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Modern Practice in Vapor Heating

Approved Methods and Devices for Installing and Operating this Type of System.

I.

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The subject of heating has so much variety, so many points of interest, and involves so much detail that few heating men are thorough masters of the craft. This is not said with any desire to reflect upon the average designer, but on the contrary it is an entirely natural result, since a busy man seldom has the time to devote to any subject, however important it may be, the amount of attention he would like to give. In the olden days a plain system of gravity steam heating served almost every purpose and there was little cause for the refinement, economy and flexibility which is demanded at the present time; nowadays so many varieties of steam heating are in existence, both patented and unpatented, that it is hard even to completely list them.

Hot-water heating may be counted as partly responsible for this, since it is the hot-water system which has forcibly brought to notice the desirability of varying the amount of heat obtained from a radiator and the improved results attained where the heat is regulated to meet the requirements of the outside temperature rather than being either all on, or all off, as was naturally the case with the common gravity steam system.

It is generally acknowledged that vapor or vacuum-vapor heating possesses certain merits, in fact, almost all of the merits which can be urged for hot-water, and at the same time does not possess the objections which are often cited as detrimental to hot-water systems. This method of steam heating also compares favorably both in economy and cost of installation with hot-water. It responds quickly to increased or decreased draft, i. e., (it is easy to control) and possesses no large body of water which must be cooled or warmed *in toto* before a variation in the quantity of heat is obtained. During unseasonable warm days this system can be shut down and the radiators carried absolutely cold until such time as the outside temperature requirements may necessitate a re-opening of the drafts, and it absolutely avoids the danger of leaks from automatic air valves, which is an item of considerable importance.

DIFFERENT DESIGNATIONS OF SYSTEM, BUT SAME PRINCIPLE

This system is variously known as the "vapor," "vapor-vacuum," "modulated" "atmospheric" or "thermograde" system. While a vacuum may be obtained at times it is not essentially a vacuum system, owing to the fact that a positive pressure is usually carried on the boiler. In spite of this the return line never rises in pressure above the surrounding atmosphere, due to the fact that the return line itself is actually open to the atmosphere and, therefore, it cannot have any pressure generated therein. This naturally leads to the heart of the matter by suggesting the query, "How can there be a pressure in the boiler without a pressure on the return line?"

This is caused by the head of water which is maintained in the return. For instance, if there is a steam pressure of 1 lb. per square inch of steam in the boiler there is a pressure of 1 lb. per square inch tending to force the water out through the return and back into the system. This is what actually happens so that in order to arrange a system to carry 3 lbs. steam pressure the lowest part of the return where the air vent is taken off and also the lowest radiation must be not less than a good 7 ft. 6 in. above the normal water-line to allow for producing the required head when the allowable steam pressure is generated. Then, when 3 lbs. is raised in the boiler, the return backs up until a head is produced which exerts a 3-lb. pressure above the normal water-line, thus counterbalancing the boiler pressure, this point being approximately 7 ft. above the normal water-line.

PRINCIPLES OF OPERATION

Referring to Fig. 1, the operation of this system may be followed in detail. In this figure the boiler B supplies steam to the steam main SM, this main supplying the steam risers S which may be either up-feed or down-feed, the radiators R shown being supplied by an up-feed system. The steam follows up the various risers to the graduated valves V on the radiators, these valves being the same as used on an ordinary vacuum system and having graduated control (so that certain portions of the radiator may be heated) such as ¼, ½, ¾ and full, as shown in plan and elevation, Fig. 2. The steam enters the radiator through these valves and heats the proportion of surface approximately as indicated on the dial over which the pointer is placed.

To enable the steam to enter the radi-

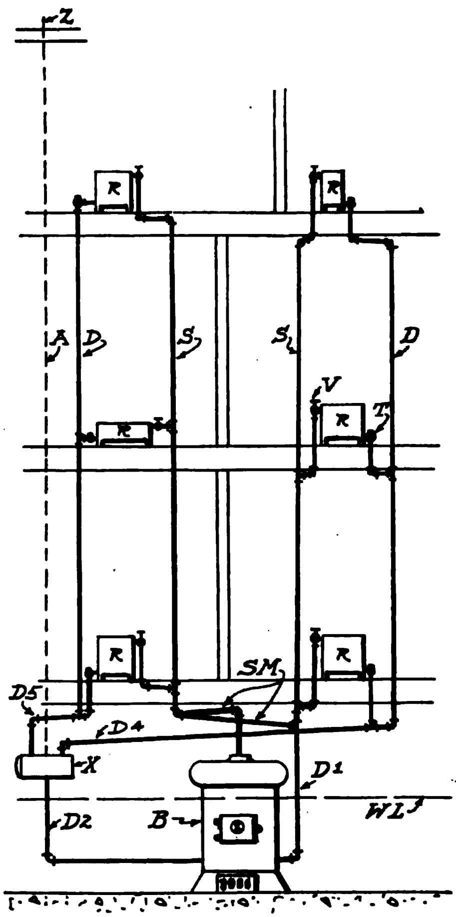

FIG. 1—DIAGRAM OF OPERATION OF VAPOR HEATING SYSTEM.

