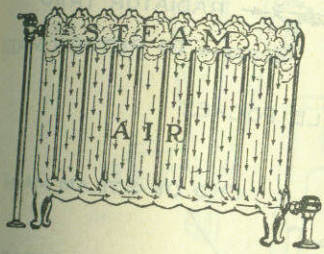
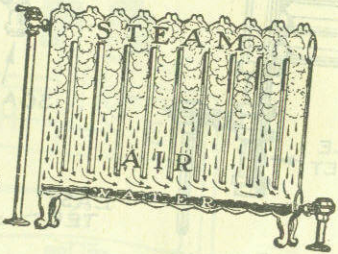
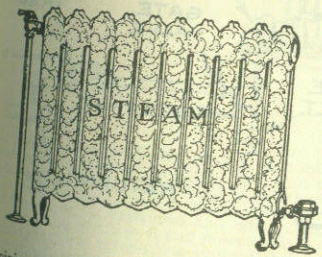
Any arrangement of the steam and return main, such as the relief circuit, divided circuit, etc., may be adapted to suit the requirements of the building. Risers are connected to the steam main at suitable points to serve the radiators, and down flow or drip pipes connect the radiator outlets with the return main, as shown in fig. 8,437.

ATMOSPHERIC PRESSURE OR SO CALLED "VAPOR" SYSTEMS

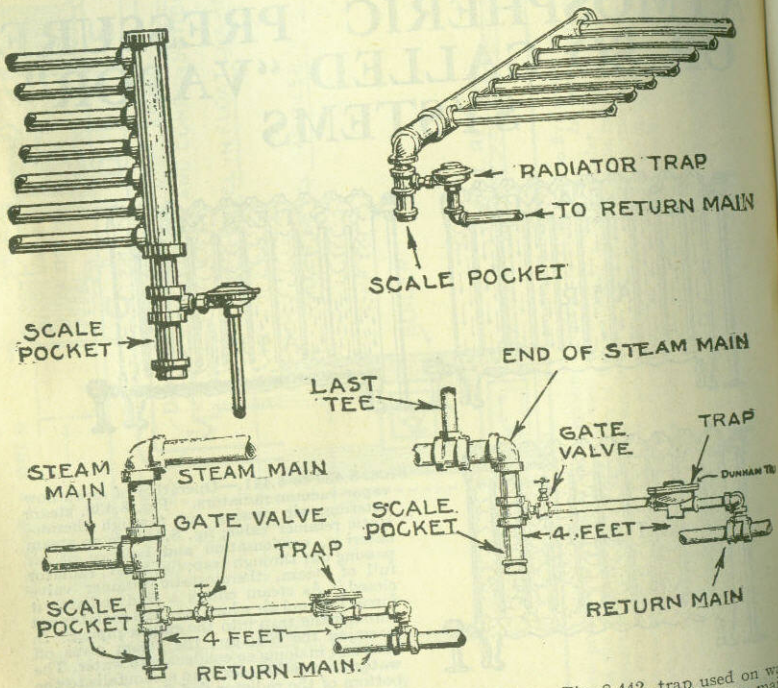






FIGS. 8,439 to 8,441.—Operation of down flow vapor-vacuum radiators. Fig. 8,439, steam entering, air passing out through thermostatic retainer valve; fig. 8,440, more steam entering, condensation and balance of air passing out through trap; fig. 8,441, radiator full of steam, thermostatic retainer valve closed. As steam enters a cold radiator it forces the cool air which is in the radiator out through the trap into the return piping. In warming the radiator, the steam gives off heat and in doing so condenses to water. The water which is heavier than steam falls to the bottom of the radiator and flows to the trap through which it also passes into the return piping. After forcing out the air the steam fills the radiator and follows the water to the trap which in the presence of steam automatically closes because the steam is hotter than either the air or water. The heat of the steam expands the valve control element, closing and holding the valve against its seat with a positive pressure, thus trapping the steam within the radiator. The radiator now thoroughly filled with steam gives off heat condensing the steam at a uniform rate and the water of condensation which is cooler than the steam flows in a steady stream to the trap which it slightly chills causing it to open allowing the water to pass out. The trap adjusts itself to a position corresponding to the water temperature just as a thermometer does to the room temperature, and permits a continuous flow of water from the radiator.

