Steam Department.

BOILERS FOR STEAM HEATING.

By Geo. C. Robb.

A BOILER intended to be used for a steam heating apparatus, should be designed to hold a large proportion of water for the amount of heating surface, and the heating surface should be large in proportion to the grate surface—that is, these proportions should be larger than is usual in boilers intended to be used for steam engines.

The reason for this is, that in a heating boiler a slow fire may be used with great economy, and as the boiler will most likely be often left for a length of time without any attention being paid to the fire, there should be a sort of reservoir of heat stored up in the water.

It is also advantageous in such boilers to have a large quantity of brick-work about the furnace, which will absorb heat when the fire is strong and give it off when the fire is low, and thus tend to maintain a more uniform temperature in the boiler.

Cast iron sectional boilers are often used, but they are most frequently recommended on account of some other reasons than their real value as safe and economical boilers to use. They may be convenient to make, and easy to set up in position, and hence from a maker's point of view be good boilers; but the man who pays for the coals, and the woman who grumbles about the want of heat on a cold day, find by experience that there are other ways of determining whether or not a boiler is a good one. The use of a boiler in a steam heating apparatus is merely to absorb the heat produced in the furnace, and by so doing change water into steam, which is conveyed by pipes to the radiators, where it again gives off the heat while changing steam to water.

There are thus four elements in the complete apparatus, viz., the furnace, the boiler, the piping and the radiators. And there should be a complete cycle going on by means of these, which may be described thus: heat absorbed producing steam from water, and heat radiated producing water from steam. Defects or derangements in any one of these four, will affect the working of the whole, and sometimes it is very difficult to determine exactly where the difficulty really is. Hence frequently a boiler is blamed as being a bad heater, when the trouble really is in the furnace or chimney. In other cases, the fact that in a certain boiler steam can be very quickly got up, is held to be sure evidence that it will answer well for heating, while really the getting up steam quickly is merely evidence of the small quantity of water in the boiler.

In a certain large steam heating apparatus several upright tubular boilers were put in by the designer, who reckoned the amount of heating surface in the boilers by calculating the whole length of the tubes as available and useful for steam making. When the job was started, it was found that while the mains were hot, the radiators remained comparatively cool, and the building could not be heated. By adding more boilers the difficulty was removed, and the apparatus worked all right. The mistake of having the boiler too small is much more frequently made than that of having the boiler too large.

It is better to estimate the boiler by its capacity for evaporating water into steam, than by its heating surface; as no proper comparison can be made between a vertical tubular boiler with fire-box, and a horizontal tubular boiler with brick furnace, if the square feet of heating surface in each be the only dimension given. But if the number of pounds of water at a given temperature which each is capable of making into steam of a given pressure be stated, then a fair and useful comparison can be made, and more especially if the amount of fuel used be also known.

It is usual to state for comparison the number of pounds of water of 212° temperature evaporated into steam at the pressure of the atmosphere per pound of coal as the measure of the evaporative power of the boiler. Thirty pounds of water evaporated in an hour is called a horse power. The term applied to boilers is very confusing, as it is often supposed to have the same meaning as the "horse power" of an engine, whereas there is really no necessary connection between the two; except that it is supposed that an engine ought to do a horse power of work for each thirty pounds weight of steam which it gets from the boiler. Some engines will do a horse power of work with twenty pounds weight of steam, and others will need no less than sixty pounds.

The boiler that is most successful for heating a building, is the one that supplies all the heat needed in the coldest day and gives the least trouble at all times. It will be impossible to do this if the boiler requires a strong fire to be kept up in order to keep up its supply of steam. Hence no matter what form or design of boiler be used, it will not give thorough satisfaction unless it be of sufficient size to keep up steam with a slow burning fire; and a slow burning fire is more efficient in a brick furnace than when the fuel is in contact with the iron of the boiler.

HOW TO PREVENT BOILER EXPLOSIONS.

A FRIEND has handed the Mechanical and Milling News the following letter, written by an old engineer of long experience, Mr. Joseph Langdon, of Hamilton, Ont., to his son, who is in charge of a steam plant in Detroit. The letter contains so much valuable advice that we willingly give it publicity. It reads as follows:

