The Locomotive

OF

THE HARTFORD STEAM BOILER INSPECTION AND INSURANCE CO.

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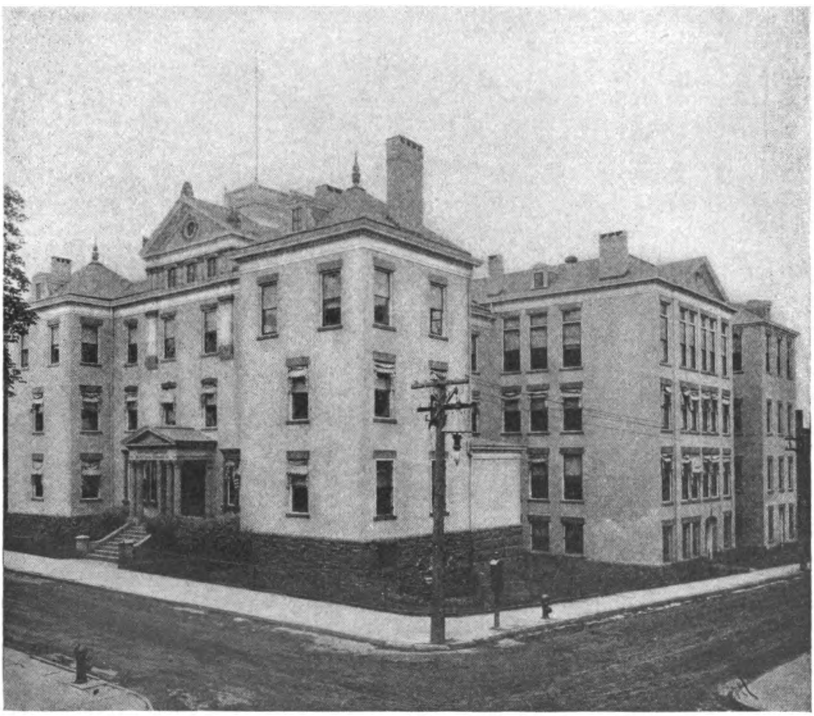


HOME OFFICE BUILDING

Prospect and Grove Streets, Hartford, Conn.

Water Gage Glasses.

CHARLES S. BLAKE.

The breaking of water gage glasses is of such frequent occurrence, that a few words concerning their attachment and use may, if heeded, prevent some accident and possibly personal injuries, besides the annoyance of frequent replacements.

The use of a visible gage as an auxiliary to indicate height of water in a steam generator has become a recognized necessity, and is required by authorities exercising jurisdiction over boilers. One municipality at least places such value on their use as to recognize a second gage glass as a substitute for the gage cocks and does not require the latter when two gage glasses are properly affixed.

The ordinary or customary gage glass is a plain cylindrical tube, ranging for ordinary use from 5/8 inches to 7/8 inches in diameter and of a length to suit the varying conditions and types of boilers. These diameters are outside dimensions. They vary slightly, but as the glasses are set in compressible washers such variation is not detrimental. They are made in this country and abroad, but those of Scotch glass are considered the best. The very nature of the material makes it brittle, and aside from its brittleness it possesses other peculiar qualities that when known should cause engineers and firemen to handle these glasses with more than ordinary care. A novice in examining a gage glass will almost immediately pronounce it defective, because of the fine lines running lengthwise in it; but such lines are usually indicative of good quality and are more pronounced in the Scotch glass than in the American.

All glasses are keenly susceptible to surface abrasions, even so minute as to be unobservable. If one receives the slightest scratch inside or out, it should not be used, and in handling or keeping them in stock, no metal of any nature should be allowed to come in contact with them. They are particularly liable to break if iron or steel touches them, and so should never be laid down even temporarily with tools, as is frequently done in preparation for a renewal.

It may sometimes be thought desirable to clean an old glass when it has every appearance of being whole and sound. In such an event waste or a cleaning cloth should be used and should be pushed through the bore by means of a wooden stick small enough to pass without force. As a rule, however, the price of gage glasses is too low to bother with the cleaning of old ones, and if one shows any deterioration at its ends, it should be discarded in any case.

In the prevention of accidents, not the least measure of importance is to have the receptacles for the glass properly attached before trying to insert it. Every one who has had occasion to put in gage glasses is familiar with the so-called gage glass "cocks," which form its support. They are not cocks, however, but valves. In some of the special types of water glass connections, cocks are used as a means of closing, but the percentage in use is very small. The valves are fitted in various ways,— sometimes directly into the boiler plate, more commonly into water columns of cast iron or those improvised from ordinary pipe and fittings. The openings to receive the valves should be parallel and threaded an equal depth, so that when the valves themselves are screwed in position the sockets in them for the reception of the glass will be in a direct line. Both top and bottom valves have these sockets bored out to a considerable depth. If the eye cannot detect the valves out of line, the glass should be inserted in them, to more clearly determine whether the valves are in true alignment or not. The glass should be cut to the greatest length that will permit its insertion, one cock or valve usually admitting it to a greater depth than the other.

In the selection of a glass, one should be used that will freely enter the valve receptacle and leave a little space around it when in position, and the nuts or glands for compressing the gaskets should be large enough not to touch the glass when screwed up. Only fresh, pure rubber gaskets or washers cut by machine, uniform in size, and prepared for such purpose should be used. After inserting the glass in the valves, it should be shifted so the washers will be at an equal distance from its ends. This is very important, for the writer in his investigations of boiler explosions has found two instances where a washer softened by the heat, under pressure of the gland, has squeezed out under the glass and closed the opening, thus permitting a false indication of the water level. The glands should first be screwed by hand, each a little in turn until they can no longer be moved by the fingers. Then a small wrench may be used on them alternately, until the glass is firm in the packing. Care should be taken that the glass does not shift in its vertical position, during this operation.

It may be needless to say that in renewing a glass with pressure on the boiler, the valves should be closed tight and the drip opened to release the pressure before attempting the removal. When a new glass has been put in, if the valves are not provided with means for opening at a distance, a board or sheet-iron shield large enough to protect one's head should be held between the face and the glass, and the valves then opened very easily and slowly to their full extent. When they are open, it is advisable to retire with the shield in front of the face to observe at a distance whether there are any leaks, and if any appear, to return to the glass with the face still protected, shut off the valves, release the pressure through the drip, and then tighten the nuts. Never under any circumstances attempt to tighten them with pressure on the glass.

In the writer's experience, he has found it possible to make the joints tight by only a slight pressure of the wrench and whenever he has found gage valves out of alignment he has trued them up. As a result of this practice during considerable experience with marine and stationary boilers never has he had a glass break under pressure.

If gage glasses are properly handled and used they will withstand great extremes of temperature, although it is well to guard against drafts from outside in cold weather. In the selection of glasses it is not necessary to pick out the ones with the heaviest walls, for those with slightly lighter walls are as strong and will last as long as the thicker ones.

The great precaution is to keep the surface from being scratched, for, as every engineer knows it requires but the slightest breaking of the skin of the glass in a circumferential way to cause it to almost fall apart. The peculiar phenomenon of the glass breaking which has lain next to iron or steel has never been explained to me, but I have a number of times as an experiment, taken a glass, run a smooth rod of iron through it and put it away. Sooner or later it has been found shattered in many pieces. My first observation of this phenomenon was when I placed a glass on a shelf in an engine room with a large pocket knife against it to keep it from rolling off. The next day I found the glass all in pieces but the pieces in their respective positions, showing that the breakage was not from violence else the pieces would have been scattered.

A Scotch Marine Boiler Explosion.

Because of the small number of Scotch marine boilers in the United States, it is comparatively rare that an explosion of one is recorded, and owing to this fact a layman often has the impression that this type is proof against explosion. That this is not the case, however, is shown by the following account of an accident to such a boiler which occurred at the plant of The Mt. Clemens Sugar Company, Mt. Clemens, Mich., on October 30, 1911. The photograph, Figure 1, gives some idea of the condition of the front of the boiler after the explosion, but the main damage was at its rear, where it was difficult to obtain a picture suitable for reproduction.

The vessel was what is known as a "wet back boiler." The general construction of such a vessel is shown by the line cut, Figure 2. The tubes and flues terminate in an internal tube sheet, "D," and communicate with a combustion chamber, "A," within the shell. The back of this chamber is formed by a sheet, "B," stayed to the rear head, "C." The space between sheet "B" and head "C" is filled with boiler water under pressure and gives the name "wet back" to the type. It was the bursting of this "wet back" and the consequent collapse of the combustion chamber that occasioned the disaster. Its initial cause was the pulling off of sheet "B" from the 172 staybolts which held it.

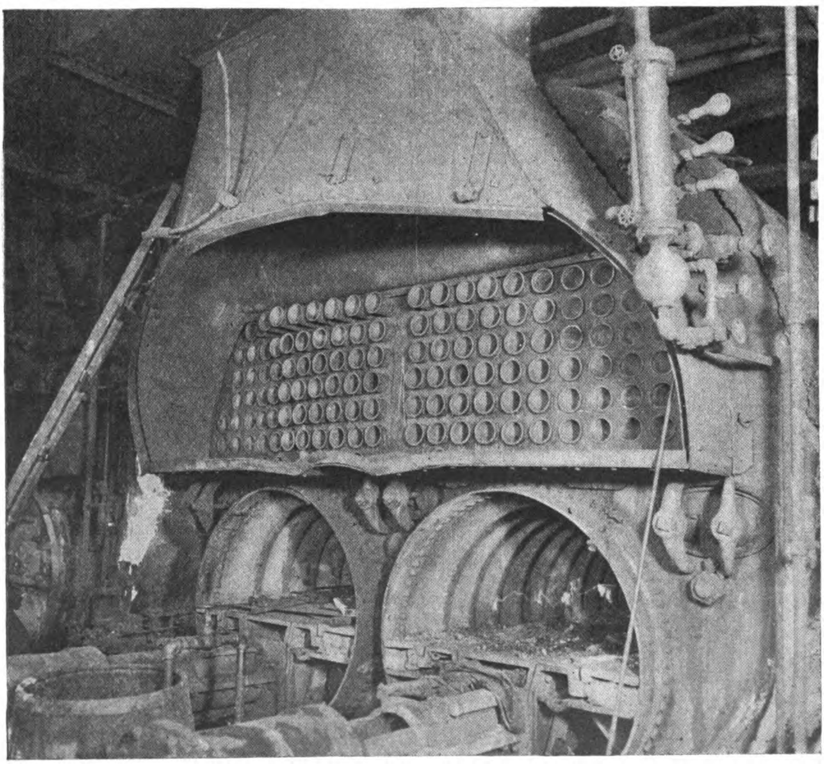


FIG. 1. DAMAGED FRONT OF BOILER.

An investigation disclosed the fact that the holding power of many of these staybolts had been greatly diminished by the buckling of sheet "B" between them, this buckling causing the staybolt holes to take a conical shape with the larger diameter of the cone on the water side of the sheet. This deformation of the holes disengaged the threads to such an extent that those remaining were unable to support the load imposed on them by the boiler pressure.

The boiler at the time of the accident was connected in line with seven others, on which all pop valves were set to 105 lbs. per square inch, so there is a reasonable certainty that the pressure did not exceed this amount. The staybolts on sheet "B" were 1⅛ inches in diameter and spaced 7¼ inches apart each way, and the sheet was 15/32 of an inch in thickness. The only

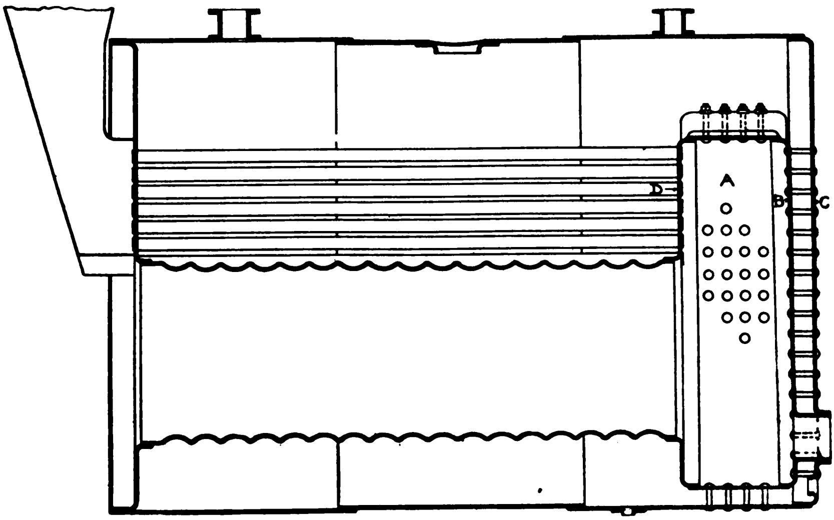


FIG. 2. SECTION OF BOILER.

plausible explanation as to how a pressure which did not exceed 105 lbs. could seriously buckle a sheet of this thickness held by stays in the manner described. is that the sheet was weakened by overheating.

From the data at hand the cause of this overheating cannot be definitely determined, but the boilers were reported clean, and if such was the case, forced driving or low water was probably responsible. Sheet "B" was thrown forward against the rear tube sheet "D" with such force that it drove a number of tubes through the front head, some of them extending as much as six inches from its face. This is shown on the accompanying view of the front of the boiler.

Three men were seriously scalded by this accident, one being so severely injured that he died shortly afterward. The property damage was chiefly confined to the boiler, with the exception of a brick wall located some distance in front, which was thrown down by the force of the explosion. The doors and hoppers of the boiler front were blown through a window twenty feet away.

An Investigation of Electrolysis in Boilers.

W. R. C. CORSON.

About a year and a half ago a case of abnormal tube pitting was brought to the attention of THE HARTFORD STEAM BOILER INSPECTION AND INSURANCE COMPANY and its assistance asked in seeking the cause and a relief for the trouble. The investigation which followed resulted in the discovery of so unexpected an electrical condition of the affected boilers that it is believed a description of it and of the apparently successful remedy which was applied will be of general interest and suggestion to those who may have steam vessels similarly circumstanced.

At first sight, the trouble appeared but the commonplace pitting which frequently occurs where a "pure water" is used for the feed, and an analysis of it promptly pronounced the water in that category. The action of such waters has been discussed at length in THE LOCOMOTIVE for June, 1896. It is here but necessary to say that it is attributed to the acids or oxidizing gases generated in a boiler from a water which does not carry alkaline salts to neutralize them. In the case in hand, tube pitting was to be expected from the "pure water," but the rapidity of the corrosion aroused the suspicion that some other influence existed to exaggerate that action and as the boilers were in the power house of an electric railway, electrolysis immediately suggested itself among the possibilities.

Now it should not be understood that those who were assigned to this investigation jumped at any conclusion thus suggested. One, at least, of these investigators (the writer admits identity) very much doubted the possibility of any such explanation. The general theory of the action of a current straying from the rails of an electric road was understood, but that it could wander into a boiler and cause any action there was not comprehensible. As THE LOCOMOTIVE once put it in doubting the responsibility of a stray current for the corrosion of an internal feed pipe, "It is hard to understand how an electric action from such a cause could take place within the closed conductor formed by a boiler shell." It was accordingly with a skeptical mind but in a spirit of thoroughness that preparation was made to investigate the electrical situation.

The boilers — three Manning vertical tubulars — were found in a power house typical of street railways of the smaller class. It was located in the rear of a car barn and repair shop which in turn fronted on the highway and main track of the railroad. In the power house a room containing the engines and dynamos was nearest the car barn, and immediately behind it the boiler room. In a rear addition a storage battery was installed for equalizing the load on the station.

Hydrants on the highway at either side of the car barn corroborated the statement of the superintendent that a water main was buried in the street and paralleled his rails for a considerable distance. These hydrants were the points selected for the first of the electrical tests. A low reading voltmeter was used and connected with one terminal in contact with the hydrant and the other with a rail. The object, of course, was to determine whether a difference of electric potential existed between these structures, and if it did, what its value was and which structure was of higher potential. The reading of the instrument fluctuated to some extent but was a maximum at about two volts, with the hydrant at the higher or positive potential. The condition thus indicated was expected, as it is characteristic of underground piping near a railway power house. The readings if anything were lower than usual, but served to show that the pipe and rail were not metallically connected in that vicinity, and that there was the tendency for a flow of electricity from pipe to rail through the earth.

In a pit near the front of the car barn access was possible to the pipe which supplied the plant with water and which appeared to branch from the main directly in front of the building. Similar tests with similar results were made between this pipe and the rails in the barn, but no sufficient length of this branch pipe was exposed to give opportunity for determining by test whether current was flowing on it or not.

Perhaps it is well here to say for the benefit of the non-technical reader that by potential is meant a sort of electrical pressure, and that where two potentials differ in value there will be — as there would be with two differing pressures of steam or air, for instance — a tendency of flow from the higher to the lower. If there is a path suitable for its conduction between such points, there will be an actual flow of current. Now a pipe, being of metal, is a suitable path for conducting electricity. If, therefore, two points on it are found at differing potentials there is clear evidence of the existence of a current in it. The tests thus far made had disclosed a difference in potential between pipe and rail, and had indicated the probability of a flow of current from the former to the latter, conceiving the ground as a suitable conducting path. It was probable that much of this current came from a distance along the structure of the water main itself, but it was essential to determine whether any flow actually existed on the branch pipe supplying the power house.

Opportunity was given by an exposed feed pipe in the engine room to make such a test and by using an instrument capable of measuring a milivolt (one one-thousandth of a volt), an indication over a short length was had that current was flowing and that it was in the direction of the street.

This was the first surprise for the investigator, for a flow in that direction meant from the boiler room, and his doubt of electrolytic action began to weaken. Further tests along the feed pipe followed — past the pumps and heater and up to the boilers. At the first of these — that in which the pitting was most aggravated — a distinct reading of nearly one milivolt was indicated between a point on its shell and the brass feed pipe near its entrance to the vessel. The instrument needle at this connection, however, was subject to frequent reversals; sometimes the shell was at higher potential, sometimes the pipe. The prevailing indication seemed to show the current flow from boiler to pipe, and the potential difference a maximum in this direction.

Then the instrument was connected between the entering feed pipe at the top of No. 1 boiler and the blowoff pipe at its bottom. The needle of the instrument swung promptly to a maximum of six milivolts and in a direction indicating that the blowoff was at higher potential. Here was certain evidence of a flow of electricity at least through the metallic structure of the boiler from its bottom to its top.

The blowoff pipes on the three boilers ran separately to a brick-lined well on the outside of the building, entering it horizontally about two feet below the surface of the ground. The ends of the pipes were well above the water in it, but from the boiler house they passed through earth which was maintained in a generally wet and conductive condition by the hot vapor with which the well was filled. Tests made by the milivolt meter between different points on the same blowoff pipe showed current flow from the well, and, while the theory was not proved, it was believed that the electricity was drawn from the earth through its wet contact with that pipe.

Here, then, existed one element of the situation which the writer had doubted. Current was wandering into and through a boiler, and that it was caused by the operation of the railway was evident from the behavior of the instrument used. Its needle, instead of remaining in any fixed and constant position, swung from one point to another as rapidly as that of the switchboard instrument which measured the current supplied to the trolley. The operation of the cars on the road accounted, of course, for the swing of the latter instrument, and it was a fair conclusion that the motion of the milivolt meter was due to the same cause. Had it been perfectly steady, a leak from the lighting wires or from the storage battery cables might have been suspected, but as it was the movement of the needle at times so exactly corresponded to the increments of current occurring when an electric car is started that one could note the steps of the operation as the motorman moved the handle over the controller. However, to be on the safe side, the run of all wires and of the cables from the battery were carefully looked over in an effort to locate any leaks which might reach the boilers and none was found.

It was clear from these tests, then, that an unexpected and unusual electrical condition existed in the boilers. But something unusual was necessary to explain the rapidity of the tube pitting, and so in spite of previous skepticism and present perplexity, the probability of a connection between the one situation and the other had to be admitted. It was still difficult to see how electrolysis "could take place within the closed conductor formed by a boiler shell," but it had been equally difficult to understand how a stray current from the rail could reach the boiler and that seemed to be a proven fact.

It had been shown by the tests that a difference in potential existed between not only the extreme pipe connections, but also between one of them and the boiler shell. Other tests showed similar differences of greater or less value between the other pipe and the shell and even between the pipe and its blowoff cock. The instrument readings were much higher in every case for the No. 1 boiler, but the same general situation was indicated on all three. Of course, these differences were most minute, but it began to be clear that if similar conditions existed in the internal structure of the boiler, the current which produced them might be an influence in the corrosion.

