

Aug. 6, 1968

HIYOSHI TATSUNO  
GASOLINE FILLING STATION

3,395,723

Filed Aug. 19, 1965

6 Sheets-Sheet 1

FIG. 1a

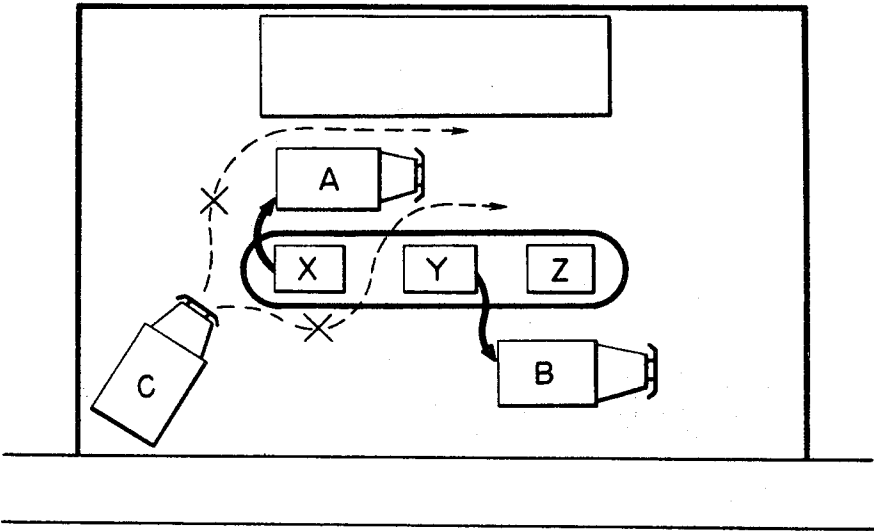
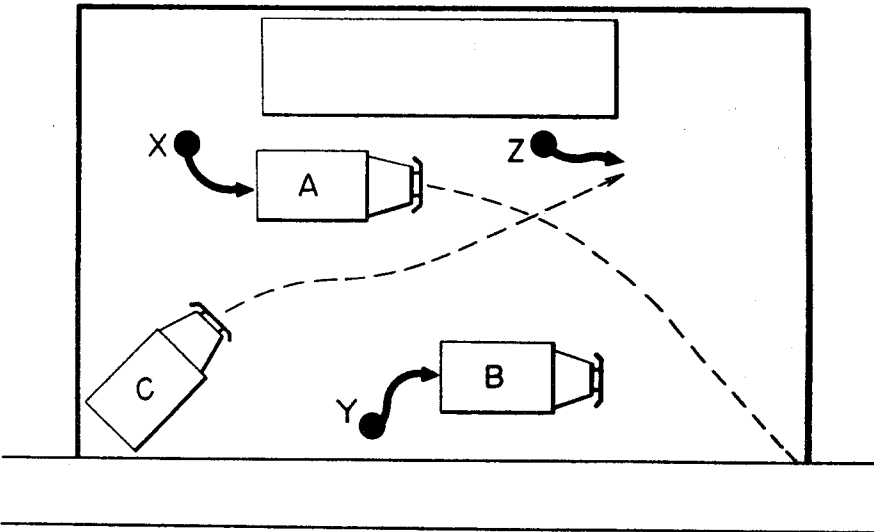


