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APPARATUS FOR CHARGING ACETYLENE CYLINDERS

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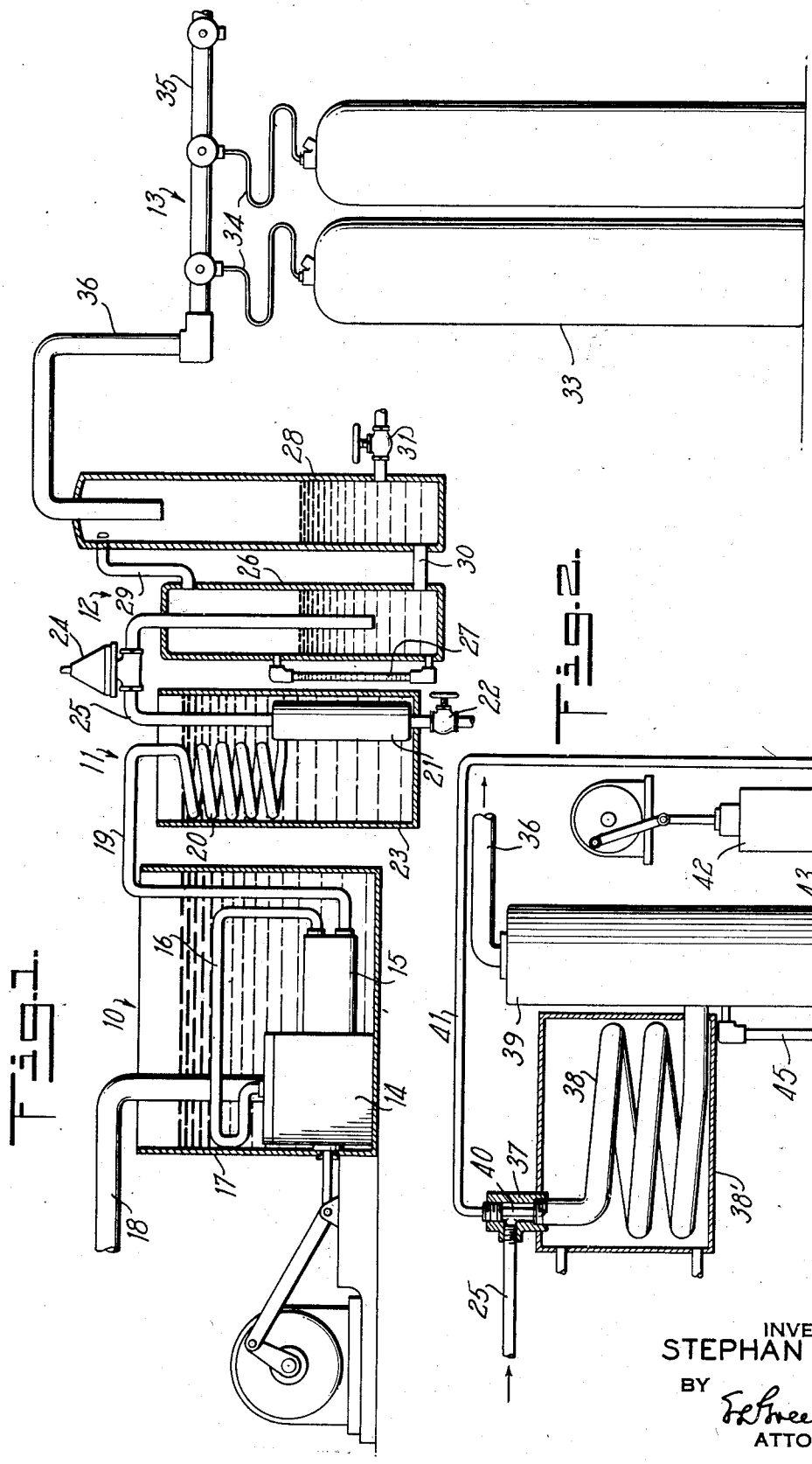


Fig. 1.

Fig. 2.

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APPARATUS FOR CHARGING ACETYLENE CYLINDERS

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This invention relates to an apparatus for charging acetylene cylinders, and more particularly to an apparatus for reducing the frequency of acetone addition when charging acetylene cylinders.

The storage and shipment of acetylene in compressed form in steel cylinders is accomplished by dissolving the acetylene in acetone which is absorbed by a porous mass with which the steel cylinder is filled.

Acetone is continually lost during the withdrawal of the acetylene from the cylinder. A part of the acetone evaporates in accordance with its partial pressure and is carried along with the acetylene, that is, as the pressure within the cylinder falls during the discharge, the proportion of acetone vapor in the acetylene delivered is initially quite low but increases to a maximum when the pressure in the cylinder reaches its lowest value at which the cylinder becomes empty of its usable gas content and must be recharged; part of it, however,—particularly with too rapid withdrawal of the gas—may also be carried along mechanically. In any event, acetone must be added to compressed acetylene cylinders in order to replace the acetone losses and to maintain the acetylene capacity of the cylinder at a certain value. The addition of acetone is frequently required after only a single discharge.

