failures, the heat lost through the second floor walls and ceilings to the cold spaces underneath the roof was so great that a cold draft of air down the open stair was sufficient to make the first floor uncomfortably cold. A careful inspection of the heating systems showed them sufficient in capacity to supply similar buildings with ordinarily well constructed walls, and excessive in capacity for the heavy stone outside walls those houses had.

Everything seemed to be satisfactory, but as a last resort I asked to see the attic construction. Here we found that the exterior walls and ceiling of the second floor had only one ordinary lath and plaster thickness separating the rooms from the attic spaces. The outside temperatures at the time were near zero, and the temperature in the attic spaces showed that the heat was going through these plaster partitions like water through a sieve. My advice in each case was to surface the outside of the studs and joists with heavy building paper or tight boards, or better, with both. I have mentioned these two cases because they show how a splendid construction may be set at naught by inexcusable carelessness in some hidden detail of construction. These houses that on the face of things were overheated, were as a matter of fact only partially heated, and through no fault of the heating man excepting that he should have insisted upon knowing what kind of construction would be used in these various walls. Most cases of poor house construction that come to the attention of the heating and ventilating engineer differ, however, from the ones mentioned, in that the failures are due to *general house debility,* and it is more difficult to say which bad feature has the greatest effect to produce failure of the heating system.

### POOR PRACTICE TO CARRY PIPES THROUGH ATTIC.

It frequently happens that in order to conceal the piping the heating engineer frequently crosses the wall and carries his pipes through the attic spaces. The practice improves the appearance of the room somewhat (and some householders insist upon it), but it is opposed to economy. In one striking example of how not to do it, a new vapor system was installed in a stone bungalow last summer with all the second floor returns and some of the mains traversing these attic spaces. The result was a freeze-up in every radiator on the windward side, alternating, of course, as the wind shifted so as to give every room some of the same experiences, and during one week of the extreme weather last winter every second floor radiator was out of commission. No insulation was put on the pipes, and I doubt if they could have been successfully insulated against the zero temperatures which were indicated by the thermometer near the pipes. Vapor system returns are especially susceptible to freezing conditions.

### OVERHANGING ROOMS SHOULD HAVE WELL-INSULATED FLOORS.

Another feature of house design that is frequently fatal to the plans of the heating engineer is the overhanging room with only one thickness of 7/8-inch flooring on the room and light ceiling over the porch. This always gives a cold floor that is not only uncomfortable to the occupants, but eliminates heating possibilities on cold days. These remarks do not apply, of course, to sleeping porches with no heat. If an overhanging room is desired, be sure to provide for a well-insulated floor.

### LOOSE CONSTRUCTION AROUND WINDOWS.

One feature of house construction that reflects against the builder rather than the architect is the loose construction around the windows. The owner wishes free moving sash, and the workmen give him everything he could desire in this regard. But how about the person who is expected to inhabit the room on a zero day when the wind is blowing a twenty-mile velocity? I have caught snow in my hand at a distance of two feet from a tightly-locked window, in a house supposed to have better than ordinary construction. What can the society do to better such conditions? Window strips, metal weather strips, and storm windows may be urged. Storm windows, top hung, give satisfactory insulation during the cold days, and at the same time provide ventilating possibilities on moderate days. An average nine-room house can be supplied with good storm windows, west, north and east, for an expenditure of from $75 to $100, and the coal saving will pay for the first cost in two years' time. Such storm windows are no hindrance to open-window ventilation when desired.

### OUTSIDE CHIMNEYS NOT GOOD DRAFT PRODUCERS.

Next, let us look at the chimney. Several points in common practice among architects tend toward inefficiency. The outside chimney, in spite of its possibilities toward exterior ornamentation, is not a good draft producer, because of the chilling effect of the outside air. Where a chimney is required in an outside wall it should be not less than two bricks thick (eight inches) on each side of the flue at the thinnest part, increasing to at least twelve inches on the lowest part. This is improved if the chimney wall is double with an air space between the walls. Such an air space may be closed in with an occasional layer of header bricks from the outside wall nearly touching the thinner wall. These header bricks cut off air circulation, and in addition steady the inner wall. They must not bind the walls together, since the lineal expansion of the two shafts are not equal. The