It has been stated that a difference in potential on a conductor is evidence of a flow in it. It is now best to further explain that the magnitude of this difference will depend on two conditions, viz., the amount of current flowing and the resistance offered to its flow by the conductor on which the difference is measured. A small current on a conductor of high resistance may produce a potential difference as great as that of a large current on a conductor of low resistance. This broad statement of these relations seems necessary to explain the reason for an experiment which the situation next suggested.

A piece of trolley wire of No. 0000 gage was bound and soldered at its one end to the feed pipe and at the other to the blowoff pipe of No. 1 boiler. If the difference of potential previously existing between these two pipes was due to a large current flowing over a comparatively low resistance in the boiler structure, the connection of this wire would have little or no effect, for it would not have influenced the amount of current, and its cross section was so small compared with that of the metal in the boiler that even though of superior conducting material it would but to a small degree reduce the total resistance. On the other hand, if the original potential difference was due to a small current traversing a comparatively high resistance, perhaps due to the various joints and seams of the vessel or the water in it, then the relative improvement of the path by the addition of the wire might be marked. The result proved that the latter situation was the case, for the bond formed by the trolley wire reduced the potential difference between the pipes to practically zero, the instrument needle moving perceptibly, but not enough to determine a value.

Strangely enough, however, the small reversing potential difference which was noted as existing between the boiler shell and the feed pipe did not seem to be affected by the connection. It remained in fact and was clearly indicated by the instrument after the power house had ceased operation for the night, and when all lights were turned off and the storage battery disconnected from its circuit. The only explanation offering was that it was due to galvanic action between the feed pipe, which was of brass, and the steel of the boiler.

Now this paper is more in the nature of a narrative of an investigation than an explanation of the phenomena discovered. It is not difficult to form a probable theory to account for current through the boiler, but to demonstrate it would require more space than is here available. There was such a current undoubtedly, but it may not be so assuredly stated that it by electrolysis produced corrosion. The further investigation showed that the boilers had accumulated a mass of magnetic oxide scale, and that oxide was in evidence at every hot water drip and leak. This substance was not only indicative of the action of acids in the boiler, but by its accumulation there, under the action of the heat, produced further oxidization of the metal parts. It did — and does now — seem probable, however, that there existed the elements essential to electrolytic action — water more or less acid for an electrolyte and metal parts of differing potentials for the electrodes — and that, therefore, there was cause for suspecting such action as an influence in this trouble.

Accordingly, it was recommended that for a time, at least, the wire bond which had been connected as an experiment be allowed to remain. Other remedial measures were also suggested, such as the thorough cleaning of the boilers and the neutralizing of the water in them by the use of soda ash. For while it was appreciated that if all were applied it would be impossible to determine from a resulting improvement which of the remedies had been most effective, it was thought more important to take every measure of protection at once. Those in charge of the boilers, however, apparently had a greater confidence in the wire bond, and took the responsibility of ignoring the other suggestions. That this confidence seems to have been justified by the result is indicated by the following quotation from a letter recently received from the superintendent of the railroad: "The bond which you put in between the blowoff and feed pipe still remains, and as we have had no more trouble from pitting would say the trouble was due to electrolysis. We ran the boiler from August, 1910, [the time of the investigation] until September, 1911, without repairs. Since that time the boiler has been shut down."

Now the facts stated in this quotation may not, perhaps, seem sufficient evidence to justify the superintendent's conclusion as to the responsibility of electrolysis. Taken with the other circumstances they would seem, however, to indicate a strong probability that such action occasioned the trouble. It is because of this probability, rather than of any positive conclusion, that it is hoped that this description may be suggestive to those who operate steam vessels under similar circumstances.

What's in a Name?

In our long service to the public as specialists in boiler inspection, we have become so familiar with a common form of repair used on return tubular boiler shells, and known as a "Horseshoe Patch," that we have felt we knew all about the matter. Probably many of our inspectors have assumed on account of their experience, that they know perfectly well how the name of such patches was derived, and have considered that the usual shape was the connection that linked the name with that of the metal protection usually attached to the hoof of the noble steed which has served mankind for generations past. It will doubtless be a great surprise to our other friends, as well as to our inspection force, to learn that the relation between the two is much closer than would be indicated by this reasoning. The discovery of the remarkably intimate connection between the name of the patch and the horseshoe was recently made by one of our representatives who was traveling in the south. He was riding on a train in Alabama, and with his head on the back of the car seat, was dozing and dreaming that he had discovered a new material for boiler shells of 100,000 lbs. tensile strength, and as ductile as gold, which would resist corrosion and all other ills to which boiler material is subjected, and that would also pass all state boiler laws, when he was rudely awakened by the sudden stopping of the train. He rubbed his eyes, and looking out of the car window discovered that he was at York; but there were many things missing beside the "New" that indicated he was not near Broadway. However, his eyes finally rested on a sign painted in large letters over the entrance of a brand new one story shop which interested him at once. This sign clearly illustrates how really intimate is the connection between the horseshoe and the boiler patch. The sign was as follows:

YORK BLACKSMITHING CO.

REPAIRS

WAGONS, BUGGIES, BOILERS, ENGINES.

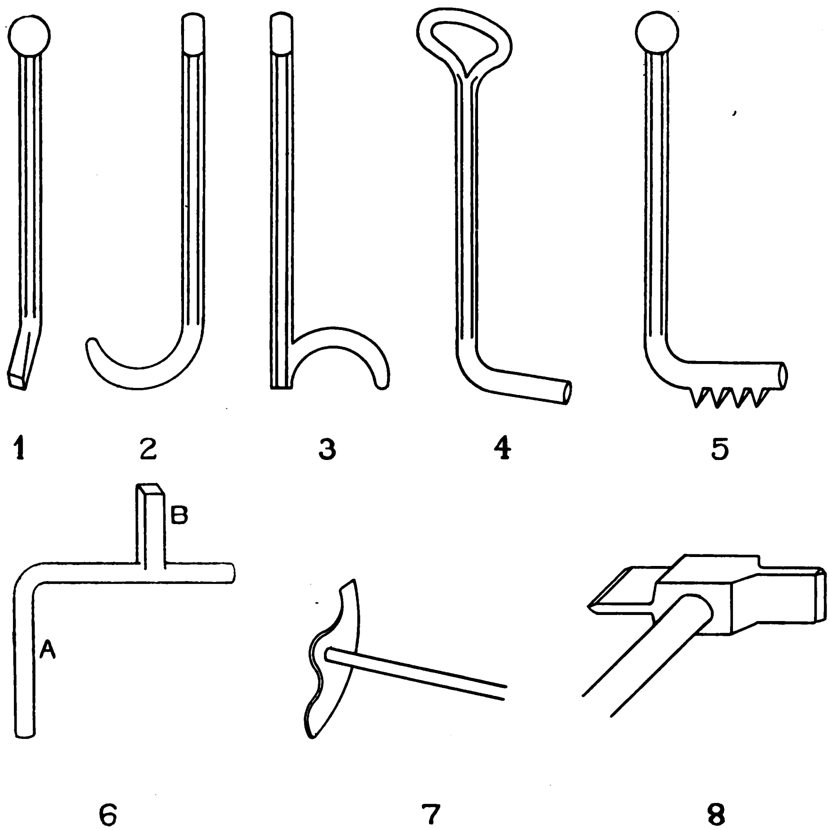
HORSEHOEING A SPECIALTY.

It is evident that the department store idea has penetrated every section of the country and many lines of business. For years past we have been thoroughly familiar with the department store methods used in the insurance field, and aside from the fact that we are not so accustomed to seeing it, the sign given above is not more incongruous than those of our competitors who advertise boiler and flywheel insurance along with an assortment of bonding, liability, accident, plate glass and burglary insurance. Reads like the description of a soup bunch purchased by the frugal housewife, doesn't it?

TOOLS FOR CLEANING BOILERS.

J. W. Hubbard, Inspector.

Much has been published in the mechanical press regarding the need of keeping boilers clean, but aside from descriptions of patented devices, little has been told of the forms of implements suitable for the purpose of cleaning. On account of the lack of information on this subject, many boiler operators are not familiar with the tools which experience has shown to be well suited to the purpose and they are so easily fashioned by a blacksmith that they should be readily procured anywhere.



Cleaning Tools.

The tools described here are not new and doubtless many engineers are thoroughly familiar with them, but they are described with the hope that more engineers may become acquainted with them and learn of their usefulness in keeping their boilers clean and free from scale.

Tool No. 1 is of general utility. The amount of angle near the point and the length of the handle can be varied to meet the requirements of each particular case. The chisel point should be ground sharp and tempered hard. The knob on the end forms a convenient handle, and adds weight to the tool at a point that makes its use effective. The knob should be left soft so that if there is occasion to use a hammer on it, the eyes of the operator will not be endangered by flying particles. All portions of the tube sheet, with the exception of the small surfaces on it between vertically adjacent tubes, can usually be reached for cleaning with this tool. One-half inch hexagonal steel is the proper size stock of which to form this implement.

Tools represented by Nos. 2, 3, and 4 are scrapers for removing the scale from the tubes and should be made of one-half inch hexagonal stock. Nos. 2 and 3 should be sharpened on the concave edges and No. 4 on both edges. By leaving off the loop handle on No. 4 and forming it of five-eighths inch steel, the cutting edge can be driven along the tops of the different rows of tubes against the head, breaking down a part of the scale which cannot be reached by No. 1. With one edge formed, as illustrated in No. 5, it is especially effective for this use.

Tool No. 6 may be used for breaking away heavy scale that may bridge the horizontal space between the tubes away from the heads. This is inserted in the vertical space between the tubes and is turned by the handle "A," which carries the projecting end "B" around in a horizontal plane and forces out the scale between the tubes. The leg "B" should of course be made of such size that it will pass easily between the tubes at points where no scale is adhering.

No. 7 is a convenient form of hoe, for removing loose scale or deposit from the bottom of the shell of horizontal tubular boilers. This tool is particularly convenient for this purpose where the boiler is only provided with a hand-hole communicating with the portion of the shell below the tubes. The points of the blade are cut away so that they may pass under the lower tubes at the side of the boiler and the edge of the blade is made to conform to the curvature of the boiler shell. This latter requirement is important, in order to make the use of this tool effective. The handle should be made of three-quarters inch pipe and the blade of one-quarter inch plate steel. The hole in the blade for the attachment of the handle should be tapped and the pipe screwed into it and held fast with a jam nut. If the space in front of the boiler is sufficient, it is preferable to have the handle of this hoe made of one piece of pipe, but if this is not practicable, it may be made of two or more pieces as required. When working with this hoe, it is often convenient to tie on the handle near the blade a small piece of waste saturated with oil, setting this on fire to light up the interior of the boiler in order to see where to reach for loose material.

A hammer of the type illustrated in No. 8 is very useful for cleaning plates, but for jarring the scale loose from the tubes a flat-faced hammer should be used.

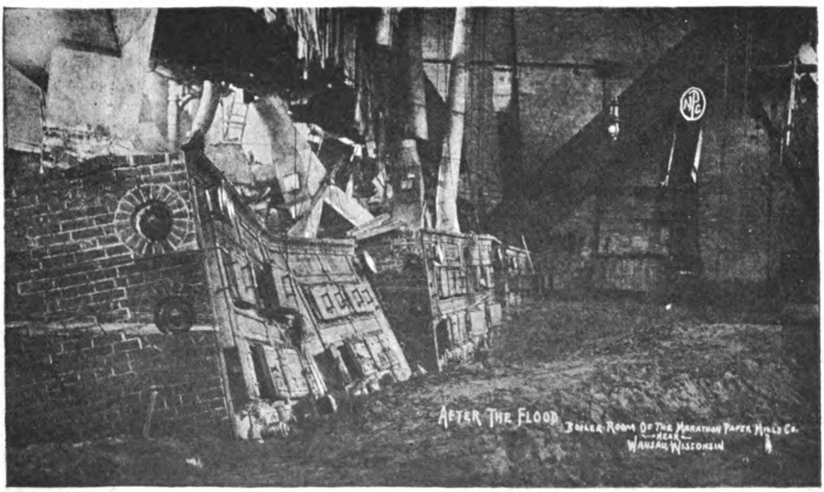
There are, of course, cases where the thorough cleaning of a boiler is impossible owing to either the hardness of the scale or inaccessibility due to design. Boilers in which the tubes are staggered or having poorly designed through bracing above the tubes or in which the tubes have been carried too far down, making the space below them cramped, are inaccessible for cleaning. In boilers of such design where the scale produced is hard, as is the case where the feed water contains sulphate of lime, it is practically impossible to properly clean them and as a consequence both safety and economy are affected.

The use of such boilers where the feed water supplied is necessarily bad. can only be attributed to lack of care or judgment on the part of those responsible for their installation.

In using the tools here illustrated or any others for a similar purpose, the greatest care should be exercised that the tubes or other portions of the boiler are not injured in the process of cleaning.

A Boiler Disaster From High Water.

The accompanying illustration shows the condition in which the boiler plant of the Marathon Paper Company was left by a flood of the Wisconsin River, on which at Wausau, Wisconsin, that company's mill is located. Unusually heavy rains in the early part of last October had caused high water in all the streams of that neighborhood, and on the sixth of the month the Wisconsin had burst its banks and overflowed the Marathon Company's property, cutting new channels between its buildings, and as it developed, undermining the boiler foundations. Late in the afternoon of that day, before the water had reached the boiler room floor and while steam was still maintained, an initial settlement occurred in the end one of a battery of six boilers. This caused a break in a feed pipe by which three of the attendants were seriously scalded. Soon after. the water invaded the room and operations had to be suspended. At 8:30 in the evening the foundation completely collapsed at the rear, wrecking the



WRECKED BY A FLOOD.

settings and steam piping and tipping the boilers on end as shown in the photograph.

These pages have frequently described the circumstances of a wrecked steam plant, the cause of which was attributed to low water, but it is quite a novelty to record in them a case such as this, where the opposite condition must be held responsible for the misfortune.

Another "Maine" Explosion.

It seems incredible that a foreign government should acquire its munitions of war from among the revered relics of a friendly nation, but that such has been the case at least in one instance, would appear probable from an account of a serious accident published by our English contemporary *Vulcan*. According to that paper, a working party at the Portsmouth (England) Dockyard was engaged in testing "a compressed air cylinder used for propelling torpedoes" when it burst "with a terrific report," killing or injuring eight men. The article continues: "At the inquest the evidence showed that the cylinder was not of the pattern generally used, but was of American make, and evidently came from the hospital ship *Maine*, which formerly belonged to the American Navy." No comment is made on this extraordinary circumstance, but perhaps as a warning to other pilferers of our national souvenirs it is added that the verdict of the jury recommended "the disuse of American cylinders." *Hospital ship, indeed!*

Boiler Room Card.

THE HARTFORD STEAM BOILER INSPECTION AND INSURANCE COMPANY has recently published in condensed form a set of suggestions for the care and management of steam boilers under the title, "Boiler Room Card." As its name implies, this sheet is intended for framing or other mounting, so that it may be hung in the boiler room for the ready reference of the attendants. The "suggestions" cover broadly conditions of maintenance and preservation as well as of safe operation of steam vessels used for power, and embody methods which an extended experience has approved as best practice. They are legibly printed in short paragraphs with prominent captions, so that reference to any particular condition may be easily made.

The Boiler Room Card is, of course, published primarily for the benefit of its policy-holders to whom it is being distributed, but in the belief that it will prove of great value in every plant where boilers are used for power, the Hartford company is glad to furnish copies free to any bona fide boiler owners who will apply for them. If you have not already received one, address the Company at *Hartford, Conn.*, and ask for the "Boiler Room Card," stating in your communication the number and pressure of the boilers you own and where they are located.

Boiler Explosions.

October, 1911.

(376.) — A hot-water boiler burst, October 1, in a "Cafeteria" at Los Angeles, Calif. Two persons were injured and property damaged to the extent of about $500.

(377.) — On or about October 1, a boiler exploded at Mercer's mill, on the Suwanee river, near Branford, Fla. No one was injured.

(378.) — On October 2, a tube ruptured in a water-tube boiler at the Passaic River & Coal street plant of the Public Service Corporation of New Jersey. One man was scalded and died the following day. The property damage was small.

(379.) — A boiler exploded, October 2, in a confectionery store at Sutherland, Iowa. Three persons were injured and machinery and buildings were damaged.

(380.) — A number of cast-iron headers fractured, October 3, in a water-tube boiler at the Louisville Gas Co.'s plant, Louisville, Ky. Considerable damage was done to the boiler.

(381.) — A boiler in the butcher shop of J. A. Spaughy at Postville, Iowa, exploded October 6. Three persons were injured.

(382.) — A boiler ruptured, October 6, at "Waverly Hall," an apartment house at 115 Mount Auburn street, Cambridge, Mass. The damage, which was small, was confined to the boiler.

(383.) — On October 6, a boiler exploded in a school-house at Clark's Summit, Pa.

(384.) — A boiler exploded, October 6, in the Astoria apartment house, Brooklyn, N. Y.

(385.) — A sawmill boiler exploded, October 7, near Waynesburg, Ky. The engineer was instantly killed and several other persons injured.

(386.) — A blow-off pipe failed, October 7, at the Cisco Oil Mill, Carbon, Texas. One man was injured.

(387.) — A small water heater exploded, October 7, in the basement of the residence of M. C. Phillips, Oshkosh, Wis. The heater was practically demolished and considerable damage was done in the basement. No one was injured.

(388.) — A boiler exploded, October 8, in the Thirteenth avenue fire engine house, Oakland, Calif. No person was injured but the fire engine horses were thrown to the ground and the building was damaged.

(389.) — The boiler of a threshing engine exploded, October 8, on William Allen's farm, near Franklinville, N. Y. Mr. Allen was struck by a part of the boiler plate and was thrown about thirty feet. He was seriously but probably not fatally scalded. One other man was slightly injured.

(390.) — On October 9 an accident occurred to a boiler at the Citizens' Ice Co., Oswego, Kansas. The damage was small.

(391.) — The boiler of a locomotive engine exploded, October 10, in the roundhouse of the Los Vegas & Tonopah railroad, at Goldfield, Nev. One man was seriously injured and the roundhouse was wrecked.

(392.) — On October 11 a hot-water heater exploded in the basement of a two-flat building at 5042 Fulton street, Chicago, Ill. Three persons were injured.

(393.) — A valve on a blow-off pipe ruptured, October 12, at the plant of the Michigan Bolt & Nut Co., Detroit, Mich. One man was killed.

(394.) — The boiler of a locomotive on the Louisville & Nashville railroad exploded, October 12, near Knoxville, Tenn. Train Master H. M. Brownlee, who was riding in the engine cab, received scalds which caused his death the following day.

(395.) — A hot-water boiler exploded, October 13, in the residence of E. Augustus Rine, Caldwell, N. J. No one was injured.

(396.) — On October 13 a boiler exploded at the plant of the National Refining Co., Marietta, Ohio, causing large damage to property.

(397.) — A tube ruptured, October 13, in a water-tube boiler at the plant of the Consumers' Hygeia Ice Co., Union Hill, N. J. Three men were injured.

(398.) — A boiler exploded, October 13, in the Stack Block, Lestershire, N. Y., causing a property damage of $200.

(399.) — On October 14 a number of cast-iron headers fractured in a water-tube boiler at the North Delaware avenue power station of the Philadelphia Rapid Transit Co., Philadelphia, Pa.

(400.) — A blow-off pipe failed, October 14, at the Day Chemical Co.'s plant, Westline, Pa. One man was scalded.

(401.) — A cast-iron header ruptured, October 14, in a water-tube boiler at the plant of the American Steel & Wire Co., Waukegan, Ill.

(402.) — One man was severely scalded, October 15, by an accident to the boiler of the tugboat *John Mahar,* at Fulton, N. Y.

(403.) — On October 16 a tube ruptured in a water-tube boiler at the Joseph H. Bromley plant, Philadelphia, Pa.

(404.) — On October 19 one or more boiler tubes blew out on the torpedo boat *Wilkes.*

(405.) — A boiler ruptured, October 19, at the plant of Wm. Goodrich & Co., linseed oil manufacturers, Milwaukee, Wis.

(406.) — On October 20 a boiler exploded in the cellar of the Greenwich Cold Storage Co., Greenwich street, New York City. The boiler, which was located beneath the sidewalk, was blown some distance from its original position, breaking ammonia pipes, a gas main and a high pressure water main, and damaging the Ninth avenue elevated structure. Eight persons were more or less severely injured and the property loss was estimated at $30,000.

(407.) — The boiler of a locomotive engine exploded, October 22, on the Chicago, Milwaukee & St. Paul railroad, at North Homan and Grand avenues, Chicago, Ill. Four men were injured, one of them seriously.

