Topic No. 5

COMPARISON OF HOT BLOW DOWN VERSUS COOL DOWN METHODS OF WASHING BOILERS

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It is generally conceded that the advent of large high pressure locomotive boilers was followed by an epidemic of cracked shells, side, door and flue sheets, stay and crown bolt leaks and broken bolts. These defects have been under discussion in our Association for some time and reports have been printed in previous issues of our proceedings, some under water treatment and others under methods of boiler washing. It has been reasonably well established that the difficulties mentioned above did not occur in smaller power with pressure in the 200# range after good methods of water treatment had been inaugurated, regardless of the method used in washing the boiler or in the frequency of the washes. With the modern high pressure locomotive with large boilers, however, we have an entirely different picture, one in which the old methods will not work. Consider just one phase, for a moment, the one and one-quarter inch contraction on cooling down and a similar expansion when firing up. While we are dealing with cool down and contraction of the metal, even expansion and rate of expansion during firing up are just as important and will be discussed later.

Our objective in this paper is not to go into detail concerning the proper methods of precooling a boiler, that has been competently taken care of in the Master Boilermaker Association proceedings dated from 1940 to 1948. We would rather explain and discuss the advantages and necessity, and, also the limitations of cooldown. At the outset, larger locomotives hauling longer trains have reduced the number of locomotives in service, taking into consideration also the inroad of diesels. The time between washes has been extended from once daily to once a month on many railroads. The net result is that we do not have enough blowdowns to keep the hot water washout plant up to the required temperature without the addition of large quantities of live steam, a costly procedure. Any method of washing that does not require large quantities of hot wash and fillup water has a distinct monetary advantage. The cooldown method fulfills that requirement.

Mr. McBrian of the D.&R.G.W. has ably demonstrated that the life of boiler steel is a function of the number of times it is cooled and preheated. After so many cooldowns it ages or loses the required physical properties It is a fair assumption that Mr. McBrian referred to the hot blowdown and fast firing up as these determinations were made before precooling or cooldown was generally advocated. Mr. Willett of the American Arch Brick

stated, "Until such time as fireboxes are designed and built to withstand the abusive treatment some railroads give them in cooling down and washing your Committee suggests that the "Cold Water Method" as described by Mr. R. W. Barrett in the 1943 proceedings should be given careful consideration. In fact, it should be reprinted."

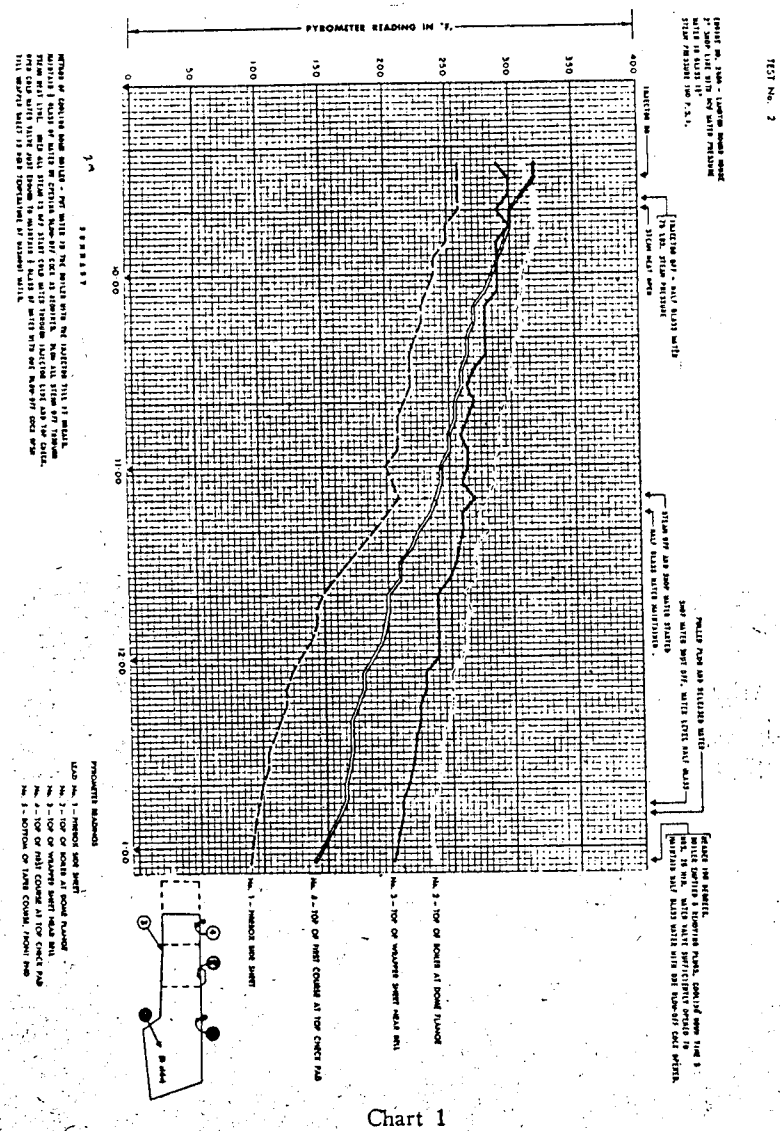

Chart 1

While the rate of cooldown, or the time it takes to cool a boiler may be important, it is far more important that the reduction in temperature be evenly distributed. In other words, the temperature should be the same in every part of the boiler insofar as possible. Metallurgists have for years recognized the need of, and practiced, controlled cooling and heating of metals to prevent permanent distortion and eliminate stresses. Anyone who has heard the expansion shoe contraction noise, sounding like a sledge hammer striking the boiler shell, when a boiler is rapidly blown down, knows that stresses are being set up in various parts of the boiler that eventually lead to broken radial and staybolts, shell cracks, cracking of the top door sheet knuckle, back flue sheet and even to the extent of the knuckle on the front flue sheet. It is inevitable that uneven cooling, such as we get with hot blowdowns, sets up stresses that eventually lead to trouble.