If manufacturers of special steam heating systems working at atmospheric, or less than atmospheric pressure, would stop trying to appear learned by using such studied terms as *fractional control*, *modulation*, *thermo-seal*, **vapor,** *syphon*, etc., etc., in describing their apparatus, and get down to plain English, so as



FIGS. 8,442 to 8,445.—Dunham piping suggestions for traps. Fig. 8,442, trap used on wall coil; fig. 8,445, trap used on ceiling coil; fig. 8,444, trap used on deep end of steam main; fig. 8,445, trap used to disperse in steam main. ***In applying,*** traps to pipe coils they should be installed as here shown. ***A scale pocket*** *should be provided at the bottom of the return header and in front of the trap.* When a trap is used for dripping steam piping it should be installed with at least four feet of connecting piping between it and the point dripped. A liberal scale pocket should be provided also a valve in the connection to the trap. When used for dripping the end of a steam main, the latter should enter beyond the last used connection and be provided with a full sized scale pocket. A rise or jump up in a steam main is dripped as in fig. 8,444. Down feed risers require individual drips and traps.

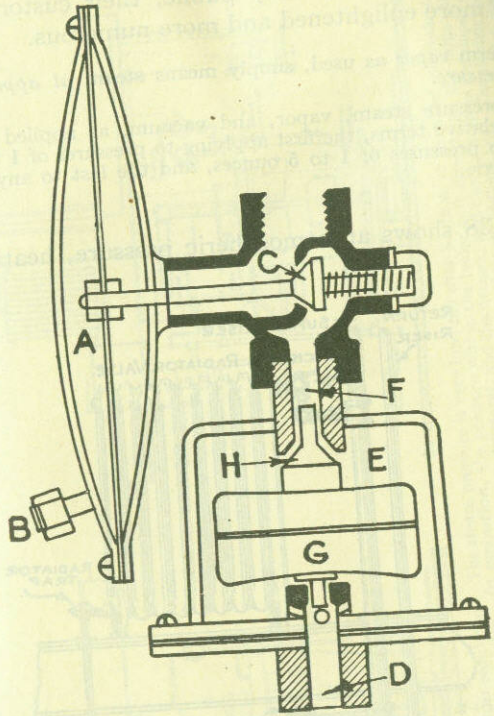


FIG. 8,446.—Dewey tri-duty air and vacuum trap as used on the Imico combined atmospheric pressure and vacuum system. This trap is placed on the return line not less than 27 ins. above water line. Diaphragm A, is attached to pressure main by small copper tube at B, nominally valve C, stands closed and held to seat by light coil spring. When fire is started in heater, air is expanded and inflates diaphragm A, and opens valve C, which remains open as long as there is any pressure on boiler. The steam passes into radiators at the top forcing air into return line and out through opening D, into float chamber E, passing into opening F, and through valve C, to atmosphere. Modulating valves are used on the radiators. If steam pass through radiators and into return line and into float chamber E, expanding thermostatic float G, closes valve H. If the steam pressure run up to a point high enough to force water up the return line to the trap, water passes into float chamber E, and raises the float G, and closes valve H. When the steam goes down, valve C, is forced to seat by coil spring and vacuum is formed by condensation in the radiators and drawing the vapor through the system until the temperature is too low in heating system to cause circulation. Then when the fire is replenished and steam commences to be given off circulation is again established before any pressure is shown and when pressure rises the **tri-duty** air and vaccum trap functions as before.

not to mystify the ordinary public, their customers would no doubt be more enlightened and more numerous.

The term *vapor* as used, simply means **steam** *at approximately atmospheric pressure.*

Low pressure steam, vapor, and vacuum, as applied to heating, are merely relative terms, the first applying to pressures of 1 to 5 pounds; the second to pressures of 1 to 5 ounces, and the last to any pressure below atmospheric.

Fig. 8,438 shows an atmospheric pressure, heating system.