(408.) — On October 22 three tubes ruptured in a water-tube boiler at the planing mill of the Cole Mfg. Co., Memphis, Tenn. The boiler was considerably damaged.

(409.) — A boiler tube burst, October 22, on the torpedo boat *Tingey,* while the vessel was off Charleston, S. C., proceeding to Hampton Roads, Va. One man was killed and another badly scalded.

(410.) — A boiler exploded, October 23, at the Sterling Sugar Refinery, Franklin, La. One man was seriously burned.

(411.) — On October 23 a boiler tube burst on the ferryboat *Peerless,* at Delta, La. One person was killed and seven others injured.

(412.) — A tube ruptured, October 26, in a water-tube boiler at the Guthman Laundry & Dry Cleaning Co.'s plant, Atlanta, Ga. Two men were injured.

(413.) — A cast-iron header ruptured in a water-tube boiler, October 27, at the Utah-Idaho Sugar Co.'s plant, Salt Lake City, Utah.

(414.) — The boiler of a traction engine. belonging to C. Anderson, exploded, October 27, near Waupun, Wis. Two men were severely injured.

(415.) — On October 28 a tube ruptured in a water-tube boiler at the State Hospital for Insane, Athens, Ohio.

(416.) — A boiler exploded, October 28, at the Hintze greenhouses, Fond du Lac, Wis. Damage to property was estimated at $2,000.

(417.) —The boiler of a locomotive on the Trinity & Brazos Valley railroad exploded, October 28, near Karen, Texas. Three men were killed.

(418.) — On October 30 a boiler exploded on the Pure Oil Co.'s steamer No. 5, at East Newark, N. J. One person was killed and five others were injured, three of them fatally.

(419.) — A boiler tube blew out, October 30, in the plant of John Diebold & Sons, Louisville, Ky. No one was injured.

(420.) — On October 31 a tube ruptured in a water-tube boiler at the sugar house of the St. Joseph Planting & Mfg. Co., Feitel, La.

(See also No. 427.)

(421.) — On October 31 the boiler of locomotive No. 852, on the Wabash railroad, exploded near Riverton, Ill. The engineer was killed and the fireman and head brakeman severely injured. The property damage was estimated at $10,000.

(422.) — The boiler of a freight locomotive on the Pennsylvania railroad exploded, October 31, at Elizabeth, N. J. Three men were severely injured.

(423.) — On October 31 a boiler exploded on the premises of Walter Oderwald, Clifton, Ill. One person was seriously injured.

November, 1911.

(424.) — The boiler of a freight locomotive exploded, November 1, on the Pennsylvania railroad near Lima, Ohio. Three men were seriously injured.

(425.) — A boiler exploded, November 1, at the plant of the Mt. Clemens Sugar Co., Mt. Clemens, Mich. Three men were seriously injured, one of whom has since died.

(426.) — A heating boiler exploded, November 1, in the basement of the high school at Niagara Falls, N. Y. One man was seriously and another slightly injured.

(427.) — On November 2 a tube ruptured in a water-tube boiler at the sugar house of the St. Joseph Planting & Mfg. Co., Feitel, La.

(See also No. 420.)

(428.) — A locomotive boiler exploded, November 3, on the premises of the W. R. Pickering Lumber Co., Pickering, La. One man was injured.

(429.) — A cast-iron elbow of a blow-off pipe failed, November 3, at the flax spinning mill of Smith & Dove Mfg. Co., Andover, Mass. One man was fatally injured.

(430.) — On November 4 a section cracked in a cast-iron heating boiler in the hotel of Rafter & Co., Nevada, Mo.

(431.) — The explosion of a small vertical boiler, November 4, at Zincite, Mo., near the Lincoln mine, seriously injured one man.

(432.) — A heater exploded, November 4, at 359 Massachusetts avenue, Indianapolis, Ind. One person was injured.

(433.) — A boiler belonging to the Standard Oil Company exploded, November 5, at St. Paul, Minn., causing a property loss of $150.

(434.) — A boiler flue failed, November 5, on the Cauvel farm, near Oil City, Pa. No one was injured.

(435.) — A boiler flue failed, November 6, on the Cauvel farm, near Oil City, Pa. One man was severely burned.

(Items Nos. 434 and 435 refer to the same boiler, the two accidents occurring on two consecutive days. After the first accident the boiler flue was repaired and the boiler again put in service, with the result noted.)

(436.) — A locomotive boiler exploded, November 6, on the Baltimore & Ohio railroad, at Brooklyn Junction, W. Va. Two persons were seriously injured.

(437.) — A tube ruptured, November 6, in a water-tube boiler at the plant of the Southern Iron & Steel Co., Alabama City, Ala.

(438.) — A boiler owned by W. N. McCann exploded, November 6, at St. Joseph, Mo. The property damage was estimated at $3,000.

(439.) — A boiler tube failed, November 6, in the power house of the Consolidated Company, Charleston, S. C. No one was injured.

(440.) — On November 8 a tube ruptured in a vertical boiler at the Oak Park Power Co.'s plant of the General Motors Company of Michigan, Flint, Mich. The boiler was used in connection with a producer gas plant. Considerable damage was done to the boiler and surrounding property.

(441.) — A Pennsylvania railroad locomotive boiler exploded, November 8, at Worthington, Ill. One person was seriously injured.

(442.) — A tube ruptured, November 8, in a water-tube boiler in the basement of the "Ellicott Square," one of the largest office buildings in Buffalo, N. Y. One man was scalded. (See item No. 444.)

(443.) — The boiler of the locomotive drawing the St. Louis & San Francisco railroad's fast train, "Meteor," exploded, November 9, near Fort Scott, Kans. The engineer and fireman were killed.

(444.) — On November 10 a tube ruptured in a water-tube boiler in the "Ellicott Square" office building, Buffalo, N. Y. Arthur Brady, a boiler maker, was killed, John Schrott, a boiler maker, and Bard Leavitt, an inspector for The Hartford Steam Boiler Inspection & Insurance Company, were severely scalded, Schrott dying a few days later.

(See Item No. 442.)

(445.) — On November 10 a boiler ruptured at the American Terra Cotta & Ceramic Co.'s plant, Terra Cotta, Ill.

(446.) — The boiler of the forward locomotive of a double-headed freight train exploded, November 11, twenty miles west of Lynchburg, Va., on the Norfolk & Western railroad. One man was killed, one critically scalded, and several other persons received minor injuries.

(447.) — A cast-iron heating boiler exploded, November 12, at the residence of Eber Downs, Kewanee, Ill. No one was injured.

(448.) — A blow-off pipe failed, November 13, in the hothouse of Hoerber Brothers, Des Plaines, Ill. Two men were slightly scalded.

(449.) — On November 13 a tube ruptured in a water-tube boiler at the Glen Allen Oil Mill, Glen Allen, Miss. One man was scalded.

(450.) — On November 15 three sections of a cast-iron heating boiler fractured at the Masonic Temple, Greenville, S. C.

(451.) — Four men were fatally scalded, November 16, by the bursting of a boiler tube in a boiler owned by Scott Brothers, canal contractors. The boiler was in use on the Seneca River section of the barge canal, near Seneca Falls, New York.

(452.) — A boiler exploded, November 16, on dredge No. 3, of the Fitzsimmons & Connell Dredge & Dock Co., at Madison street bridge, Chicago, Ill. Four men were slightly burned.

(453.) — On November 19 a mud drum, attached to a boiler, ruptured on the sugar plantation of the Estate of H. C. Minor, Houma, La.

(454.) — The boiler of the locomotive of the Overland Limited on the Union Pacific Railroad exploded on the morning of November 20 near Rawlins, Wyo., severely scalding the engineer and fireman.

(455.) — A heating boiler exploded, November 21, in St. James' Parish School, St. Louis, Mo. No one was injured.

(456.) — The boiler of a Big Four locomotive exploded, November 22, near Fortsville, Ind. Three trainmen were seriously injured.

(457.) — A tube ruptured, November 27, in a water-tube boiler at the Inman Mills, Inman, S. C. The fireman was injured.

(458.) — A boiler on the farm of Oliver Launstein, at Owosso, Mich., exploded, November 27. Mr. Launstein was painfully but not seriously injured.

(459.) — The boiler of a locomotive exploded, November 29, while standing in the yards at Creston, Ill. The engineer was badly burned and the fireman sustained slight burns and scalds.

(460.) — Two boilers exploded, November 29, in the Lower Merion Y. M. C. A. building, Ardmore, Pa. No one was seriously injured but the property loss was estimated at $5,000.

(461.) — On November 29 the boiler of a locomotive on the Lake Erie, Alliance & Wheeling railroad exploded, near Wattsville, Ohio. The engineer was seriously injured and the firemen was badly scalded.

(462.) — The boiler at the gin of C. L. Davis, near Bonham, Texas, exploded, on or about November 30. No one was injured. Damage to property was estimated at $1,800.

The record of boiler explosions for December, 1911, and the summary and statistics of such disasters for the past year, which have previously found a place in the January issue, will appear in that for April, 1912. The verification of the latest explosions and the compilation of the complete data would cause a delay in the current number which we believe unadvisable.

The Locomotive of The Hartford Steam Boiler Inspection and Insurance Co.

HARTFORD, JANUARY. 1912.

SINGLE COPIES *can be obtained free by calling at any of the company's agencies.*
Subscription price 50 cents per year when mailed from this office.
Recent bound volumes one dollar each. Earlier ones two dollars.
Reprinting of matter from this paper is permitted if credited to
THE LOCOMOTIVE OF THE HARTFORD STEAM BOILER I. & I. CO.

We call attention to the enlarged title appearing on this, the first number of a new volume. The old familiar name of the periodical is retained, but incorporated with it is also the name of the institution responsible for its publication. This change from the shorter title of the past forty-four years is symbolic of our desire and purpose that hereafter THE LOCOMOTIVE shall be more closely identified with THE HARTFORD STEAM BOILER INSPECTION AND INSURANCE COMPANY and more representative of the activities of that corporation and of its views on the mechanical and insurance conditions essential to the protection of power apparatus.

The reason for the purchase of protection against loss from damages for personal injury in a boiler insurance contract, by the holder of a liability policy, obviously is to supplement the protection afforded by the latter in those cases of serious boiler disaster for which the liability policy limits may prove insufficient or inapplicable. It cannot be with any desire to assist the liability company by contributions from other insurance in the settlement of claims that such purchaser expends his money in additional premiums; and yet when he selects a boiler policy in which the personal injury insurance is made to contribute proportionately with the liability insurance, he may be defeating his very purpose and be practically reinsuring the liability risk in a manner which leaves himself not fully indemnified for personal injury claims, although with an unconsumed balance of liability insurance. Moreover, for the minor boiler accidents, such as tube, blowoff pipe, and water glass explosions, the limits of the liability policy alone would generally afford ample protection, without in any way diminishing the amount of liability insurance in force for future accidents; for while liability insurance policies limit the amounts payable for injuries or death of one person, or of several persons hurt in one accident, there is no limit to the number of persons or accidents covered and thus no limit to the amount the liability insurance company might have to pay during the term of its policy. On the other hand, steam boiler policies necessarily insure for a definite amount to cover all accidents during the period for which the policy is in force, and what is paid on one accident is deducted from this amount. Thus every time the boiler insurance is called upon to help the liability insurance company settle a loss, the boiler explosion protection that the assured has paid for is diminished for the benefit of the liability company, without any compensating benefit to the assured for the depletion of his insurance against subsequent loss from boiler explosions.

This situation is due to the provisions commonly incorporated in each form of contract that where other insurance is applicable the assured cannot recover a larger proportion of the loss under one policy than the insurance available under it bears to the total available under all policies. Such has been the commonly adopted provision of boiler policies.

The Hartford Steam Boiler Inspection and Insurance Company, realizing this deficiency in the older forms, has recently put out an improved contract which in addition to the usual indemnity against property loss, affords insurance against loss from death and personal injury in a manner which, while as fully as any other protecting the assured where no liability policy exists or where it is inadequate or inapplicable, does not force contributions from the assured's boiler insurance to the liability company's losses.

A complete discussion of this whole matter has been made by President Brainerd and published by The Hartford Steam Boiler Inspection and Insurance Company in a pamphlet entitled "The Excess or Non-Contributing Form of Policy versus The Concurrent and Contributing Forms." Every steam user who protects himself both by boiler and liability insurance should read this pamphlet and carefully consider its contents. It may be obtained from any of the offices of the Company, which are listed on the last (cover) page of this issue.

From time to time, we are asked for an opinion as to the relative responsibility of owner and tenant, with regard to the explosion of a boiler. As a general proposition, if, after the explosion, it can be shown that the boiler was in excellent condition, but care and management were bad, the tenant would be held liable. On the other hand, if, after the explosion, it can be shown that the care and management were excellent, but the design and construction of the boiler poor, the owners might be held, but it is one of those cases which depends entirely upon circumstances, which circumstances are brought out by the explosion, and cannot be predicted beforehand.

As a concrete case report No. 642 to the Secretary of the British Board of Trade is of interest. That report describes the explosion of a boiler in a corn mill, caused by the wasting of the shell plates due to corrosion. The Court blamed the owner for neglecting to have the boiler examined and he was ordered to pay. The tenant was blamed for neglecting to ensure that the boiler was working under safe condition, and he also was ordered to pay.

It is safe to say, therefore, that for full protection of both the owner and the tenant, the interest of each should be covered by a boiler policy.

No good business man would make a loan on property which was not protected by fire insurance, yet loans are made on property containing steam boilers, where no insurance protection against their explosion exists. This too in the face of the obvious fact that the effect of a boiler explosion is immediate and almost instantaneous with the event itself, while with a fire subsequent to its discovery efficient measures may be taken to minimize the resulting loss.

One explanation why boiler insurance is not carried in such cases lies in the mistaken idea that after a boiler explosion, fire will likely ensue, and the total loss will then be collectible from the fire insurance companies. This is not the case, however. A fire policy takes hold where the boiler policy leaves off, so that if a boiler explodes in a building which was worth say, $50,000, and if after the explosion the building because of its wrecked condition is worth but $4,000, the latter amount only would be collectible under a fire insurance policy for a fire which completed the destruction.

This is a matter which should receive the attention of bankers and others who, though not owning steam plants, may loan money on them. They should see that the property which secures the loan is itself secure from the effects of a boiler disaster by adequate insurance under a steam boiler policy.

Obituary.

Benjamin F. Cooper, late Chief Inspector of THE HARTFORD STEAM BOILER INSPECTION AND INSURANCE COMPANY, at Cincinnati, Ohio, died suddenly of heart failure in that city November 1, 1911.

Mr. Cooper was born in Kenton County, Kentucky, in 1844. Prepared by a good common school education and an apprenticeship to the machinist trade, he early took up the work of a stationary engineer. In this he became most proficient and held many important engineering positions. In 1883 he entered the service of the Hartford company at Cincinnati, and in 1909 received his appointment as Chief Inspector of that department.

Mr. Cooper served during the Civil War from 1862 to 1865 as a private in the 4th Ohio Cavalry, and ever after remained a loyal comrade of his associates in that great struggle and a zealous member of the Grand Army of the Republic. He was prominent in Masonic circles and held in high esteem for his many sterling qualities of heart and mind by a broad circle of friends and associates. Many of our assured, who have benefited by consultation with Mr. Cooper on matters pertaining to their steam plants, and who have thus come to know the value of his advice and his carefully formed opinion, will feel with the Hartford company that in his death has been lost a good friend, a painstaking official, and a conscientious adviser.

Mr. Cooper was buried with the honors of the Grand Army of the Republic by his comrades of the Cincinnati local post. He is survived by two sons, Cassius G. Cooper of Chicago, and Frank P. Cooper of Cincinnati.

Personal.

THE HARTFORD STEAM BOILER INSPECTION AND INSURANCE COMPANY regrets to announce that Allan D. Risteen, Ph.D., who for the last twenty-three years has been in the service of the Company as Assistant Editor and Editor of "THE LOCOMOTIVE," has severed this connection. Dr. Risteen is an expert mathematician and a versatile writer and lecturer in other branches of science. He has been a contributor to many technical journals and encyclopaedias and has now in course of preparation a new encyclopaedia of his own, covering in condensed form the fields of history, literature, and science. His articles in THE LOCOMOTIVE have been highly regarded from an academic as well as a practical standpoint, and have been a potent influence in obtaining for that paper a place of merited appreciation in the libraries of the higher technical schools and colleges.

In leaving the "Hartford" Dr. Risteen bears with him the high regard of its officers and of his associates and the sincere good wishes of all for his future success and happiness.

In December, 1911, Walter Gerner was appointed by THE HARTFORD STEAM BOILER INSPECTION AND INSURANCE COMPANY, Chief Inspector at its Cincinnati office, vice Benjamin F. Cooper, deceased.

Mr. Gerner's early career was largely connected with the sea, during which he advanced through the several grades of marine engineering to that of chief engineer of trans-Atlantic vessels, including in the duties of the latter position the supervision of construction and repair of the vessels of the line with which he was connected.

During his service with this Company, Mr. Gerner has acquired a broad experience with inspection work in field, shop, and office. By this and his engineering training he is well equipped to serve the interests of our patrons in his new territory.

William A. Craig, who has been connected with its inspection force since 1893, has been promoted by THE HARTFORD STEAM BOILER INSPECTION AND INSURANCE COMPANY to the position of Assistant Chief Inspector of its Pittsburg department. We are sure Mr. Craig's advancement will receive the general approval of his associates in our Company and of his many friends among the steam users of his district.

On December 31, 1911, Inspector Johnston Nolan resigned from the force of our Philadelphia department in order to engage more actively in the manufacture and sale of a blowoff valve which he has invented. We learn that his valve has met with favorable consideration, and we wish Mr. Nolan all success in his undertaking.

THE METRIC SYSTEM OF WEIGHTS AND MEASURES. A valuable indexed hand-book of 196 pages of convenient size (3½" x 5¾") and substantially bound, containing a brief history of the Metric System, and *comparative tables* carefully calculated, giving the English or United States equivalents in all the units of measurement.

Everyone who has had occasion to convert English weights and measures into their metric equivalents, and conversely, is familiar with the irritation produced, either by the necessity of calculating them, or by finding that the particular units required are not included in the tables at hand. But the tables in this hand-book are so numerous that this annoyance will be reduced to its lowest terms. The book is of convenient pocket size and well bound.

Published and for sale by *The Hartford Steam Boiler Inspection & Ins. Co., Hartford, Conn. U. S. A.* . . . . . . Price $1.25.

Boiler Explosion Injures Inspector.

Although not without precedent, it is rare that a boiler inspector is injured in an explosion. An accident with this result occurred on November 10th at the Ellicott Square office building at Buffalo, New York, when one of our local inspectors, Bard Leavitt, was seriously scalded by the bursting of a tube in a water-tube boiler next to one which he was inspecting. Two boiler makers, Arthur Brady and John Schrott, were working on the boiler with the inspector. Both lost their lives, Mr. Brady being killed outright and Mr. Schrott dying several days later.

Inspector Leavitt was particularly fortunate to escape with his life, as he was under the tubes in the back connection when the explosion occurred. In order to escape, it was necessary for him to crawl through a cleaning door about 18 inches square, into a narrow passageway which was filled with steam and hot water from the explosion. Mr. Leavitt was so blinded by the steam and the pain of his injuries that in leaving the boiler room he ran into a pumping engine which was in motion, and severely cut his mouth and nose on the connecting rod or the crank pin.

We are glad to state that Mr. Leavitt is on the road to recovery.

Inspection Work for the year 1911.

The activity of the inspection force of THE HARTFORD STEAM BOILER INSPECTION AND INSURANCE COMPANY for the year just closed is evidenced in the statistical tables of the following pages. This data is compiled from the record of the work accomplished and is published in this form that those who are interested in such matters may obtain a realization of the magnitude and value of the service which is performed by our inspectors in the boiler plants of the United States.

The summaries on page 25 are particularly interesting. From a comparison of their figures it appears that an inspector on the average found something defective at nearly every visit he made, and in every ten a condition which if continued was dangerous to the operation of the vessel. These figures are significant, for the breadth of the field covered by the tabulated experience is great enough to represent the average situation of the steam vessels of the country. If once out of ten visits to a boiler room a trained inspector discovers a dangerous condition the necessity and value of his visitation is emphasized, without mention of the benefit derived at every visit from his warning of a defect which may be remedied before it reaches a critical stage.

From the summary of defects the character of the several diseases which afflict boilers may be seen and an idea gained of the relative frequency with which each occurs and the probability of its attaining a dangerous state. The predominance of defects due to impure water is most marked.

