United States Patent

Irie et al.

[15] **3,670,930**

[45] **June 20, 1972**

[54] OVERHEAD TRAVELING TYPE FUEL SUPPLYING APPARATUS

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[73] Assignee: **Tokyo Ltd.**, Kanagawa-ken, Japan

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[21] Appl. No.: **126,525**

[30] **Foreign Application Priority Data**

March 23, 1970 Japan.....45/24262

[52] **U.S. Cl.**.....**222/527**, 137/355.16, 137/615, 138/178

[51] **Int. Cl.**.....**B67d 5/60**

[58] **Field of Search**.....222/74, 75, 527, 529, 538; 138/120, 178; 137/355.16, 355.23, 355.28, 615; 239/184, 185, 186, 187; 134/123, 172

[56] **References Cited**

UNITED STATES PATENTS

2,893,422	7/1959	Schlitz	239/186 X
2,948,306	8/1960	Kuraeff	137/615 UX
3,439,700	4/1960	Preston	137/354

FOREIGN PATENTS OR APPLICATIONS

823,966	12/1951	Germany	239/185

Primary Examiner—Robert B. Reeves
Assistant Examiner—Frederick R. Handren
Attorney—Waters, Roditi, Schwartz & Nissen

[57] **ABSTRACT**

A fuel supplying apparatus consists of a traveling unit which moves in either of opposite directions, a delivery unit which communicates with the traveling unit and has a fuel hose carrying a fuel supplying nozzle at one end thereof and being lowered and raised, a fixed conduit which communicates with a reservoir and extends uprightly near to the traveling unit, and a folding tube which connects the fixed conduit with the traveling unit. The folding tube is composed of a plurality of non-flexible rigid tubes each of which is pivotally connected and internally communicates with its adjacent tubes at its ends. As the traveling unit moves, the folding tube stretches or contracts without deforming the component tubes.