We have a report with charts from a Canadian member, Mr. F. R. Milligan, Gen. Boiler Inspector of the eastern district of the Canadian Pacific Ry. Co. showing the cooldown system used on that railroad with charts and temperature readings made with pyrometers in different sections of the boiler while cooling down.

Test method of handling cool down and maintaining ½ glass of boiler water which proved unsatisfactory because of the varied pyrometer temperature readings, more specially at dome flange. Eng. 2454 at Lambton. In roundhouse with pressure of 160#, 1½" of water in glass. At 9:25 A.M. temperature at top check as indicated by black line #4 was 320°. Temperature at top of boiler dome flange was 310° (blue line #2). At top of wrapper sheet near the bell the temperature was 290° (brown line #3). Firebox side sheet temperature was 260° (red line #1). Injector was started at 9:30, shut off at 9:36 with ½ glass of water and 75# pressure. Steam heat valve opened at 9:40 and all steam pressure released from boiler at 11:10. Temperature readings then were as follows:

Black line	#4	240°
Blue line	#2	280°
Brown line	#3	270°
Red line	#1	210°

At 11:15 cold water with line pressure of 60# was started maintaining one half glass of water in boiler until shut off at 12:47. At 12:50 washout plugs were pulled to release water from boiler. Boiler emptied and washing started at 1.05. Cooling time 3 hours and 25 minutes. Temperature readings at this time were:

Black line	#4	140°
Blue line	#2	235°
Brown line	#3	201°
Red line	#1	90°

Temperature of wash water was 100°.

Summary of the Canadian Pacific method of cooling boiler is as follows: Fill boiler with injector until it breaks, maintaining ½ glass of water by opening blowoff cock as required. When injector breaks blow off steam thru steam heat line. When all steam pressure is off boiler start cold water thru injector with top checks just enough to maintain ½ glass with one blowoff cock open. Continue cold water until wrapper sheet is near temperature and that of washout water.

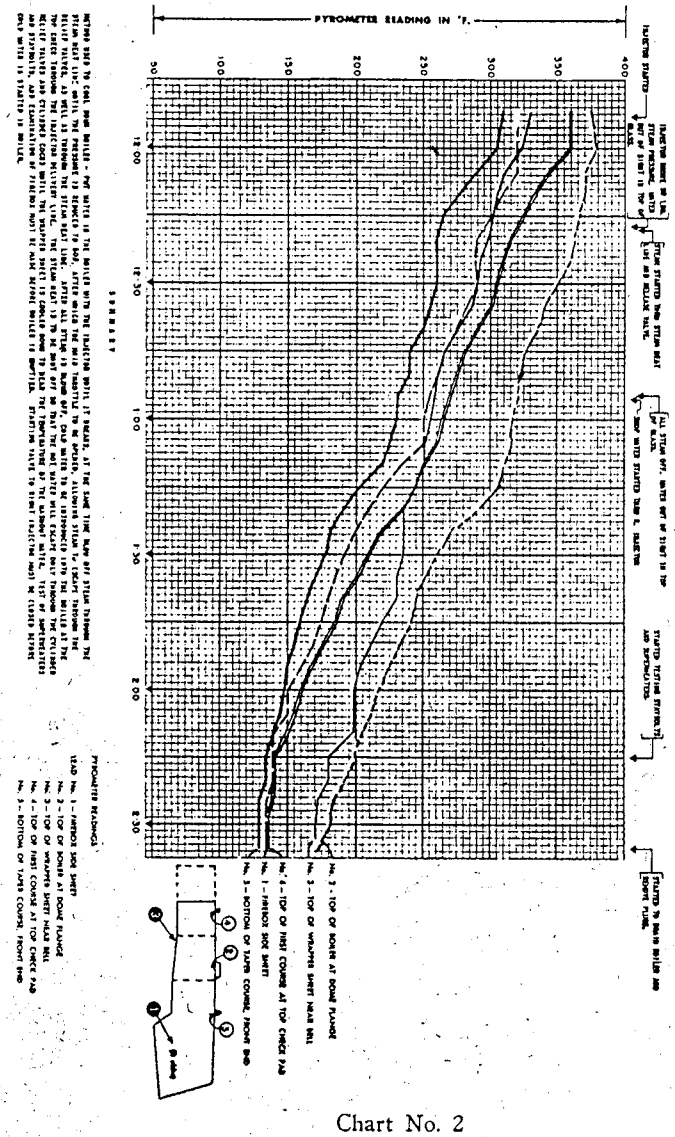

Chart No. 2

Shows a more satisfactory temperature reading and cooling down method used on the Canadian Pacific Ry. Procedure and temperature readings as follows:

Engine 5332 at Lambton Round House at 11:40 A.M., boiler pressure 92 lbs., 2 inches of water showing in glass. Temperature reading line #1 top at dome flange 375 degrees. Line #3 top of wrapper sheet near bell 330 degrees. Line #2 firebox sheets 360 degrees. Line #4 top of first course

top check pad 320 degrees. Line #5 bottom of taper course at front end, 310 degrees temperature.

