

# CONTRACTOR STORIES

## Banging Pipes

A thorough investigation into one homeowner's pesky system.

BY HARVEY RAMER

When I hear the words "banging pipes," my mind immediately goes to those old steam systems that have been around for the last century. In my head I see a family settled down for the evening in the living room. The icy cold winter wind is howling around the corners of the house and filtering through the windows causing the curtains to flutter a bit. Yet everyone is warm and toasty because that old steam radiator under the window is piping hot and casting a warm glow across the whole room. Mom sits in her rocking chair knitting while dad is in his chair reading the paper. The kids have a serious game of Lincoln Logs going on. All is well.

Until suddenly: BANG!

The startled kids jump, knocking over their Lincoln Log project. Mom jabs herself with a knitting needle and lets out an exclamation that immediately causes her face to turn red as a beet. Dad slowly lowers the paper and looks across the room to make sure everyone is okay. Then everyone goes back to what they were doing. They are used to it, but it still startles them every time. They need a good steam guy to fix the banging pipes.

So that's what happens in a neglected steam system. But banging pipes are certainly not unique to steam systems. It



A

When no call for heat exists, the supply piping from the boiler to the zone valves is completely isolated from the expansion tank. During a call for heat, this section of piping is full of hot water.



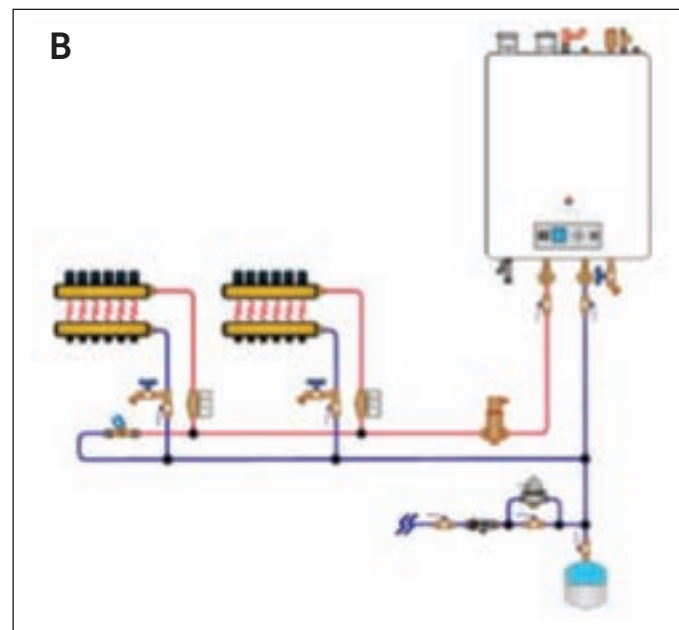
seems they can appear almost anywhere, and for a host of different reasons. I encountered one situation that baffled me for a day or two.

### Symptoms

I received a call from a distraught customer one day not so long ago. He had scraped together the money and purchased a new boiler for his house. And to his dismay, the boiler had one problem after the next. I'm not sure where the original installer was, but I got the honors of troubleshooting the system. Apparently I was the third guy to come in, which made me even more determined to find, and fix, the problem.

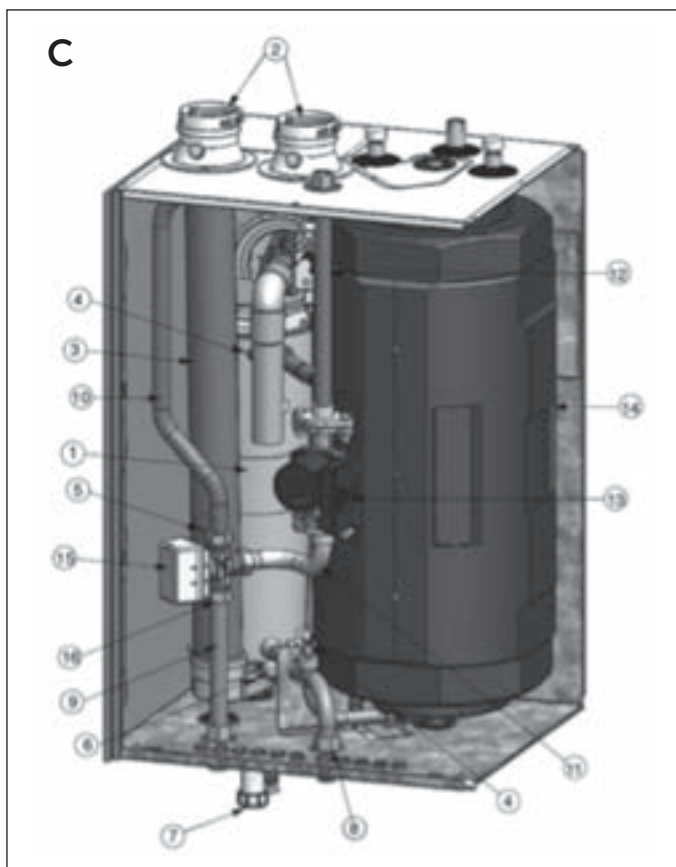
I came out to the residence to meet with the homeowner, and I saw right away he had little faith. I don't blame him. He had already thrown a lot of money at this system to make it work. I reassured him that I would be able to find and fix the issues. Little did I know, this one would end up being a toughie!