These statistics are of the work among steam boilers, meaning by that term, steam containing vessels generally. In addition the inspection force of the company has made during the year 92 examinations of steam pipe lines, economizers, and miscellaneous apparatus, and 4,234 inspections of fly-wheels and pulleys.

Summary of Inspectors' Work for 1911.

Visits of inspection made,	180,842
Whole number of inspections (both internal and external).	352,674
Number of complete internal inspections,	140,896
Boilers tested by hydrostatic pressure.	12,724
Total number of boilers condemned,	653
Total number of defects discovered,	164,713
Total number of dangerous defects discovered,	17,410

Summary of Defects Discovered.

Nature of Defects.	Whole Number.	Dangerous.
Cases of deposit of sediment,	19,710	1,400
Cases of incrustation and scale,	42,879	1,699
Cases of internal grooving,	2,756	305
Cases of internal corrosion,	14,083	649
Cases of external corrosion,	9,755	898
Defective braces and stays,	2,485	545
Settings defective,	5,686	731
Furnaces out of shape,	7,191	397
Fractured plates,	3,479	440
Burned plates,	4,837	477
Laminated plates,	509	44
Cases of defective riveting,	3,026	636
Defective heads,	1,349	234
Cases of leakage around tubes,	11,188	1,627
Cases of defective tubes,	9,447	2,935
Tubes too light,	1,901	521
Leakage at joints,	5,417	373
Water-gages defective,	3,447	773
Blow-offs defective,	4,509	1,373
Cases of deficiency of water,	313	90
Safety-valves overloaded,	1,124	319
Safety-valves defective,	1,225	329
Pressure gages defective,	7,836	525
Boilers without pressure gages,	532	71
Unclassified defects,	29	19
Total.	164,713	17,410

Grand Total of the Inspectors' Work from the Time the Company Began Business, to January 1, 1912.

Visits of inspection made,	3,312,922
Whole number of inspections (both internal and external),	6,413,587
Complete internal inspections,	2,518,922
Boilers tested by hydrostatic pressure.	299,852
Total number of boilers condemned,	21,620
Total number of defects discovered,	3,987,980
Total number of dangerous defects discovered.	409,639

Inspectors' Reports for July, August, and September, 1911.

Nature of Defects.	July.		August.		September.	
	Total defects.	Dangerous.	Total defects.	Dangerous.	Total defects.	Dangerous.
Cases of deposit of sediment,	1,803	151	1,586	95	1,624	124
Cases of incrustation and scale,	4,083	170	3,519	119	3,378	135
Cases of internal grooving,	219	22	237	24	201	17
Cases of internal corrosion,	1,568	66	1,277	65	1,150	54
Cases of external corrosion,	950	81	959	128	762	60
Defective braces and stays,	190	31	180	48	194	43
Settings defective,	514	77	455	46	450	51
Furnaces out of shape,	738	43	601	43	583	30
Fractured plates,	284	36	283	34	268	32
Burned plates,	401	30	387	27	407	34
Laminated plates,	63	5	38	4	34	4
Cases of defective riveting,	200	43	181	39	275	62
Defective heads,	100	11	108	25	119	20
Cases of leakage around tubes,	826	156	918	121	876	129
Cases of defective tubes,	733	190	791	210	679	199
Tubes too light,	140	41	281	51	207	53
Leakage at joints,	413	29	396	25	396	27
Water-gages defective,	295	78	328	65	263	70
Blow-offs defective,	385	108	398	125	355	101
Cases of deficiency of water,	21	8	32	5	21	8
Safety-valves overloaded,	91	26	93	29	86	28
Safety-valves defective,	102	21	117	35	110	29
Pressure gages defective,	648	36	613	39	618	39
Boilers without pressure gages,	32	4	22	2	29	5
Unclassified defects,	2	2	2	2	2	2
Totals,	14,801	1,465	13,802	1,406	13,087	1,356

Inspectors' Reports for April, May, and June, 1911.

Nature of Defects.	April.		May.		June.	
	Total defects.	Dangerous.	Total defects.	Dangerous.	Total defects.	Dangerous.
Cases of deposit of sediment,	1,746	122	1,669	116	1,791	126
Cases of incrustation and scale,	3,959	270	3,802	131	3,957	112
Cases of internal grooving,	267	45	294	48	280	29
Cases of internal corrosion,	1,220	60	1,266	70	1,686	60
Cases of external corrosion,	841	82	790	65	969	88
Defective braces and stays,	294	60	242	48	187	39
Settings defective,	533	76	482	75	517	56
Furnaces out of shape,	736	46	523	26	655	45
Fractured plates,	304	38	288	32	252	42
Burned plates,	443	56	421	45	396	27
Laminated plates,	37	5	46	5	42	1
Cases of defective riveting,	287	65	269	41	243	39
Defective heads,	110	14	91	16	120	22
Cases of leakage around tubes,	1,025	132	1,004	112	861	113
Cases of defective tubes,	892	229	775	220	796	237
Tubes too light,	160	34	113	23	142	51
Leakage at joints,	503	37	461	23	431	36
Water-gages defective,	293	63	242	50	269	71
Blow-offs defective,	425	112	371	124	420	132
Cases of deficiency of water,	25	8	23	6	27	7
Safety-valves overloaded,	103	28	87	16	82	23
Safety-valves defective,	106	17	88	29	97	23
Pressure gages defective,	701	45	682	38	643	43
Boilers without pressure gages,	28	2	26	1	64	7
Unclassified defects,	4	4	8	2	2	2
Totals,	15,042	1,650	14,063	1,362	14,929	1,431

SUMMARY OF INSPECTORS' WORK SINCE 1870.

Year.	Visits of inspection made.	Whole number of boilers inspected.	Complete internal inspections.	Boilers tested by hydrostatic pressure.	Total number of defects discovered.	Total number of dangerous defects discovered.	Boilers condemned.
1870	5,439	10,569	2,585	882	4,686	485	45
1871	6,826	13,476	3,889	1,484	6,253	954	60
1872	10,447	21,066	6,533	2,102	11,176	2,260	155
1873	12,824	24,998	8,511	2,175	11,998	2,892	178
1874	14,368	29,200	9,451	2,078	14,256	3,486	163
1875	22,612	44,763	14,181	3,149	24,040	6,149	216
1876	16,409	34,275	10,669	2,150	16,273	4,275	89
1877	16,204	32,975	11,629	2,367	15,964	3,690	133
1879	17,179	36,169	13,045	2,540	16,238	3,816	246
1880	20,939	41,166	16,010	3,490	21,033	5,444	377
1881	22,412	47,245	17,590	4,286	21,110	5,801	363
1882	25,742	55,679	21,428	4,564	33,690	6,867	478
1883	29,324	60,142	24,403	4,275	40,953	7,472	545
1884	34,048	66,695	24,855	4,180	44,900	7,449	493
1885	37,018	71,334	26,637	4,809	47,230	7,325	449
1886	39,777	77,275	30,868	5,252	71,983	9,960	509
1887	46,761	89,994	36,166	5,741	99,642	11,522	622
1888	51,483	102,314	40,240	6,536	91,567	8,967	426
1889	56,752	110,394	44,563	7,187	105,187	8,420	478
1890	61,750	118,098	49,983	7,207	115,821	9,387	402
1891	71,227	137,741	57,312	7,859	127,609	10,858	526
1892	74,830	148,603	59,883	7,585	120,659	11,705	681
1893	81,904	163,328	66,698	7,861	122,893	12,390	597
1894	94,982	191,932	79,000	7,686	135,021	13,753	595
1895	98,349	199,096	76,744	8,373	144,857	14,556	799
1896	102,911	205,957	78,118	8,187	143,217	12,988	663
1897	105,062	206,657	76,770	7,870	131,192	11,775	588
1898	106,128	208,990	78,349	8,713	130,743	11,727	603
1899	112,464	221,706	85,804	9,371	157,804	12,800	779
1900	122,811	234,805	92,526	10,191	177,113	12,862	782
1901	134,027	254,927	99,885	11,507	187,847	12,614	950
1902	142,006	264,708	105,675	11,726	145,489	13,032	1,004
1903	153,951	293,122	116,643	12,232	147,707	12,304	933
1904	159,553	299,436	117,366	12,971	154,282	13,390	883
1905	159,561	291,041	116,762	13,266	155,024	14,209	753
1906	159,133	292,977	120,416	13,250	157,462	15,116	690
1907	163,648	308,571	124,610	13,799	159,283	17,345	700
1908	167,951	317,537	124,990	10,449	151,359	15,878	572
1909	174,872	342,136	136,682	12,563	169,356	16,385	642
1910	177,946	347,255	138,900	12,779	169,202	16,746	625
1911	180,842	352,674	140,896	12,724	164,713	17,410	653

The Hartford Steam Boiler Inspection and Insurance Company.

ABSTRACT OF STATEMENT, JANUARY 1, 1912.

Capital Stock, . . . $1,000,000.00.

ASSETS.

Cash on hand and in course of transmission,		$204,693.25
Premiums in course of collection,		263,453.33
Real estate,		91,100.00
Loaned on bond and mortgage,		1,166,360.00
Stocks and bonds, market value,		3,249,216.00
Interest accrued,		71,052.02
Total Assets,		$5,045,874.60

LIABILITIES.

Premium Reserve,		$2,042,218.21
Losses unadjusted,		102,472.53
Commissions and brokerage,		52,690.67
Other liabilities (taxes accrued, etc.),		47,191.65
Capital Stock,	$1,000,000.00	
Surplus over all liabilities,	1,801,301.54	
Surplus as regards Policy-holders,	**$2,801,301.54**	2,801,301.54
Total Liabilities,		$5,045,874.60

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L. F. MIDDLEBROOK, Assistant Secretary.
W. R. C. CORSON, Assistant Secretary.

S. F. Jeter, Supervising Inspector.
E. J. Murphy, M. E., Consulting Engineer.
F. M. Fitch, Auditor.

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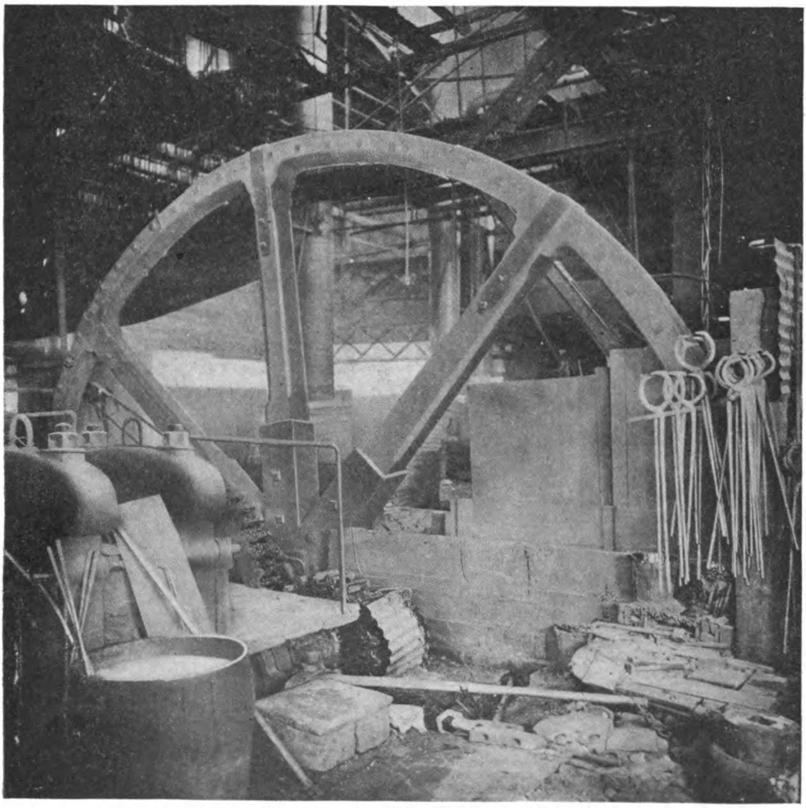
The Locomotive
of
THE HARTFORD STEAM BOILER INSPECTION AND INSURANCE CO.

VOL. XXIX. HARTFORD, CONN., APRIL, 1912. No. 2.



AN OLD FLY-WHEEL.

Another Automatic Engine Bursts its Fly Wheel.

The illustration on the front cover of this issue of THE LOCOMOTIVE shows the wreck resulting from the failure, May 10, 1912, of a fly wheel on an engine of the high speed, simple, automatic type. The engine in question was a 12" x 12", center crank, and was belted to a generator at the Higginsville, Mo., electric light plant. This illustration is of particular interest, because of the wide-spread notion among engineers, that engines of the "automatic" shaft governed type cannot run away. A somewhat similar instance was recorded in THE LOCOMOTIVE for April, 1911.

It would appear that in this case the governor pulley failed first, and we are told that fragments went through the roof with considerable violence. This failure may have been hastened by a blow delivered to the rim of the wheel by the governor weight. When relieved of the first wheel, the engine seems to have slewed around on its foundation, fouling the other pulley on the sub-base, and shearing its spokes free from both the hub and the rim. This rotation of the whole engine is in the right direction (left handed), to be explained by the principles of gyroscopic motion. If we consider the crank shaft balanced for weight by the two wheels, when running normally, it would become immediately unbalanced by the failure of one of them. This failure would probably occur at high speed, and so is favorable to such an assumption. It is of course well known to those who have experimented with the simple gyroscopic tops of their school days, that if the wheel is spinning, the top may

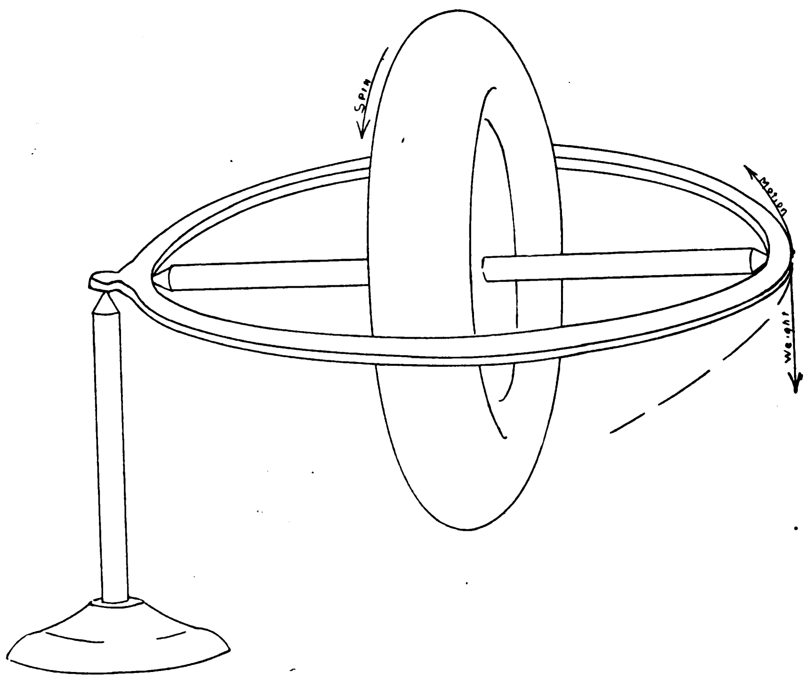


FIG. 2. SIMPLE GYROSCOPE.

be held at a point on the rim of the stationary ring, where it is unbalanced for weight, and in this position, instead of falling under the force of gravity, it rotates about a vertical axis, with a speed which depends on that of the wheel, and which will be greater, the heavier the top, or the more it is out of gravity balance. This appears to have been the behavior of the engine. Fig. 2, in which the directions of rotation correspond to those in the engine, will perhaps make clear our point of view.

A Disastrous Locomotive Boiler Explosion

The boiler of Locomotive No. 704 of the Southern Pacific Ry. Company exploded Monday, March 18, 1912, at 8:55 A. M., in the yards attached to the railway shops at San Antonio, Texas. This locomotive had been in the shops for repairs from February 12th to March 18th, and was being prepared for its initial run when the explosion occurred, but was still in the hands of the hostlers, inspectors, and shop men.

From the report of Chief Inspector Ensign of the Interstate Commerce Commission, as printed in "Power," the following facts and conclusions are abstracted, together with the results of tests on the sling stays made at the National Bureau of Standards.

The locomotive was of the heavy passenger 4-6-0 type, and was owned and operated by the Galveston, Harrisburg and San Antonio Ry. Co. It was built in March, 1908, by the American Locomotive Company at the Brooks Works. The firebox was of three-piece construction, crown bar type. The working steam pressure was 200 lbs. per square inch. The barrel of the boiler was made of ¾-in. steel, in three sections or courses, constructed with butt longitudinal joints having diamond shaped welts. The dome was located on the third course. The wrapper sheet was of ⅝-in. steel, the back head sheet and back flue sheet ½-in. steel, and the firebox door sheet, crown and side sheets, ⅜-in. steel. The firebox was stayed with rigid bolts ⅞-in. diameter at the ends, reducing to ¾-in. at the center of the bolts; four rows of Tate flexible bolts at the top of the firebox and two rows at each end, staggered at the top corners. The crown bolts were of a driving fit with countersunk heads 1⅛-in. diameter at the bottom end, and 1 in. diameter at the top end, extending through the crown bars with nuts on the top. The crown sheet was supported with 15 crown bars hung from the wrapper sheet by 168 sling stays, ⅝x3 in. and 12 sling stays 1½x 2¾ in. The flues numbering 355, were of 2-in. diameter. The boiler was equipped with three 3-in. Crosby safety valves.

The investigation brought out the following facts: During the time the locomotive was laid up, the following repairs were made to the boiler. Two hundred flues reset, one back head brace repaired, one front flue sheet brace and two throat stays repaired, eighty staybolts renewed, safety valves ground in, steam gauge tested, and hydrostatic pressure of 250 lbs. per square inch applied. Repairs were completed about 5:45 p. m. March 17th, and the locomotive fired up but no steam was raised. It was again fired up at about 6:10 a. m., on March 18th, and the safety valves began to blow when the steam gauge registered 50 lbs. pressure, at about 7:30 a. m. The safety valves were screwed down and again opened at about 8:00 a. m. The locomotive had a heavy forced oil fire from 8:00 to 8:55 a. m., at which time the explosion occurred.

FIG. 1. SHOWING BROKEN SLING STAYS.

An employee of the railroad company, was engaged in setting the safety valves at the time of the explosion. The valves themselves could not be tested after the explosion owing to the damaged condition of the disks and springs, but the casings, with the adjusting screws and lock nuts were found and proved to be valuable pieces of evidence in unraveling the causes of the explosion. On one of the adjusting screws, the lock nuts were missing, another screw was bent, and the end burred over, and on all of them there was evidence that the corners of the hexagon heads had been rounded over in an attempt to tighten them, which resulted apparently in the subsequent application of a Stilson wrench in an attempt to further tighten the springs.

The steam gauge was shown to have been tested but there was no evidence to show that the siphon or connections were tested or known to be free from obstruction, and indeed, the government inspector found that on another locomotive of similar type, at the same shops, there were two valves between the gauge and the boiler, which when opened had their handles, one at right angles, and one parallel to the pipe. This arrangement was so confusing and unsafe that one of them was ordered removed.

Reference to Figure 1 will show the general character of the explosion which resulted in the immediate death of 26 men and we are informed, in the subsequent death of three more, making a total of 29. It will be noted that the explosion apparently started in the firebox, which was blown directly down. The front head with many of the tubes attached will be seen to have been projected forward and to the right, while the wrapper sheet and part of the third course, carrying the dome, were blown backward some three blocks and were said by observers to have attained a considerable height, estimated to have been some 500 feet. These sheets, weighing some 6,000 lbs. landed in a dooryard and are shown in Figure 2. A glance at Figure 3 will show at once the terrific character of the explosion, and also the fact that the damage was much greater at the rear end of the locomotive than at the forward end, as one of the after drivers is seen to have been completely forced from the axle.

