Bulk Plant Design

Loading and Unloading Simplified by Reversing the Direction of Pump Rotation

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BUTANE-PROPANE News MAY — 1946

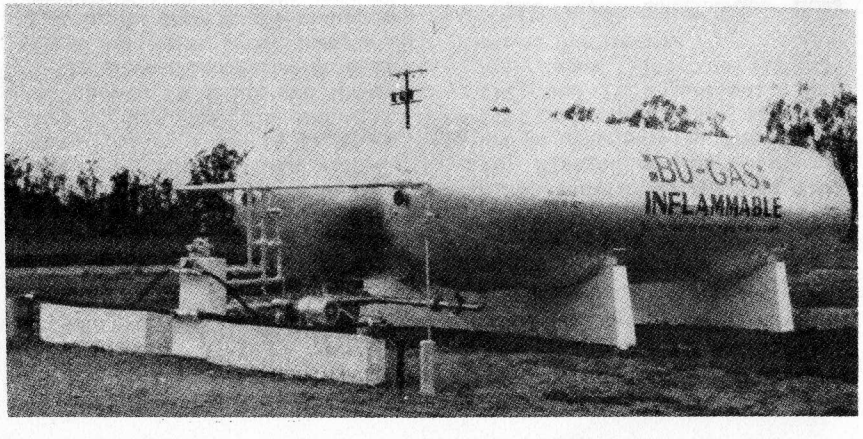
IN the designing of a liquefied petroleum gas bulk plant, special consideration should be given to facilities for fast transfer in the filling of storage from tank car or from tank truck and trailer unit, as well as for rapid reloading of products into distributing trucks.

There was recently installed in Santa Maria, Calif., a bulk plant that may well be cited as an excellent example of successful installation, with emphasis on both speed and safety.

The illustration below shows this plant, which is owned by the California Butane Co., Los Angeles, and which was designed by that firm's chief engineer, Geo. Brereton.

This installation consists of two 10,000-gallon propane storage tanks which are connected by 3″ pipe lines to a single Model M-3 Smith butane-propane pump, driven by a 7½ HP explosion-proof, electric motor. A reversing switch is provided which permits the pump to be operated in either direction of rotation, so that loading and unloading of tank trucks can be handled by the same pump with a minimum of valves and piping.

The tanks and piping, as shown, are well protected, by the heavy concrete wall and steel guard posts, against contact with truck and trailer in handling into filling position. The electric control switch and the vapor return valves are seen mounted at the top of a central concrete pillar, while liquid hoses for simultaneous attachment to truck and trailer are supported, as can be seen, over the top of the concrete wall with attachment valves laying in Y supports at either end.



Piping System Is Simple

The diagrams, Figs. 1 and 2, shown on the other side of this sheet indicate the simplicity of the piping system. The only lines from the bottom of the tank are the 3″ lines which are provided at each tank outlet with 3″ excess flow valves. For greater safety, a third 3″ excess flow valve is placed in the liquid line just ahead of the tee to which the truck and trailer hose lines are attached.

The vapor return lines which are seen above the tank ends are 2″ pipe size, and each tank is provided with a 2″ excess flow valve where this line enters the tank.

A third 2″ excess flow valve is also provided at the point where the vapor return hose lines are attached to the tee at the central pillar. The additional excess flow valves provided on both liquid and vapor lines are to safeguard the installation in the event of any hose line being broken or accidentally detached.

The pump by-pass line carries bypassed fluid back to the tank, and is provided with both an automatic, spring-loaded by-pass valve set to a 50 lb. differential pressure, and an emergency hand by-pass valve as indicated. This hand valve is often conveniently used to establish initial flow by eliminating gas from the line, or for pump testing, or may be used to divert a large part of the pump discharge capacity when filling small containers. Double 3″ strainers have been provided to protect the pump, in either direction of flow, from pipe scale, weld shot, or other foreign matter.

Fast Unloading Time

It is interesting to note that tests of this unit show a delivery time of 18 minutes to fill 1662 gallons from storage tank into a single tank truck unit, or a filling rate of 92.2 gallons per minute.

The time for unloading a truck and trailer unit of 6092 gallons was recorded as 1 hour and 16 minutes, or just over 80 gallons per minute. However, at the time of this test. incorrect fittings had been provided for the vapor return line, resulting in a vapor pressure differential of over 20 lbs. Larger vapor connections have now reduced the filling time to 70 minutes, which indicates a rate of 87 GPM.

While this unloading time is considered very satisfactory, a still further reduction in time is anticipated when a Y fitting can be substituted for the present tee fitting now used at the juncture of the two hose lines, since this will considerably reduce the fluid velocity loss now occasioned by the direct impingement of the two incoming streams of liquid in the tee fitting.