Injector was started at 11:40 A.M. filling boiler at top, injector broke at 12:22 at 30 lbs. of steam on boiler. Steam was then released through steam heat line and release valves, 12:52 P.M. all steam pressure was off boiler and maintaining a full boiler of water. Roundhouse 2 inch water line was connected at right injector line using 60 pounds round house water pressure. 2:15 P.M. hammer testing of staybolts and water test to superheater units was applied 2:38 P.M. water was started to drain from boiler and washout plugs removed. Total time of cooling down and testing of staybolts and superheater units 2 hours and 58 minutes.

Temperature reading at this time are as follows:

#1 line — 170 degrees top of dome flange
#3 line — 170 degrees at wrapper sheet near bell
#2 line — 135 degrees firebox sheets
#4 line — 135 degrees top at first course at check pad
#5 line — 130 degrees bottom of taper course front end

Method Used to Cool Down Boiler — Put water in the boiler with the injector until it breaks, at the same time blow off steam through the steam heat line until the pressure is reduced to 50 lbs. after which the main throttle to be opened, allowing steam to escape thru the relief valves, as well as thru the steam heat line. After all steam is blown off, cold water to be introduced into the boiler at the top check thru the injector delivery line. The steam heat is to be shut off so that the hot water will escape only thru the cylinder relief valves and cylinder cocks until the wrapper sheet is cooled down to near the temperature of the washout water. Test of superheaters and staybolts, and examination of firebox must be made before boiler is emptied. Starting valve to right injector must be closed before cold water is started in boiler.

I would like to thank Mr. Milligan and his railroad for the information and the trouble they have gone to in making these charts.

Important as even cooling down is, beyond any doubt the most damaging effect of hot blowdowns is the formation of distinct layers of baked on sludge caused by the evaporation of boiler water and sludge adhering to the flues and sheets. While not as hard as raw water scale it has well known insulating properties. Large sheets with firebox temperatures as high as 2700° and evaporation rates up to 90,000# of water per hour just will not stand up even with thin layers of baked on sludge. It might be mentioned that certain types of treated water bake on more sludge than others. Waters with well coagulated sludge and low dissolved solids seem to be the best, that is, they leave less scale baked on the hot metal. The damaging effect of oil in boilers is reduced by pre-cooling. The reason is that sludge acts to absorb oil and any sludge baking on the metal acts as a carrier for the oil which then carbonizes on the hot metal. Carbonized oil is one of the best insulators known.

Precooling now has been in use long enough for us to evaluate its benefits and objections. The two main benefits have been mentioned. The most frequent objection heard is that it takes too much time and that the dispatcher will not permit holding the engine. When I hear that I wonder how many engines are tied up for patches and bolt replacement which should be in service. I have never heard that objection from railroads which are practising cooldown. Their engines are available except for about six to eight hours once a month. If other practises are as they should be washing

once a month is sufficient. During the hour to one hour and forty-five minutes it takes to cool the boiler such work as cleaning or replacing the brick arch, cleaning the combustion chamber and sump, blowing out or washing the flues, front end inspection and repairs to front end appliances can be carried out under much better and cooler working conditions. As it works out there is an actual time saving considering all the work done. The actual time for washing is less as little more than a rinse is needed as long as no part of the boiler gets dry. That is not the case with hot blowing.

Another objection heard is that precooling did not dry up stay or crown bolt leaks. The primary cause of bolt leaks is oveheating the sheets and overheating is generally due to scale on the water side. The scale can come from poor water treatment or baked on sludge. The evidence is ample and conclusive that precooling stopped leaks, broken bolts and cracks when no other cause for them could be determined. Precooling has also failed to stop them when the sheets have been permanently distorted by repeated overheating and uneven cooling.

Cooldown or precooling is not a cure all but it is an integral part of good railroading. If the water treatment is good enough to prevent scale; if continuous blow is used to maintain good boiler water so frequent washing is not demanded; if a good steam conditioner is used to prevent foaming and subsequent reports for water changes; if the boiler is washed only on inspection with no intervening water changes, then cool down is a valuable aid to good boiler maintenance.

At the outset I stated that the details of precooling would not be discussed. There is one difference in method, however, that I would like to take up. Is a circulation pump necessary or not? It is not necessary but its use has many advantages. Draining a boiler with a circulation pump permits removal of washout plugs in barrel of boiler much sooner. Maintenance crews have the advantage of working in a dry pit where inspection such as running gear, quarterly draw bar tests, stoker repairs and others can be made while boiler is being washed. In the winter time it is almost impossible to drain the boiler water into pits or sumps from the blowoff cock or plug holes without filling the house with steam and causing grievances, and, unsafe working conditions. Draining the boiler rapidly with compressed air is effective but far too expensive.

The Duluth, Missabi and Iron Range Railroad has used the cooldown for years. Their large Mallets were never washed any other way except during a short period when they were leased to other railroads. These powerful 2-8-8-4 locomotives are among the largest ever built and are used for hauling ore from the mines to the ore docks. With good water treatment and cooldown I know of no repairs that have been made on these boilers except to comply with the I.C.C. rulings. Mr. J. L. Callahan, Chief Boiler Inspector of the National Aluminate Corporation and an active member of this Association has for years been telling us of the perfect boiler conditions on the Missabi and your committee can verify his statements as we have checked boiler conditions a number of times at Two Harbors with Mr. Anderson, Boiler Foreman of the D.M. and I.R. Ry.