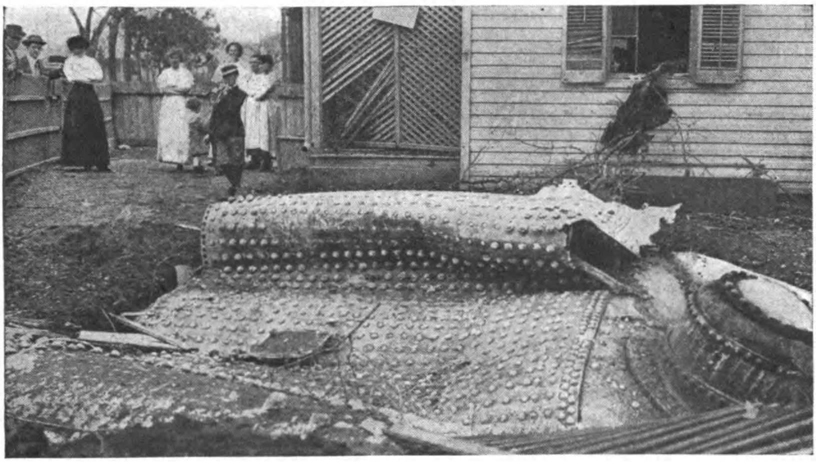


FIG. 2. WRAPPER SHEET AND DOME IN DOOR YARD.

The crown bar sling stays were shown on examination to have been made of wrought iron, where the specifications called for steel. It was further shown that five 1-in. bolts had been used to attach the sling stays to the crown bars and also to the wrapper sheet, where the specifications on the drawing had required 1¼-in. bolts. The crown bars were not supported on the side sheets as is customary in this type of boilers, therefore the whole strain was carried by the sling stays. It was further shown that the sling stays failed by stretching out the eyes, which were much reduced in section. This can be clearly seen by reference to Figure 1, and would seem to indicate that the stays

failed by a gradual application of stress far in excess of that which they could safely carry.

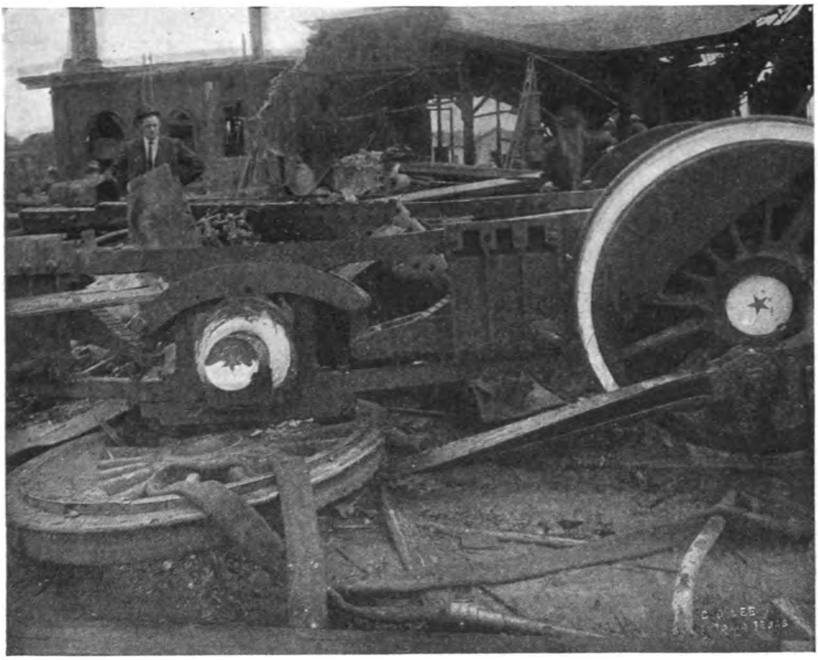


FIG. 3. DRIVER BLOWN FROM AXLE.

Five crown bar sling stays from this locomotive were tested by the United States Bureau of Standards to determine the load the stays would support when 1in. and 1¼-in. bolts were used. The bolts used were some taken from this boiler at the time of the explosion. Stays numbered 1 and 2, using 1-in. bolts, failed at total loads of 26,650, and 21,840 lbs. respectively, yielding for the lower value, a factor of safety based on the net section of only 2.67 while the higher figure would give a factor of safety of 3.26. Stays numbered 3, 4, and 5 broke at total loads of 30,000, 33,890, and 31,620 lbs. respectively. The 1¼-in. bolts were used with these specimens, and showed factors of safety varying from 3.67 to 4.15. The tensile strength of the material in the sling stays was found to be 43,200 to 48,300 lbs. per square inch, and the elongation from 18 to 40.5% in 2 inches. These tests are taken to indicate that the stays were drilled too near the ends.

The investigating inspector finds that the cause of the explosion was excessive pressure, due probably to a defective gauge, and the attempted setting of the safety valves by men of insufficient experience. He censures the railroad company severely for permitting such men to handle work of this character. He also finds that the local inspector had sworn to a report of the setting of the safety valves and the testing of the steam gauge on the day before, although it was clearly shown that the actual work of setting the safety valves was in progress at the time of the explosion. He finds further that the railroad company was negligent in keeping a boiler in service whose factor of safety as shown by test was far below the limits generally set in such cases.

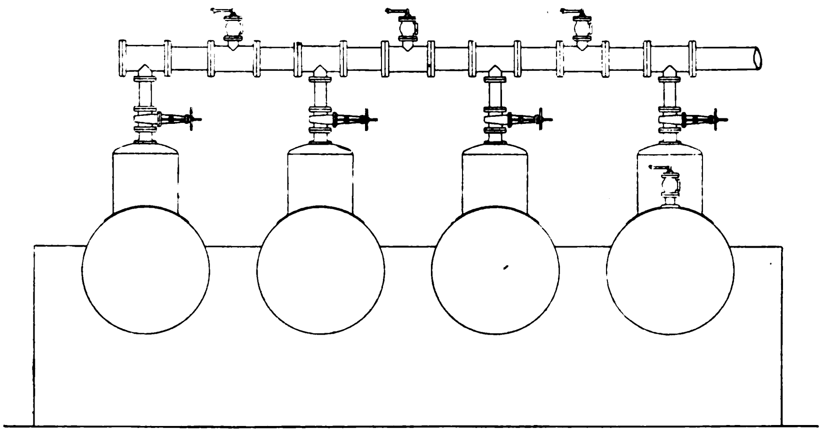
We understand from press accounts, that the Galveston, Harrisburg, and San Antonio railway company have made a public statement since the finding of the government inspector, in which they give the report of their own investigating board. This consisted of the following gentlemen: Col. Charles H. Clark, U. S. A., ordnance department; Capt. George A. Schreiner, U. S. A.; Lt. R. C. Burleson, U. S. A., expert on high explosives; J. H. Holmgren, president of the Alamo Iron Works, San Antonio, Tex.; G. W. Taylor, superintendent of motive power, S. A. & A. P. railway; W. B. Tuttle, manager, San Antonio street railway; Daniel Cleary, locomotive boiler inspector, S. A. & A. P. railway; A. M. Fischer, druggist, San Antonio, Tex.; F. McArdle, road foreman of engines, S. A. & A. P. railway; and T. H. Mooney, former master mechanic, G. H. & S. A. railway. This board differed widely in their conclusions. Four declared themselves of the belief that the wreck was due to overpressure. Two considered low water to have been the cause, followed in their estimation, by the pumping of cold water upon a hot crown sheet. One of the army officers expressed the opinion that "it is evident that the explosion was caused by some unusual, and extraordinary cause." All agree however, that the inspector of the Interstate Commerce Commission was at fault, in censuring the railway company as to the incompetence of its employees. We can understand something of the feelings of these gentlemen, especially as the accident occurred during a strike when rumors of dynamite and violence were prevalent, nevertheless, the photographs at hand, and the report of the tests made at the Standards Bureau, seem to give ample confirmation to the views of Inspector Ensign.

There seems to have been no member of the railway company's board who had a realization of the fact that a boiler full of water, when hot and under a considerable steam pressure, constitutes in itself, a high explosive of no mean order. These gentlemen base their arguments against over pressure, apparently upon the fact that the injectors were said to have been working just previous to the explosion, and refer to a statement of the makers, that about 240 lbs. is the limit at which this type of injector will continue to throw water into a boiler. They fail to realize, it seems, that a boiler with its safety valve "gagged," and with a heavy fire such as this locomotive is shown to have had, can accumulate a dangerous pressure with great rapidity, the time in this case, of course, being less than might have been expected on account of the weakness of the furnace sling stays, when used with one inch bolts.

A Dangerous Installation of Safety Valves.

The accompanying sketch of a steam pipe arrangement may be of interest as indicating the extreme of ignorance or carelessness in the installation of devices which are vitally necessary to the safety of a steam plant.

Our company had covered the boilers of this mill by a policy of insurance which expired in the latter part of 1911, and which we failed to renew because, as the assured stated, they had received much lower rates from a competitor.



UNSAFE ARRANGEMENT OF STEAM PIPES.

Sometime later the manager of the plant, meeting one of our inspectors, told him that he was not altogether satisfied with a rearrangement of piping which had been made, although he himself was not sufficiently expert in such matters to point out the defects. He made the request that our inspector visit the plant to advise him. Our inspector did so and found that since our coverage two boilers had been added and the steam piping remodeled in the manner shown by our sketch and that this had been done without remonstrance or criticism on the part of our competitor's inspector.

It is needless to add that when the absolute danger of the arrangement was pointed out, the management of the plant insisted that the competing policy be immediately canceled and that such premium be paid as was necessary to secure HARTFORD insurance and HARTFORD inspection service.

Furnace in Scotch Boiler Fails From Overheating.

The illustrations printed herewith show a dry back Scotch boiler after removal from the Dredge "Thor," one of the largest gold mining dredges on the Pacific Coast, used near Oroville, Cal.

The boiler is 8 ft. 2 in. in diameter, and 13 ft. long. The shell is of ¾-in. steel with the longitudinal joints of the triple riveted double butt strap type. The heads are ⅝ in. thick. The boiler is fitted with 128-3 inch tubes, and with a Morrison suspension furnace, 50 inches in diameter, and 13 feet long. The original thickness of the furnace plate was 9/16 in., but a measurement obtained by drilling at a point 4 in. from the end after the collapse, showed the actual thickness to be 17/32 in.

We are told that the ordinary working pressure was 135 lbs. and that this was about the pressure on the boiler at the time of the failure. Oil was used as fuel.

The failure which occurred on March 18, 1912, consisted in a flattening of the furnace, the top going down about 28 in. and the bottom coming up about 22 in., till the sheets met, forming a sort of figure 8 turned on its side, as may be seen by reference to Fig. 2. The front head was pulled in, so that a number of the tubes above the furnace, projected through the sheet, from ¾ to 1½ in. and of course resulted in severe leakage.

After the accident, the oil burner was turned off and the steam used up in propelling the dredger to the bank, getting its buckets on shore, and hauling the water and oil barges alongside, some twenty minutes being consumed in the operation. No one was injured.

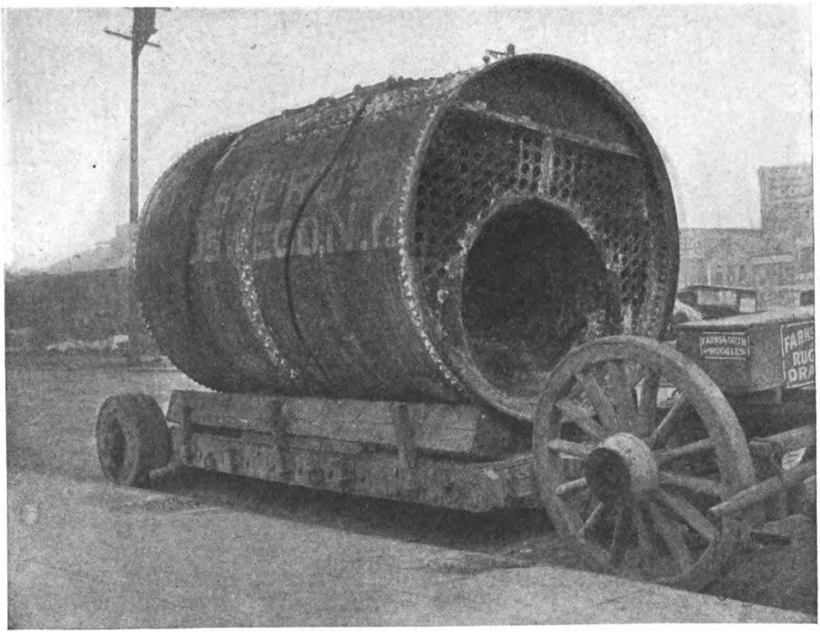


FIG. 1. BOILER OF THE "THOR."

The boiler was removed and shipped to San Francisco, with the idea of putting in a new furnace, and making other necessary repairs. It was found, however, on inspection that the boiler was so distorted as to make this impossible. It was also found that the tubes and furnace were so heavily coated with oil as to indicate that the cause of the failure was due to the furnace sheet becoming overheated, a very frequent cause of trouble when such oil films are allowed to collect on the inside surface of those parts of a boiler directly exposed to the action of the fire. The dredger was operated condensing and apparently no effort was made to prevent the oil used in the cylinders for lubrication, from entering the boiler with the feed water.

It would seem that this case is one of those preventable accidents which need not have occurred if the boiler had received regular and thorough internal inspections, as it is difficult to believe that a competent inspector could have failed to detect this particular trouble long before it reached the danger point. We understand that the boiler was comparatively new. No insurance was carried.

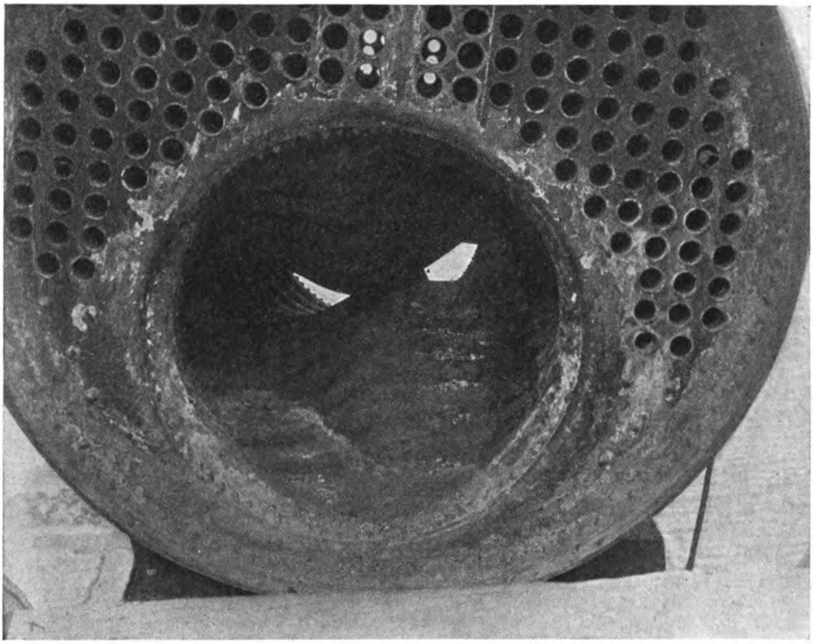


FIG. 2. THE COLLAPSED FURNACE.

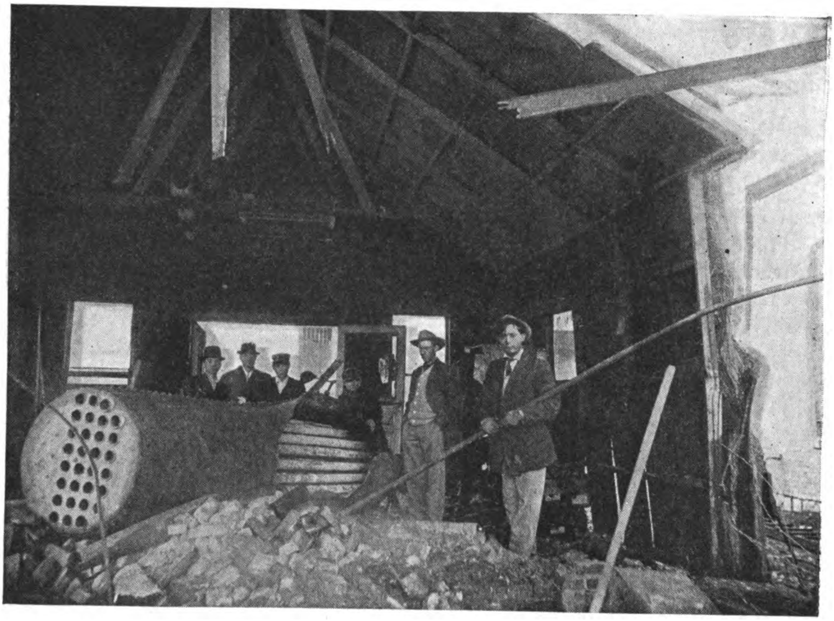
Locking the Door After the Horse is Stolen.

W. B. WARNER, Special Agent.

The accompanying illustration shows the condition of a boiler and premises, after an explosion which occurred recently, the location of which we do not mention for obvious reasons.

Our "Special" had solicited the insurance on this boiler periodically for several years, and at each visit had been given various excuses by the owner for not taking insurance. A few weeks ago the "Special" was again in the district, and having in mind this boiler and its owner as a possible prospect, made a stop on the chance that he would have better luck this time, as we feel that every uninsured boiler is a prospect, and that sometime we will get it.

When within a hundred miles of this place, he was advised of the explosion, and when he arrived at the town, he concluded to go over and see how serious the accident was, and incidentally, to speak of the folly of procrastination in matters of boiler insurance. As our "Special" approached the place, Mr. Owner spied him some fifty yards from it, and greeted him thus: "Hello Mr. ———, why the d—— didn't you make me insure my boiler the last time you were here?" "I did everything legitimate," replied the "Special," "to induce you to do so, and I thought I would come over and learn what new excuse you had to offer this time." "Well," said the owner, "my boiler blew up about two



THE BOILER WHICH DID NOT NEED INSURANCE.

weeks ago, and I am just getting this one ready to use. I am ready for the insurance now. I wish I had taken it before."

We now have a policy covering this plant, and if a similar accident occurs, it is our loss.

Boiler Explosions.

MARCH, 1912.

(138.) — The boiler of Locomotive No. 669 of the Philadelphia and Reading Railroad, attached to a through freight, exploded outside the station at Muncy, Pa., at about 9.30 p. m., March 1. Engineer William Fink, Fireman William Meyers, Conductor Boulton Whitenight, and Brakeman Harry Robinson, were killed. One man was injured.

(139.) — On March 2, a boiler in the factory building, at 794 Tenth Ave., New York City, exploded, during a fire which completely wrecked the building. Deputy Fire Chief Binns, and several firemen were in the boiler room just previous to the explosion and were injured seriously.

(140.) —A tube in a water tube boiler ruptured March 2, at the Allentown Portland Cement Co.'s plant, Allentown, Pa.

(141.) — On March 3, two tubes ruptured at the plant of the Fox Paper Co., Lockland, O., killing Frank Brunkamp and Ernest Williams. This was the second case of tube failure at this plant within a week. (See item 137 in the February list.)

(142.) — On March 3, a tube ruptured in a water tube boiler at the plant of the Illinois Steel Co., South Chicago, Ill. Geo. Novak and Alec Simon were injured.

(143.) —An accident occurred March 3, at A. Lisner's department store, the "Palais Royal," Washington, D. C. Considerable damage was done to the boiler.

(144.) —A tube failed March 6, at the Commerce St. power house of the street railway company, Milwaukee, Wis. Two men were badly scalded.

(145.) —March 7, the boiler at a stone crusher used in connection with the construction of a dam at Hamilton, Ill., exploded.

(146.) —A boiler exploded March 7, at the toy, and umbrella handle factory of Gilpin Bros., Greentown, Pa.

(147.) — The drum of a water tube boiler ruptured March 9 at the plant of the Sharon Tin Plate Co., Sharon, Pa.

(148.) — On March 9, a tube ruptured in a water tube boiler at the Ehret Magnesia Mfg. Co., Valley Forge, Pa.

(149.) — On March 9, boiler failed at the plant of the St. John Wood Working Co., Stamford, Conn. The damage was small.

(150.) —About March 9, the boiler in the old school building at Sellersville exploded.

(151.) —An accident to the boiler of the torpedo boat destroyer, U. S. S. Paul Jones, at San Diego, Cal., March 9, caused the death of Albert Grau, fireman, and the serious injury of Peter Wiera, fireman, and John J. Eberlein, coal passer.

(152.) — The boiler at the Belle Springs Creamery, Abilene, Kans., exploded on the morning of March 9, slightly injuring engineer Smart.

(153.) —A tube ruptured March 10 in a water tube boiler at the plant of the Columbia Chemical Co., Barbertown, O. Considerable damage was done to the boiler. (See also item 168.)

(154.) — On March 11, three sections of a cast iron sectional heating boiler failed at the Hotel Princeton, owned by Chas. M. Randall, Boston, Mass.

(155.) —A boiler ruptured March 11, at the plant of the Anderson and Middleton Lumber Co., Aberdeen, Wash.

