **142** is compressed between the barrel portion of sleeve **138** and the end of conduit **114** to provide a seal preventing fuel from leaking into the conduit assembly from the flow path **42**. Scrapers are added to remove debris from conduit **112** that might damage the O-rings.

The sleeve **138** fits closely around the smaller diameter upper conduit **112**, and the sleeve bore is provided near its upper end with an annular groove **144**. A dynamic O-ring seal **146** is mounted in the groove **144** to provide a seal between the sleeve **138** and the upper conduit **112**. The dynamic seal **146** accommodates telescopic extension and retraction of conduit **112** relative to conduit **114** and at the same time maintains an effective fluid tight seal between the two conduits of the conduit assembly.

In use, the nut **92** is initially applied to the threads **80** loosely such that the fingers **88** are not pressed tightly against pipe **22**. Likewise, the fitting **68** is initially applied to the threads **66** in a loose condition so that the seal ring **86** is not squeezed tightly against pipe **22**. This allows the pipes **22** and **24** to be telescopically adjusted to the proper overall length to accommodate the tank installation in which the column pipe assembly is to be installed. When the pipes **22** and **24** have been adjusted to the proper length, the base **68** is tightened fully onto the adapter bushing **50** so that the seal ring **86** is compressed to provide an effective seal against pipe **22**. Preferably, the end of the base **70** is butted against base **52** of the adapter bushing, and the parts are secured in this position by tightening of the set screw **76** or by the self locking threads.

The nut **92** is then tightened onto sleeve **78**, preferably with a wrench applied to the wrench flats **102**. As the nut is progressively tightened on the fitting **68**, the taper of surface **96** acting against the fingers **88** forces the fingers inwardly by wedging action against the outside surface of pipe **22**. The fingers **88** thus grip against pipe **22** and, when the nut **92** is fully tightened, the fingers **88** securely grip against pipe **22** to lock it in place and prevent it from extending or retracting relative to the lower column pipe **24**. The electrical conduits **112** and **114** are similarly telescopically adjusted to the proper length, and this is easily accomplished since the smaller diameter pipe **112** can simply be slid inwardly or outwardly relative to the larger diameter conduit **114** until the desired overall length of the conduit assembly is achieved.

The column pipe assembly **20** can then be installed. It is noted that a fuel flow path is provided from the pump through passage **32** of the discharge head **16**, through the flow passage **30** provided within the lower column pipe **24**, through the flow passage **42** provided within the upper column pipe **22** and through chamber **44** of the distribution head to pipe **46** from which the fuel is delivered to the dispensing unit. The telescoping conduit assembly encloses the electrical cord **128** and maintains it isolated from the fuel flow path so that the electrical system remains completely isolated from the fuel in order to comply with applicable regulations and maintain safe conditions.

It is thus apparent that the column pipe assembly of the present invention accommodates quick and easy field adjustment to the proper length while maintaining the integrity of the fuel containment within the column pipe and also maintaining isolation between the fuel and the electrical system which applies power for operation of the pump **10**. If the column pipe needs adjustment to a different length, this can be accomplished by loosening nut **92** and fitting **68** to the extent necessary to allow the column pipe adjustment before again tightening the fitting and nut and securing them with the set screws or the self locking threads.

From the foregoing it will be seen that this invention is one well adapted to attain all ends and objects hereinabove set forth together with the other advantages which are obvious and which are inherent to the structure.

It will be understood that certain features and subcombinations are of utility and may be employed without reference to other features and subcombinations. This is contemplated by and is within the scope of the claims.

Since many possible embodiments may be made of the invention without departing from the scope thereof, it is to be understood that all matter herein set forth or shown in the accompanying drawings is to be interpreted as illustrative, and not in a limiting sense.

Having thus described the invention, what is claimed is:

1. An apparatus adjustably connecting a submersible electric pump to a distribution head which receives flammable fuel pumped by the pump, said apparatus comprising:

first and second pipes connected to telescopically extend and retract, said first pipe being connected with the distribution head and said second pipe being connected with the pump to establish a flow path for the fuel through the pipes from the pump to the discharge head;

first and second electrical conduits connected telescopically and extending inside of said first and second pipes, said first conduit being connected with the distribution head and said second conduit being connected with the pump;

electrical wiring extending in said first and second electrical conduits from the distribution head to the pump to supply electrical power for operation of the pump;

means for sealing said first and second conduits together to isolate said wiring from the fuel in said flow path, said sealing means allowing the conduits to extend and retract telescopically;

a fitting connected to one of said pipes and having a plurality of flexible fingers overlapping an other of said pipes;

releasable means for pressing said fingers against said other pipe into gripping engagement therewith to lock said pipes together;

an adapter bushing secured to said one pipe and including a sleeve extending around said other pipe; and

a threaded base portion of said fitting having a threaded connection with said sleeve of the adapter bushing, said fitting including a sleeve portion which projects from said base portion and carries said fingers thereon.