FIG. 1b



Aug. 6, 1968

HIYOSHI TATSUNO

3,395,723

GASOLINE FILLING STATION

Filed Aug. 19, 1965

6 Sheets-Sheet 2

FIG. 2

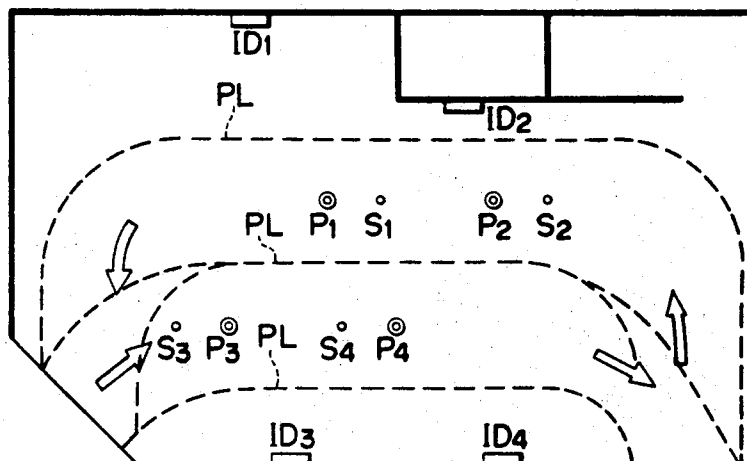
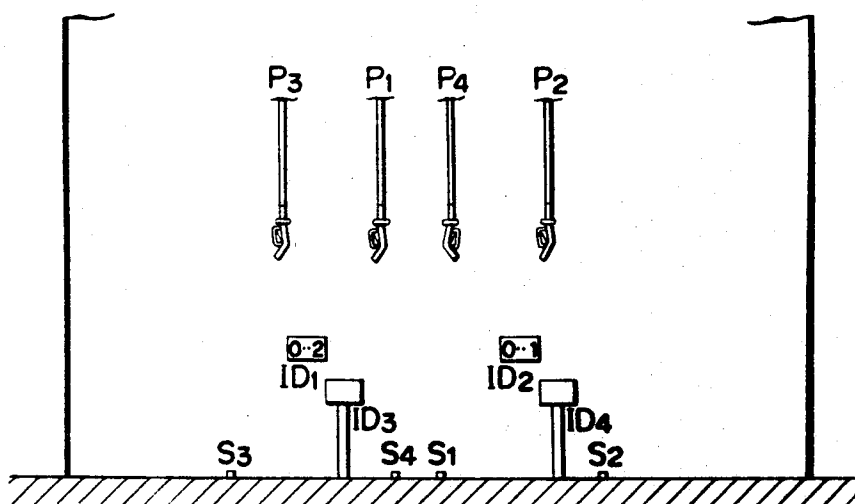


FIG. 3



Aug. 6, 1968

HIYOSHI TATSUNO  
GASOLINE FILLING STATION

3,395,723

Filed Aug. 19, 1965

6 Sheets-Sheet 3

FIG. 4

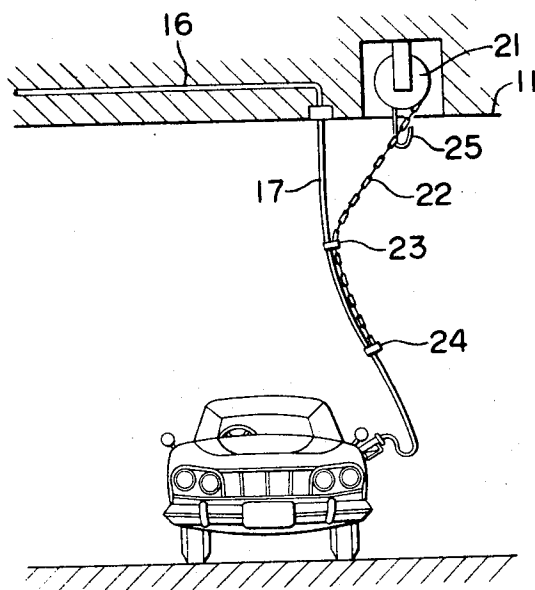
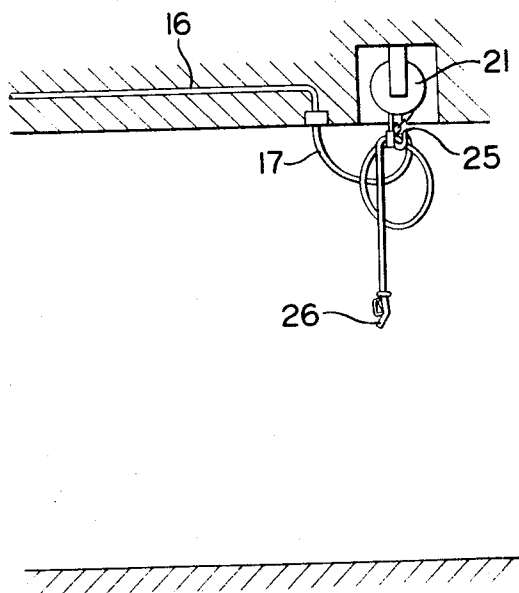