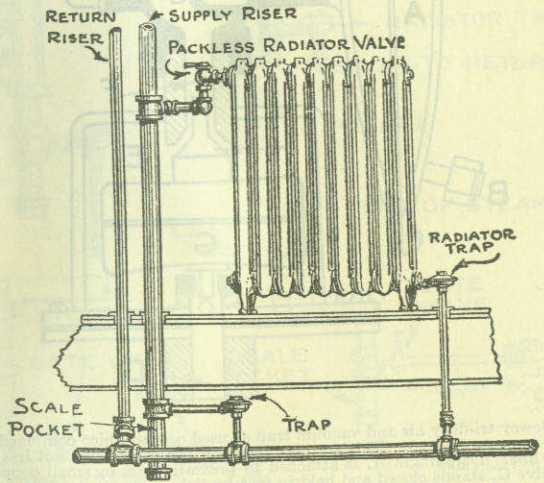
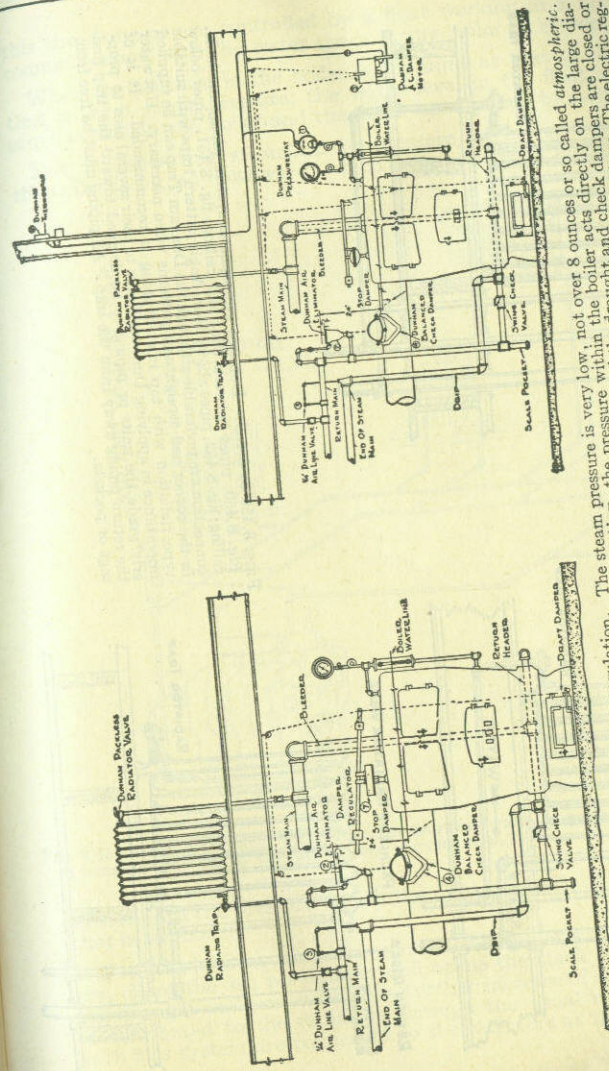
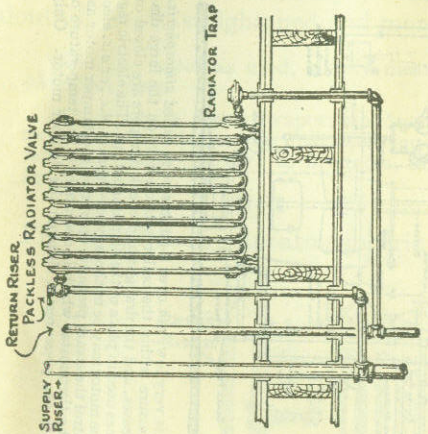


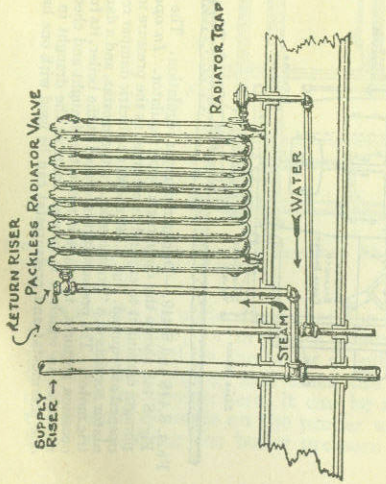
FIG. 8,447.—Dunham piping suggestions for radiator connections, radiator trap and traps used to drip a down fed riser.