6 Claims, 6 Drawing Figures

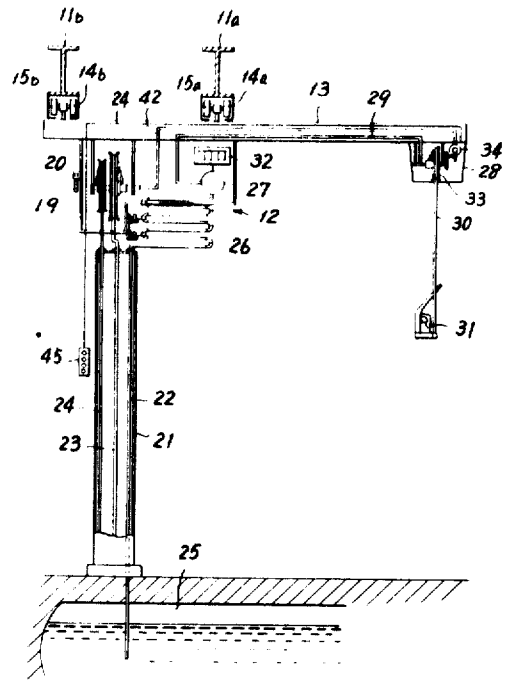

FIG. 1

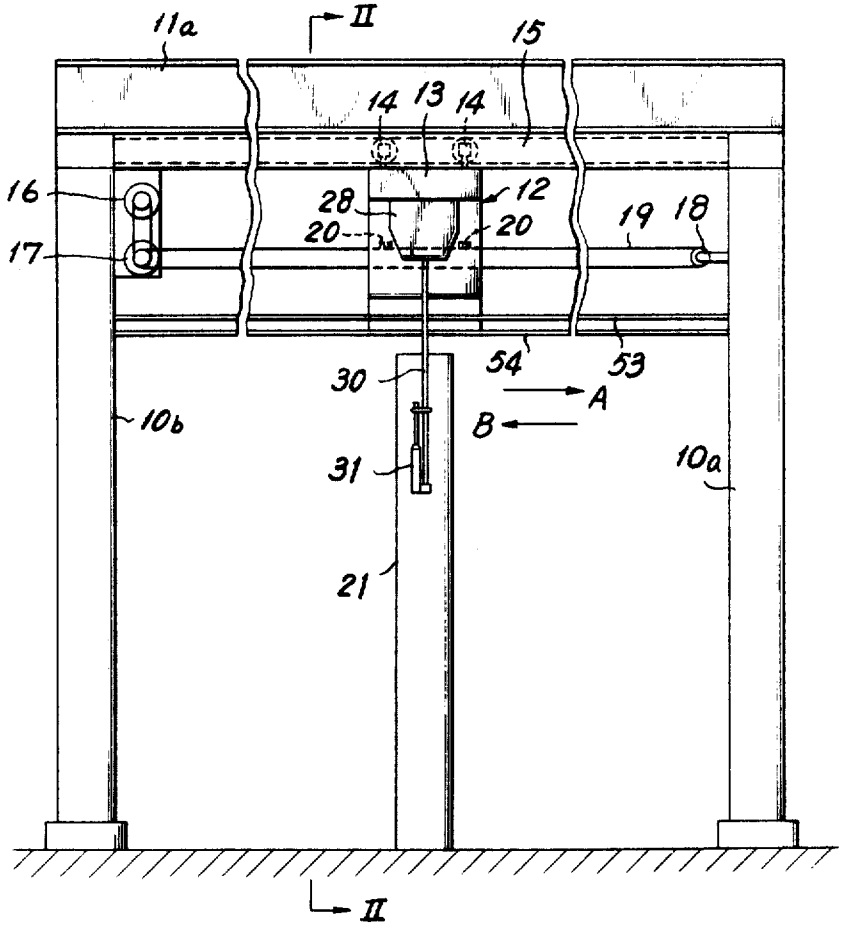

FIG. 2

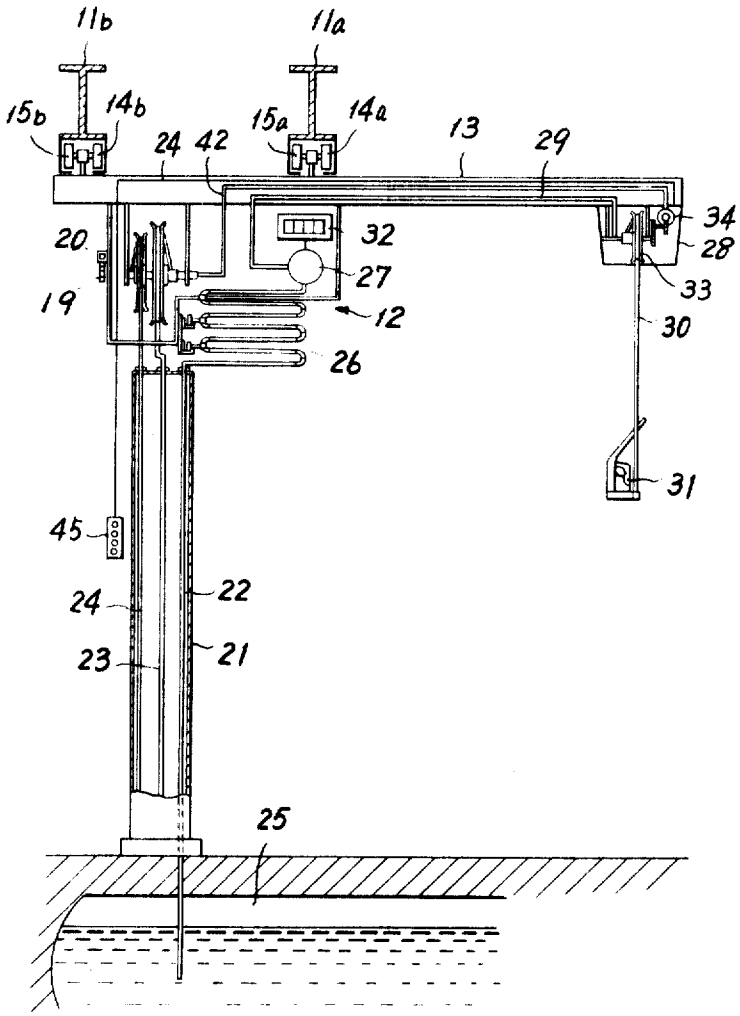
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FIG. 3

