Unloading Tank Cars

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IN the several articles which have preceded this one, under the title of "Pump Problems," we have given particular attention to examples which would help to make clear the general physical principles involved in the pumping of butane and propane. This plan has been followed because with a basic understanding of the practical differences between pumping B-P Gas and that of pumping water or oil, a better analysis of existing plant troubles can be made, and new plant layouts can be developed with greater certainty of success.

The present article covers pumping equipment and layout for unloading railroad tank cars, but in addition to the brief description of the plants here sketched, certain basic items previously covered must not be overlooked, since these are important to the success of any butane or propane pump installation. Three of these may be briefly summarized as follows:

1. We must be sure that the installation is so that the pump will be filled with liquid, and that the piping is so arranged that the pump section cannot constitute in itself a vapor trap.

2. We must see to it that a supply of liquid will be carried to the pump by gravity flow alone in sufficient volume to equal the pump capacity. There must be no dependence on pump "suction" to accomplish this.

3. We must limit the required outlet differential pressure to as little as is consistent with practical performance. In other words, balance vapor pressures where possible, provide reasonable size outlet lines and fittings and do not incur unnecessary back pressure resistence to add to the power cost and general pump wear expense.

Fig. 1 shows a plant of a California operator who uses a positive displacement rotary gear pump to handle propane from tank cars to storage tanks C and D. This same pump is also used to serve his bottling plant E, as well as to load or unload tank trucks in positions F and G. The sketch shows a single pump installation, but a second standby pump has been added with a valve arrangement whereby either pump may be cut in to perform any of the several operations, or whereby one pump may be used for unloading, while the second pump is independently handling the bottling plant or tank truck loading. This second pump offers an important service safeguard since either pump alone can be made to handle every requirement in case of emergency.

Unloading Procedure

When the railroad tank car is spotted for unloading, liquid hose lines 1 and 2 are connected to a Y fitting 3 attached to valve 4. Both 2-in. tank car liquid lines are used because much higher transfer speed is found possible under these conditions, and there is also less danger of closing the tank car excess flow valves.

However, the flow through a rotary pump is smooth and free from impulses and this aids materially in avoiding this particular difficulty. Vapor exchange hose 5 is connected to valve 6 on vapor return pipe line 7. In this installation, the vapor line was kept elevated to a height just above the top of the storage tanks. This is done to avoid added vapor line pressure through fluid head which can develop when depressed lines become flooded. The elevated vapor line to the storage tanks is of larger size than usual, since it is also used in this case to handle the by-pass flow from the pump.

For delivery of propane from tank car B to storage tank C, operation is as follows: Opening valve 4 admits fluid to fiuid line 8. Valve 9 is closed and fluid flows through open valve 10. Valves 11 and 12 are closed so flow passes through strainer 13 into pump A, from which flow is through open valves 14, 15, and 16. A spring loaded by-pass valve 17 is arranged to discharge through line 18, back through vapor line 7 either to the tank car or to storage tanks C or D. A hand by-pass valve 19 is placed to provide a simple release of air or gas from the pump line section in case of vapor lock.

After making connections as above described and starting the pump, valve 19 is closed, and very rapid transfer takes place in accordance with the ability of the pump to perform. In this layout, with ample pipe sizes, and with the pump close to both tank car and storage tanks, and with plenty of inlet head or height of liquid above the pump, all conditions are exceptionally favorable.

Opening valve 20 and closing valve 16, carries the flow to storage tank D. As can be readily seen, the flow may be reversed to withdraw liquid from C or D and discharge to R.R. tank car by opening valve 11 and 9, and closing valve 10, 14, and 15. Or valve 14 may be opened and valve 9 closed and discharge from storage tank C and D be made either to the truck loading position F or to the bottling plant E.