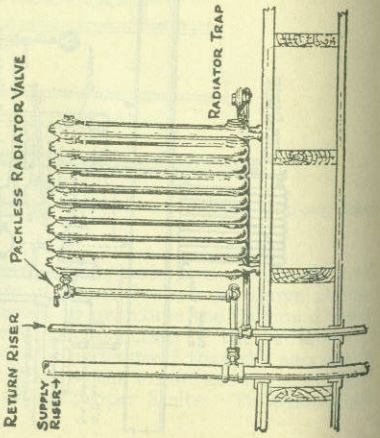
It should be understood that the term atmospheric pressure is only used for convenience, for in fact a pressure of about five ounces above atmospheric is carried on the boiler or sufficient to overcome the frictional resistance of the piping, and since the return connection of the radiators is open to the atmosphere, it can be readily understood that the success of the system depends on the proper working of the automatic damper regulator in keeping the boiler pressure within proper limits. To accomplish



FIGS. 8,448 and 8,449.—Dunham damper regulation. ***In operation,*** the steam pressure is very low, not over 8 ounces or so called *atmospheric.* Fig. 8,448 shows the diaphragm type regulator. The motor may be of three types—spring, *d.c.*, or *a.c.* electric motor. The pressurestat is located at the boiler, its function is to control the steam pressure, operating the damper motor as required. Fig. 8,449 shows an electric damper regulator sometimes used in place of the diaphragm type. The electric regulator consists of a "pressurestat," a thermostat, and a damper motor. The thermostat which is operated by the damper motor. Only occasion requires, to make it move the draught in conjunction with the pressurestat through the damper motor. Only the room in which it is located controls the draught in conjunction with one heating plant. one thermostat and pressurestat can be used with one heating plant.







FIGS. 8,450 to 8,452.—Dunham atmospheric system piping methods. Fig. 8,450, pipes between floor and ceiling; fig. 8,451, pipes below ceiling; fig. 8,452, pipes above floor. Angle pattern traps with suitable connection are preferable although the Dunham Trap can be supplied in the corner and straightway patterns when necessary. Hot water type radiation with top inlet tapping is recommended. It is of importance in applying Dunham Traps to their several uses to properly grade the units or piping to be dripped toward the trap and the return piping away from the trap. All piping must be free from sags or pockets.

this the dampers are controlled by a float working in a float chamber in communication with the water space in the boiler as shown.

When the pressure in the boiler is the same as that of the atmosphere, that is, zero gauge pressure, the water level in the float chamber is the same as that in the boiler and the index hand points to zero.

Now in generating steam as the pressure increases, the water level in the boiler is forced downward, which causes the level in the float chamber

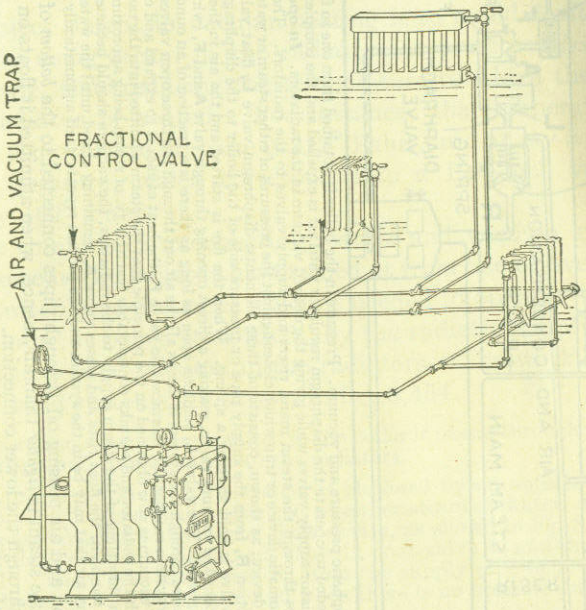


FIG. 8,453.—Imico combined atmospheric pressure and vacuum system showing proper method of installing the Dewey tri-duty air and vacuum trap.

to rise until the pressure due to the difference AB, of water levels balances that in the boiler.