FIG. 5



HIYOSHI TATSUNO  
GASOLINE FILLING STATION

6 Sheets-Sheet 4

Aug. 6, 1968

HIYOSHI TATSUNO  
GASOLINE FILLING STATION

3,395,723

Filed Aug. 19, 1965

6 Sheets-Sheet 5

FIG. 7

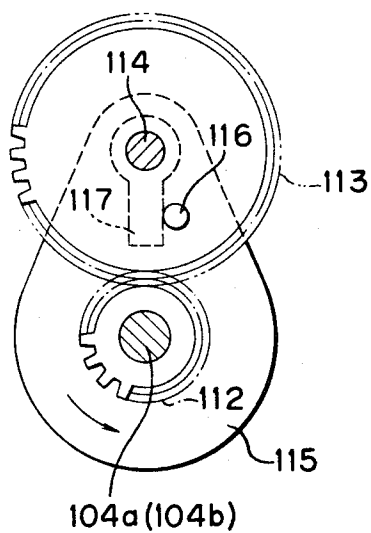
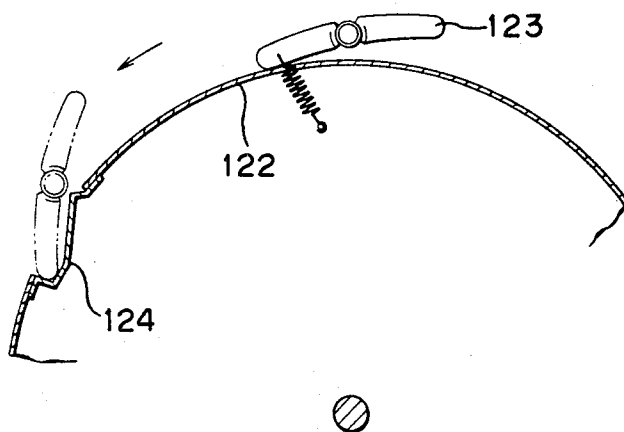


FIG. 8



**Aug. 6, 1968**

HIYOSHI TATSUNO

**3,395,723**

GASOLINE FILLING STATION

Filed Aug. 19, 1965

6 Sheets-Sheet 6

**FIG. 9**

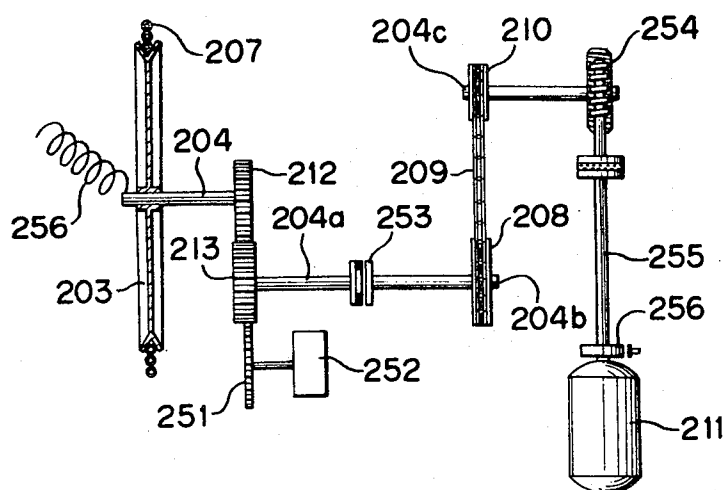
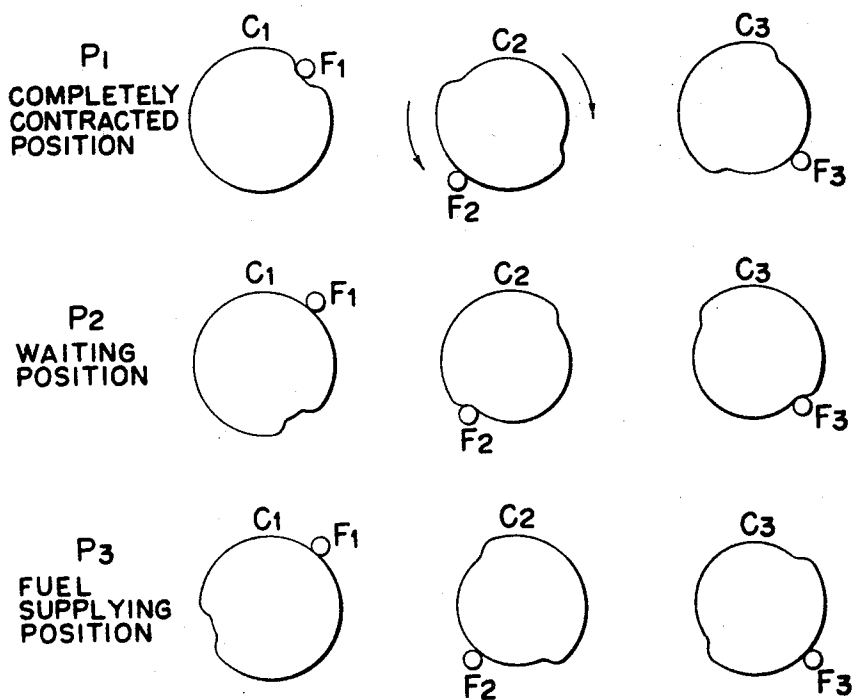