(156.) — The boiler in the crating mill of Asa Smiley, Jamestown, N. Y., exploded March 11, seriously injuring the proprietor, and inflicting minor injuries to one other. The entire plant was wrecked.

(157.) — March 12, the principal building of the Columbus Contractors' Supply Co. at Taylors Station, near Columbus, O., was destroyed by fire following the explosion of the boiler. The loss was estimated at $60,000.

(158.) — The heating boiler in the home of Louis Muhs, Minot, N. D., exploded, March 12, fatally injuring Mr. Muhs, who was firing the boiler at the time.

(159.) — On March 13, the furnace of a vertical boiler ruptured on the Barge Canal Contract of Holler and Shepard, Ft. Edwards, N. Y.

(160.) — On March 15, a tube ruptured in a water tube boiler at the Western Branch, National Home for Disabled Volunteer Soldiers, National Military Home, Kans.

(161.) —A blow off pipe ruptured March 15, at the Port Huron Gas Co., Port Huron, Mich. Joseph Brown, fireman, was somewhat injured.

(162.) — On March 16, the boiler at the plant of the Mills-Ellsworth Lumber Co., Pine Bluff, Ark., exploded, doing considerable damage to the plant. One man was slightly injured.

(163.) —A tube ruptured March 18 at the plant of the Illinois Glass Co., Alton, Ill. One man was slightly injured.

(164.) —A locomotive boiler exploded in the yards of the Southern Pacific Railroad, at San Antonio, Tex., March 18. Twenty-five men were killed, four injured fatally, and many minor injuries inflicted. The damage to property was great.

(165.) — The internal furnace in a Scotch marine boiler collapsed March 18, on the gold mining dredge "Thor," near Oroville, Cal. No one was injured, but the boiler was so distorted as to be a total loss.

(166.) — On March 19, a boiler ruptured in the office building belonging to the estate of Thomas McGraw, Detroit, Mich.

(167.) — The boiler of a logging engine exploded March 20 at the saw mill of Jeams Bros., Rockland, Tex. Jesse Patrick and Lewis Furguson were fatally burned, and Jack Best, engineer, was slightly burned.

(168.) —A tube ruptured March 20 at the plant of the Columbia Chemical Co., Barbertown, O. This was the second accident within a month. (See also item 153.)

(169.) — The boiler of a locomotive attached to a coal train on the N. & W. R. R. exploded March 20, near Blue Ridge Springs, Va. One man, John W. Hunter, engineer, was killed, and two were injured, one fatally.

(170.) — On March 22, a wash-out plug blew out on a locomotive at the round house, Carthage, N. Y. The engine was under steam, and a workman was attempting to tighten the plug. He was fatally scalded.

(171.) — Five men were scalded, none fatally, when the boiler at the mine of the Turner Coal Co., Evans City, Pa., exploded March 23.

(172.) — On March 23, the boiler at the Cramer Creamery, Camden, N. J., exploded. No one was hurt, and the damage was confined to the boiler.

(173.) — On March 25 the boiler of a well drilling machine belonging to Denny & Cypher, Contractors, exploded at the Melarky farm near Marwood, Pa. No one was injured.

(174.) —A tube ruptured in a water tube boiler at the plant of the Victor Talking Machine Co., Camden, N. J., on March 25.

(175.) —A saw mill boiler owned by Stewart and Hardin, at Holcomb, Miss., exploded March 25, killing four men and injuring three more, one fatally.

(176.) —A boiler exploded March 26, at the McCormick Works of the International Harvester Co., Western Ave. and Thirty-first St., Chicago, Ill. Six were injured,. one of whom died soon after the accident.

(178.) — On March 26, a boiler exploded at the saw mill of H. L. Hearn, Salisbury, Md. Five men were instantly killed and three more injured.

(179.) — On March 27, one man was slightly burned by the explosion of a boiler at the City power house, Wellington, Kans.

(180.) —A blow-off pipe failed March 25, at the Fall River Iron Works, Fall River, Mass. Antone Casmere, fireman, was scalded.

(181.) — The boiler of an engine used to run a circular saw at the farm of H. H. Peterson, Whiting, Ia., exploded March 27, killing one man, and injuring four others, one seriously.

(182.) —A Delaware and Hudson locomotive exploded March 29, near East Worcester, N. Y., killing Howard Wickham, engineer, and Jacob Houck, fireman. Three others were injured, one seriously.

(183.) — Two cast iron headers fractured March 30, in a water tube boiler at the plant of the American Laundry Co., Mobile, Ala.

(184.) — On March 30, the boiler of a locomotive exploded near Tuscola, Ill., on the Cincinnati, Hamilton and Dayton R. R. Alva Friddle, brakeman, was killed, and three others injured.

APRIL, 1912.

(185.) — On April 1st, a plate ruptured in a boiler at the Connors-Weyman Steel Co., Helena, Ala.

(186.) — A blow-off pipe ruptured April 2, at the plant of the Southeastern Yaryan Naval Stores Co., Brunswick, Ga.

(187.) — About April 2, two boilers exploded on David Hoover's saw mill operation, near Saxton, Pa.

(188.) — A heating boiler exploded in the high school building, Pewaukee, Wis., on April 28, just after the close of the session. No one was injured.

(189.) — On April 28, the boiler at the mill of the Ida H. mine, near Belle Center, Ill. Two men were seriously injured, a small dog is said to have been killed.

(190.) — A boiler in the cant hook factory of C. A. and M. E. Wellman, at South Boardman, Mich., exploded April 5. One man was killed, and five others injured, one perhaps fatally.

(191.) — On April 4, a locomotive belonging to the Southern Pacific R. R. exploded near Rice Hill, Ore. M. M. Bartlett, engineer, and Bert Anderson, fireman, were killed.

(192.) — A boiler at the plant of the Salisbury Ice Co., Salisbury, Md., exploded April 5. One man was killed, one fatally injured, and several others were slightly injured.

(193.) — On April 6, an accident occurred to the boiler at the Painted Post, N. Y., plant of the Ingersoll-Rand Co. Considerable damage was done to the boiler.

(194.) — On April 8, Solomon Burke was killed as the result of a boiler explosion at the saw mill of W. M. Walker, Linden, N. C.

(195.) — The explosion of a locomotive boiler on the Southern Pacific, at Stanwix Station, Ariz., April 9, resulted in the death of C. C. Vaughn, engineer, and the fatal injury of B. E. Norton, fireman.

(196.) — On April 9, a heating boiler in the Turkish Baths at 120-122 Ridge St., New York City, exploded, fatally scalding two persons.

(197.) — On April 10, the boiler at the mill of the Orillia Lumber Co., Orillia, Wash., failed, injuring three men, one fatally.

(198.) — A tube ruptured April 10, at the plant of the Virginia Portland Cement Co., Fordwick, Pa. John A. Harris, fireman, was injured.

(199.) — A cast iron header ruptured April 10, in a water tube boiler at the mill of the American Steel and Wire Co., Waukegan, Ill.

(200.) — A blow-off pipe failed at the Moxie Co's plant, New York City, on April 12.

(201.) — On April 12, a stop valve on the main steam line ruptured at the Western Branch, National Home for Disabled Volunteer Soldiers, National Military Home, Kans. John Ockerman, helper, was killed.

(202.) — A boiler ruptured April 13, at the plant of the Union Dairy Co., Rockford, Ill. The damage was small.

(203.) — On April 15, a boiler used for well drilling at New Martinsville, W. Va., exploded, killing Thos. S. McNight, a tool dresser, and injuring one other.

(204.) — On April 16, the crown sheet of a locomotive portable boiler pulled off the stay bolts at the Holran Stone Company's quarry, Maple Grove, O.

(205.) — On April 16, as the result of a boiler accident at the plant of the Pacific Coast Steel Co., South San Francisco, Cal., one man was fatally injured.

(206.) — A boiler exploded April 17, at an oil well near Cannonsburg, Pa. One man was injured, and will probably die.

(207.) — On April 17, a boiler exploded at a fertilizer plant near Seven Stars, Pa. One man was slightly injured.

(208.) — The boiler at the plant of the Powell River Milling Co. exploded April 19. Leonard Swanson and Henry Hollingsworth were killed, and some six others injured, one fatally.

(209.) — On April 19, a boiler failed at Newbill's saw mill, Lebanon, Pa. Three men were killed and three injured, one fatally.

(210.) — A tube ruptured April 19, in a water tube boiler, at the Donora, Pa., plant of the American Steel and Wire Co. Considerable damage was done to the boiler.

(211.) — A copper cooker failed April 20, at the Fleishmann yeast plant, Cincinnati, O. One man was killed and five were injured, two fatally.

(212.) — An Illinois Central locomotive boiler exploded in the yards at Bloomington, Ill., April 21. Weaver Hillerman, engineer, was killed and Orville Clay, fireman, seriously injured.

(213.) — A boiler ruptured April 22, at the plant of the Flower City Tissue Mills Co., Greece, N. Y. The damage was slight.

(214.) — On April 22, the boiler of a Western Pacific locomotive exploded near Elko, Nev., killing three trainmen.

(215.) — The boiler at the Butterfield saw mill, Kelso, Wash., exploded April 23. Three men were scalded, and property damaged to the extent of about $1,000.

(216.) — A tube failed April 25, in the basement of the Rike-Kumler store, Dayton, O. Two men were injured.

(217.) — On April 25, a tube failed in a boiler at the power house of the Sheboygan Railway and Electric Co., Sheboygan, Wis. Two men were slightly injured.

(218.) — On April 25, a tube ruptured in a water tube boiler at the Pickands Mather Co's furnace, Toledo, O. One man was injured.

(219.) — A tube ruptured on April 26, at the power house of the Metropolitan St. Ry. Co., Central Ave. and Water St., Kansas City, Kans.

(220.) — On April 27, the crown sheet of a locomotive collapsed on the main line of the Union Railroad Co., Port Perry, Pa. W. H. Watkins and W. F. Wesser, engineers, were injured.

(221.) — A plate failed in a boiler at a paper box factory, Thomas and Cambridge Sts., Milwaukee, Wis., on April 28. One man was scalded.

(222.) — A tube ruptured April 30, in a water tube boiler at the power plant of the Mobile Electric Co., Mobile, Ala. The damage was small.

(223.) — Several cast iron headers fractured April 31, at the plant of the Quaker Lace Co., Philadelphia, Pa.

MAY, 1912.

(224.) — On May 1, the furnace of a Scotch marine boiler collapsed at the plant of the National Biscuit Co., 409 Liberty St., Pittsburgh, Pa. The damage to the boiler was considerable.

(225.) — The heating boiler at Public School No. 1, Long Island City, N. Y., exploded May 2. Over 1600 school children were marched out of the building in less than three minutes, no one was injured.

(226.) — A heating boiler exploded May 3, in a residence at Ridley Park, Chester, Pa. One man was injured.

(227.) — On May 3, two concave heads in the steam drum of a water tube boiler collapsed, at the plant of the Ohio Iron and Steel Co., Lowellville, O..

(228.) — A tube ruptured May 5, in a water tube boiler, at the plant of the Tri-State Railway and Electric Co., East Liverpool, O. Clyde Jones, fireman, was injured.

(229.) — On May 5, the boiler of the launch Orin B., used by the Atlantic Gulf and Pacific Co., on the barge canal works near Glen Falls, N. Y., exploded. Charles Grilse, engineer, was killed and George H. Terry, injured.

(230.) — The boiler of a threshing machine exploded May 6, on the farm of Otto Drake, Dundee, Mich. Two men were killed.

(231.) — On May 6, the flanging of a vulcanizer failed at the plant of the Boston Woven Hose and Rubber Co., Cambridge, Mass.

(232.) — A tube ruptured May 6, in a water tube boiler, at the Diamond Crystal Salt Co., St. Clair, Mich.

(233.) — A water heater exploded May 6, in Hanscomb's restaurant, So. Ninth St., Philadelphia, Pa. The loss was estimated at $5,000.

(234.) — A tube ruptured May 9, at the rolling mill of Moorehead Bros. and Co., Sharpesburg, Pa. Considerable damage was done to the boiler, and Wick Velump, fireman, was injured.

(235.) — On May 11, a boiler at the Landingville knitting mill, Landingville, Pa., exploded. Harry Warmkessel, fireman was scalded.

(236.) — A tube ruptured May 12, in a water tube boiler at the plant of the Kenosha Gas and Electric Co., Kenosha, Wis.

(237.) — On May 15, a boiler failed at the Duquesne Steel Foundry, Kendall Station, Pa. The damage was confined to the boiler.

(238.) — A vulcanizer exploded May 16, at the Empire Rubber Co's plant, Trenton, N. J., killing one man, and fatally injuring two more.

(239.) — A blow-off pipe failed May 16, at the Lessing Apartments, owned by Chas. E. Rector and T. J. Tucker, Chicago, Ill. Chas. O'Conner, engineer, was slightly injured.

(240.) — On May 18, a flue in a dryer collapsed at the Kansas City, Kans. plant of the Swartzchild & Sultzburger Co. The damage was confined to the vessel itself.

(241.) — The boiler exploded May 18, at the saw mill of John de Frain, near Brownback's Church, Pa. Charles Smith and Chester Herzog were killed, and three others injured.

(242.) — On May 21, a steam pipe burst on the steamer James E. Davidson, in Lake Superior. Eight men were scalded, two fatally.

(243.) — A saw mill boiler exploded May 24, at Farina, Ill. One man died as the result of injuries received.

(244.) — The boiler of a well drilling machine exploded May 24, on the property of F. Marion Vanderveer, North Branch, N. J. Two men were injured.

(245.) — A tube ruptured May 25, in a water tube boiler at the blast furnace of the Upson Nut Co., Cleveland, O.

(246.) — On May 25, a flue failed in a boiler at the power house of the Wheeling Traction Co., Wheeling, W. Va. Charles Grubb was injured.

(247.) — A cast iron header failed May 30, in a water tube boiler at the plant of the Diamond Alkali Co., Fairport, O. No other damage is reported.

(248.) — On May 31, a boiler ruptured at the plant of the Dallas Portland Cement Co. The damage was small.

Fly Wheel Explosions.

(To Complete the 1911 List.)

(57.)— On September 16 an automobile fly wheel burst at the corner of Pico and Howard Streets, Los Angeles, Cal. One man was severely injured.

(58.)— A fly wheel at the plant of the Pittsburg Brewing Co., Connellsville, Pa., failed September 21, doing damage to property to the extent of $5,000.

(59.)— The fly wheel at the Transit Shoe Company's plant, Franklin, Pa., exploded October 9. One man was injured.

(60.)— October — a fly wheel burst at the plant of the United States Handle & Cooperage Co., Malden, Mo. Two men were killed and two others injured.

(61.)— On October 24 a fly wheel at the plant of the Hagerty Shoe Company, Washington Court House, Ohio, exploded, doing considerable property damage. (See Power for November 14, 1911.)

(62.)— On December 2 Harry Waldron was killed at the plant of the Standard Motor Construction Co. by the bursting of a gasolene engine's fly wheel. The engine was being prepared for installation in a motor boat.

(63.)— The fly wheel attached to an air compressor at the Ready Bullion Mine, Treadwell, Alaska, exploded about December 13. The compressor and building were demolished, and several hundred men thrown out of employment temporarily.

Fly Wheel Explosions, 1912.

(1.)— A fly wheel attached to a pumping engine used in connection with the construction of a sewer at Richmond Hill, N. Y., exploded January 1. One man received a broken arm as the result of the accident.

(2.)— On January 21 a large fly wheel failed at the plant of The Fox Paper Co., Lockland, Ohio. Oscar Cummins, an oiler, was attracted to the engine by the breaking of the main belt. The engine attained a dangerous speed, and he was killed by the bursting fly wheel while trying to close the throttle.

(3.)—The fly wheel attached to a deep well drilling machine exploded January 25 at the yards of the Paris Coal and Ice Co., Paris, Tenn. Will Dowe, engineer, received injuries which resulted in the loss of an arm.

(4.)—A fly wheel at the mill of the Friend Paper Co., West Carrolton, Ohio, exploded January 26. No one was injured, but the mill was closed one day as the result of the accident.

(5.)—On February 17 a fly wheel attached to the engine at the shingle mill of the Humbolt Manufacturing Co., Arcata, Cal., burst. Property was damaged to the extent of about $500, and one man, a saw filer, was killed.

(6.)—A wooden fly wheel at the saw mill of Triplett and McCann, Lost Camp, Mo., exploded April 17, killing John Triplett, one of the proprietors.

(7.)—On April 24 a fly wheel in the Westchester Lighting Company's power plant, Yonkers, N. Y., exploded. There was some property damage, but no one injured.

(8.)—The bursting of a fly wheel on April 28, at the plant of the Atha Tool Co., Newark, N. J., inflicted slight injuries to one man.

(9.)—On May 1 a 12-foot pulley burst in the dynamo room at the paper mill of Dill and Collins, Philadelphia, Pa. Property damage to the extent of from $3,000 to $4,000 resulted, principally through the rupture of a steam line, and the pipes of the sprinkler system by flying portions of the wheel.

(10.)—The fly wheel of an engine at the Higginsville, Mo., electric light plant failed May 13, doing property damage to the extent of about $3,000. (See front page of this number of THE LOCOMOTIVE.)

(11.)—On May 22 a fly wheel at the brick yard of Nevill Bros. and Mink, Llanwellyn, Pa., exploded, resulting in damage to the plant estimated at $1,500.

(12.)—A fly wheel attached to the engine at the Louisiana and Arkansas R. R. shops, Stamps, Ark., exploded June 4. The loss is thought to be under $1,000.

(13.)—On June 7 a pulley burst at the Rittersville Electrical Works, Allentown, Pa. One man was injured.

(14.)—A fourteen-foot fly wheel burst June 7 at the Phœnix Cement Works, Nazareth, Pa. The damages are estimated at $3,000.

(15.)—On June 10 the fly wheel of an engine at the East Jordan (Mich.) Electric Light and Power Co. burst, killing A. Z. Wilcox, the engineer, and damaging the plant to such an extent as to leave the town in darkness for a week.

(16.)—A fly wheel exploded June 11 at the power plant of the D. & H. R. R., Green Island, N. Y. The plant was damaged to the extent of $1,000.

A Narrow Escape.

W. J. SMITH, Inspector.

The opportunity of witnessing a "real live" lap seam crack in action is seldom afforded boiler operators. This unique and rather undesirable experience was recently afforded several employees of The Anderson-Middleton Company, Aberdeen, Washington. The fireman, desiring to operate a valve in a steam line over the boilers, was attracted by the issuance of steam from the insulating material on top of the boiler. Removing this covering, the steam and water were seen to spurt from a crack about ten inches long, the edges of which vibrated under the pressure.

The Chief Engineer being called, with great presence of mind instead of shutting off the engines and turbines, which might have produced a shock or increase of pressure, immediately banked the fires, closed the draft and opened the feed water valves. In this manner the pressure was soon reduced to less than forty pounds. The main stop valve was then shut off. The boiler, being one of three fired in battery, a division wall was built in the furnace and the day following the other boilers were in operation.

The defective portions were cut out of the boiler and revealed a crack one eighth of an inch from the edge of the inner lap, and about 5 ft. 6 in. long, no portion of which was visible from the inside.

The boiler was about seven years old, had been operated at its designed working pressure and had frequent and careful supervision with good care and management.

It is needless to say there is considerable congratulation going the rounds among those interested, for aside from the probable heavy loss of life, the boiler was part of a very expensive plant and surrounded on all sides by high grade machinery and equipment.

We wish to commend the coolness and good judgment of the chief engineer, and firemen of this plant. This type of boiler defect is undoubtedly one of the most treacherous of the many possible causes for boiler explosions, as it too often reveals itself only after the property is destroyed.

Instead of stopping his engines, this chief had the good sense and nerve to cover his fires, and control his steam by using it up, thus saving not only the company's property, but perhaps many lives as well. EDITOR.

A "Mexican" for a Safety Valve.

We record on another page of this issue, an instance of safety valves being so erroneously installed as to become objects of danger, by the possibility of their leading to a feeling of false security, but it remains for the following, extracted from one of our inspection reports, to cap the climax, as a display of ignorance of the vital importance of this particular boiler accessory. We give the extract verbatim.

"Engineer (?) of above plant explained that his reason for removing the safety valve from boiler was that it leaked, and that he thought as long as he had a Mexican watch the steam and not let it get too high, that the boiler was safe. He stated further, that he had a perfectly good ash pit door, and that by closing it the steam would go no higher. I tried to make it plain to all concerned, that Mexicans, and ash pit doors, would not answer in any way the purpose of a safety valve." (The inspector found that the safety valve had been replaced with a solid plug.)