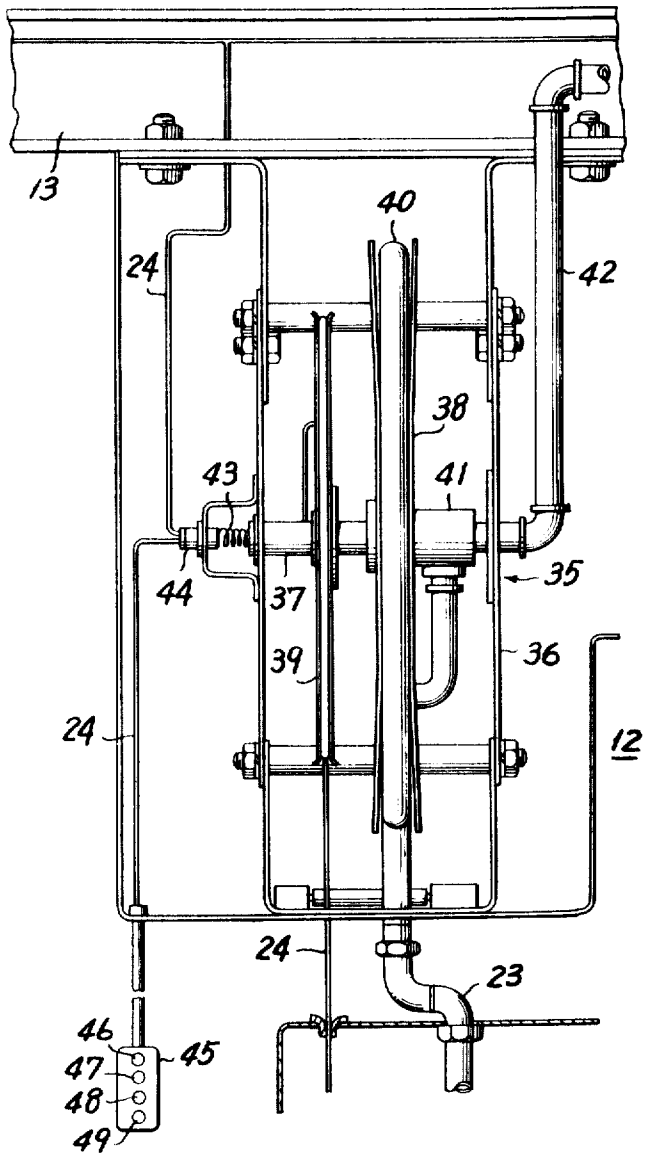

FIG. 4

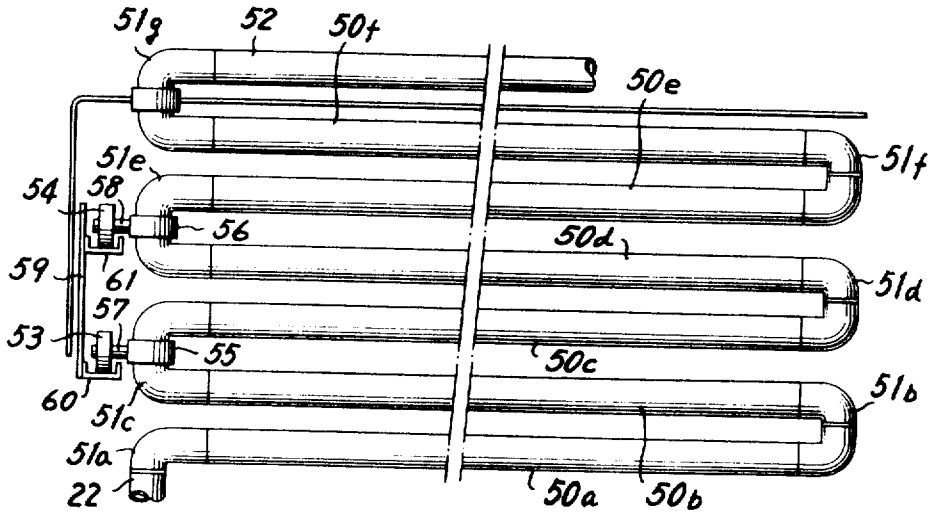
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FIG. 5

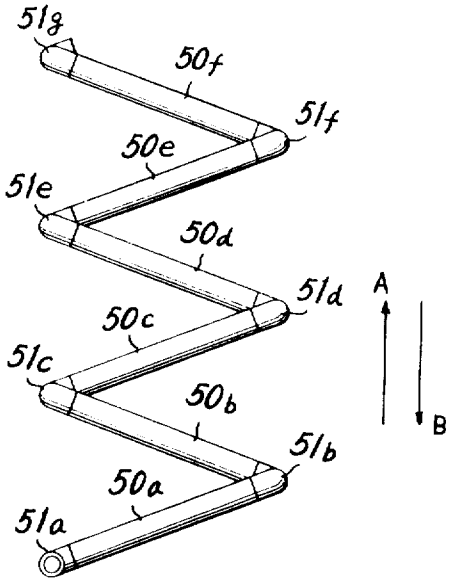
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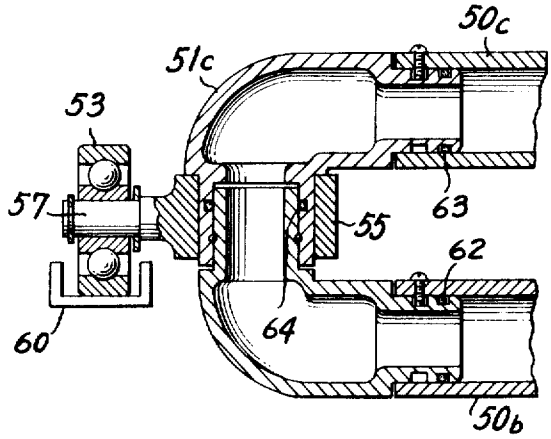
FIG. 6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OVERHEAD TRAVELING TYPE FUEL SUPPLYING APPARATUS

