the heater or boiler. A float-controlled valve is placed on the air outlet of the separating tank and so arranged that when the water of condensation has insufficient head to flow by gravity to the point of use, the air will be confined in the upper part of the tank. Its operation is such that when the pump continues to deliver water and air to the tank the pressure within the tank increases until it becomes sufficient to discharge the water, thus lowering the water line and eventually permitting escape of

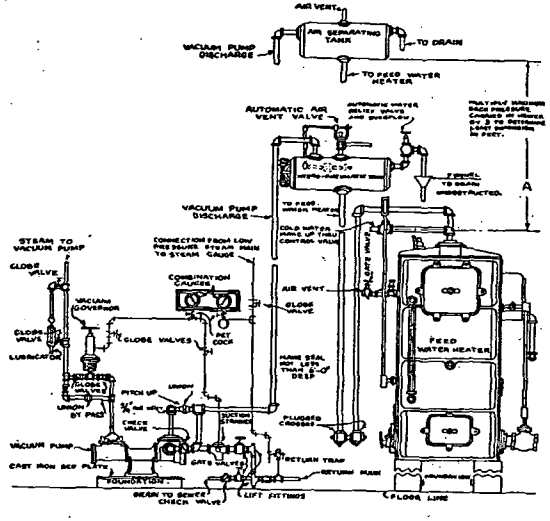

FIG. 3. METHOD OF CONNECTING VACUUM PUMP, FEED WATER HEATER AND SINGLE CONTROL HYDRO-PNEUMATIC TANK OR AIR SEPARATING TANK

the surplus air through the float-controlled air valve. The confined air pressure in the tank plus the gravity head in the tank discharge pipe, must be sufficient to cause flow to the place of disposition. This confined air pressure, plus the column of mixed air and water in the pump discharge to the tank, constitute the total head against which the pump must act. Fig. 3 shows a hydro-pneumatic separating tank, as well as a freely-vented separating tank, for alternate use as conditions require.

Where the pressure in the heater, boiler, etc., varies materially from time to time and where it is desired to save energy by diminishing the head against which the pump shall work, a hydro-pneumatic type tank may be used, instead of a plain tank set at a higher elevation, to overcome the peak pressure in the boiler or heater.

Table 13 gives the size of plain and hydro-pneumatic tanks for air separating purposes and also those for storage of returns. In the latter case the tanks are based upon storing the quantities of water which will be discharged during five minutes at the basis of hourly rates given in the first column.

When the head on the delivery side of steam-driven vacuum return pumps exceeds 15 lb. per square inch the condensate should be delivered

TABLE 13. SIZES OF PLAIN AND HYDRO-PNEUMATIC SEPARATING TANKS

CONDENSATION POUNDS PER HOUR	FOR AIR SEPARATION ONLY		FOR AIR SEPARATION AND WATER STORAGE	
	Diameter Inches	Length Inches	Diameter Inches	Length Inches
4,000	12	24	24	36
6,000	12	36	24	48
8,000	18	30	24	72
10,000	18	48	30	48
16,000	24	48	30	60
24,000	30	48	36	60
.....	24	72	36	72
34,000	36	60	36	96
.....	36	72	42	72
45,000	42	60	42	96
.....	36	96	..	..
60,000	42	72	48	72
.....	42	96	48	96

to a vented receiver located close to the level of the vacuum pump outlet. This receiver should be connected to a separate steam or power driven water pump capable of delivering against the maximum head and should be controlled by a throttle valve or motor control, actuated by some suitable means, from the water line in the receiving tank.

Typical vacuum pump connections for several different conditions of service, are shown by Figs. 4, 5 and 6.

LIFTS

In vacuum heating systems where condensation is to be raised to a higher level it should be accomplished by means of lift fittings.

Lifts of 6 ft. or over should be made in steps rather than in one rise or through drag lift (consisting of long upwardly-inclined pipes.) In any case the pipes between the lifts should grade downward toward the pump.

SPECIFICATIONS FOR PUMPS

General.—Reciprocating and power driven pumps should be specified as to make, size, working water and steam pressures, piston speed, temperature of water to be handled, electric motor characteristics, and to insure economy in production, such standard practices as subsequently indicated.

The kind of drive should be specified for power-driven pumps.

Centrifugal and rotary pumps should be specified as to make, type, capacity, temperature of water to be handled, speed and motor characteristics, including the following:

(1) Name of motor manufacturer; (2) manufacturers rated horsepower; (3) the maximum temperature rise (deg. cent.) for any part of the motor above the temperature of the surrounding air; (4) full-speed in revolutions per minute; (5) current characteristics; (6) whether the motor is to be