The float in rising, since it is connected by pulleys and chains to the dampers, closes the ash pit damper and opens the stack damper, thus checking the draught and preventing the further increase of steam pressure. Steam is distributed to the radiators through the usual risers, which, however, with this system are connected to the radiators at the top as shown in the

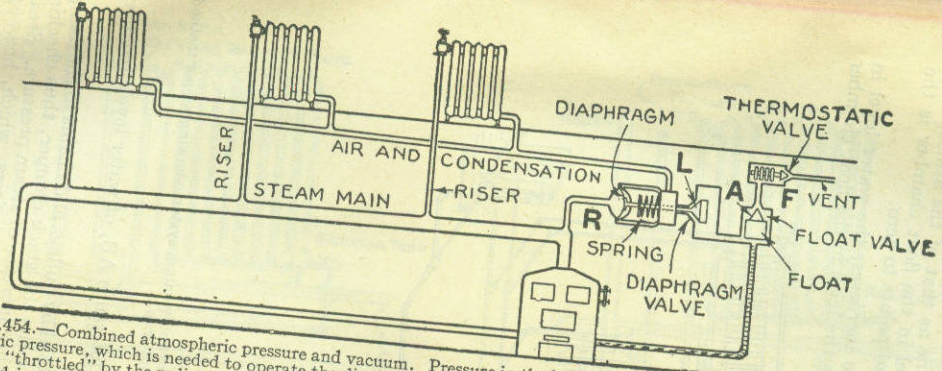


FIG. 8,454.—Combined atmospheric pressure and vacuum. Pressure in the boiler is obtained from one to five ounces above atmospheric pressure, which is needed to operate the diaphragm regulator until air is expelled and the complete system filled, it being then "throttled" by the radiator supply valves while giving the desired vacuum in the radiators. ***In operation,*** when steam is raised in the boiler it passes through the steam main, risers and supply valves to the radiators. The proper working of the system is obtained by an automatic device or trap which closes against the pressures of either steam or water and allows air to pass out, but not return. This device, as shown, consists of three elements: diaphragm valve **L,** float valve **A,** and thermostatic valve **F.** There is a connection **R,** from the supply pipe or pressure side of the boiler to the diaphragm and when there is no pressure in the boiler this valve is held shut by a spring. When the fire is started and the air in the boiler is expanded, the diaphragm is inflated and opens the vacuum valve, making a direct opening through valve **A** and **F,** (which under this condition are also open) to the atmosphere. The valve **L,** remains open as long as there is a fraction of an ounce pressure on the boiler Now, as steam forms and passes through the system it drives all the air out through the three open valves, **L,A,F,** but when the steam on its return from the system reaches the thermostatic valve **F,** the heat causes it to expand and close, thus the system is filled with steam only. The vacuum is now obtained on the principle that the steam admitted into the radiators condenses, while transmitting its heat through the radiator and shrinks considerably (each cu. ft. of steam being approximately reduced in volume to 1 cu. in.). If by too much throttling of the steam supply to the radiators, the vacuum should become strong enough to draw up water in the return pipe too high, the float rises and closes valve **A,** remaining closed until the water recedes, then it opens allowing valve F, to expel any air that may be in the system and the process repeats itself automatically.

figure, the condensation and air passing off through pipes connected to the *bottom* of the radiator. The reason for this is because steam is *lighter* than air, hence, when admitted it floats on top of the air, thus driving the latter out through the lower connection.

The chief feature of the atmospheric pressure system is that the amount of heat given off by each radiator may be regulated by the steam valve (so called fractional control, modulation valve, etc.). Thus, in fig. 8,438, the valve of radiator C, is opened just a little, which will admit only just enough steam to heat the upper portion of the radiator; the valve of D, is half opened, admitting enough steam to heat a larger portion of the radiator; with valve wide opened on E, the entire radiator is heated.