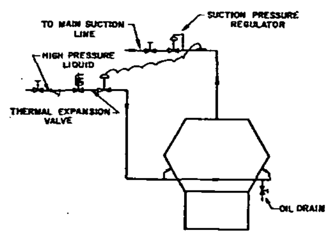

Fig. 9 .... Jacket Cooling by Use of Ammonia

the jacket can be taken directly into a suction line leading to the compressors. Fig. 9 illustrates this type of jacket cooling. For the method using the hand valve and solenoid valve, the branch suction line should enter the suction main ahead of a suction trap or a low-pressure receiver.

For rotary low-stage compressors, it is desirable to maintain even temperatures around the cylinder in order to obtain even expansion and contraction and one method of accomplishing this is to flood the cooling chamber with a fluid such as Refrigerant 11 and let this fluid operate in a thermal cycle. Fig. 10 shows an arrangement with this type of cooling. Refrigerant 11 flows as a liquid from the upper chamber into the annular space of the rotary compressor, where some of it evaporates and flows out the top connection of the rotary compressor back into the upper shell where it is condensed by circulating cooling water.

Among other methods that have been used for cooling rotary compressors are water or oil circulation through the annular space.

CONDENSER AND RECEIVER PIPING

The main consideration in the piping around condensers and receivers is to keep the condensing surface at its highest efficiency. To do this, it is necessary to keep the liquid ammonia draining out of the condenser promptly as it is condensed and also to keep air and other non-condensables purged out.

Horizontal Condenser and Through Receiver

Fig. 11 shows a horizontal water-cooled condenser draining into a through type receiver. Water is introduced into the lower tubes of the condenser and leaves from the upper tubes. This method results in the highest log mean temperature difference and will keep the condensing pressure at the lowest value. Since air is heavier than ammonia vapor, it will tend to migrate to the lower part of the shell where the water is coldest.

Control of water flow to maintain head pressure is not always necessary in ammonia plants. There is usually adequate pressure to force the ammonia to the various evaporators without water regulation. The economics of each situation has to be evaluated on the basis of water costs versus brake horsepower cost savings at lower head pressures.

The water piping should be arranged to keep the condenser tubes filled with water at all times. Air vents should be provided on the condenser heads with hand valves for manual purging.

Receivers should always be located below the condenser so that the condensing surface is not flooded with ammonia. The piping should be such that there is free drainage away from the condenser and that the static height of ammonia above the first valve out of the condenser is greater than the pressure drop through the valve.

The drain line from the condenser to receiver is designed on the basis of 100 fpm maximum velocity in order to allow gas equalization between condenser and receiver, and also allow the air to migrate into the receiver. Sizing of this line, based on pounds of ammonia per minute is given in Table 1.

Any ammonia vessel that can be valved off must be provided with an automatic relief valve. Sizing of the valve should be in accordance with National Board of Boiler and Pressure Vessel Inspectors. The valve should be automatic reseating.

In order to be able to test relief valves, it is necessary to be able to pump out the vessel or provide a means of using a dual valve, such as is shown in Fig. 12, using two relief valves. The stop valve is constructed so that it is always open to one of the relief valves while the other is being removed for checking.

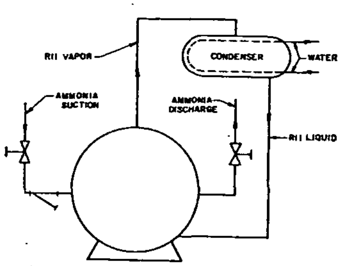

Fig. 10 .... Rotary Booster Compressor Cooling with Refrigerant 11 Thermocycle

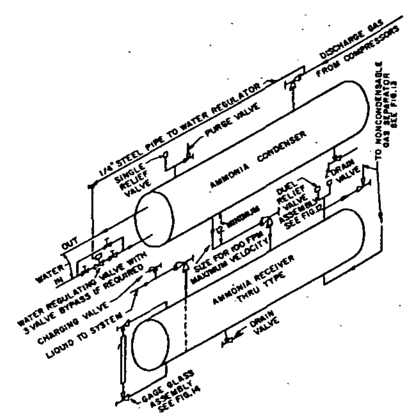

Fig. 11 .... Horizontal Condenser and Through Receiver Piping

A dual type relief valve is recommended for use on receivers because normally it is not possible to put all the liquid ammonia in the low side. On condensers and other system components that can be pumped out easily, a single relief valve may be used.