2. The apparatus as set forth in claim **1**, wherein said releasable means comprises a nut having threaded engagement with said fitting and a tapered surface engageable with said fingers to progressively force said fingers toward said other pipe as the nut is threaded onto said fitting.

3. The apparatus as set forth in claim **1**, wherein said adapter bushing has a threaded connection with said one pipe.

4. The apparatus as set forth in claim **1**, including means for effecting a seal between said fitting and said other pipe.

5. The apparatus as set forth in claim **1**, including:

an end surface on said adapter bushing located adjacent to said other pipe;

a shoulder on said fitting facing generally toward said end surface; and

a seal ring extending around said other pipe between said end of the adapter bushing and said shoulder, said seal ring being compressed against said other pipe upon progressive threading of said base of the fitting onto said sleeve of the adapter bushing.

6. The apparatus as set forth in claim **5**, wherein said releaseable means comprises a nut having a threaded connection with said sleeve portion of the fitting and a tapered surface engaging said fingers to progressively force said fingers toward said other pipe by wedging action as the nut is threaded onto said sleeve portion of the fitting.

7. The apparatus as set forth in claim **1**, wherein said releasable means comprises a nut having a threaded connection with said sleeve portion of the fitting and a tapered surface engaging said fingers to progressively force said fingers toward said other pipe by wedging action as the nut is threaded onto said sleeve portion of the fitting.

8. The apparatus as set forth in claim **1**, including a stop secured to an end portion of said other pipe and engageable with said adapter bushing to prevent said first and second pipes from separating.

9. An apparatus adjustably connecting a submersible electric pump to a distribution head which receives flammable fuel pumped by the pump, said apparatus comprising:

first and second pipes connected to telescopically extend and retract, said first pipe being connected with the distribution head and said second pipe being connected with the pump to establish a flow path for the fuel through the pipes from the pump to the discharge head;

first and second electrical conduits connected telescopically and extending inside of said first and second pipes, said first conduit being connected with the distribution head and said second conduit being connected with the pump;

electrical wiring extending in said first and second electrical conduits from the distribution head to the pump to supply electrical power for operation of the pump;

means for sealing said first and second conduits together to isolate said wiring from the fuel in said flow path, said sealing means allowing the conduits to extend and retract telescopically;

an adapter bushing having a base threaded onto an end portion of one of said pipes and a sleeve extending from said base to substantially encircle an other of said pipes;

a fitting having a base portion threaded onto said sleeve of the bushing and a sleeve portion extending from said base portion to substantially encircle said other pipe;

a plurality of fingers extending from said sleeve portion of the fitting; and

a nut threaded onto said sleeve portion of the fitting and having a tapered surface contacting said fingers to progressively force said fingers inwardly against said other pipe by wedging action as the nut is progressively threaded onto said sleeve portion, thereby releaseably locking said pipes together.

10. The apparatus as set forth in claim **9**, including a stop secured to an end portion of said other pipe and engageable with said adapter bushing to prevent said first and second pipes from separating.

11. The apparatus as set forth in claim **9**, including means for effecting a seal between said fitting and said other pipe.

12. The apparatus as set forth in claim **9**, including:

an end surface on said sleeve of the adapter bushing;

a shoulder on said fitting spaced from and generally facing said end surface; and

a seal ring extending around said other pipe between said end surface and shoulder, said seal ring being compressed to effect a seal against said other pipe upon progressive threading of said fitting onto the sleeve of said adapter bushing.

13. In a fuel dispensing installation having a submersible electric pump which pumps flammable fuel to a distribution head from which the gasoline is dispensed, the improvement comprising:

first and second pipes connected to telescopically extend and retract, said first pipe being connected with the distribution head and said second pipe being connected with the pump to establish a flow path for the fuel through the pipes from the pump to the discharge head;

first and second electrical conduits connected telescopically and extending inside of said first and second pipes, said first conduit being connected with the distribution head and said second conduit being connected with the pump;

electrical wiring extending in said first and second electrical conduits from the distribution head to the pump to supply electrical power for operation of the pump;

means for sealing said first and second conduits together to isolate said wiring from the fuel in said flow path, said sealing means allowing the conduits to extend and retract telescopically;

an adapter bushing secured to an end of one of said pipes and having a projecting sleeve terminating in an end surface located adjacent to an other of said pipes;

a fitting threaded onto said sleeve and having a shoulder facing said end surface, said fitting having a plurality of fingers located adjacent to said other pipe;

a seal ring extending around said other pipe between said end surface and shoulder, said seal ring being compressed to effect a seal against said other pipe upon progressive threading of said fitting onto the sleeve of said adapter bushing; and

a nut threaded onto said fitting and having a tapered surface forcing said fingers inwardly against said other pipe by wedging action as said nut is progressively threaded onto said fitting, thereby locking said pipes together.

14. The improvement of claim **13**, including a stop secured to an end portion of said other pipe and engageable with said adapter bushing to prevent said first and second pipes from separating.

15. The improvement of claim **13**, including a sleeve portion of said fitting extending around said other pipe and carrying said fingers, said nut being threaded onto said sleeve portion of the fitting.

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