Firing Up Practices

If we are to be consistent in this matter of avoiding too rapid temperature and pressure changes in our locomotive boilers, we must pay attention to firing up practices also. Most railroads who give this matter any thought at all usually prescribe two hours or more as being required to reach operating pressure in order to heat the boiler uniformly and avoid too great expansion strains. Blower lines may be bushed down in certain cases to give only enough draft so that the correct amount of time will be used in firing up the boilers.

In certain very large boilers, steam jet circulating devices are required to insure that cold water can not stratify in the lower parts of the boiler at the same time when full pressure and temperature is reached in the top part of the boiler. We feel that individual railroads should investigate such requirements as the variation in type of fuel used, whether or not direct steaming is used, fire lighing equipment, and other such differences make it difficult to make a recommendation except in very general terms.

Everyone should agree that any practice that eliminates temperature differentials in the boiler structure and meets the general requirement of heating or cooling the boiler uniformly and gradually should be adopted as this will certainly help to reduce boiler maintenance and improve reliability of performance.

Conclusions

The most important part of our investigation has to do with the cooldown system and in this connection your Committee is unanimously of the opinion that the cooldown method of boiler washing should be adopted generally to improve boiler operation and thus reduce maintenance costs and improve the reliability of operation of the steam locomotive.

By F. E. Godwin

After reading the favorable reports submitted by Committees of previous years on this topic, it is gratifying to our being one of the pioneer roads using this method, to know that cooling down boilers by the cold water method is gaining in popularity both in this country and abroad, and according to reports hot water washing will be discarded by all steam power railroads in the near future.

It is interesting to note the different methods being tried out by the various railroads adopting this cool down system. Some use circulating and draining pumps, others use this method in conjunction with direct steaming. No doubt the change-over is a problem to some roundhouses due to insufficient overhead piping and inadequate pump facilities, however this is all valuable information to railroads that are contemplating adopting this system; this way they have the advantage of studying the most economical system to meet their requirements.

We do not advocate any policy that cuts down on the wash-out time because we favor this period on occasion when proper examination and maintenance is given to every vital part of the locomotive, which in a great many cases would have been neglected had the law not compelled us to hold the engine for a washout period.

We boiler men are well aware that cold water is dynamite when used with temperatures in boilers under a full head of steam, therefore we must see that the proper procedure in cooling down is carried out at all times and no short-cut methods tolerated. The ultimate results can be obtained from dollars invested in water treatment chemicals in keeping these boilers clean by this cool down system. The procedure we follow after the engine is housed is to open the inspirator, next couple up the cold water hose at the top check and as soon as the inspirator breaks proceed to open this valve to completely fill the boiler; next couple up the blow down hose to the back cooling valve located on top of the boiler, when boiler is full, open this valve, discharging water to the hot well or blow down tank; since the boiler remains completely filled during the cool down period there is no need to check the water level in the glass, cooling down continuous until the naked hand can be held comfortably on any part of the firebox sheets. The boiler is then drained into the pit through the two blow-off cocks, the washing out operations can commence immediately water recedes below crown sheet level.

The Canadian National cool down system commences with each locomotive being equipped with a top check, with cold water valve attachment to take 1¼" fill up hose and a 1½" blow down angle valve situated back of the dome. Two blow-off cocks are located at right front corner of throat sheet. The roundhouse piping arrangement consists of three separate overhead pipe lines, cold water, hot water, and blow down line as illustrated in accompanying photographs. The capacity of the blow down tanks are according to requirements, 30 to 60 thousand gallon tanks.

Water pumps are situated in the Mechanical rooms, driven by 50 H.P. motors; delivery rate is 300 gallons per minute against 150 lbs. pressure.

Hot water is used for refilling boilers through a direct line from the blow down tanks. Hot water lines are also connected with cold water lines for washing out boilers therefore it is important that pump facilities should be arranged to supply adequate pressure through all pipe lines when maximum demand is required through hot or cold water lines.

This cool down system has been in effect on our road for the past 25 years. The results obtained leaves no doubt in our minds that this method cannot be improved upon without some type of a sacrifice to our boilers.

"Mr. Barclay read the report as printed in the Official Program. Also Mr. J. E. Godwin's paper."

Mr. Barclay (continuing): We have, I believe, Mr. Chris Anderson of the Missabi Railroad in this room. I would like to have him make a comment on just what the Missabi has done. They have pioneered this cool-down for some time, and furthermore we would like to hear from Mr. Anderson what Mr. Callahan has been telling us for years about the cooling down of locomotive boilers on the Missabi railroad.

Mr. Callahan: I said it all last year.

Mr. Barclay: Mr. Edlund, of the Milwaukee Railroad, I would like for you to say something in regard to the cooling down systems.

COMMENTS ON TOPIC NO. 5

Mr. A. A. Edlund (Asst. Gen. Boiler Insp.) Chi., Mil., St. Paul & Pacific R.R.: Mr. President, Mr. Chairman, knowing the amount of very careful preparation and the extent of well debated thought that went into preparing this paper it is doubtful whether anything could be added that would be of material value, and likewise knowing somewhat of the many tests and the very carefully collected data on which the paper is based its doubtful whether it would be proper to take issue with any particular part of it because it appears to be within reason to assume that any practice that has for its aim the careful handling of a boiler to avoid the many known pitfalls in the line of boiler maintenance, certainly in time must bring beneficial results.