ator it is necessary for it to force a certain amount of air out of the radiator, all of this air passing out through the return, there being no air valves on this system. Therefore, the return valves T are what are known as "air and water-relief" valves, as shown in Fig. 3, being identical with the return valves used for radiators on strictly vacuum systems. In fact, any sort of a trap passing both air and water may be used for this purpose.

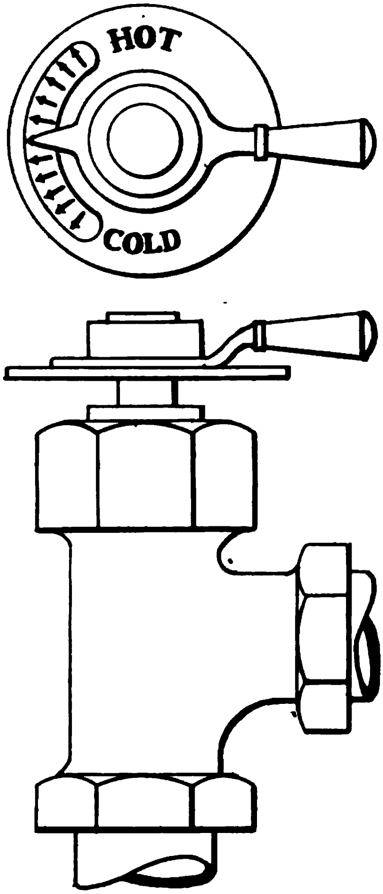

FIG. 2—TYPICAL DESIGN OF RADIATOR VALVE FOR VAPOR HEATING SYSTEM.

TYPES OF VALVES USED ON RADIATORS

These valves are of two separate and distinct types, one operated thermostatically and the other having a float mechanism. The thermostatic type is made in two forms, the older style having some material (with a high expansion coefficient) which expands when heated and closes the return valve in just the same manner as the modern automatic air valve closes when the steam strikes it.

Referring to the float or "water-seal" valve, in one type the air rises in the annular space around the float and follows down the space around the stem into the return. This path is open at all times except when the water enters the trap or rises a sufficient amount to raise the float. At this time a plate on the tube through the center of the float raises a valve against the air outlet into the top and also raises a valve off the seat in the bottom, thus permitting the water to flow out. After the water is relieved the float again assumes the lower position.

Another return valve for radiator use is of the "sylphon" type in which the common and well-known sylphon bellows displaces the expansion member used on the plain thermostatic valve.

These valves remain open, for the passage of air at least, until steam strikes them at which time they close to the steam and remain closed, allowing only the air and water to pass through into the return lines D. The air and water follow down these returns, ultimately being collected by the return mains D4 and D5 in the basement. This main is carried as high as possible since its height, together with that of the air relief pipe and the radiation, determine absolutely the pressure which can be carried on the boiler, as previously explained.

The air and water flow along this return main and into the tank X where the air relief line A leaves the top of

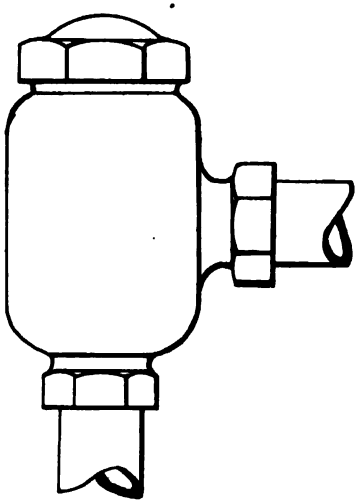

FIG. 3—TYPICAL "AIR AND WATER RELIEF" VALVE.

the return tank X, this permitting the air to escape when it is caught between the return water and the water in the vertical boiler return pipe D2. The air passes out through the vent pipe A which is carried through the roof at Z or to the atmosphere at some other convenient point. The condensation water then passes down through the boiler return pipe D2 and enters the boiler B.

Where necessary to drip steam mains or low points of steam pipes on the radiator side of the return valve, drip lines must be installed and, in order to avoid a multiplicity of return valves, these drips are all connected into a horizontal line in the basement which is drained by a drip valve which discharges the water into the drip return D4 or D5 or with the boiler return D2. Since the air finds its outlet entirely through the radiators it is not essential that the drip return be above the water line, as the flooding of this pipe does not interfere with the air relief in the system or with the returning of the drip to the boiler.