"I see by a recent number of the *Stationary Engineer*, that the Detroit City Inspector says you can prevent boiler explosions by lifting the safety valve every morning. Now, that is misleading to a young engineer, and as I do not want you to trust to any such foolish plan, I will give you a better one. In the first place, you must keep your boilers clean; and to do this you must wash them out often—in many places once a month is sufficient. In preparing for this, work your fires down as low as possible; then work your steam down as low as possible; shut off all connections with other boilers, if you have any; clean out all the clinkers, ashes, and soot. Now let the boiler stand for a day and a night, so that it and the furnace walls will cool off gradually. Then fill with cold water up to the water line, and run it off again. Now take off your man-hole and mud-hole covers, and wash out thoroughly with the hose. Do this thoroughly and carefully, and you will have a clean boiler. The next thing to do is to examine your boiler carefully. Examine the bottom of the boiler to see that it is not bogging or bulging. Now try the bottom of the boiler with your hammer, tapping it lightly all over. If you hear a hollow or dead sound, that is lamination of the iron; or, in other words, the iron was not properly welded in its manufacture. The blistering of the sheets results from this. Next examine the seams and rivets—ascertain if they have been leaking, and have been caulked, look for marks of the caulking tool or the hammer. Where the iron has been bruised much in this way, the gases from the fuel take effect on it, and cause outside grooving. Look also for drift pin marks, which you will see by means of small cracks from the rivet to the edge of the sheet. Examine carefully the tube ends; see that they are even in length and that they have been properly expanded in their places. If you have a mud-hole back and front, examine very carefully all around each, and see that the action of the fire and water has not caused corrosion, thus reducing the thickness and strength of the heads. I will now call your attention to the method of examining the outside of a boiler. Look at your feed pipe, and if there is scale or sediment around it, clean it out properly. If you cannot do this, have a new one put in. Look carefully at your try-cock and water column pipes, especially those at or near the water line. Next try all your stays—see that there is the same tension on each. You can tell this by the sound they give out when tapped lightly. Examine the nuts or keys and bolts, for the next time you go in you may find so.. e of them broken—nuts off, or keys out. This will prove the workmanship of construction, as it will show the stays were not each taking its share of the strain and of the expansion and contraction. Now examine the seams and rivet heads. Look for pitting or grooving, or, as it is sometimes called, channelling. The pitting will make the sheet look as though it was marked with small pox marks. This and the channeling is caused by the chemical properties in the water, which of course is worse in some localities than in others. The channeling usually occurs along the horizontal seams, and sometimes goes to the depth of ⅛ of an inch. Examine your safety valve; see that it is clean and tight, and that it works free. Should you discover any defects in any parts of this boiler, report it at once, and insist on having it properly repaired. See that your water column and glass gauge are of the right height. Have glass so set that you will have one inch of water in the tubes when . ter is just visible at the bottom of the glass. When you have got through with this inspection, make your man-hole and mud-hole joint, and fill up your boiler, and, if possible, when you have two boilers, use the spare water from your pump, as all that water goes through your heater. Now prepare your fuel, and if you do not want the boiler till the next day, do not fill it. When you look at your glass the next morning, you will see a bright mark where you left your water, but the careful *engineer* will find out by *actual trial* whether the water is really there or not. He may find that the water has gone out of his glass, and even out of the boiler, and yet he will say, "I know it was there, for I saw it." Now you may think some enemy or mischievous person has let the water off, for you could see no other way it could get out. But if you look around you may find it has gone into the other boiler, owing to some of the fuel connections having been left open; or it may have leaked out your blow-off cock; or you may have forgotten to shut your steam cock, and the water siphon out. Above all things be sure your water is at its proper level before you start your fire. Slip the weight on your safety valve close up to the valve, so that the valve will blow off long before your pressure is at the proper height—thus getting rid of the air in the boiler, for it will not do your engine any good. Set your ball in the proper place on the lever. Never put extra weights on it nor attempt to carry higher steam than your safety valve will respond to. I do not think pulling your safety valve open every morning, or every hour for that matter, will ever save a boiler explosion; it will only injure the seat of the valve and make you extra work. Keep your valve levers and pins clean, and see that the valve responds to the gauge pressure you have it loaded for, and you will succeed.

I think you will be able to infer from the foregoing remarks, what causes boiler explosions, and whether there is any difference between "engineers," and "smart alecks" who call themselves such. Engineers' associations are being formed all over the continent for the purpose of educating their members so that the right man will be in the right place; and as time passes the older engineers will accept better situations, and the younger ones take their places, without any loss or injury to the employer or his machinery. At present, unfortunately, vacancies caused by these changes are sometimes filled by the aforesaid "smart alecks." I will give you an idea how these "know alls" work. One of this class begins by not being able to work a pump and heater that has done service in this plant for some time, and by using his cheek with the employer, throws them out and gets an inspirator. Now he begins to crowd his fires, and soon down goes his furnace walls or front arch. He then finds he has not grate surface enough, so he puts it all out, and has it all bricked over again. Still he is not satisfied. The grates are warping and twisting out of shape, and he cannot get enough steam. Now a smoke-burner man appears, and between them they are going to fix things. They persuade the proprietor to put on a smoke burner, for which they take a ¾ inch pipe from the boiler, which results in 20% of the smoke being consumed, and in 30% more fuel being used.

Now the careful and intelligent engineer can prevent 10% of the smoke, and in doing so he will save fuel. I could follow this "smart aleck" until he goes aloft in a boiler explosion, but it is not necessary. You attend to all these matters I have written you about, follow my directions, and your boiler will not explode, your coal bills will not be too high, and you will be able to satisfy any reasonable employer."

THE NECESSITY OF A SYSTEM.

A LESSON to be learned from the costly experience of many millers in the transition to roller milling, is that there must be a definite system for every mill. If eight breaks are to be employed, then a complete system adapted to that number of breaks must be planned, and if but four or two breaks are to be employed, then a system complete in itself must be planned and adapted to such number of breaks. Many changes have been made that have proved unsatisfactory because they did not form a complete system. A plan to be correct must be based on an actual knowledge of what the products of the given number of breaks are to be, and the numbers and lengths of the cloths must be correctly given, for the required reductions. The product of four breaks varies from that of eight or any other number of breaks, and of course requires a different treatment. The time has come when all this should be known to a certainty, and no miller should add any number of rolls without knowing that he is to have all that is required to make his system complete, and to handle all products as they should be. It is the want of this knowledge that accounts for failures and unsatisfactory results. If we do not have the knowledge, we will save money by securing the services of those who do. There has been much experimenting by mill builders at the expense of mill owners, but there are reliable parties who can now plan and build a mill and guarantee results, but not without the complete line of machinery clearly set forth. Such is the surest way to get a satisfactory mill, if we are lacking in experience ourselves. It takes a certain amount of machinery and it costs a certain amount of money, and the expert who is constantly building mills can save us money and avoid mistakes, if he is what he ought to be, but there are some so-called experts who do not know all they claim to know.—*Millers' Review*