Some of us have been a little bit skeptical of the claims made by certain railroads that employ precooling, as we on our own roads had set up practices which closely resemble accepted methods of pre-cooling but failed to derive any appreciable benefit over such locomotives which were not subjected to it. Then again we were able to point to locomotives operating on certain districts on our own railroads which without the benefit of pre-cooling were in good condition insofar as boiler and firebox was concerned, after accumulating miles far in advance of those claimed by proponents of pre-cooling. This of course should be so and it only indicates that certain factors exist on some railroads that cause considerable difficulty which other roads don't have to contend with.

The paper as presented makes no claim that pre-cooling is one of those sugar coated pills or an antidote for all of the faults of improper boiler

maintenance, however in such places where boiler materials are not entirely proper or where water is used that is not well treated or difficult of treatment there is no question but what pre-cooling will be of considerable aid.

Some exception has been taken in the past to pre-cooling methods chiefly because of the length of time involved. That happens to be an item today which must be given close consideration because of the great stress laid upon the importance of availability. In this connection it might be well to mention one of the methods of pre-cooling which reduces the time element considerably. An opportunity was had to witness the pre-cooling operation as employed on the Northern Pacific Railroad and since it is not covered in this paper a brief account of their practice may be of some interest.

The Northern Pacific Railroad applies pre-cooling to its locomotives of the modern type and only those which are equipped with overhead boiler checks, which comprises all of their large boilers. The locomotive on which the operation was witnessed happened to be a 4-8-4 Class Locomotive of 240# pressure, having a generous size boiler. This locomotive had flue and side sheet mileage closely approximating four years of service and inspection made of the firebox when it came into the roundhouse showed it to be absolutely void of leakage. The firebox was equipped with only arch tubes and the conventional arch brick.

This particular locomotive was brought into the Roundhouse at a pressure of 205# and with one half glass of water at 11:15 A.M. Immediately on coming into the roundhouse the washout crew was ready and got on the locomotive and began filling the boiler with the right injector through the overhead check. Twenty five minutes later the injector broke and had filled the boiler to a point somewhere above the top of water glass, and had reduced the boiler steam pressure from 205# to 25#.

At this point a circulating line from the hot water washout plant having a temperature of 120 degrees was attached to the right injector delivery line, at the same time a circulating or unloading pump was connected to both blowoff cocks and a circulating process begun which continued for a period of 15 minutes by which time the boiler pressure had been reduced to zero.

At this stage the circulating or unloading pump was shut off and the boiler which had been partially drained during the pre-cooling process was completely filled with water from the hotwater washout plant which required seven minutes. The boiler was then allowed to stand for a period of five minutes for the purpose of adjustment. After the period of adjustment the draining of boiler began and when the water had receded from sight in the glass, a vent valve located in the steam dome was opened to assure that no pressure remained in the boiler, with this assurance boiler washers began removing the washout plugs located along top of boiler and over crown sheet and began washing boiler while the drain-process was continuing. By the time the unloading pump had drained all the water in the boiler, the boiler washer had completed washing over the flues and crown sheet and were ready to start removing the balance of plugs and complete washing lower part of boiler and around firebox.

The entire period of pre-cooling, washing and filling boiler as it was witnessed on the Northern Pacific Railroad required 4½ hours for a crew of three boiler washers. This time element appears very nominal and one that is fully justified where conditions are had that warrant pre-cooling and as we are aware there are many of them. Where conditions do not warrant of course it is not the object of the committee to suggest that pre-cooling be employed.

That there are other methods of pre-cooling which have been in effect for a number of years on certain railroads and have been giving good results is well realized but to those who hesitate to use pre-cooling on account of the length of time involved it is suggested that they get in touch with Mr. Barclay of the Northern Pacific Railroad for it does appear that they have a method of pre-cooling that is worthwhile investigating.

Thank you. (Applause)

Mr. Barclay: Thank you Mr. Edlund for your comments.

Mr. Barclay: Is Mr. Lasalle, of the Bessemer and Lake Erie Railroad, in the house?

Mr. F. W. Lassalle (General Boiler Inspector, Bessemer and Lake Erie Railroad Co.): Mr. Chairman, I do not have much to add to your report. Mr. Edlund mentioned that he could not see where they saved any time by using the cooldown method. We know that, on our road, leaking staybolts and flues have been prevalent in other years during the months of July, August and September, when water conditions are poor. About a year ago, we adapted the cooldown system and this summer we have not encountered this trouble.

This eliminates running repair work to our fireboxes. Therefore, I feel the time saved from dumping fires and re-firing these boilers must be taken into consideration.

Mr. McBrain said yesterday that the life of the boiler steel is a function of the number of times it is cooled and preheated. The elimination of expansion and contraction to our fireboxes would increase the life of the firebox materials. I feel the cooldown method has saved time and materials on our railroad. (Applause)

Chairman Barclay: Thank you, Mr. Lasalle.

Mr. Barclay: I have just a few words that I would like to say. I asked for a report from our Boiler Foreman along the Northern Pacific on the reaction of the cool-down. When we first started cooling down these locomotives for about the first six months we got a heavy load of scale out of the boilers. Today we don't know what scale is. We just get a little sludge and mud, which speeds up our washing operation.

We on the Northern Pacific are not only figuring on our locomotive boilers but our Engineer of Water Service and I have gone a lot farther, we are into the stationary boiler now. It was a year or two ago when I was here in Chicago that I went out to the National Aluminate plant. They have a stationary boiler that they showed me that has not been washed since 1943. That opened up my eyes a little bit.

I believe the Great Northern washes their modern plants once a year. We on the Northern Pacific have a few modern plants. We go along with our Chief Engineers, they believe in a frequent washout, or did We have extended five of our plants to twice-a-year washout. The other plants are on a 90-day basis. We are working them up slowly to get our Chief Engineers in line with us.