A non-condensable gas separator (purge unit) is useful on most plants but especially where a suction pressure below 0 psig is used. Purge units on ammonia systems are piped to the receiver as shown in Fig. 13. High-pressure liquid is expanded through a coil in the purge unit, providing a cold spot in the purge drum. The suction from the coil should be taken into one of the high-temperature suction mains. Ammonia vapor and non-condensable gas are drawn up into the purge drum and the ammonia is condensed on the cold surface and drained back to the receiver. When the drum fills up with air and other non-condensables, the thermostatic valve opens permitting them to leave the drum and pass into the open bottle. When the non-condensables leave, the bulb on the thermostatic valve warms up to close the valve.

A receiver should be equipped with a gage glass so that the quantity of ammonia in the receiver can be easily determined. The valves on each side of the gage glass should be constructed with a check valve in such a way that if the glass breaks, the check valve will prevent loss of the refrigerant from the receiver. Fig. 14 illustrates a gage glass assembly.

Sufficient liquid ammonia has to be charged into the system to seal the outlet pipe of the receiver and to prevent hot gas from blowing over to the low side. The outlet pipe should extend down into the receiver to a distance of one pipe diameter from the bottom. The lowest liquid level in the receiver should be equivalent to two diameters of the outlet pipe for both top and bottom outlet receivers.

For a 1¼ in. top outlet on a 30 in. diameter receiver, the pipe should extend to 1¼ in. of the bottom of the receiver and the lowest ammonia level should be 2½ in. from the bottom of the receiver.

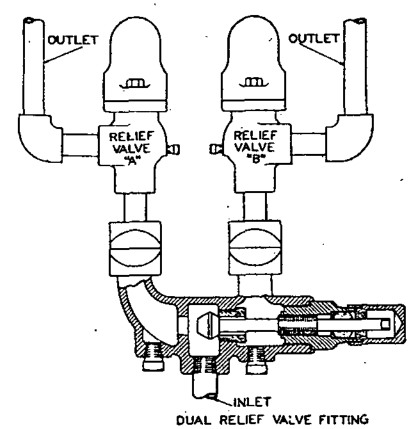

Fig. 12 .... Dual Relief Valve Fitting for Ammonia Condenser

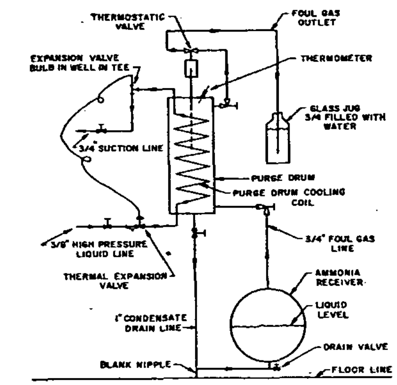

Fig. 13 .... Purge Unit and Piping for Noncondensable Gas

A through type receiver is piped so that all of the ammonia from the condenser passes through on the way to the low side. It should be large enough to at least take care of the fluctuation in liquid supply to the low side. It is helpful for maintenance if it is sized to hold the entire plant charge.

Parallel Condensers

Two condensers operating in parallel with one through type receiver are shown in Fig. 15. The length of horizontal liquid drain lines to the receiver should be kept to a minimum. Equalization between the shells is accomplished by keeping the velocity in the drain line within 100 fpm. The drain line may be sized from Table 1 or from Chapter 69.

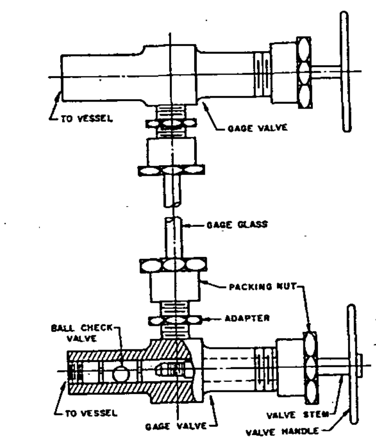

Fig. 14 .... Gage Glass Assembly for Ammonia