FIG. 10



1

3,395,723  
**GASOLINE FILLING STATION**  
Hiyoshi Tatsuno, 161 Azabu-Hommura-cho,  
Minato-ku, Tokyo, Japan  
Filed Aug. 19, 1965, Ser. No. 481,141  
8 Claims. (Cl. 137—355.22)

## ABSTRACT OF THE DISCLOSURE

Supplying fuel to vehicles from a reservoir having a fixed pipe leading therefrom, a flexible pipe connected to the fixed pipe, a reel, and a driving mechanism for rotating the reel and thereby raising and lowering the flexible pipe wherein the flexible pipe may be automatically lowered from a completely contracted position to a waiting position, from which position it may be manually lowered to a fuel supplying position and wherein the flexible pipe may be raised from the fuel supplying position to either the waiting position or the completely contracted position.

This invention relates to a gasoline filling system and more particularly to a filling station or gas station wherein the fuel can be more effectively supplied to vehicles.

It has been a common practice in the usual gas station that the fuel reservoir is provided under the ground surface and one or more so-called gasoline pumps or fuel supplying posts are located on an island on the ground surface at the center of the gas station or in the vicinity thereof. The fuel or gasoline, which includes all sorts of fluid fuels to be supplied to vehicles at fuel filling stations, is stored in said reservoir. It is transferred to the vehicle through fixed conduit means leading from said reservoir to the supply post, pumping means, meters and indicators which are housed in the supply post and then through a length of flexible conduit means. The measured volume of the fuel supplied to the car is to be shown to the driver and operator by means of any suitable indicator mounted on the post. In the conventional gasoline station having such fuel supplying posts, the vehicle must be brought alongside the desired post. However, for the drivers it is annoying and often difficult to enter the station site, approach the desired supplying post and leave the gas station since the passageway is narrowed by said posts standing at the center portion of the gas station. As the position where the fuel is supplied to the vehicle is fixed and the fuel filling position is inflexible, there may be posts standing idle due to the other vehicles receiving fuel supply from the other posts and barring the passage of vehicles. The circumstances are more serious when two or more types of fuel are supplied in the same gas station.

An object of the present invention is, thus, to avoid and overcome the faults referred to above in a gasoline filling station by removing the fuel supplying posts from the ground.

The above object is accomplished in accordance with the present invention by separating the equipment housed by the supply posts according to function and locating the equipment in positions where it will not obstruct the free passage of vehicles. For instance, the pumping means, which is actuated when it is desired to transfer fuel from the reservoir to the vehicle, and the meters, which measure the volume of fuel supplied to a vehicle, may be located under the ground surface, on the front wall of the office house, or on any suitable supporting structure over the passage such as a beam or ceiling. The indicators, which display the measured volume of fuel supplied to a vehicle, may be located on the front wall of the office house or suspended from the supporting structure over the passage-

2

way, so as to be readily observable by the driver and the operator. The flexible conduit means, which has an outlet for supplying fuel to the fuel tank of the vehicle, may be located above the passageway in such a manner that it can be contracted into compact form and extended to reach the vehicle to be supplied with fuel.

According to this invention, the flexible conduit means has a free end which is connected to the inlet of the fuel tank in the vehicle and an outer end which is connected above the passageway to the outlet of the fixed conduit means which runs upward from the reservoir under the ground surface through filter means, a metering device and the like. The flexible conduit means is normally contracted in such a way that the intermediate portion thereof is wound to form several loops and that the lower portion thereof is suspended at such a distance from the ground surface as not to hinder the car passage for instance 3.5 to 4 meters, and the flexible conduit means may be extended manually or by means of any motive power to the waiting position where the outlet of said flexible conduit means is spaced from the ground surface so as to be accessible to the operator, for instance 1.8 to 2 meters, and further accessible to the fuel supplying position.

Various other objects and advantages of the present invention will be clear as the invention is understood by studying the following detailed explanations made in reference to the accompanying drawings which illustrate preferred embodiments wherein:

FIG. 1a is a schematic view of the conventional gas station showing how the fuel supplying posts and the island hinder smooth and efficient filling.

FIG. 1b is a schematic view of a gasoline station according to the present invention for the purpose of illustrating the advantages thereof,

FIG. 2 is a schematic view of another arrangement of the present invention showing passageways and positions of flexible conduit means, actuating switches and indicators,

FIG. 3 is a diagrammatical elevation of the gas station of FIG. 2,

FIG. 4 is a schematic elevation of the flexible conduit means in the fuel supplying position in one of the simplest embodiments of the present invention,

FIG. 5 is a schematic view showing the contracted position of said flexible conduit means,

FIG. 6 is a schematic sectional view of the reel and its accompanying devices for winding up and unwinding the flexible conduit means in accordance with a second embodiment of the present invention.