An object of the present invention is to provide a simple apparatus which makes it possible to reduce to any desired extent the frequency of liquid acetone addition.

These and other objects of this invention and the novel features thereof which achieve these objects will become evident from the following description, having reference to the accompanying drawing, in which:

Fig. 1 is a diagrammatic view partly in section of an apparatuus embodying the principles of this invention and adapted to add acetone to the compressed acetylene charged into cylinders; and

Fig. 2 is a diagrammatic fragmentary view on an enlarged scale of another embodiment of the apparatus.

Acetone is the solvent most commonly employed in acetylene cylinders. However, other solvents for the gas could be employed and where the term "acetone" appears in the specification and claims, it is intended that the term shall include any liquid that is utilized as a solvent in the cylinders being charged.

According to the present invention, the so-called empty cylinders are filled with acetylene which is loaded with acetone vapors. The process is carried out, for example, by providing a device built into the line between the compressor and the filling rack for acetylene cylinders which device is arranged to load the gas flowing to the cylinders with acetone vapors. The gas may be charged with acetone, for example, in a trickle tower in which the gas enters at the bottom and wherein acetone is introduced at the top. Another procedure for carrying out the process consists therein that the gas is conducted through a bubbler vessel containing acetone.

Since it is particularly advantageous to keep the cross sectional area and volume of the gas space at a low value, a suitable apparatus is one comprising a tubular coil inserted in the compressor discharge line into which liquid acetone is sprayed in a finely divided state by means of a pump and a nozzle (similar to the fuel pumps and nozzles utilized in Diesel engines). The acetone is thereby atomized and evaporated into vapors and taken up by the acetylene. The excess part of the acetone which is not evaporated is trapped in a suitable separator and again conducted to the pump.

Referring now to the drawing and particularly to Fig. 1, there is shown generally at **10** an acetylene compressor, at **11** a moisture trap, at **12** an acetone vaporizer, and at **13** a cylinder charging rack. The compressor **10** is of the customary type and may have two stages **14** and **15** and an intercooler **16** connecting the discharge valves of the first stage with the inlet valve of the second stage. The cylinders and intercooler may be submerged in cooling water contained in the box **17**. Acetylene at low pressure from a gas holder, or generator enters the compressor through pipe **18**. The compressed acetylene customarily contains excess water vapor which is preferably removed. Lubricant also tends to be carried over from the compressor and is preferably removed. To this end a moisture trap **11** is provided that may comprise a cooling coil **20** receiving gas from the compressor through conduit **19**. The moisture condensed in coil **20** is separated in a trap **21** into which the coil **20** discharges. The trap **21** is provided with a drain valve **22** and both trap **21** and coil **20** are submerged in cooling water in a jacket **23**.

In order that the removal of moisture may be efficient when the cylinder pressure at **13** is low, a back pressure valve **24** may be interposed in the discharge conduit **25** from the trap **21**. The back pressure valve does not permit the

passage of gas until the pressure in the trap exceeds a set value providing efficient moisture removal. The compressed and partly dried gas is then passed through the acetone vaporizer 12 which, in the embodiment illustrated in Fig. 1, comprises a bubbler chamber 26 containing acetone whose level may be indicated by a gauge glass 27. The acetylene is conducted below the surface of the acetone in chamber 26 and bubbles therethrough and after the acetone is saturated with acetylene the acetone will be evaporated and carried by the acetylene in an amount which depends upon the temperature and pressure of the acetylene. The acetylene containing acetone vapor passes through a trap 28 for removing any acetone mechanically carried along through the connection 29. The acetone collected by trap 28 flows back into chamber 26 through the lower connection 30. To add acetone to the vaporizer a valved connection 31 is provided.

The cylinders 33 to be charged are connected by flexible connections 34 to a charging rack manifold 35 in the customary manner. The acetone-loaded compressed acetylene is conducted to the manifold 35 from trap 28 by the pipe line 36. It is important that no liquid acetone be carried over to, or be deposited by, condensation in the pipe line 36 or manifold 35 because such liquid may pass into the first cylinder connection it reaches and thus overload the cylinder connected thereto with acetone. The acetone, therefore, should be maintained in the vapor state. Hence it is preferable to maintain the pipe line 36 and manifold 35 warmer than the vaporizer 12. The temperature of the vaporizer 12 and the acetylene may be maintained at any desired value by suitable means, such as heating jackets containing warm water or steam, and thereby the amount of acetone vaporized into the acetylene can be exactly regulated.