I followed him down into the basement, and there it was. A nice, shiny Triangle Tube Prestige Excellence



B

## | CONTRACTOR STORIES |



mounted on the wall. I spotted a bucket sitting under the pressure relief valve. I carefully listened while he explained that the boiler spits water out of that pipe every now and then. I thought to myself, "Well this is easy." But I didn't tell him that. I just listened while he continued listing the things that he didn't feel were right. Being a good listener really helps customers who are at the end of their rope.

He went on to explain that he had to bleed air out of the baseboards all the time and even still, he could hear water sloshing around every time the boiler ran. Again, I thought to myself, "This is easy. What kind of part-timers has this guy been hiring?"

Then he started on the boiler. He said that almost every time this thing runs, he hears a weird moaning sound come from the boiler. It didn't do it all the time or for the same amount of time each time, but when it happened, it could be heard throughout the house.

We investigated. He turned on the hot water faucet and let it run. Not long after, the boiler fired. No problem there. But as it reached temperature and started modulating down, there it was. It sounded like a foghorn.

And then, the banging pipes. He said the pipes bang so loud sometimes that he has actually run down into the basement thinking the boiler fell off the wall. Other times it sounded like a machine gun being fired. "Okay," I said, "let's try to replicate it so I can pinpoint the problem." But try as we might, it just wasn't happening. Don't you hate that? Admittedly, I was having a little bit of trouble believing him, but I took his word for it.

### System configuration

As I stated earlier, the boiler was a Triangle Tube Prestige Excellence, a good boiler. It was direct piped with two zones of fin tube baseboard. The zoning was done with Taco 570 Series zone valves.

### A little history

According to the homeowner, this system ran fine for

the first year after it was installed. Then the first problem occurred; the pressure relief valve started spitting out water. He called a contractor who determined the one expansion tank was bad. That's correct; the system originally had an expansion tank on both the supply and return piping. The contractor told the homeowner that he needed only one expansion tank, to remove the bad tank and leave the good one connected to the return piping as shown in the manual.

That's when the banging pipes started. The homeowner called the contractor back and told him about the new problem.

The contractor looked at the banging pipes. And of course, the pipes didn't bang the whole time he was there. These are contrary pipes. They only do it when no one is looking. The contractor made a couple of phone calls and reached the conclusion that a pressure bypass valve should be installed. He said the water hammer was happening when one of the zone valves were closing. He couldn't have been further from the truth, but I did agree with the pressure bypass valve installation. The bypass is a spring-loaded valve that allows supply water to be bypassed into the return in the event that one of the system zones turns off while the other stays on. This maintains flow through the boiler regardless of the position of the system zones.

But that was too easy. The banging pipes came back. The homeowner called back the contractor.

The contractor replied, "I'm busy."

Go figure.

### Isolating the problem

Without further ado, I carried my tools down to the basement and went to work. I started with the pressure relief valve. I always like starting with the easy stuff because it gives me time to think. If you are like me, you think best with busy hands. A short time later I informed the homeowner that the expansion tank was bad. That's what was causing the pressure relief valve to pop off. I saw a look of consternation appear on his face as he looked at what the contractor had just replaced. I demonstrated for him, depressing the Schrader core. Water squirted out. I explained how there should only be air in the respective side of the tank. Finally, he nodded his understanding.

So there's that.

Then I began explaining the air problem. If you look in picture A, you will see there is only four inches of straight pipe leading into the inlet of the air separator. Those Taco air scoops need 18 inches of straight pipe before the inlet. That allows the air bubbles to rise to the top of the pipe before entering the scoop, where they will be separated into a chamber at the top and removed by the HyVent threaded in the top. After explaining all that to the homeowner, he agreed that we would be best served to replace the air scoop with a microbubble air separator. Given the piping constraints, that was the only logical choice.