FIG. 7 shows the mechanism for allowing manual unwinding of the flexible conduit means from the waiting position to the fuel supplying position, which is used in the device of FIG. 6 and illustrated as seen from the left hand side in said figure,

FIG. 8 is an elevation of an assembly consisting of a wing stopper and drum, the former being removably engaged with a notch formed on the circumferential surface of the latter, which is provided for the purpose of locking the reel in the fuel supplying position,

FIG. 9 is a diagram illustrating a third embodiment of the present invention,

FIG. 10 shows various positions of cams and followers for use with the embodiments of FIG. 6 or FIG. 9.

As seen in FIG. 1a, there are, for instance, three fuel supplying posts X, Y and Z standing on the island on the ground surface and at the center of the usual gas station. If cars A and B are receiving fuel respectively from the posts X and Y, a car C will not be able to enter the vicinity of the post Z. In the gasoline station according to the present invention as seen in FIG. 1b, which has

the same area as the gas station of FIG. 1a, the car C can easily reach the fuel supplying position Z since the cars A and B are being supplied with fuel, respectively, from the flexible conduits or fuel supplying pipes X and Y which have been extended and there is no enclosure to hinder the access of the car C to a location where the free end of the pipe Z can be extended.

According to the present invention, there may be provided four flexible fuel supplying pipes P<sub>1</sub>, P<sub>2</sub>, P<sub>3</sub> and P<sub>4</sub>, as seen in FIGS. 2 and 3, each of which is wound into a compact form to be unwound so that the free end thereof is extended to a fuel supplying position. To each of said pipes respective actuating switches S<sub>1</sub>, S<sub>2</sub>, S<sub>3</sub> and S<sub>4</sub> as well as indicators ID<sub>1</sub>, ID<sub>2</sub>, ID<sub>3</sub> and ID<sub>4</sub> may be provided. Said switches which may be of the push button type may actuate electric motors which drive, a corresponding reel so as to unwind or wind the flexible pipe. Each of the indicators ID<sub>1</sub>, ID<sub>2</sub>, ID<sub>3</sub> and ID<sub>4</sub> shows the amount of fuel supplied, respectively, from the pipe P<sub>1</sub>, P<sub>2</sub>, P<sub>3</sub> and P<sub>4</sub>.

Said indicators are electrically connected to the metering devices located remotely therefrom. When the switch S is actuated to put the flexible pipe P at its fuel supplying position, the indicator ID may be reset to zero for preparation of the coming operation. The electrical mechanism for such purposes may be any known system which may be easily worked by those skilled in the art as occasion demands and thus shall not be illustrated in this specification.

In FIGS. 4 and 5, there is illustrated one of the simplest embodiments of the present invention. Reference numeral 11 shows a ceiling extended from the office house above the passageway in the station site, along which is laid a fixed fuel conduit 16 running upward from the reservoir (not shown) under the ground surface. To the outer end of said conduit 16 is connected one end of a flexible conduit 17. At the ceiling 11, there is mounted a conventional spring balancer 21, around the reel of which is wound a flexible cable or chain 22 which runs through one or more guide rings 23 fixed along said flexible pipe 17. The free end 24 of said chain or cable 22 is fixed to the pipe 17 at the vicinity of the free end thereof or nozzle 26. As seen in FIG. 5, the flexible conduit 17 is wound to form a few loops below the balancer 21 so that the distance from the nozzle 26 to the ground surface is about 2 meters. If desired, the operator can grasp the nozzle to pull down the pipe 17 against the force of a spring in the balancer 21 into the fuel supplying position as shown in FIG. 4. When he releases the nozzle 26, the spring will wind the chain 22 around the reel of the balancer 21, and accordingly the flexible pipe 17 may be contracted to form a few loops which may be engaged with a hook 25 supported under the spring balancer.

FIGS. 6 through 8 illustrate a second embodiment. In FIG. 6, a fuel reservoir 96 may be located at any suitable place, such as under the service area of the gasoline station, and a conduit 97 leads from the fuel reservoir 96 to a pump 98 which pumps the fuel to the vehicle to be serviced through a conduit 99, a meter 100, a fixed conduit 106 and a flexible pipe 107. Reference numeral 101 represents a supporting structure provided above the car passageway in the gas station enclosure. From said supporting structure a casing 102 is hung, in which a reel 103 is fixed on a shaft assembly 104a-104b, the latter member being fitted on or in the former in alignment so that they are relatively rotatable on bearing means 105a and 105b, respectively, provided at the opposite side walls of the casing 102. One end of said shaft 104a is rotatably inserted in the outer end of a fixed conduit means or pipe 106 leading upward from the fuel reservoir under the ground surface. The shaft 104a is axially hollowed at the vicinity of said one end thereof so that this extended hollow or bore provides an inlet portion to a flexible conduit means or pipe 107 wound around the reel 103. At the connecting portion of the fixed pipe 106 with the rotatable inlet por-

tion of the flexible pipe 107, there is preferably provided sealing means such as a sealing ring 108. The bore terminates at the middle of the shaft 104a where it leads to a connecting pipe 109 which is radially branched from said shaft and then connected to the flexible pipe, the inner end of which is fixed to the reel 103 by any suitable means such as a fitting 110.