Provision is also made to un-

FIG. 1

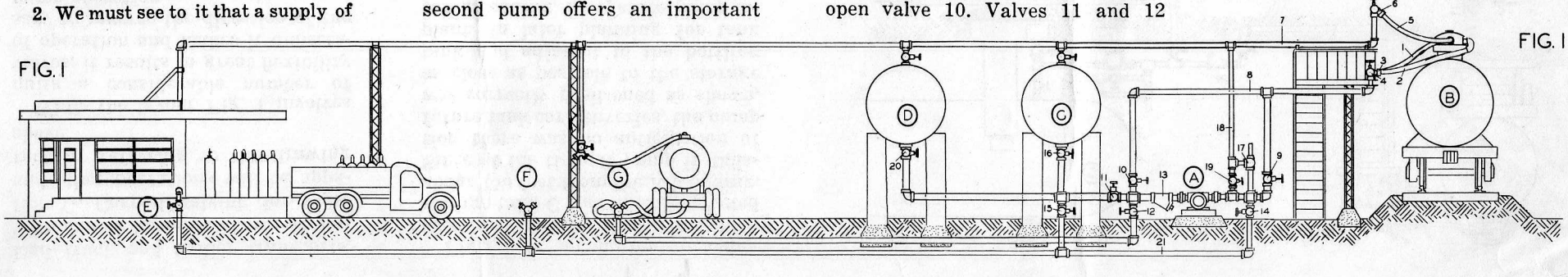

FIG. 1

load truck and trailer transports, with double hoses as shown at station G. Correct valving for these and other operations will be apparent by referring to the drawing above.

While the layout Fig. 1 involves quite a considerable number of valves, it results in great flexibility of operation and makes it unnecessary to reverse the direction of the pump operation.

Reverse Switch for Pump

A somewhat simpler layout with fewer control valves is outlined in Fig. 2. In this plan a reverse switch is provided to operate the pump in either direction for handling into and out of storage. The single main outlet line 21 carries high pressure butane or propane to the tank truck loading rack, or to the bottling plant as may be required. All incoming fluid passes through a single strainer 22. However, the pump is protected from foreign matter in the reverse direction of flow by a settling pot 23 which is merely a pipe extension as shown with a drain plug for occasional cleaning. This pot catches all heavy foreign matter such as weld shots which might otherwise be swept in from the tank bottom under heavy flows.

Fig. 3 is an outline drawing showing another plant in which storage tank C was initially erected about 150 feet from the R.R. siding. Since at the time of pump installation there was no anticipation of future tank car deliveries, the pump was correctly positioned as shown, as close as possible to the storage tank and adjacent to the bottling plant. In later planning for tank car unloading, a separate pump located close to the siding was definitely indicated. However, a vapor compressor was already available at this plant, so it was decided to make use of this equipment to establish an adequate pressure differential to feed the pump under positive pressure, in spite of the long suction line. In operation, tank car B was connected with two hose lines 1 and 2 from both liquid outlets to a Y fitting 3 attached to valve 4. Vapor hose 5 was connected to the vapor return line 7 through valve 6. The vapor compressor was connected as shown on either side of valve 24. A 4-way valve 25 allows for reversal of the compressor suction and discharge outlets as shown. With valve 24 closed, and valve 25 positioned as shown, the vapor compressor was started. As indicated by arrows,

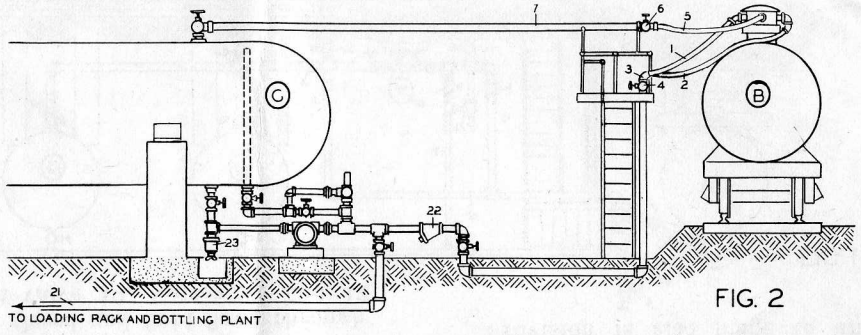

FIG. 2

vapor is withdrawn through vapor line 7 from the storage tank C and discharged into R.R. tank B. The compressor alone is run until a differential pressure of approximately 10 lbs. is reached, after which the pump A at the storage tank is started. Even through this long line, the flow was very rapid and it was found that the speed of transfer more than doubled that which was obtainable with either pump or compressor operating separately.

Other features of this layout will be apparent. Two strainers 22 and 22A protect the pump in either direction of flow. The pump motor is provided with a reversible switch for operation in either direction, for pumping in and out. Hand valve 19 is useful to permit the rapid clearing of all air or gas accumulation in pump section when necessary. By-pass valve 17 protects against over pressure in case of operating pump against closed valves. A hand valve shown above the bottling manifold, gives control of manifold pressure differential and is used for speed control similar to that incorporated in the bottling plant layouts shown in the June and November issues of Butane-Propane News.

After all liquid is removed from the tank car B, the reversal of valve 25 will withdraw remaining vapor which is compressed and delivered to the storage tank.

The sketches shown in this article are diagrammatic and are intended merely to convey the general plan of operation. Many additional features for operating convenience and safety should be provided, such as an adequate number of pressure gauge outlets, blow down connections, and pressure relief valves to suit the requirements of each individual plant.