This invention relates to an overhead traveling type fuel supplying apparatus and more particularly to a fuel supplying apparatus which performs supplying of fuel by having a traveling unit and a delivery unit traveled overhead and pulling down a fuel supplying nozzle at a desired position.

Known in the art is a stationary type fuel supplying apparatus in which a required number of fuel supplying stands or posts each containing a motor, suction pump, flowmeter and indicator are provided on islands in a service area of a fuel supplying station.

In this known fuel supplying system, the whole service area cannot be used effectively for supplying fuel to vehicles such as automobiles. Besides, the fuel supplying system has s disadvantage that an automobile entering the service area is not entirely free from danger of colliding with the fuel supplying post.

In order to eliminate these disadvantages, it has been proposed to provide a fuel supplying hose and nozzle which can be lowered from and raised to a ceiling or a beam of a structure extending horizontally from a wall or a post and to lower the hose and nozzle to a desired position in fuel supplying operation. This system, however, is disadvantageous in that the fuel supplying hose to be lowered from the ceiling or beam is of a limited length and therefore the fuel supplying operation cannot be effected in case a vehicle stops outside of the extent to which the fuel supplying hose can be stretched. Particularly in a place where many vehicles park in rows, e.g., a fuel supplying station for buses, a number of fuel supplying units must be installed and the cost for installation tends to become enormous.

For the purpose of eliminating disadvantages of the aforementioned fuel supplying apparatus, a fuel supplying apparatus of a type having a delivery unit which travels over the service area thereby moving the fuel supplying hose to a desired position has been proposed. This type of apparatus is disclosed, for example, in U.S. Pat. No. 2,893,422 specification "Overhead traveling dispenser unit." In this proposed type of fuel supplying apparatus, a dispenser unit traveling with a beam is connected with a fixed a conduit extending from a reservoir by way of a flexible hose.

It is, however, observed that a flexible hose generally expands in its diameter when supply of fuel is stopped. When the valve of the nozzle provided at the end of the hose is abruptly closed during fuel supplying operation, fuel which has been flowing through the hose tends to continue its flow by inertia and expands the hose. By reason of expansion of the hose, the measured quantity of fuel supplied includes error and the measured value becomes inaccurate. This inaccuracy in measurement due to the error caused by expansion of the hose is of a magnitude which cannot be ignored. In Japan, for example, the official measurement regulation stipulates that a metal tube must be used as a fuel conduit except a fuel supplying hose at the end of a fuel supplying conduit. Accordingly, in the aforementioned proposed apparatus, error in measurement of quantity is so great that it cannot be put to a practical use.

Further, in the proposed apparatus, winding and unwinding of the flexible connecting hose on the reel during movement of the dispenser unit exert a strong twisting force or excessive force on the hose. This is due to the fact that the hose is wound on the reel not in an orderly manner but rather disorderly and a strong force is exerted when the hose is unwound. In case an elastic substance such as air passes through the hose, this twist in the hose does not present a serious problem. However, in case liquid such as fuel oil passes through the hose, the liquid is not substantially compressed and the hose will be broken if a large twist is produced in it. In a fuel supplying apparatus, the liquid to be dealt with is an inflammable and explosive fuel oil and it will be very dangerous if the hose is broken and the fuel oil is scattered about. Accordingly, it is absolutely necessary to prevent the damage of the hose and from this standpoint also the aforementioned proposed apparatus cannot be put to a practical use.

Particularly in an apparatus such as one used for a bus station where, as mentioned previously, a dispenser unit or a delivery unit must travel over a great distance, the connecting hose must be a long one and the error in measurement of quantity and the damage of the hose will become serious disadvantages.

It is, therefore, a general object of the present invention to provide a novel and useful overhead traveling type fuel supplying apparatus thereby to settle the problems and eliminate the disadvantages of the aforementioned conventional apparatus and the proposed apparatus.