Just three weeks ago one of our officials called to my attention a boiler that had been on a line for 147 days, they had knocked it down. We furnished steam there for a 1500-kwt. turbine. We have a big car shop there. They were very scared of the carryover, but we knocked one of these big stationary boilers down, we let it cool for 14 to 20 days and filled the

boiler completely full of water. With the dissolved solids that were in suspension, a little chemical had drifted over in the superheater drum and into the superheater flues which caused all this excitement. The boiler had been cleaned out when I arrived and I crawled into the superheater drum and, gentlemen, I want to tell you I never saw a prettier boiler on the inside, it just shown, the flues and all were just polished. I talked to the boiler washer and he said it was the easiest job he had ever had in his life to clean that boiler up.

I brought back samples of what came out of that superheater drum and sent them to our Engineer of Tests. The material was finer than face powder. I haven't any report but I know we are not hearing any more about the carryover on that boiler or the condition of it.

I think not only on our locomotives but on our stationary plants I am beginning to feel just like Mr. Callahan. If we leave the water in there it is a lot better the longer it is there, by checking your dissolved solids each day and twice a day if it is necessary; it isn't much of a job to educate our chief engineer to make these tests and he knows just exactly what the condition of his boiler water is at all times.

Mr. Barclay: Now I would like to call on Mr. Schudlich, Engineer of Water Service of the Northern Pacific Ry., for his comments on this subject.

Mr. H. M. Schudlich: Officers, members and guests: I do not have very much to add to the boiler washing practices that have already been outlined, but I would like to say a word with respect to water treatment. Years ago, not so much recently, the water service engineers and chemists were blamed for leaks, cracks and other failures, and more especially scale accumulations which contributed to a high maintenance program.

After the development of the cool down system of washing and the extended washout period, the boiler makers, and more especially the maintenance men, began to realize that the frequent dumping of the boiler water produced a progressive film of accumulated scale which finally got thicker and thicker until it would prevent the proper transfer of heat and the consequent overheating of the boiler sheets. As this washing and blowdown practice progressed and the boiler washing time was extended it has been proven that a clean boiler could be maintained with practically the same treatment at a lesser cost since less excess chemical was required to maintain a zero hardness which is absolutely necesary to maintain a scale free, clean boiler. Properly conditioned water was blown into the sewer and was replaced with a water which from the scaling standpoint was of poor quality. When the scale and accumulated sludges can be eliminated the boiler makers will realize that the maintenance costs are reduced by the practices so recently outlined, but sometimes it is rather difficult and almost impossible to convince the average boiler washer that this is a reality. He believes the first thing done when extending the boiler washing period is to cut forces, but I think on the Northern Pacific Railway it has been proven that even though the boiler washing period has been lengthened there has been no material reduction in the boiler washing crews, they have been put on different work and even in some cases promoted to better positions. When this is understood active cooperation has promoted improved practices and working conditions.

I believe that the first thing to do is to convince the employes that they will be kept on the payroll. Once this is realized a program can be developed which will eventually result in cleaner boilers without too much change in the water treatment, and in some cases with a reduction in water treating chemicals and costs. (Applause)

Mr. Barclay: Thank you, Mr. Schudlich.

Mr. Barclay: We have Mr. Hutton of the Bird-Archer Company here. We would like to hear what he has to say on this subject.

Mr. J. C. Hutton (Vice-President, The Bird-Archer Company, Toronto, Ont., Canada): Mr. President, Mr. Chairman and Gentlemen: In connection with the subject of the cooling of boilers I was very closely associated with your late President, Mr. Milton, during the time of the development on the Canadian National of the original cooling, possibly 25 or 26 years ago, and that development along with water treatment on our Canadian Roads have given very beneficial results: clean boilers and a minimum of boiler work.

Thank you. (Applause)

Mr. Barclay: Thank you Mr. Hutton.

I would like to call on Mr. Milligan of the Canadian Pacific Ry., who has contributed valuable material.

Mr. Milligan: We were having considerable trouble with broken staybolts, leaking tubes, leaking superheater joints in the headers, side sheets leaking and cracked headers, and this seems to be more pronounced after a washout. These troubles were so severe that it was necessary to find what was the cause, so we borrowed a Brown Electric pyrometer from the Imperial Oil Limited. This pyrometer has six leads, and the leads were attached to the boiler, and in some cases superheater header, in the manner shown on the charts you have just seen on the screen. We also took the readings during lighting-up period. Readings were taken while cooling the boiler down, eleven different ways. The charts shown on the screen showed our original method, and the method now in use. Since putting this method in practice our troubles have practically disappeared. Staybolt breakage is practically nil, tube leakage is practically nil, and they have not cracked the superheater header, and eliminated the superheater pipe joint to the header leakage after washout. We do not permit the cooling down of boilers for washouts or any other purpose other than by the manner shown.

Some of you might wonder why we run the cooling water through the superheater and out through release valves. This has proven quite beneficial; it not only cools your header down, but washes out the superheater pipes, and where multiple throttles are used it washes out the throttle. This method of cooling down is saving the Canadian Pacific a considerable amount of money in reducing sheet renewals and improved superheater performance. However, to obtain full benefit, it is absolutely necessary that your water treatment is correct for the District in which the engine is operating.