The Locomotive of THE HARTFORD STEAM BOILER INSPECTION AND INSURANCE CO.

C. C. PERRY, EDITOR.

HARTFORD, JULY, 1912.

SINGLE COPIES *can be obtained free by calling at any of the company's agencies.*
Subscription price 50 cents per year when mailed from this office.
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THE LOCOMOTIVE OF THE HARTFORD STEAM BOILER I. & I. CO.

On another page we print a news item and editorial comment from the *Hartford Courant* announcing the reinsurance of the boiler and fly-wheel business of The Casualty Company of America by THE HARTFORD STEAM BOILER INSPECTION AND INSURANCE COMPANY. Of course we are gratified at this event for many reasons, but perhaps especially because of the confidence in us which is thus signified by the management of so prominent an institution as the Casualty Company. Obligations to its assured required that the service which supplanted its own should be above criticism, and self interest demanded that its reinsurance should be placed only with a company of high financial standing. We accordingly feel a pardonable pride in the recognition of our standing implied by this selection and expressed by President DeLeon of the Casualty Company in his announcement of the change to his agents as follows:

"I need not call to your attention the standing and reputation of The Hartford Steam Boiler Company throughout the United States, or to the splendid service rendered by that company to its policy holders everywhere, which has made the Hartford company pre-eminently the *leading boiler insurance company of America.*"

Appreciation like that from a one-time warm competitor is a compliment indeed. We shall endeavor to justify it by a service to the boiler and fly-wheel owners whom President DeLeon has entrusted to us which will force their endorsement of his opinion. We welcome them all to the HARTFORD STEAM BOILER fold.

The Casualty Company of America has been one of the four larger multiple-line casualty underwriters in the boiler and fly-wheel field. In 1911 according to its official statement it wrote $117,594 in premiums of these two lines, and of this amount $108,229 was for boiler insurance. There were in 1911 twenty-four casualty companies competing with the HARTFORD in steam boiler underwriting. The total of premiums written by them was $1,101,922, an average of about $46,000 per company. The Casualty Company of America, writing more than twice as much business as its average multiple-line competitor, and exceeding all but three of those competitors in the volume of that business, would seem to have had a favorable position in the field. If it has become discouraged with the prospects and financial returns from such business what bright future can allure the twenty smaller companies?

The truth is that steam boiler insurance,— and this applies to fly-wheel insurance also — is peculiar and distinct from other lines of underwriting in that to experience a normal loss ratio a technical supervision of the apparatus covered is necessary. It is obvious that the expense of such a service must be proportionately greater with a company which insures a small number of widely scattered boilers than with one whose business is so great as to justify a broad distribution of inspection centers from which all its assured may be economically reached. To make the small boiler business successful, the company writing it must either be content with little or no profits, or it must charge more for its protection than its large competitor, or it must reduce the character and frequency of its inspection service at the risk of a higher loss ratio, more accidents, and the consequent annoyance and dissatisfaction of its assured.

The HARTFORD STEAM BOILER with a business of $1,300.000 annually and with over 100,000 boilers under its care, has been able to establish a standard of service which steam users generally have come to appreciate. It has been deriving from its business an average underwriting profit less than 9%. This is certainly a moderate return for the energy expended and the risks carried. Is it likely that an insurance company would be content with less? If not it follows that the small boiler underwriter must charge more for its protection or reduce the character of it. The public is too well posted to pay to others a larger premium than will purchase HARTFORD insurance, nor will it long permit a character or lack of inspection service which risks disastrous explosions. The result is the dilemma of the kind in which the Casualty Company of America found itself and which it has solved in the manner announced.

A correspondent sends us a newspaper clipping descriptive of the action of a New York tug captain in attempting after a collision to run his boat ashore before the water leaking in could reach the boilers "and cause an explosion". With it he writes that this "and numerous articles in relation to the 'Titanic' and other sinking ships leads me to ask you if there is any foundation whatsoever for the newspaper theory that boilers in sinking steamships explode because of being plunged into cold water".

We agree with the view of this gentleman as further expressed that the theory is not tenable and that even should a boiler under such circumstances fail locally the force of the explosion would be slight owing to the almost instantaneous condensation of the steam when submerged in the cold water. We admit that we have not ourselves been on a sinking steamship, but our company has had opportunity of examining boilers which have passed through that ordeal, and others which because of a fire have had cold water poured upon them. The evidence thus available would indicate that not always at least does submerging cause a boiler explosion, and further we do not see why it should.

It may be stated without fear of contradiction, that a boiler explodes because it is incapable of withstanding the internal pressure exerted in it. The disaster may be caused either by an abnormal increase in the pressure or by an equally abnormal decrease in the strength of the boiler material. Now, so far as we can see, none of the conditions necessary to an increase in pressure would be produced by submerging in water a boiler under steam. Such a treatment would naturally reduce the temperature and consequently the pressure very promptly. The treatment could have little effect, either, on the strength of a vessel made up of steel plate although it is probable that local contraction strains would be produced by a gradual rather than sudden submergence. The steel used in boilers is not usually a brittle material and withstands sudden and violent changes in temperature without cracking. Failing to discern among the conditions which attend the submerging of a boiler anything which would increase the pressure or decrease its strength and being to an extent backed by the slight experience already suggested, we will — pending evidence to the contrary — continue in the belief that a boiler explosion is not a necessary circumstance in the sinking of a ship.

It may be added that the tug captain first mentioned did not according to the clipping succeed in "beaching" his boat before it sank, and if in sinking the boilers exploded, the effect was too insignificant for the reporter to record.

Announcement.

Hartford, Conn., July 1, 1912.

In the January number of The Locomotive our Company announced with regret the resignation of the editor who had so ably conducted this paper for a number of years. Since then we have been seeking a man to fill the place thus made vacant and from a number under consideration have selected Mr. Clarence C. Perry, who commences his editorial duties with this issue.

We feel that Mr. Perry is especially equipped by his experience and education for a work which requires both a theoretical and practical knowledge of steam and allied engineering practices and also a wide acquaintance with the literature of those subjects. He is a graduate of The Sheffield Scientific School of Yale University, class of 1904, and since then as a member of the faculty of that institution has been instructing the students of the Department of Electrical Engineering in physics and steam engineering subjects. While in this position Mr. Perry was frequently called in consultation where expert advice on steam matters was desired and thus was brought in intimate contact with the practical problems of installation and operation.

I take pleasure in this opportunity of introducing Mr. Perry to those of our own organization who have not met him personally, as well as to our assured and other readers, and express my conviction that under his management our paper will continue in its position of authority and interest among technical periodicals.

Lyman B. Brainerd, *President*.

Obituary.

Sylvester W. Higgins, special agent for the Hartford Steam Boiler Inspection and Insurance Co., at Detroit, Mich., died May 7 at his home, 120 Euclid

Ave., in that city. His death came as the culmination of an illness of several months duration.

Mr. Higgins was born in Utica, N. Y., in 1834, but removed to Detroit with his family at an early age. The family were prominent both in the city and state, being associated closely with church work in Detroit. His father was at one time State Geologist of Michigan.

Mr. Higgins had been the Detroit representative of the Hartford Steam Boiler Inspection and Insurance for some twenty years, and his sterling qualities won for him the esteem and respect of all his business associates.

He is survived by a widow and three daughters, Frances E. and Ethel M. of Detroit, and Mrs. R. R. Strong of Pueblo, Col.

Personal.

Mr. Joseph H. McNeil, who, since 1898, has been connected with the boiler inspection service of the State of Massachusetts, first as inspector, and later as chief inspector, and chairman of the Board of Boiler Rules, tendered his resignation, to take effect July 8th, in order that he might accept the position of chief inspector in the Boston Department of THE HARTFORD STEAM BOILER INSPECTION AND INSURANCE COMPANY.

Mr. McNeil's experience has been both wide and varied, and is of such a nature as to fit him most admirably for the position he now enters with the HARTFORD. Born at Charlottetown, Prince Edward Island, in 1865, he was educated in the public schools, and Prince of Wales College. His experience has included railway work, both mechanical and executive, with the Prince Edward Island Railway and the various phases of stationary and marine engineering. He has held the position of chief engineer of ocean going vessels, under licenses, both from the United States government and from the British Board of Trade. Of his work for Massachusetts, it is perhaps only necessary to say that the well-known boiler inspection law of that state owes much of its success, if not its very existence, to his judgment, tact, and executive ability.

Chief Inspector Frank S. Allen, who has had charge of both the Boston and Hartford departments, will by this appointment be relieved of the detailed supervision of the large number of boilers in the former district. He will continue in immediate charge of the inspection service handled from Hartford, and will be able to devote his attention to the general inspection problems of the Home Office to a greater extent even than in the past.

The Boiler and Fly Wheel Insurance of The Casualty Co. of America Taken Over By the HARTFORD.

[From The Hartford (Conn.) Courant June 28, 1912.]

The Hartford Steam Boiler Inspection & Insurance Company has taken over and reinsured all of the steam boiler and fly wheel business of the Casualty Company of America of New York City.

The Casualty Company of America was organized and commenced business in September, 1903, as a multiple line company, and it has gradually built up and developed the numerous casualty lines to an extent that its aggregate net premium receipts last year exceeded $2,500,000. From the insurance commissioner's report of 1912, it would appear that it is one of the stronger and more progressive companies, having a paid up cash capital of $750,000, a net surplus over all liabilities exceeding $205,000, and total assets exceeding $2,801,000.

As relating particularly to the steam boiler line, the Casualty Company of America ranks as the fourth or fifth company in point of volume, its steam boiler premiums written last year exceeded $108,000, and the volume of business taken over by the Hartford Steam Boiler Insurance Company exceeds 12,500 boilers and about $100,000,000 of insurance liability. This is undoubtedly the largest transaction that has ever taken place in this particular line of insurance.

From an interview with President Brainerd of the Hartford Steam Boiler Insurance Company it was learned that conditions pertaining to the steam boiler line are in a very unsettled and unsatisfactory condition, and that competition is very keen. He further said that as the steam boiler line was so limited in volume as to render it impossible for any one company to develop and greatly expand it, in view of the fierceness of competition and the great cost of maintaining an inspection service, such as is now demanded by the insuring public and in many instances required by law, the management of the Casualty Company of America had reached the decision that the resources of the company and the time and energy of its officers could be better and more profitably employed in developing and building up its other and more prominent and more promising lines of insurance.

It appears that the total amount paid last year for steam boiler insurance throughout the United States amounted to but $2,303,104, and that of this amount $1,275,103 was paid to the Hartford company, notwithstanding there were no less than twenty-five companies competing for this small volume of business. It was further explained that because of the peculiar character of steam boiler and fly wheel insurance, their distinctive feature being the maintenance of an efficient inspection service, they are two of the most limited and most expensive lines to conduct of all the numerous casualty lines, and that unless a considerable volume can be controlled in each state throughout the Union, an efficient inspection service cannot be maintained with any promise of profit, in view of the expenses in maintaining an organization and an inspection service as today required, if the business is to be properly conducted.

It will at once be observed that if the premiums paid for steam boiler insurance should gradually become equally apportioned between all the companies at this time competing for it (and all things being equal, and each company maintaining an equal and as extended an organization and efficient inspection service, there is no reason why this condition should not obtain), there would be an average of less than $100,000 annually that it would be possible for any one company to secure, and that this sum would be barely sufficient to maintain one inspector in each state throughout the Union.

The Hartford Steam Boiler Inspection & Insurance Company was organized and commenced business in 1866, and on January 1 last its paid-up capital was $1,000,000, its net surplus over all liabilities exceeded $1,801,000, and its assets amounted to $5,045,874.60. It makes a specialty of steam boiler and fly wheel insurance and conducts no other class or kind of insurance.

This is the seventh instance in which the Hartford Steam Boiler Company has taken over the steam boiler line of other companies.

EDITORIAL COMMENT.

It is an important announcement that President Brainerd of the Hartford Steam Boiler Inspection and Insurance Company makes this morning — the acquisition of the steam boiler business of the Casualty Company of America. The amount of reinsurance is said to equal about one-tenth of the Hartford company's present business. It is a substantial business deal, comprehending an original premium income of over $300,000.

The steam boiler insurance business has been conducted profitably in Hartford and many small companies have been formed to enter the field. These companies find that an adequate inspection service, such as the Hartford company maintains, is a great expense and one sure preventative of large profits. It would not be surprising, therefore, if other companies followed the Casualty Company's lead. The Hartford company can take over this insurance with very slight increase in its working force. It means more business for Hartford.

Boiler Tubes Undergo a Marked Loss of Ductility.

By a Chief Inspector.

In the examination of boilers and other vessels operated under steam pressure, the inspector often meets conditions which to him at least are unexpected and peculiar. But while they may be new to him, generally on conferring with other inspectors, he will learn of similar instances. The present incident, with its tests showing the nature of the trouble, may be of assistance to some one in clearing up such a difficulty.

The agent for a large manufacturing concern desired an examination of one of his boilers, which were of the water tube type, and all duplicates. They had been in service but a comparatively short time. He requested this inspection not because of any trouble, but on general principles, as several months had elapsed since the last regular examination. The writer responded to this request, finding one of the boilers properly prepared for inspection. No ordinary defects were found. The boiler was clean and free from scale in all its tubes and drums. The tubes were of full thickness, and under the hammer test not the slightest indication of anything defective was conveyed to the examiner. He noted however, a peculiar appearance to those tubes which were accessible, and directly exposed to the fire. Touched with a fine file the metal was bright, and its appearance was perfectly normal. The unusual color of the tubes however disturbed him very much, and he requested that some of them be removed for testing; since while they might prove soft and ductile, he was of the opinion that they were dangerously brittle, and feared from the general arrangement of the fire room that loss of life would follow the failure of a tube at the high pressure carried. He held this view notwithstanding the fact that these boilers were designed with a good factor of safety for the pressure carried, for he considered the danger of personal injuries greater than that of a property loss. The mill agent took up the question of testing the tubes at once. The first blow struck with a chisel in cutting off one of them close to the drum, caused the tube to break. Every tube was then removed and test specimens one inch wide cut from each. All were found to be practically as brittle as the first, and showed an entire absence of ductility. It was felt that if they had been continued in service, a shock, or even the vibrations of the engine would have been sufficient to have fractured a tube, and the reaction might well have caused the breaking of several more.

Samples of four of these tubes were sent for chemical analysis, the result of which is given in table 1.

Table 1.

	No. 1.	No. 2.	No. 3.	No. 4.
Carbon	.06%	.06%	.06%	.06%
Manganese	.02%	.02%	.02%	.02%
Phosphorus	.079%	.073%	.065%	.073%
Sulphur	.020%	.026%	.024%	.020%
Silicon	.154%	.159%	.143%	.154%

Compared with the requirements for fire box steel boiler plate the low percentage of carbon and manganese, with high phosphorus will be at once noted, and will indicate why the tubes were so deficient in ductility.

At about this same time, a similar change was found to have occurred in the tube cap bolts of another type of water tube boiler, from the same maker, but belonging to another firm. These bolts which were not exposed either to the direct action of the fire, or to so high a pressure as in the first case, were found by the inspector to be so brittle that on sounding them with his light hammer, many of them broke as if they had been glass rods. The chemical analysis of these bolts was very similar to that of the tubes mentioned above, though differing from it to a slight extent. The conclusion is obvious that the stock in both the tubes and bolts was of a very inferior quality and ought never to have been used in any place exposed to high temperatures or to strains due to pressure.

A new tube and several bolts from the same stock as those removed, were tested physically and showed good ductility, but analysis proved that the material was no better than that which had been rejected for its extreme brittleness.

It has long been a dream of the writer that all material used for boiler work should be plainly marked, the marks to be uniform with all manufacturers, and to indicate the quality of the material. These could be placed upon the head of a bolt in forging, at slight expense, and in welded tubes, could be made at the time of welding. Solid drawn tubes present of course, a slightly different problem, but that process itself would perhaps be a guarantee of a better quality of material than would be used for welding.

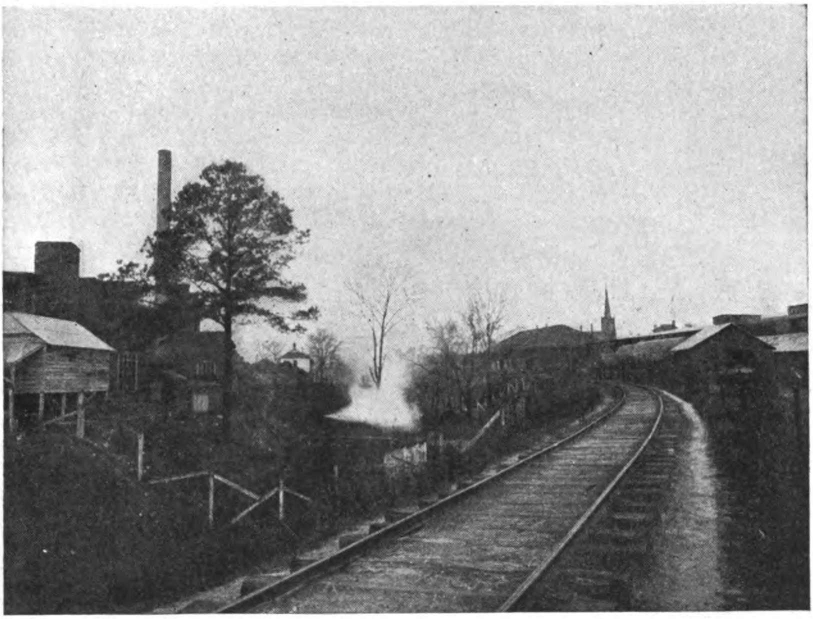


FIG. 1. THE OIL TANK, RAILROAD AND BOILER HOUSE.

An Alabama Mystery.

The accompanying photographs were sent us by a correspondent whose veracity we have no reason to doubt, in substantiation of the following most remarkable boiler accident. This mishap occurred to what was then the No. 2 boiler of the Eufaula Cotton Mill, Eufaula, Ala., early in 1897. This boiler is said to have discharged certain of its tubes bodily through the tube sheets, sending four of them out of a window, across a gulley and a railroad track, until they were intercepted by an oil tank which they pierced. The relative location of the track, gully, boilerhouse, and oil tank can be seen by reference to the photograph, Fig. 1, which shows the present appearance of this locality. A close scrutiny of Fig. 1 will show patches applied to the tank, and if one will turn to Fig. 2, which is a nearer view, one will see that they consist of a horseshoe, and three round patches, said to have been placed there in repairing the damage done by the flying tubes. A fifth tube missed the tank, but punctured the stack which occupied the site of that shown in Fig. 1, but has since been removed to a location such that it was impossible to obtain a photograph of it.

The accident happened early one Sunday morning, about 5 a. m., when no one except the watchman was about the plant. He was attracted by an unusual noise in the direction of the boiler house, but the performance was over before he could reach the scene. The cause of this peculiar action was never satisfactorily explained, and remains one of the mysteries of our Atlanta Department.

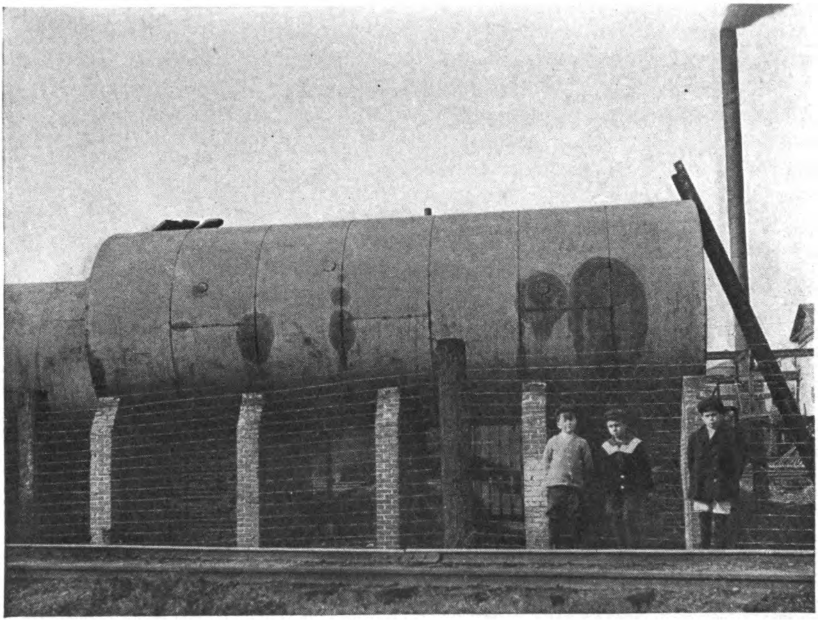


FIG. 2. THE PATCHED OIL TANK.