Another object of the invention is to provide a fuel supplying apparatus in which a traveling unit communicating with a fuel supplying nozzle is connected with a fixed conduit communicating with a reservoir by way of non-elastic folding tube. By this arrangement, the connecting folding tube does not expand when fuel supplying operation is stopped and therefore no error in measurement of quantity occurs.

A further object of the invention is to provide a fuel supplying apparatus which employs, as a connecting tube connecting the traveling unit and the fixed conduit, a folding tube consisting of a plurality of tube sections pivotally connected and internally communicating with swivel joints at their ends. The folding tube is capable of being stretched and contracted by folding and unfolding as a whole and follows in an accurate movement the traveling unit without producing twist in the tube irrespective of direction of the movement of the traveling unit. Since no twisting force is exerted upon the folding tube, it is entirely free from danger of being broken.

A still further object of the invention is to provide a fuel supplying apparatus employing a folding tube which is completely folded when the traveling unit is at the middle of its traveling range and is stretched to the maximum extent when the traveling unit has moved to either end of its traveling range. Since the traveling unit is normally at the middle position, it can move in either of opposite directions in relatively short traveling time. Further, since the folding tube is completely folded at the middle position, required length of the folding tube can be relatively short.

Other objects and features of the invention will become apparent from the description made hereinbelow with reference to the accompanying drawings, in which:

FIG. 1 is a front view of one embodiment of an overhead traveling type fuel supplying apparatus according to the invention;

FIG. 2 is a vertically sectional side view taken along the line II–II of the apparatus shown in FIG. 1;

FIG. 3 is an enlarged vertically sectional side view of a reel part of the traveling unit;

FIG. 4 is an enlarged side view of the connecting folding tube;

FIG. 5 is a plan view of the folding tube shown in FIG. 4 in its stretched state; and

FIG. 6 is a vertically sectional side view of the swivel joint part of the folding tube shown in FIG. 4.

In FIGS. 1 and 2, upright posts **10***a* and **10***b* are fixed location at both sides of a service area of a fuel supplying station. Between the posts **10***a* and **10***b*, there are supported beams **11***a* and **11***b* having an I-shaped in cross section. A traveling unit **12** is fixed to the lower surface of the base portion of a moving beam **13** which projects horizontally. A delivery unit **28** is fixed to the lower surface of the foremost end portion of the moving beam **13**. The moving beam **13** has rollers **14***a* and **14***b* rotatably provided on the upper surface thereof. The rollers **14***a* and **14***b* are guided along roller guides **15***a* and **15***b* provided on the bottom of the beams **11***a* and **11***b* thereby moving the moving beam **13** in the directions shown by arrows A and B in FIG. 1.

A reversible electric motor **16** is fixed to the upper portion of the post **10***b*. A reduction gear **17** serves to reduce the rotation of the motor **16**. A chain **19** is provided between the reduction gear **17** and a sprocket **18** fixed to the upper portion of the post **10***a*. The traveling unit **12** is fixed to the chain **19** by means of fasteners **20**. The chain **19** driven by rotation of

the motor **16** causes the traveling unit **12** to move in either direction of the arrow A or B.

A hollow upright post **21** is provided at a position which is substantially in the middle between the two posts **10***a* and **10***b* and which does not obstruct passage of vehicles. The post **21** protects a fixed fuel pipe **22**, an air pipe **23** and an electric wire **24** respectively passing through the interior of the post. One end of the fuel pipe **22** communicates with an underground reservoir **25** through a pump (not shown) which is driven by a motor. The other end of the fuel pipe **22** communicates with a connecting folding tube **26** to be described later in detail. The folding tube **26** is connected to a fuel supplying nozzle **31** through a flowmeter **27** of volume type or turbine type, a fixed pipe **29** provided in the moving beam **13** and a flexible fuel hose **30** wound on a reel **33** provided in a delivery unit **28**. A mechanical or electrical indicator **32** provided at a place which can easily be watched by the operator and a customer indicates a result of measurement of the flowmeter **27**.

In the delivery unit **28**, the reel **33** is driven by an air cylinder **34** and rotates to wind the fuel hose **30**. When air is exhausted from the air cylinder **34**, the hose **30** is unwound downwardly by self weight of the fuel hose **30** and the nozzle **31** or by a force of a spring.