Said shaft 104b has an end on which is mounted a sprocket wheel 118 which is rotated through a sprocket chain 119 by a second sprocket wheel 125 which is fixed on the output shaft of an electric motor 111. A worm-wheel gearing is preferably provided between motor 111 and input shaft 104b. When the motor 111 is actuated, for instance by pushing a button switch not shown, the shaft 104b is rotated clockwise as seen from the left hand side in FIG. 6. The shaft 104a has a gear wheel 112 fixed thereon at the vicinity of its inner end, said gear wheel 112 meshing with a second gear wheel 113 rotatably mounted on a short axle 114 which is fixed to a gear supporting arm member 115 which is in turn fixed rigidly to the other shaft 104b. As illustrated best in FIG. 7, a stopper 117 is rigidly mounted on said arm member 115 so that it may engage with a stopper pin 116 planted on the gear wheel 113. The pin 116 normally abuts the stopper 117 owing to the force of a spring 120 to be explained in more detail hereinafter. Thus, even if the shaft 104b and consequently the arm member 115 is rotated clockwise, the gear wheel 113 can not be rotated owing to said abutment of the pin 116 with the stopper 117. Thus, said gear wheel 113 is merely revolved around the gear wheel 112. The clockwise revolution of said gear wheel 113 thus rotates the gear wheel 112 clockwise which in turn rotates the shaft 104a and consequently the reel 103 which is fixedly mounted on said shaft 104a, which unwinds the flexible pipe 107 so that the free end thereof descends to a level, referred to as the waiting position, where said end will not hinder vehicle movement along the passageway but is accessible to the operator. By means of any suitable mechanism, such as a cam and follower device as shown in FIG. 10 cooperating with a microswitch, the motor may be deactivated so that the rotation of the reel 103 is stopped at said level. It is preferable to provide an electromagnet brake to be deenergized when the motor is shut off to be effective to prevent the reel from overdriving due to inertia. When the free end of the flexible pipe 107 is manually pulled down from the waiting position against the working of the spring as referred to above and to be explained hereinafter to the fuel supplying position or level, the reel 103 is further rotated in the same direction, which rotates the gear wheel 112 clockwise. However, the arm member 115 can not be rotated at this time by said rotation of the gear wheel 112 since the shaft 104b rigidly supporting said arm member can not be rotated due to self-locking of the worm-wheel gearings provided between said shaft and the motor. Accordingly the clockwise rotation of gear wheel 112 will cause gear wheel 113 to rotate counterclockwise. Thus, the pin 116 planted on the gear wheel 113 is departed from the engagement with the stopper 117. Before the counterclockwise rotating pin 116 comes to the opposite side of the stopper 117, the free end of the flexible pipe has been moved from the waiting position to the fuel supplying position. During the rotation of the reel, said coil spring 120 is compressed since one end thereof is fixed to the now unrotatable shaft 104b and the other end to the spring casing 121 and consequently to the now rotating reel 103. Thus, when the free end of the flexible pipe 107 is released, the reel is reversely rotated owing to the stored force in said spring 120 so as to rewind the flexible pipe around the reel. This reverse rotation due to the spring force may be preferably prevented by engagement of a butterfly or wing stopper 123 with one of notches 124 formed on the circumferential surface of a drum 122 mounted fixedly on said shaft 104b. The wing stopper 123 is easily disengaged from the notch 124, as is well known, when the flexible pipe is suddenly

5

6

released. The coil spring 120 rewinds the flexible pipe to the waiting position. When the motor 101 is actuated to reversely rotate, the flexible pipe is further wound to the contracted position due to the abutment of pin 116 with stopper 117 which causes both shafts 104a and 104b to rotate counterclockwise and thereby causes reel 103 to rotate counterclockwise to contract the flexible pipe.