Detail Explanation of Figs. 1 and 2

Fig. 1 is a plan layout showing two 10,000 gallon propane tanks A and B, interconnected by 3″ piping to discharge or to be filled through a single pump unit C, connected to a tee D, to which two 2″ hose lines are connected. As shown, the truck and trailer tanks are both connected through these hose lines, which insures a full intake flow to the pump, so greatly accelerating the over-all delivery rate as noted in the accompanying article.

A heavy concrete wall is provided to protect the propane tanks, valves, and pumping equipment from any possible injury by the truck and trailer unit, or from road traffic.

Fig. 2 is an elevation showing the piping arrangement, particularly the vapor return and by-pass return lines. Reference letters and figures shown in both Fig. 1 and Fig. 2 indicate the following parts:

A—No. 1. 10,000 gallon propane tank; B—No. 2. 10,000 gallon propane tank; C—propane electric-driven rotary pump unit, capacity 100 GPM; D—tee connection to double hose liquid lines; E and F—truck and trailer transport unit; G—concrete wall protecting station equipment; H—reversing, electric explosion proof switch.

(1) Liquid line from truck tank. (2) Liquid line from trailer tank. (3) 3″ excess flow valve. (4) Vertical outlet for by-pass return. (5) Flanged coupling. (6) 3″ strainer for incoming flow. (7) Rotary gear propane pump. (8) 3″ strainer for outgoing flow. (9) Flanged coupling. (10) 3″ tee to distribute to two tanks. (11) and (11′) flanged coupling. (12) and (12′) lubricated plug type valves. (13) and (13′) 3″ excess flow valves.

The vapor equalization lines can be particularly traced in Fig. 2, and can be seen in the accompanying photograph reproductions. (14) and (14′) are 1″ hose lines connected from the upper part of truck tanks E and F, to duplicate valves (15) and (15′) which are attached to the vapor return line (16), in which a 2″ excess flow valve (17) is placed and which is connected through union (18) and line (19) to the cross connection J and J′ shown broken in Fig. 1, and which leads back to both storage tanks, as shown with an additional excess flow valve (20) and (20′), at the entrance to each tank.

The pump by-pass line may be traced in Fig. 2, as leading from the tee (21) and fitting (4) in the liquid line and passing through double lines (22) and (23). Line (22) has a spring-loaded, automatic by-pass valve (24), while line (23) is provided with a hand control valve (25).

Both by-pass lines are connected to the header K and K′, shown broken in Fig. 1, and to both tanks through two 2″ excess flow valves (26) and (26′).

FIG. 1

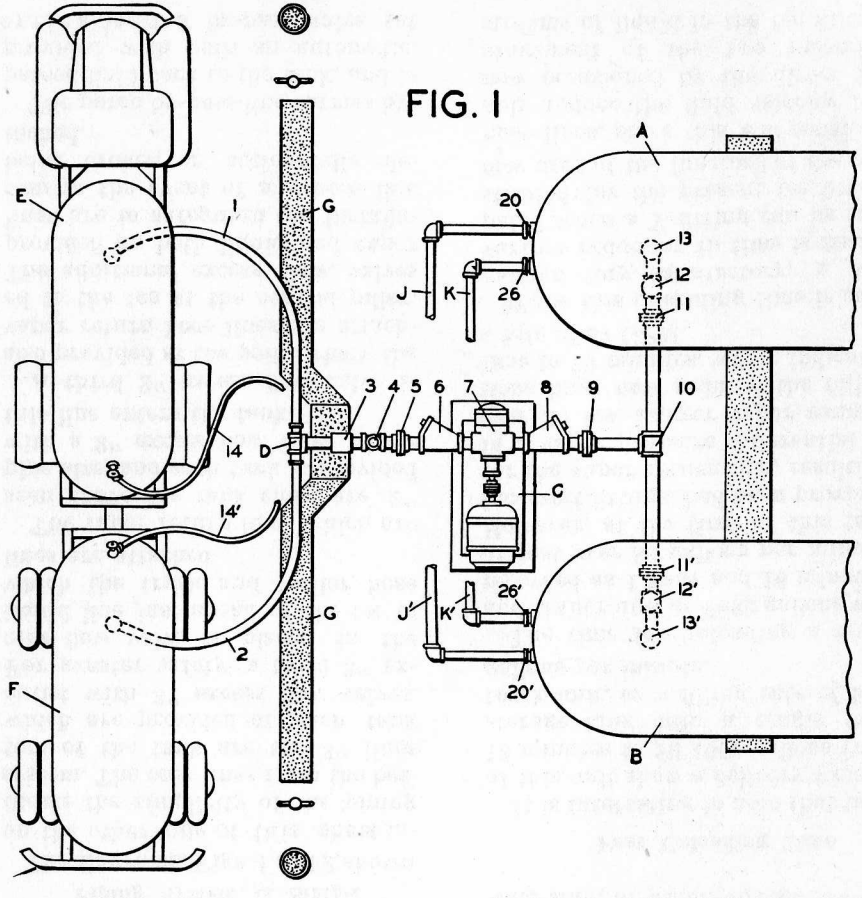


FIG. 2