Referring to FIG. **3**, the internal construction of the traveling unit **12** will be explained. A reel part **35** contains reels **38** and **39** fixedly mounted on the lower surface of the moving beam **13**. The reel **38** on which an air hose **40** is wound and the reel **39** on which the electric wire **24** is wound are respectively mounted on a shaft **37** journalled by a frame **36** to rotate integrally therewith. One end of the air pipe **23** passing through the post **21** communicates with a compressed air source through an electromagnetic three-way changeover valve (not shown) and the other end of the air pipe **23** communicates with one end of the air hose **40**. The other end of the air hose **40** is connected to one end of a fixed air pipe **42** provided in the moving beam **13** through a joint **41** which is mounted coaxially on the shaft **37**. The other end of the air pipe **42** is connected to the air cylinder **34**. The reels **38** and **39** respectively wind the air hose **40** and the electric wire **24** by the force of springs (not shown). The other end of the electric wire **24** wound on the reel **39** is electrically connected to a connector **44** through a spiral cable **43**. The spiral cable **43** will not be broken or produce an unnatural twist whichever direction the reel **39** may rotate. The reels **38** and **39** respectively hold the air hose **40** and the electric wire **24** in their wound up states when the traveling unit **12** is in the middle between the posts **10***a* and **10***b*.

A switch box **45** is connected to the connector **44** and hangs down from the traveling unit **12** at an easily operable height. In the switch box **45**, there are provided four switches, i.e., a switch **46** for rotating the motor **16** in a forward direction to move the traveling unit **12** in the direction of the arrow A, a switch **47** for rotating the motor **16** in a reverse direction to move the traveling unit **12** in the direction of the arrow B, a switch **48** for changing over the three-way changeover valve provided in the air pipe **23** to supply air into the air cylinder **34** and wind the fuel hose **30** upwardly, and a switch **49** for exhausting the air cylinder **34** to unwind the fuel hose **30** downwardly. In the present embodiment, starting and stopping of the motor to drive the pump provided on the fuel pipe **22** are performed by a switch (not shown) mounted on the hose reel **33**. When the nozzle **31** is lowered below a predetermined height, this switch is closed to start the motor. Conversely, when the nozzle **31** is raised above a predetermined height, the switch is opened to stop the motor.

Nextly, the connecting folding tube **26** which constitutes an essential part of the apparatus according to the invention will be illustrated with reference to FIGS. **4** to **6**. The folding tube **26** consists of straight metal tubes **50***a* to **50***f* of a predetermined length which are disposed in mutually vertically spaced relation. Among the metal tubes **50***a* to **50***f*, two adjacent metal tubes are pivotally connected and communicated with each other by means of swivel joints **51***b* to **51***f*. The metal tube **50***a* is further pivotally connected and communicated with the fuel pipe **22** by means of a swivel joint **51***a*. The metal tube **50***f* is further pivotally connected and communicated with a fixed pipe **52** connected with the flowmeter **27** by means of a swivel joint **51***g*.

Rollers **53** and **54** are rotatably mounted on shafts **57** and **58** of roller supporting members **55** and **56** which are secured to the swivel joints **51**c and **51**e. The rollers **53** and **54** are guided along guide rails **60** and **61** spaced from each other and secured to a mounting plate **59**. The guide rails **60** and **61** extend in parallel with the roller guides **15***a* and **15***b*.

A vertical section of the metal tubes **50***b*, **50***c* and the swivel joint **51***c* is shown in FIG. **6**. The two joint parts of the swivel joint **51***c* are jointed watertightly with the metal tubes **50***b* and **50***c* by means of O-rings **62** and **63**. The two joint parts are mutually pivotally and watertightly jointed by means of an O-ring **64**.

Operation of the fuel supplying apparatus having the above described construction will now be described.

Before starting of the fuel supplying operation, the traveling unit **12** is positioned in the middle between the posts **10***a* and **10***b*, namely right above the post **21**. The fuel hose **30** is in the state of being wound up on the reel **33**, the nozzle **31** being lifted nearly up to the delivery unit **28**.

Let it be assumed that in this condition a vehicle to which fuel is to be supplied stops near the post **10***a* side of the service area of the fuel supplying station. An operator pushes the switch **46** of the switch box **45** to close it. As the switch **46** is closed, the motor **16** rotates in a forward direction. This rotation is reduced by the reduction gear **17** and then is transmitted to the chain **19**. As the chain **19** runs, the traveling unit **12** moves and travels with the moving beam **13** in the direction of arrow A, the rollers **14***a* and **14***b* being guided along the roller guides **15***a* and **15***b*. When the delivery unit **28** reaches the position substantially above the stopping vehicle, the operator releases the switch **46** to open it. The motor **16** stops its rotation and the traveling unit **12** stops its movement.