The indicator of the fuel amount supplied during the foregoing operation may be reset to zero when the flexible pipe has commenced to descend, for instance by means of a microswitch at any suitable portion of the device. Upon the completion of the reset operation, the motor for the pumping device may be automatically actuated so that the fuel is ready to be supplied for the next operation merely by opening the nozzle valve. It is believed there is no need for explaining in detail the electrical devices and circuitry used in this invention since the matters per se are obvious to those skilled in the art and easily worked by them as occasion demands.

In the foregoing embodiments the free end of the flexible pipe is pulled down to the fuel supplying position against the force of the spring which may rewind said flexible pipe up to the waiting position.

In the third embodiment to be described hereinafter, the operation for pulling down the free end of the flexible pipe from the waiting position to the fuel supplying position is carried out by a friction clutch cooperating with a worm gear device consisting of a worm and worm wheel and with three cam-follower and microswitch devices in lieu of the coil spring cooperating with the gear wheel supporting arm providing the stopper abutting with the stopper pin planted on the gear wheel in the second embodiment illustrated in FIGS. 6 through 8. In the case of this third embodiment which is illustrated in FIGS. 9 and 10, the flexible pipe is rewound from the fuel supplying position rewound to the completely contracted position by the motor.

The construction and operation of the embodiment of FIG. 9 is similar to that of FIG. 6, and in order to functionally relate the two embodiments, similar elements have been given reference numerals in which the last two digits are identical with 100 having been added to the reference numerals in FIG. 9.

In FIG. 9, there is provided a reel 203 around which a flexible pipe 207 is wound in its contracted position. The reel 203 is fixedly mounted on a shaft 204 which is rotatably mounted on bearings provided on the wall of the casing. On said shaft 204 is fixedly mounted a gear wheel 212 meshing with a second gear wheel 213 which is fixedly mounted on a second shaft 204a. It is noted that shafts 204 and 204a are not in alignment as are 104a and 104b of the second embodiment. The end of said shaft 204a is rigidly fixed to one member of a friction clutch 253. The other member of said clutch is fixed to an inner end of another shaft 204b which is mechanically connected with a fourth shaft 204c, for instance through a sprocket wheel 208, chain 209 and sprocket wheel 210. The shaft 204c is rotated by means of an electric reversible motor 211 through a worm gearing 254 consisting of a worm and worm wheel and a universal joint 255. A further gear wheel 251 meshes with said gear wheel 213. Gear wheel 251 is rigidly mounted on the input shaft of an electrical switch box 252 which contains three switches cooperating with three followers F<sub>1</sub>, F<sub>2</sub> and F<sub>3</sub> (FIG. 10) rolling around the respective circumferences of cams C<sub>1</sub>, C<sub>2</sub> and C<sub>3</sub>, which cams may be synchronizably rotated by said input shaft on which said gear wheel 251 is mounted.

The operation will be described with respect to FIGS. 9 and 10 starting from the fully contracted position P1. At position P1 cam-followers C1-F1 and C3-F3 open their respective circuits and cam-follower C2-F2 closes its associated circuit. When the main switch is closed the circuit associated with C2-F2 actuates motor 211 which rotates shaft 204b in a clockwise direction through the worm gearing and the sprocket mechanism. The rotation of shaft 204b is transmitted to shaft 204a which rotates gear 213

in a clockwise direction which in turn rotates gear 212 in a counterclockwise direction. This latter rotation turns reel 203 which lowers flexible pipe 207. The rotation of gear 213 also rotates gear 251 in a counterclockwise direction. When flexible pipe 207 reaches its waiting position P2, cam-followers C2-F2 and C3-F3 open their respective circuits, and cam-follower C1-F1 closes its associated circuit. The opening of the circuit associated with C3-F3 stops motor 211 and allows the flexible pipe 207 to remain in position P2. If the main switch is closed at this time, the circuit associated with C1-F1 will actuate motor 211 to rotate shaft 204b in a counterclockwise direction. The rotation of shaft 204b drives reel 203 in a clockwise direction through shaft 204a, gear 213 and gear 212 to rewind flexible pipe 207. While the flexible pipe 207 is at waiting position P2, the operator may manually pull the flexible pipe down to the fuel supplying position P3. This manual movement of flexible pipe 207 rotates reel 203 in a counterclockwise direction which turns gears 212, 213 and 251. The friction clutch 253 is constructed so that shaft 204a and the lefthand member of clutch 253 may rotate while the shaft 204b and the right hand member of clutch 253 remain stationary. The rotation of gear 251 to position P3 causes the circuit associated with C2-F2 to be open, and the circuits associated with C1-F1 and C3-F3 to be closed. The circuit associated with C1-F1 will cause the flexible pipe 207 to be rewound when the main switch is closed, as described above. The circuit associated with C3-F3 will energize the pump so that fuel will be supplied when the nozzle valve is opened and will also control motor 211 such that the flexible pipe 207 will stop at waiting position P2 when being rewound so that it may be pulled down for the next fuel supplying operation or rewound to position P1.