In the past, the object has been to see how quickly a boiler can be cooled down and washed out and placed back in service. In my opinion, it was a bad mistake. I cannot see how an engine being stopped once every 30 days for washout can have any bearing on the availability of a locomotive. There is other work that must be performed at this period that occupies as much, if not more time, than the actual washing out of the boiler. Very likely if you will take the trouble to check, you will find out that your boilers are being cooled down more often for other causes than boiler washout, and it seems to me if this work were properly performed at the washout period, it should not be necessary to cool boilers down any more than once each 30 days. At no time should you force cooling down, but allow sufficient time to permit the temperature in all sections of the boiler to drop evenly. You may think you are increasing the availability of a locomotive by hurrying the washout — that may be so for today, but to-

morrow your boiler will likely be in the backshop for a couple of months, to make repairs to defects caused by rapid cooling down.

Mr. Barclay: Thank you, Mr. Milligan.

I wonder if Mr. Godwin of the Canadian National has a word or two to offer on the cooling down subject.

Mr. Godwin: I have very little to add to what has already been said this morning because I am quite new at this game. Mr. Barrett of the Canadian National who is present here this morning is one of the pioneers on this pre-cooling method.

All I can say is this, on the Canadian National we have been treating our boiler waters about the same length of time as we have been pre-cooling, so I cannot honestly tell you which is doing the best job. However, I do know that over a period of many years we have been absolutely trouble free on firebox maintenance, cracking of side sheets, broken bolts, and flue bead cracking is something we don't have.

In conclusion I will say this; good results can be obtained by this cool down method and a proper chemical treatment.

Mr. Barclay: Time is running out on this subject but I would like to have our good friend Mr. Stiglmeier say what he has to say regarding this subject before turning it over to our President.

Mr. Stilgmeier: Gentlemen, I fully agree with the report of the committee.

Mr. Barclay: I believe our time has run out on this discussion so I will turn this over to our President, Mr. Heidel.

President Heidel: Mr. Barclay, as Chairman of Topic No. 5, we wish to thank you and your Committee for a very good Report.

Mr. Barrett (Canadian National): I would like to say a little on this subject.

Mr. President and Members: I feel I would be remiss if I missed this opportunity to register a little criticism in regard to some of the methods that have been adopted in this pre-cooling system. The other day we listened very attentively to a paper which will be a subject of next year, and that is "the advantages of the top check over the side check." Then it was pointed out that by the application of the feed water through the side checks there is a tendency for the cold water to get to the sidesheets and there cause a lot of sidesheet trouble.

W saw set forth this morning and also in our previous paper that some of the Railways are pre-cooling by putting the water into the top check and running it out through the blow-off cocks at the bottom. There you are setting up the same condition which you are complaining about in regard to top checks versus the side checks, for your cold water will naturally go to the bottom of the boiler and there your temperatures will be rapidly reduced. I see in this report that you cool down a boiler under 45 minutes, if so you certainly are going to get cold water through your blow-off cocks down to your side sheets.

As Mr. Godwin has pointed out in his paper, we have an incoming valve at the top check and an outgoing valve on top of boiler and our experience has been for many years not only has it eliminated considerable firebox trouble but also barrel trouble.

Our large Northern and Mountain types are made of silicon-manganese steel; they have been in operation now from ten back to twenty-five years and we are still to have any major trouble with those barrels. It is true on some that were built twenty-five years ago we have experienced a little trouble, but on the majoirity of our power today we have practically no bother at all in regard to cracking of barrels, neither do we have any appreciable trouble with our fireboxes, and we attribute that much to the fact that we take our cold water into the top and allow the hot water to disperse through the top and not allow it to run down through the blow-off cocks.

Mr. Barclay: Mr. Barrett of the Canadian National, we are proceeding with our cool-down on all our modern power, which is 2-8-8-4's and 2-6-6-4's, and I was just going to comment on the remark of taking the hot water through the top checks and discharging out of blowoff cock. At certain portions on our railroad we have been doing this for five years, at first without the use of the circulator pump. The last two years we have been using the circulator pump and taking our drainage water out through our blow-off cocks and we have reduced the number of broken staybolts and have very few leaky staybolts in side sheets. Any gentleman in this hall who would like to come up on our railroad and look at the condition of our fireboxes we would be more than pleased to take them out and show them exactly the condition of fireboxes. Mr. Edlund made a statement that he and Mr. Heidel, President of the Master Boiler Makers' Association, were there to make an examination and they were surprised when they looked into that firebox that we did not even have a teardrop and this locomotive will be due for class 3 repairs in January 1950, after a full 4 year term of service. This system that we have has worked very successfully. There may be some detrimental things that will show up later but five years is a pretty good test period. Mr. King, whom I followed onto this job, and myself are very, very proud of the condition of our fireboxes and we would gladly welcome anybody if they are interested in this cool-down to come and make an investigation. I thank you.

President Heidel: Any further remarks from the floor?

Mr. William H. Romich. (Gen. Locomotive Foreman, Bessemer and Lake Erie Railroad Co): Would you allow a Boilermaker who is not a member of this organization to say something?

President Heidel: Yes, indeed!

Mr. Romich: We are highly interested in the cooldown system. We are new in this field, having followed this practice a little less than two years, but we have much praise for the cool-down system.

I would like to say that possibly 10 years ago, at least long before we thought anything about the cool-down system, we made some pyrometer readings on a boiler to determine the movement of the various parts of the boiler in the firing-up process and cooling down process. It was the opinion of many that much damage was done to the locomotive boilers in rapid firing and I was one of that group.

We made a number of tests and we made charts of the pyrometer readings taken at various parts of the boiler and to our great surprise the greatest movement took place in the cooling-down process rather than in the firing-up, so when the proposition of cooling boilers came up we were vitally interested in what might be accomplished.

