FLUID SAMPLE APPARATUS FEATURING INTEGRAL CONSTRUCTION WITH A MOTOR DRIVEN SAMPLING SYSTEM

Matter enclosed in heavy brackets [ ] appears in the original patent but forms no part of this reissue specification; matter printed in italics indicates the additions made by reissue.

This is a continuation of application Ser. No. 08/336,830, filed Nov. 9, 1994, now abandoned, which is a Reissue of 07/418,522, now (surrendered) U.S. Pat. No. 4,928,536.

BACKGROUND OF THE DISCLOSURE

The present apparatus is directed to an integrated construction of a fluid sampling apparatus and more particularly to one which incorporates a fluid sampling metering mechanism. It is particularly adapted for use with flowing fluids in pipelines of variable pressure. It can be used with a pipeline flow system with pressures as high as necessary for operation of the pipeline, as low as might be encountered, and all pressures in between. It is also intended for use with gases or liquids.

The present inventor has been involved heretofore in various and sundry high pressure pumps, sample collection devices, and devices which insert into a pressure vessel including a pipeline. Such items are exemplified by the following U.S. patents:

3,945,770: HIGH PRESSURE PUMP 4,346,611: INSERTION REGULATOR FOR PRESSURIZED PIPELINES 4,403,518: SAMPLER APPARATUS 4,440,032: SAMPLER INCLUDING A PURGE SYSTEM 4,525,127: VANISHNG CHAMBER CRUDE OIL SAMPLER 4,557,151: SAMPLER INCORPORATING PRESSURE BALANCED CHECK 4,628,750: INTEGRATED PUMP AND SAMPLE VESSEL

These patents as well at the catalog of products of the corporate manufacturer of the devices described thereby represent systems utilized heretofore for obtaining samples from a fluid flow system. It is the purpose of the present disclosure to set forth a fluid sampling apparatus which is an integrated structure having advantages set forth below.

Consider a typical situation involving a fluid flow pipeline which may fluctuate between 500 and 2,500 psi pressure, the fluctuations in part arising from variations in demand. Consider the same situation where the pipeline may deliver natural gas or oil; the sales price for the fluid will fluctuate depending on BTU content, CO_2, and other variables. The sample is removed from the pipeline in proportion to flow. It is removed into a storage vessel, and that is periodically carried to a laboratory for testing. The sample must be collected in proportion to the flow and thus, one part per million or one part per billion may be sampled, stored and assayed to determine price. In one example, the BTU per mcf assay is determined and the payment obligations for the natural gas transaction can then be calculated. The same is also true of liquid deliveries. In summary, it is important to obtain measured quantities of sample.

The sample storage container may have an internal pressure which is greater or less than the pipeline pressure. That pressure can vary widely also. Another variable of importance is the portion to be taken to make up the sample. Again, it can vary by perhaps three or four orders of magnitude.

An important factor in the present disclosure is the ease and the facility in which an installation can be made. Briefly,

such an installation is often required at remote locations in gas field gathering lines, or perhaps at an intermediate sized pipeline. Such locations are remote and difficult to access. It is difficult to make complex equipment installations in the field. In part, this relates to the difficulty in drilling into the pipeline and forming what is known as a hot tap. Even where the connection is made without the hot tap, it is an expensive undertaking. Cost, complexity and reliability are substantially impacted by the present apparatus. It is more readily installed and installed with a good deal of ease in contrast with the typical system which is assembled in the field with a multitude of components. The present apparatus is characterized as an integrated system which can be attached at a hot tap or alternately in original field installation before the pipeline is placed in service. In either case, the installation process is enhanced by use of an integrated system. Moreover, the integrated system enables fluid flow to be diverted into the equipment, subjected to control by an off/on valve and directed into the system for sampling. More sample is taken out of the pipeline than is required and only a portion thereof is subsequently stored. In other words, the tapped flow is much larger than the sample quantity required and so it is further reduced in volume to match the desired sample output. This is accomplished with pressure isolation. That is, the sample which is delivered at pipeline pressure is isolated for storage at the pressure of the storage vessel. Accordingly, a fluid operated piston with a connected piston rod received in the cylinder is utilized to take timed bites from the removed sample flow. The sample bites are pressure isolated from the pipeline pressure and are delivered to a sampling valve including a check valve and are then delivered out of that apparatus at whatever pressure is necessary to be received in a storage container. Any back pressure encountered is overcome.

The integrally constructed apparatus incorporates a piston and connected piston rod cooperative with a sampling valve. All of this equipment must be properly aligned for installation. By means of integral construction, field alignment is thereby avoided. Further by proper alignment, flow passages through the device are provided so that a small sample flow is derived from the pipeline. The device includes an integrated off/on valve. There are two embodiments of the present disclosure and the one is particularly intended for flowing [gases]. In that embodiment, there are two off/on valves, one for the sample deliver and the other connected in the sample return line so that any surplus sample is returned back to the pipeline.

A [liquid] embodiment is also set forth. The [liquid] embodiment incorporates a similar off/on valve. The [liquid] embodiment is able to remove a [liquid] sample flow which is delivered through a sampling valve and is delivered bite by bite to the sample storage device. The sample storage device is typically a detachable or removable fixed volume container which lends itself to easy removal, transportation to a laboratory and subsequent testing to assay the nature of the sample and to typically obtain the dollar in accordance with some pricing relationship.

The foregoing is directed to some advantages of the present invention but more advantages will be noted and understood on review of the preset disclosure in conjunction with the drawings set forth below.

BRIEF DESCRIPTION OF THE DRAWINGS

So that the manner in which the above recited features, advantages and objects of the present invention are attained and can be understood in detail, more particular description