As described above, C1-F1 acts to rewind the flexible pipe 207 from positions P2 and P3 and acts to prevent any further rotation of reel 203 once position P3 is attained. C2-F2 acts to unwind flexible pipe 207 until it reaches position P2 at which time C2-F2 prevents any further automatic unwinding. C3-F3 acts to stop flexible pipe 207 at position P2 when it is being rewound from position P3 and further acts to control the pump for the immediate supply of gasoline once the flexible pipe is in its fuel supplying position and the nozzle valve is opened.

The cam-follower system above described with respect to the embodiment of FIG. 9 may be utilized with the embodiment of FIG. 6 by merely associating the cams with shaft 104a, for instance, by way of a cam shaft secured to a gear adapted to be rotated by rotation of shaft 104a.

In as much as the present invention is subject to many other modifications, variations and changes in details, it is intended that all matter contained in the foregoing description or shown in the accompanying drawings shall be interpreted as illustrative and not in a limiting sense.

What is claimed is:

1. In a fuel filling station having an area in which vehicles are serviced, the combination comprising a fuel reservoir;
  - a first conduit having an inlet and an outlet;
  - a second conduit communicating between said fuel reservoir and said inlet of said first conduit;
  - pumping means for transferring the fuel from said fuel reservoir through said first conduit and said second conduit;
  - metering means for measuring the amount of fuel transferred by said pumping means;
  - means for supporting said first conduit above the area in which vehicles are serviced including
    - a reel adapted to lower and raise said first conduit;
    - means for automatically rotating said reel to lower said outlet of said first conduit from a completely contracted position to a waiting position; and
    - means for allowing said outlet to be normally lowered to a fuel supplying position from said waiting position.

2. In a gasoline station having a service area, the combination comprising,  
 a flexible conduit,  
 means for supporting said flexible conduit above the service area of the gasoline station,  
 a reel adapted to have said flexible conduit wound around it,  
 a shaft secured to said reel,  
 driving means,  
 means selectively connecting said driving means to said reel shaft to lower said flexible conduit to a waiting position from a completely contracted position;  
 means for allowing said flexible conduit to be manually lowered from the waiting position to a supplying position, and  
 means rotating said shaft to raise said flexible conduit from the supplying position to the waiting position.

3. The invention of claim 2 wherein driving means includes a driving shaft and said selective connecting means includes means securing said driving shaft to said reel shaft to rotate said reel shaft whenever said driving shaft is rotated but to allow said reel shaft to rotate without rotating said drive shaft.

4. The invention of claim 3 wherein said securing means includes an arm member fixed to said driving shaft, a stopper rigidly mounted on said arm member, a first gear wheel fixed to said reel shaft, a second gear wheel meshing with said first gear wheel and secured to said arm member through its axis, and a stopper pin mounted on said second gear wheel whereby the abutment of said stopper and said stopper pin, when said flexible conduit is in the completely contracted position, causes both said driving shaft and said reel shaft to be rotated when said driving means is actuated and whereby the rotation of the reel shaft in lowering said flexible conduit from its waiting

position to its supplying position is permitted due to said stopper pin moving away from said stopper.

5. The invention of claim 4 wherein a spring is secured at one end to said reel and at another end to said driving shaft whereby rotation of said reel without rotation of said driving shaft compresses said spring to provide a reverse rotation of said reel.

6. The invention of claim 3 wherein said securing means includes a friction clutch.

7. The invention of claim 6 wherein said selective connecting means includes a first gear wheel connected to said reel shaft and further comprising a second gear wheel meshing with said first gear wheel, a control shaft secured to said second gear wheel and a cam-follower control network responsive to said control shaft to control said driving means.

8. The invention of claim 3 wherein said driving means includes a reversible electric motor and further comprising cam-follower means responsive to the rotation of said reel shaft to open and close circuits for energizing said electric motor.

#### References Cited

##### UNITED STATES PATENTS

|           |         |       |              |
|-----------|---------|-------|--------------|
| 2,219,201 | 10/1940 | Smith | 137—355.23   |
| 2,742,320 | 4/1956  | Grise | 137—355.23 X |
| 2,887,121 | 5/1959  | Magee | 137—355.23   |

##### FOREIGN PATENTS

|           |        |         |
|-----------|--------|---------|
| 618,397   | 4/1961 | Canada. |
| 1,201,400 | 7/1959 | France. |

LAVERNE D. GEIGER, *Primary Examiner.*

E. J. EARLS, *Assistant Examiner.*