As I said before, we have not followed this practice long enough yet to know any tangible effects that it might have on flues and boiler sheets

because a lot of damage has already been wrought on these parts before we started the cooling-down system.

We are not a large railroad, as we only have 105 locomotives, but half of this equipment is as large as any in the country, being 2-10-4 type and carrying 250 pounds of steam with 96,700 pounds tractive effort.

We find in our roundhouse work that we can move these boilers through the test period more rapidly by using the cool-down system than we did before, and we can gain some time in the preparation of the boiler for various tests in the cleaning out, etc., which work can be started before the boiler is entirely cool.

Our method is to use the injector until it kicks off, which is down around 70 pounds steam pressure. As soon as the injector kicks off we open our valve at the dome and turn on our water into the feed pipe which opens into the boiler through a side check. The injector delivery pipe used is on the right side of the locomotive.

This cooling down system will make that locomotive boiler ready for tests or anything else we wish to do with it quickly and we can wash out in two hours if we use cooling water from 110 to 120 degrees Fahrenheit. If we use cold water, around 60 to 80 degrees F., we can cool that boiler in an hour and a half. The latter system is preferable to me, although we have not followed that regularly. Our instructions to our Roundhouse forces now are to use the tempered water around 110 to 120 degrees.

We don't expect to eliminate cracked sidesheets and cracked flue-sheets entirely, but we have found out this: we have eliminated to a very great extent leaky staybolts and leaky crown bolts; we have eliminated on our later sidesheet applications the cracking of sidesheets and staybolt holes. Just what service we can get from this method on new sheets is to be determined in the future. We expect great things.

It took a lot of persuasion to tell me that this was the proper thing to do because I had always been cautioned about the use of the injector after the fire was knocked out of the firebox, but we have found out that no serious damage and in fact, the boiler is helped and improved by following the cool-down method. If we can eliminate the splitting of flues as some Railroads have done, I feel that we will have accomplished something worth-while. As I said, we have large boilers, high steam pressure, using 2¼" and 3½" tubes, and our only trouble with these tubes has been the splitting of the beads on the smaller flues at the bottom of the boiler. We are sure that we can eliminate cracked flue sheets and, from the experience of other Railroads, split beads on our tubes on our large boilers.

I am glad for this opportunity to offer my nickel's worth on this subject. I am the General Locomotive Foreman in the Shop. I have been a Boiler-maker since 1901 when I began my apprenticeship on this same railroad.

I thank you. (Applause)

DISCUSSION

Mr. M. R. Francis (General Boiler Maker, Norfolk & Western R. R.): I would like to ask the gentleman from the Northern Pacific, do you test your units monthly?

Mr. Barclay: We have started to test our staybolts and units. We previously made a quarterly test on units, but now with the boiler full of water it is very simple matter to test our units.

Mr. Francis: What type of wash-out plugs do you use?

Mr. Barclay: We use the TZ wash-out plugs. We have some Huron and some of the old Prime brass plugs on small power.

President Heidel: If there is nothing further, the topic is closed.

I will call upon Mr. Stiglmeier to say a few words.

GOOD OF THE ASSOCIATION

Secretary Stilgmeier: Gentlemen, there is very little I have to say other than to let you know what your registration has been. We have had registered at this convention: Life members 8, Honorary members 16, New Members 14, Active members 110, and Associate members 61, a total of 209, this with Guests, Ladies 88, Men 46 a total of 132, a grand total of 341 registered with the Master Boiler Makers' Association.

What I would again like to say, that each one of you consider yourself a committee of one to secure new members, I am of the opinion that there are many who will join your association if given the opportunity. We anticipate to appoint a membership committee, with some of our friends in the industrial field as committee members, for the simple reason that they travel throughout the country, and I am quite confident that our friends in the industrial field will give their support and cooperation in this move.

Mr. Mumford in his message to the association, stated, steam power has still got a kick-back in it, so let us as Boiler Makers have the same kick. (Applause)

President Heidel: Thank you.

At this point in the program, the President is turning the gavel over to the newly-elected President. I have enjoyed working with you gentlemen, and have enjoyed working with the officers. You have all been a great help all the way through. If you will give my successor the same help that you have given me, the job will be as pleasant for him as it has been for me.

Mr. Gilley, these Boiler Makers at their regular election in this room have elected you President of this organization for the coming year. I present you with the gavel as the badge of your office and I know it will be in the hands of a very able man to conduct the affairs of the Association. (Applause as Incoming President Gilley accepted the gavel.)

President Gilley: Thank you, Mr. Heidel.

Gentlemen, as I said yesterday, you have conferred a very great honor upon me and also, I believe, a lot of work. We have plans in the making which we think will be of great benefit to the Master Boiler Makers' Association and as they are worked out we will endeavor in some way to advise you just how things are going along. We also are going to ask each one of you to give us possibly a little more help than you have in the past on committee work and membership work.

I want to leave a little thought with you that Mr. Lyon brought out yesterday in his paper on some training of supervision. There is a big field ahead for the boiler supervisor providing he fits himself for that advancement. I want to make mention of a little occurrence that happened five or six years ago on a certain Railroad when there was a job open for an Assistant Locomotive Foreman. The Boiler Inspector had been recommended for this job and he was considered the best man, but when we went up to the Superintendent of Motive Power and suggested that the Boiler Inspector be made Assistant Locomotive Foreman he said he thought that a trained Machinist would be better fitted for the job. In the argument that followed an old Shop Superintendent connected with that Rail-