Next we had the obnoxious foghorn to deal with. I'm fairly certain it comes from incorrect combustion settings or gas valve tracking. Not knowing the exact sweet spot for this boiler, I made a quick phone call to technical service. The guy on the other end of the line knew exactly what I was talking about. In no time at all we had the boiler fine-tuned and running like a song. There is nothing wrong with calling tech service for issues like that. It can save you time and the homeowner money.

And last but not least — the banging pipes. Though I



## | CONTRACTOR STORIES |



mulled over different theories and ideas, I hadn't come up with anything that made sense. I decided to call the tech department at my supply house. They sell these boilers. Maybe someone had run into this before?

The guy on the other end of the line was somewhat baffled when I explained the situation. He suggested replacing the Grundfos pump that comes in the boiler, with a Taco 007. The reasoning being that the 007, with a flatter pump curve, wouldn't cause water hammer against the zone valves. I just wasn't buying it. The Taco 570 series zone valves are slow closing valves. They don't cause water

**I just listened while he continued listing the things that he didn't feel were right. Being a good listener really helps with customers who are at the end of their rope.**

hammer unless they are installed backwards. Not only that, but the system also had a differential bypass valve installed, so it definitely wasn't water hammer on a zone valve. He also suggested switching the system to primary-secondary piping. "But why," I asked? The system ran fine for the first year piped the way it was. He didn't have a good answer.

I told the homeowner that I needed to go home to think this through. I told him, if he could, to record the noise.

Later that day, he sent me a recording along with another tidbit of information. It was exactly as he said. The pipes emitted a loud bang followed by a rapid succession of diminishing hammer. However, the extra tidbit he provided was critical in solving the problem. He said it only happens at the start of a space heating cycle, before the boiler fires.

So, let's do some logical thinking. When there is a call for heat, power is first applied to the Taco 570 zone valve. The power starts heating up a wax motor in the

valve actuator. As the wax heats up, it expands and starts pushing the valve disc away from the seat of the valve body, in the same direction as the water flow. It is not until the valve is almost completely open that the end switch is closed and a signal is sent to the boiler. When the boiler receives the signal for heat, it activates the internal three-way bypass valve and switches it to the heating position. This bypass valve is always in the DHW position unless there is a call for central heating. (See component 15 in Picture C for a visual.) Next in sequence, the boiler pump is activated, and lastly, the boiler fires.

If the water hammer happens before the boiler turns on, the pump really can't have anything to do with the problem. It has to be the zone valve. But in order for the zone valve to hammer like that, the fluid pressure has to be higher on the outlet of the valve than the inlet. As the wax is heating up, instead of opening smoothly, it must first apply pressure to the disc that is equal to the pressure differential across the valve body. When it finally does break the disc loose from the seat, it springs open. The fluid immediately starts rushing backwards through the valve to equalize the pressure. As it does so, it slams the disc back on the seat, abruptly halting the flow and causing water hammer. As soon as the fluid flow stops, the heated wax wins again, pushing the disc back off the seat. This process repeats itself in rapid succession until the pressures are equalized.

And how can this pressure differential exist in the first place? The only way is if the fluid on one side of the valve is isolated from the expansion tank. So I did a bit of research and discovered that the three-way bypass valve in the boiler is a positive seal valve, and that it is always in the DHW position when there is no call for heat. The zone valves are also a positive seal valve, and the differential bypass valve is a one direction flow with a positive seal as well.

When no call for heat exists, the supply piping from the boiler to the zone valves is completely isolated from the expansion tank. During a call for heat, this section of piping is full of hot water. When the call for heat goes away, the water starts cooling off. As it cools it becomes denser and wants to shrink, if you will. Since it is isolated from the expansion tank, it falls into a vacuum. And there is your pressure differential, the source of the water hammer.

Thoroughly elated, I called the homeowner and told him I found his problem.

### The repair

The repairs were quite easy once I had the problems isolated. I replaced the expansion tank and installed a Caleffi microbubble separator. I purged the system and added a Fernox inhibitor to the fluid.

To remedy the banging pipes, all I had to do was braze in a 1/4-inch capillary tube between the supply and return, as seen in Picture D. This allowed the pressures to stay equalized during a boiler off cycle and ceased the banging in the pipes.

Simple, right? ●

*Harvey Ramer is the owner of Ramer Mechanical (RM) LLC. RM specializes in radiant heating and hydronic heating systems. The company also provides other mechanical services to the residential and light commercial market. Ramer also provides heating system design services and consultation across the country.*