Referring to Fig. 2, the compressed and dried acetylene is conducted by conduit 25 to the side opening of a T connection 37 at the upper end of a pipe coil 38. The lower end of the coil 38 connects to a trap 39 which may contain pieces of solid material or a porous filling to reduce the size of the gas spaces. Through the remaining opening of the T 37 is inserted a spray nozzle 40 supplied with acetone under pressure by conduit 41. The acetone is supplied at relatively high pressure to conduit 41 by a force pump 42 which may be of a variety similar to those employed in Diesel engines for pumping measured amounts of fuel oil. For example, the pump 42 may be provided with means for accurately varying the rate of discharge so that the addition of acetone to the gas may be controlled in accordance with the average acetone deficiency of the cylinders on the rack 13. The suction valve of the pump 42 may be connected to the lower end or sump of the trap 39 by conduit 43 and the acetone necessary to maintain a liquid level in the sump may be added through connection 44. The level in the sump of trap 39 may be measured by a gauge glass 45.

The apparatus of Fig. 2 may be operated so that only enough acetone is pumped by the pump 42 to completely evaporate in coil 38, in which event the exact amount of acetone added to the acetylene is controllable by regulating the pump output, or an excess may be pumped into the coil 38 so that the excess is removed by the trap 39 and in this event the amount of acetone added is to be controlled by regulating the temperature of the gas and trap 39, as, for example, by heating the coil 38 by warm water passed through jacket 38' around coil 38.

The quantity of acetone which is taken up by the acetylene depends upon the pressure and temperature of the acetylene. Inasmuch as the maximum filling pressure is generally fixed, the volume of acetone carried along can be regulated chiefly by effecting suitable control of the temperature. In the event that greater quantities of acetone are to be introduced into the cylinders with the acetylene, it is necessary to suitably heat the saturator as well as the connecting portions of the pipe line to the cylinders.

In view of the quantity of acetylene to be charged into the cylinders and the hydraulic expansion of the cylinder contents due to normal temperature changes, they can never be entirely filled with acetone and there must always be a gas space. For the above reasons, care must be taken to insure that the quantity of acetone which is introduced into the cylinders with the acetylene in accordance with the invention is smaller than, or no more than equal to the average quantity of acteone which was lost during the previous discharge of gas from the cylinders. This is of particular importance inasmuch as the temperature of the gas during discharge is generally lower than the charging temperature due to the cooling of the cylinder by the negative heat of solution. When, for example, the cylinders are used outdoors in the colder months of the year, the discharge temperature may be appreciably below the charging temperature. In all these cases, care must be taken to see that the acetylene does not introduce more, but preferably less, acetone to the cylinder than was lost during the discharge. In this manner dangerous over-filling of the cylinders with acetone is avoided and yet the frequency of acetone addition is greatly reduced. The acetone deficiency in each cylinder is determined in the customary manner by weighing and taking into consideration the calibrated tare weight of the cylinder and the pressure of any small amount of residual gas that may remain in the cylinder and the average deficiency is readily determined from such records.

The new method of operation was explained in detail above in connection with the filling of acetylene cylinders. This method can be also employed in a similar manner for filling any container in which gases are to be dissolved under pressure in any type of solvent. In such cases the gas to be dissolved is loaded with the respective solvent in order to compensate for solvent losses during the gas discharge.

I claim:

1. Apparatus for charging cylinders for dissolved acetylene which comprises means for supplying compressed acetylene at a pressure exceeding that of the cylinders to be charged; a vaporizer having a passage for conducting the compressed acetylene therethrough, said passage having relatively narrow successive cross sectional areas; means for injecting acetone into said passage in a finely divided state; a cylinder charging rack; means for conducting vapor-bearing acetylene from said vaporizer to said rack; and means for preventing acetone in the liquid state from flowing to the cylinders.

2. Apparatus according to claim 1 including means for controlling the temperature of said vaporizer so as to regulate the amount of acetone

vapor carried by the acetylene into the cylinders.

3. Apparatus according to claim 1 including a trap for separating acetone in the liquid state from the acetylene leaving said vaporizer; and a pump for drawing liquid acetone from said trap and supplying said liquid acetone under relatively high pressure to said acetone injecting means.

4. Apparatus for compensating a deficiency in the amount of solvent in acetylene cylinders which comprises means for supplying compressed acetylene at a pressure exceeding the pressure within said cylinders; a washing tower of relatively small volume for charging said acetylene with vapor of acetone; means for constantly flowing said compressed acetylene through said washing tower in intimate contact with acetone therein; means for supplying liquid acetone to the upper portion of said tower; means for separating from the vapor-bearing acetylene leaving said tower any entrained particles of liquid; and means for conducting said vapor-bearing acetylene into said cylinders.

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