The folding tube **26** is in its folded state as shown in FIG. **4** when the traveling unit **12** is located in the middle between the two posts **10***a* and **10***b*. As the traveling unit **12** moves as described above, the fixed pipe **52** and the swivel joint **51***g* move with the traveling unit **12** whereas each metal tube **50***a* to **50***f* moves in a pivotal motion with its ends held by the swivel joints **51***a* to **51***g* since one end of the metal tube **50***a* is connected to the fixed fuel pipe **22** through the swivel joint **51***a*. Thus, the folding tube **26** stretches as shown in the plan view of FIG. **5**. During this movement, the swivel joints **51**c and **51**e move linearly with the rollers **53** and **54** being guided along the guide rails **60** and **61**. Accordingly, the folding tube **26** stretches in the direction of arrow A starting from the swivel joint **51***a* as viewed in FIG. **5**.

During the aforementioned movement, the air hose **40** and electric wire **24** respectively wound on the air hose reel **38** and the electric wire reel **39** are unwound from these reels and extended as the traveling unit **12** moves. Since the reels **38** and **39** rotate against the force of the springs, energy is stored in these springs.

Then, the operator pushes the switch **49** to close it. As the switch **49** is closed, the three-way changeover valve is changed over and the air under pressure in the air cylinder **34** is exhausted through the pipe **42**, air hose **40** and pipe **23**. The fuel hose **30** wound on the hose reel **33** is lowered by the resilient force of the spring provided in the hose reel **33** or by self weights of the fuel hose **30** and the nozzle **31** whereby the nozzle **31** is lowered to a height within the reach of the operator. The operator further pulls down the nozzle **31**, causing the spring in the hose reel **33** to store energy, and inserts the nozzle **31** into the fuel tank of the vehicle and opens the valve of the nozzle **31**. The fuel stored in the underground reservoir **25** is discharged from the nozzle **31** through the folding tube **26**, pipe **52**, flowmeter **27**, pipe **29**, delivery unit **28** and fuel hose **30** whereby fuel supplying operation is effected. In pulling

down the nozzle **31**, the switch provided on the hose reel **33** is closed to start the motor for driving the pump. Instead of providing this switch on the hose reel **33**, a switch may be provided which is closed by closing of the valve of the nozzle **31**. Alternatively, a switch which is manually operated may be provided in the switch box **45**. Flow quantity measured by the flowmeter **27** is indicated on the indicator **32**.

When the indicated quantity of the indicator **32** has reached the quantity required by the customer, the operator closes the valve of the nozzle **31**. When the operator lets go his hold of the nozzle **31**, the fuel hose **30** is wound up to its standby position by the force stored in the spring of the reel **33** and the motor for driving the pump stops its rotation. Then, the operator pushes the switch **48** to close it. As the switch **48** is closed, the three-way changeover valve is again changed over to supply air to the air cylinder **34** and the fuel hose **30** is wound on the hose reel **33** lifting the nozzle **31** nearly up to the delivery unit **28**. Nextly, the operator pushes the switch **47** to close it. The motor **16** rotates in a reverse direction and causes the chain **19** and the traveling unit **12** to travel in the direction of arrow B. When the traveling unit **12** has reached the middle position shown in FIG. 1 or any other desired position, the switch **47** is opened to stop the rotation of the motor **16** and the traveling unit **12** stops at that position.

As the traveling unit **12** travels in the direction of arrow B, the folding tube **26** contracts in the direction of arrow B in FIGS. 1 and 5 in a motion opposite to the stretching motion described above, the rollers **53** and **54** being guided along the guide rails **60** and **61**. At the same time, the air hose **40** and the electric wire **24** are respectively wound on the reels **38** and **39** rotated by the force of the springs provided in the reels **38** and **39**. If the traveling unit **12** is moved past the middle position shown in FIG. 1 in the direction of the arrow B, the folding tube **26** once reaches its most contracted state and then stretches in a direction opposite to that shown in FIG. **5**.

Since the metal tubes **50***a* to **50***f* are disposed and mutually connected in vertically spaced relation, the folding tube **26** can effect its contracting and stretching movements continuously even when the traveling unit moves in either direction past the aforementioned middle position.

When the folding tube **26** stretches and contracts as described above, metal tubes **50***a* to **50***f* move in only pivotal motion in horizontal planes parallel with one another about the swivel joints **51***a* to **51***g* by which both ends of each metal tube are pivotally connected. Consequently, in stretching and contracting of the folding tube **26**, no undesirable external force such as twisting force is exerted on the metal tubes **50***a* to **51***f* and the folding tube **26** smoothly moves in a pivotal motion for stretching and contracting.