DRIP VALVES ON MAINS MUST BE OF WATER-SEAL TYPE.

Particular attention is called to the fact that a drip valve on the main cannot be used satisfactorily unless of the "water-seal" type, owing to the steam drip being so hot as to seriously affect the operation of a thermostatic trap. If it is desired to use syphon traps throughout it is necessary to connect the steam drip to the trap through a water-seal leg about 24-in. deep to prevent the high temperature water interfering with the thermostatic action.

Some firms which have made a specialty of this class of work maintain that an air-separating tank should be used to give the best results connected up in the manner shown in Fig. 1, as this avoids the danger of carrying any part of the return water up into the vent pipe as might possibly happen when only pipe connections are used. Others use simply a tee with the return coming into the branch, the air line off the top and the boiler returns out of the bottom.

ADVANTAGE OF USING WATER TYPE OF RADIATORS

A typical radiator connection is shown in Fig. 4 and it will be noted that the radiators are of the water type, with a

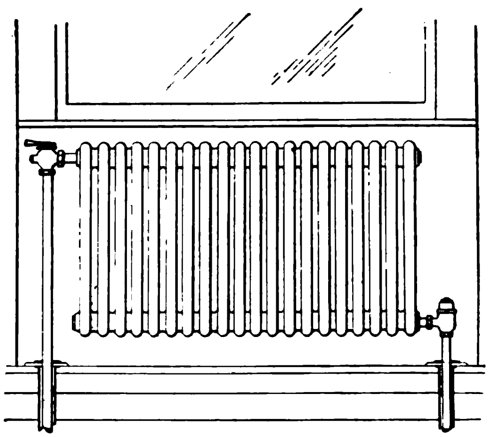

FIG. 4—TYPICAL RADIATOR CONNECTIONS FOR VAPOR HEATING.

top connection on the supply side. This is not absolutely necessary but with leg radiators it is an advantage, making the graduated valves V more accessible than if they were located at the bottom of the radiator, as is customary with ordinary gravity steam systems.

On the other hand, with a wall radiator it would be inconvenient to have the valve at the top of the radiator owing to the difficulty of reaching same when the radiator is 5 ft. or more above the floor. For this reason the valve is located on the wall at hand height but the top connection is used to allow flexibility of connection between the radiator and the riser. It would be entirely practicable in this case to use a bottom connection when it is possible to get a swing joint or other flexible type of pipe connection between the radiator and the riser with the supply in this location.

STEAM TYPE OF RADIATOR USED WITH THERMOSTATIC CONTROL

Where thermostatic control is employed the hot-water type, of radiator with the top inlet and bottom outlet, is abandoned and the regular steam type is used. The supply and return valves are common diaphragm-operated globe valves which are controlled by *positive*-action thermostats.

TRAPPING OF DRIP LINE

It is desired to call attention again to the matter of the drip line and the trapping of same. It is not required to use a trap in this location at all provided a sufficient depth of waterseal can be obtained; that is to say, if it is expected to run this system on a maximum pressure of 1 lb., a water-seal of 2½ ft. would be ample to prevent steam blowing into the return and then out through the air vent. Owing to the liability, however, of excessive pressure being used by accident at times, it is believed to be much better to practice to employ a trap.

OPERATION OF SYSTEM ON A PARTIAL VACUUM.

Another advantage possessed by this system is its ability to be run as a partial vacuum if so desired; the only change required to make this feasible is the placing of a check-valve in the air-relief pipe so that air once blown out of the system cannot come back again upon the production of a partial vacuum within the system. This check valve should be of the type commonly known as an "impulse" check which is made largely on the same style as the ordinary check but which has the tongue suspended on an angle of approximately 60°, instead of 45°, making the operation of the check exert much less back pressure on the system than when the ordinary type is employed. Of course it is desirable to facilitate air relief in every way possible and on this account the impulse check should be given the preference over the common type.

Where this system is installed radiators set under window seats or in recesses can be controlled by carrying the extended valve spindle up through the grille either on the top or on the side—which, of course, means that in this case the valve itself must be turned on its side; these graduated valves work with equal facility either way.

For coils on the ceilings, walls, or other inaccessible places chain wheels are mounted on the graduated valves and carried down to corresponding chain wheels with indicating dials located at a convenient point on the wall.

If it should prove desirable at any time to raise the steam pressure over that originally contemplated and permitted, or if the vertical head obtainable is very small, a trap may be used which will allow a boiler pressure of 5 or 6 lbs. to be carried.

In next month's and succeeding issues the principal makes of vapor and vapor-vacuum heating systems will be discussed in detail, with a view of giving the reader a comprehensive idea of the various devices and apparatus that have been developed in this branch of the art.