In the above described embodiment, metal tubes are employed as the folding tube **26**. However, the invention is not limited to this but any hard and strong material which is non-elastic, non-flexible and oil-proof may be used.

Further, in the above described embodiment, the air hose **40** and the electric wire **24** are wound on and unwound from the reels **38** and **39** and therefore the twist may occur in the air hose **40** and the electric wire **24** in winding and unwinding thereof. However, the twist in the air hose **40** very seldom damages the air hose **40** since air in the air hose **40** has a sufficient contractibility. Even if the air hose **40** is damaged and air leaks from it by any chance, there is no danger of causing a serious accident such as a fire which is likely to take place when fuel leaks from the fuel hose. As to the electric wire **24**, the twist in the electric wire **24** will not have such a serious effect as cutting off the electric wire. However, in order to protect the air hose **40** and the electric wire **24** from twisting force or any other excessive force, it is desirable that a folding tube of the same construction as the above described fuel conduit should be used as the air hose or the electric wire to connect the post **21** and the traveling unit **12**.

While the invention has been described with respect to the specific preferable embodiment, various modifications and variations thereof will be apparent to those skilled in the art without departing from the scope of which is set forth in the appended claims.

What We claim is:

1. An overhead traveling type fuel supplying apparatus which comprises a horizontally extending guiding member, a traveling unit which moves and travels guided along said guiding member, a horizontally extending moving beam which moves with said traveling unit, a delivery unit which is fixed to the foremost end of said moving beam and has a fuel hose which is provided with a nozzle at one end thereof and can be lowered and raised, means for moving said traveling unit along said guiding member in either of opposite directions, a reservoir for storing fuel liquid, a first fixed fuel conduit which has its one end communicated with said reservoir and the other end disposed near the middle point of the moving range of said traveling unit, a second fixed fuel conduit extending through said traveling unit, moving beam and delivery unit one end of which communicates with said fuel hose, and a folding tube both ends of which are respectively pivotally connected and internally communicated with the other end of said first fixed fuel conduit and the other end of said second fixed fuel conduit, wherein said folding tube comprises a plurality of tubes which are mutually pivotally connected and internally communicated with their adjacent tubes at the ends thereof and is so arranged that it is completely folded when said traveling unit is near the middle point of the traveling range and it stretches and contracts without deforming said plurality of tubes themselves as said traveling unit travels, and said plurality of tubes are made of a hard, non-flexible and non-elastic material.

2. The fuel supplying apparatus as defined in claim **1** wherein said plurality of tubes composing said folding tube are disposed in mutually vertically spaced relation, said tubes being pivotally connected and internally communicating in sequence with their adjacent tubes at their ends, and said folding tube is capable of stretching in either of opposite directions when said traveling unit may move from said middle point of the traveling range.

3. The fuel supplying apparatus as defined in claim **1** which further comprises a guiding means for guiding the pivotally connected parts of said plurality of tubes of said folding tube in a direction parallel to said guiding member.

4. The fuel supplying apparatus as defined in claim **1** which further comprises posts for supporting said guiding member and an upright post located substantially in the middle between said posts and having said first fixed fuel conduit extend therethrough, one end of said folding tube being pivotally connected and communicating with the other end of said first fixed fuel conduit above said upright post.

5. The fuel supplying apparatus as defined in claim **1** wherein said traveling unit, moving beam and delivery unit are disposed at least at a height at which passage of vehicles to which fuel is to be supplied is not obstructed.

6. The fuel supplying apparatus as defined in claim **1** wherein said moving beam extends at right angle to the longitudinal direction of said guiding member.

* * * * *

UNITED STATES PATENT OFFICE
CERTIFICATE OF CORRECTION

Patent No. 3,670,930 Dated June 20, 1972

Inventor(s) Yoshihiko Irie, et. al.

It is certified that error appears in the above-identified patent and that said Letters Patent are hereby corrected as shown below:

On the cover sheet, [73], "Tokyo Ltd.," should read -- Tokico Ltd., -- .

Signed and sealed this 12th day of December 1972.

(SEAL)
Attest:

EDWARD M.FLETCHER,JR.
Attesting Officer

ROBERT GOTTSCHALK
Commissioner of Patents

USCOMM-DC 60376-P69
☆ U.S. GOVERNMENT PRINTING OFFICE : 1969 O—366-334.