The boiler itself did not leave the setting, indeed it was not sufficiently disturbed to disconnect it from the steam pipe. Nine tubes left the boiler entirely, and seven or eight more were projected part way through the front head. Aside from slight repairs to the setting, the only work needed on the boiler was the replacing of these sixteen or seventeen tubes.

The question remains unanswered as to what made this boiler cut up this particular sort of caper, and if anyone can answer it, or cite a parallel case, we shall be very glad to hear from him.

Patching a Boiler Without Rivets, Bolts, or Welding.

E. J. ENOCH, *Inspector.*

Not long since a brother inspector, in reporting upon a patch applied to a boiler, remarked that "the job looked as though it had been done by a shoemaker."

The writer was recently sent to inspect a job of repair involving a patch, but as it was neither pegged, nailed or sewed, it could hardly be said to display the art of shoemaking, resembling more the handiwork of a bricklayer.

The patch in question was placed on the rear drum of a Hawley down draft furnace. This was attached to a horizontal tubular boiler which carried a working steam pressure of one hundred and twenty-five pounds. A crack had developed in the drum, starting at one of the tube holes in the upper row, near the center, and extending circumferentially to a point near the top, a length of about five inches. The boiler maker (?) who was called to make repairs prepared a patch of ⅜" plate, shaped like Fig. 1 to fit over the top of the drum, and down each side of the tube opposite the fracture. A liberal quantity of asbestos cement was spread over the crack, the patch placed over the cement, and the brick arch, or deflecting wall rebuilt on top of the patch to keep it in position.

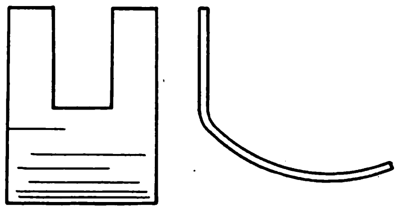


FIG. 1. THE PATCH.

It is not known what pressure was attained after the repair was completed, as the attendant was kept so busy in a fruitless effort to maintain a fire in the furnace against the flow of water from the fracture, that he failed to note the reading of the pressure gage. Nevertheless the patch was not blown out of the furnace, and the greatest damage was to the purse of the mill owner.

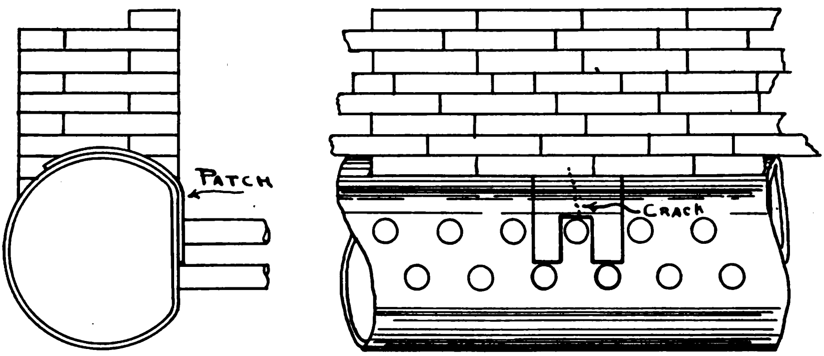


FIG. 2. PATCH BRICKED AND CEMENTED IN PLACE.

Queer Cause for an Erratic Steam Gage.

By INSPECTOR J. J. MCCURRY.

One of our inspectors relates the following incident relative to an incorrect steam gage, and the queer cause which he found for its lack of truthfulness.

He was called to a plant to make a test as the gages were not reading together. There were two gages in the boiler room, one on each of two Stirling boilers, and one, a recording gage, in the engine room. On removing the gage from boiler No. 1, it was found to be 5 lbs. "slow", but on resetting, and replacing it, it agreed perfectly with the recording gage. The other gage on the No. 2 boiler was then found to be 12½ lbs. ahead of the one just reset, and it

(No. 2 gage) had been supposed to register correctly. This caused the engineer to question the inspector's test gage. The inspector, however, took down and tested the No. 2 gage, and found it to be 2 lbs. "fast" as compared with his test gage. The engineer was now certain of the inaccuracy of the test gage, and not too sure of the reliability and usefulness of boiler inspectors in general, but the inspector, loath to distrust his old and tried friend, sought for some obstruction in the gage connection, without however succeeding in his search. As he tersely puts it, "She was wide open, and so was the engineer." Still, unable to lose all faith in his pet gage and pump, he ordered the offender replaced on the No. 2 boiler, and there it stood with its hand quite still at 125 lbs. The inspector, now wholly aroused, climbed up on a ladder to obtain if possible, some additional information. The hand seemed clear of the glass and dial, but he finally noticed a slight bulge near the center of the dial, sufficient to cause the hand to hang up. He removed the face, set the dial back, and replaced the gage, only to find it still 10 lbs. off, as compared with that on the other boiler.

This set the inspector thinking. He was sure the hand was not resting on the dial when he set the gage, and tested it with his pump. He had also done all the work himself except taking it down, and putting it back, which fact at last lead him to the answer to his puzzle. He examined the screws which held the gage to the boiler front, and found them all set up tight, clamping the back of the gage securely to the boiler front. This, instead of being perfectly flat, was somewhat uneven, and thus caused the back of the gage to be pushed forward enough to make the dial encounter the hand, causing considerable friction, and explaining its erratic action. He found that he could easily vary the reading 10 lbs. by merely manipulating these holding screws, and when all tension was removed from the back of the gage, it fell into line, not only with the gage on the other boiler, but with that in the engine room as well, completely vindicating his pet test gage, and we are lead to judge, somewhat discomfiting the engineer.

A NOVEL METHOD FOR THE PREVENTION OF BOILER EXPLOSIONS.

We extract the following from a letter, written by one of our southern inspectors.

"Some few years ago a man in southern Arkansas owned and operated a small single boiler sawmill. The boiler after several years service, had developed a small steam leak at a longitudinal seam. The firemen reported the fact to the proprietor and stated that he, (the fireman) was afraid she would "bust." The German brains of the proprietor devised and executed the following idea. Securing several lengths of log chain, and fastening them together at the ends until a sufficient length was obtained. He wrapped the boiler in a spiral fashion with several turns of the chain, hauling it taut with a yoke of oxen, after which wedges were driven under the chains at several points."

The Hartford Steam Boiler Inspection and Insurance Company.

ABSTRACT OF STATEMENT, JANUARY 1, 1912.

Capital Stock, . . . $1,000,000.00.

ASSETS

Cash on hand and in course of transmission,		$204,693.25
Premiums in course of collection,		263,453.33
Real estate,		91,100.00
Loaned on bond and mortgage,		1,166,360.00
Stocks and bonds, market value,		3,249,216.00
Interest accrued,		71,052.02
Total Assets,		$5,045,874.60

LIABILITIES.

Premium Reserve,		$2,042,218.21
Losses unadjusted,		102,472.53
Commissions and brokerage,		52,690.67
Other liabilities (taxes accrued, etc.),		47,191.65
Capital Stock,	$1,000,000.00	
Surplus over all liabilities,	1,801,301.54	
Surplus as regards Policy-holders,	**$2,801,301.54**	2,801,301.54
Total Liabilities,		$5,045,874.60

L. B. BRAINERD, President and Treasurer.
FRANCIS B. ALLEN, Vice-President. CHAS. S. BLAKE, Secretary.
L. F. MIDDLEBROOK, Assistant Secretary.
W. R. C. CORSON, Assistant Secretary.

S. F. JETER, Supervising Inspector.
E. J. MURPHY, M. E., Consulting Engineer.
F. M. FITCH, Auditor.

Incorporated 1866. Charter Perpetual.

The Hartford Steam Boiler Inspection and Insurance Company

ISSUES POLICIES OF INSURANCE COVERING

ALL LOSS OF PROPERTY

AS WELL AS DAMAGE RESULTING FROM

LOSS OF LIFE AND PERSONAL INJURIES DUE TO EXPLOSIONS OF STEAM BOILERS OR FLY WHEELS.

Full information concerning the Company's Operations can be obtained at any of its Agencies.

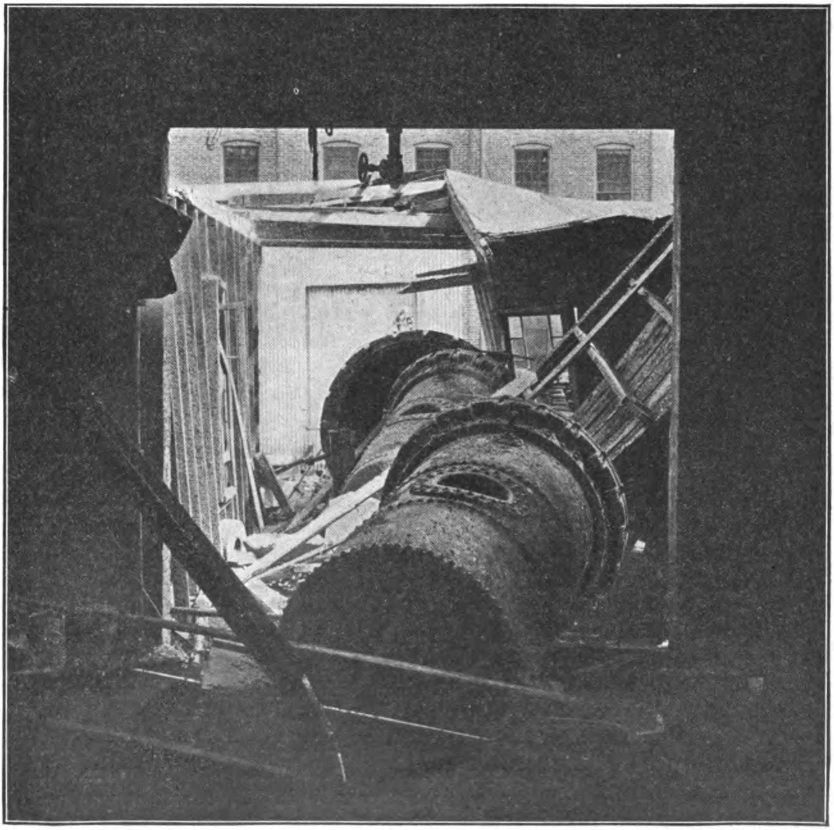
Department.	Representatives.
ATLANTA, Ga., . . 611-613 Empire Bldg.	W. M. Francis, Manager & Chief Inspector.
BALTIMORE, Md., . . 13-14-15 Abell Bldg.	Lawford & McKim, General Agents. R. E. Munro, Chief Inspector.
BOSTON, Mass., . . 101 Milk St.	C. E. Roberts, Manager. Joseph H. McNeil, Chief Inspector.
CHICAGO, Ill., ... 160 West Jackson St.	H. M. Lemon, Manager. James L. Foord Chief Inspector. J. T. Coleman, Assistant Chief Inspector.
CINCINNATI, Ohio, . First National Bank Bldg.	W. E. Gleason, Manager. Walter Gerner, Chief Inspector.
CLEVELAND, Ohio, . Century Bldg.	H. A. Baumhart, Manager & Chief Inspector.
DENVER, Colo., . . Room 2, Jacobson Bldg.	Thos. E. Shears, General Agent & Chief Inspector.
HARTFORD, Conn., . 56 Prospect St.	F. H. Williams, Jr., General Agent. F. S. Allen, Chief Inspector.
NEW ORLEANS, La., . 833-835 Gravier St.	Peter F. Pescud, General Agent. R. T. Burwell, Chief Inspector.
NEW YORK, N. Y., . 100 William St.	C. C. Gardiner, Manager. W. W. Manning, Chief Inspector.
PHILADELPHIA, Pa., . 432 Walnut St.	Corbin, Goodrich & Wickham, General Agents. Wm. J. Farran, Chief Inspector. S. B. Adams, Assistant Chief Inspector.
PITTSBURG, Pa., . . 1801-1802 Arrott Bldg.	C. D. Ashcroft, Manager. Benjamin Ford, Chief Inspector. W. A. Craig, Assistant Chief Inspector.
PORTLAND, Ore., . . 306 Yeon Bldg.	McCargar, Bates & Lively, General Agents. C. B. Paddock, Chief Inspector.
SAN FRANCISCO, Cal., . 339-341 Sansome St.	H. R. Mann & Co., General Agents. J. B. Warner, Chief Inspector.
ST. LOUIS, Mo., . . 319 North Fourth St.	V. Hugo, Manager & Chief Inspector.
TORONTO, Canada, . Continental Life Bldg.	H. N. Roberts, General Agent.

The Locomotive

of

THE HARTFORD STEAM BOILER INSPECTION AND INSURANCE CO.

Vol. XXIX. HARTFORD, CONN., OCTOBER, 1912. No. 4.



A Vulcanizer Explosion.

Vulcanizer Explosion.

Our front cover shows the failure of a vulcanizer May 16 at the plant of the Empire Rubber Company, at Trenton, N. J. This type of vessel presents an interesting problem in design because of its large size and the necessity of providing it with a large cover, which shall be at once amply strong and capable of quick opening and closing, a feature which usually results in the use of some form of casting, with all the difficulties which that type of construction involves. The failure of one of these vessels is apt to be very destructive and is frequently attended by loss of life. In the present instance one man was killed outright, and two others were fatally injured. This was explosion No. 238 in our list for May, 1912.

Old Boilers.

The subject of a proper retiring age for old steam boilers is one which comes frequently to light, and which has been in the past a most fruitful source of controversy. Of course there can be no question as to the propriety of condemning to forced retirement those boilers whose diseases of one sort or another have reached the chronic stage, and are no longer curable, but there is at once the basis for a deal of argument when an inspector approaches the owner of a boiler with the statement that it must be replaced because of old age, especially if it is known to have all the apparent qualifications except youth, for many additional years of service.

In the past many curious properties have been attributed to old boilers. One of the most interesting was the notion that they could not explode violently. It was supposed that an old boiler would merely rupture, allowing the pressure to be relieved much as if the safety valve had opened. This idea was discussed at some length in the LOCOMOTIVE in 1881. It was definitely disproved along with many other fallacies, and much popular mystery concerning boiler explosions, by a series of experiments conducted by Mr. Francis B. Stevens, of Hoboken, the founder of Stevens Institute, and Prof. R. H. Thurston, at the Sandy Hook proving grounds in the fall of 1871. These tests consisted of a series of prearranged boiler explosions in which old boilers, and some new boiler elements were exploded by raising a steam pressure in them sufficient to produce failure. They gave the first conclusive proof of the fact that a boiler filled with water to its normal level could explode, and also that a boiler might explode violently when hot and under steam at a pressure less than that which it had successfully withstood under the ordinary hydrostatic test.

In 1881 Mr. W. B. LeVan, of Philadelphia, proposed to the American Society of Mechanical Engineers* that all steam boilers should be retired at the age of ten years arbitrarily, in much the same way that car wheels and axles are retired after a certain mileage. His reason for this view was his general distrust of boiler inspection, and although he admitted that the use and care a boiler received must influence its life, he was unwilling to believe in the probability of an inspector finding the extent of that influence, and so expected to forestall all danger by his ten year limit. Of course it was pointed out at that time that such a rule would work great hardship to the owner who

* "The Lifetime or Age of Steam Boilers," W. B. Le Van, Trans. A.S.M.E. Vol. II., Page 503.

used a good boiler well, and would unduly encourage the unscrupulous owner to push his poor boilers, by fair means or foul, to accomplish their utmost in the allotted ten years.

However there is a border line between the obvious defects an inspector can detect, and that gradual change in the physical character of the metal coming with advanced age and long use, which can only be implied by a knowledge of similar cases. Here it is that an insurance company must at times make a stand for the removal from service of an old boiler, or at least for a great reduction in the pressure at which it is worked. In order to prove the soundness of such rulings, old boilers have been tested from time to time, and it is the purpose of the present article to review certain of these tests, and show the character of the evidence upon which these old age retirements are based.

In general two sorts of tests can be made. One sort, of which the early tests of Stevens and Thurston are examples, consists in subjecting the entire boiler, considered as an engineering structure, to either a steam, or hydrostatic pressure great enough to cause rupture. The hydrostatic test is usually employed since it permits careful measurements of the strains at various points to be made as the test progresses, and with these an accurate record of the pressures producing them. The other class includes tests of the metal taken from different parts of a boiler, to show its physical and chemical properties, and if the original condition of the material is known, is of great value. It of course may very well form an addition to a test of the first sort. Within a short time, five old boilers, whose entire history is known, have been tested to destruction by the application of hydrostatic pressure. Three of these, the property of the Oliver Iron Mining Co., of Ishpeming, Mich., were tested by Mr. A. M. Gow, their assistant engineer. The other two were presented to the Bureau of Standards for test by Mr. Nicholas Sheldon, treasurer of the Kendall Manufacturing Co., of Providence, R. I. These boilers were tested to destruction at the plant of W. H. Hicks, boiler makers, Providence, R. I., by Mr. James E. Howard, engineer — physicist of the Bureau of Standards, assisted and advised by Mr. F. B. Allen, vice-president of THE HARTFORD STEAM BOILER INSPECTION AND INSURANCE CO. All five of these boilers had been carried on the books of the HARTFORD, and had been removed from service at their request.

The boilers tested by Mr. Gow, were known in the records of the HARTFORD by the numbers 301, 302, and 303 and will be designated in this way. They were nearly identical in construction, of the horizontal return tubular type, 72 inches in diameter, and 15 feet long. The shells were in five courses, and were made of 3/8 inch plate. The heads were 1/2 inch in thickness. The longitudinal seams were of the double riveted lap type fastened with 3/4 inch rivets, pitched 2 inches apart, and each boiler was fitted with a cast iron manhole frame on top of the next to the last course, with a clear opening of about 12×16 inches having its greatest diameter girthwise of the boiler. Two 4 inch cast iron nozzles were also fitted to each boiler, one on the rear, and one on the second course, for the attachment of the safety valves and steam pipes. The blow off connections were in the rear heads, and had been used for a long time for the introduction of the feed water. Reference to Fig. 1 will make clear the general arrangement of the boilers, and will indicate their only point of difference, namely that No. 302 contained 112 three inch tubes, while both No. 301, and No. 303 were provided with 83 four inch tubes.

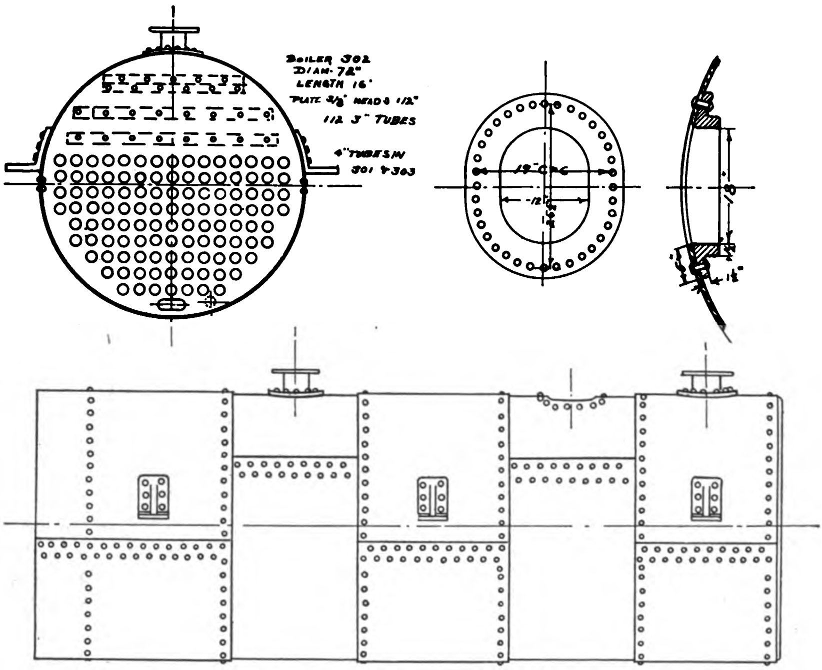


FIG. 1. DETAILS OF BOILERS 301, 302, AND 303.

The report of the HARTFORD'S inspector shows that these boilers, aside from age were in apparent good order. There was evidence that no rivets had been replaced, and that the seams had never been chipped and caulked. No fire cracks were visible, and although there was a slight indication of over-heating on the bottom sheets of the rear courses, this was considered trivial. The only repairs known to have been made, were several complete renewals of the tubes.

All three boilers appear to have been made by Kendall and Roberts of Boston, No. 302 about 1877, and the other two about 1879. The steel plates in No. 302 were branded "Bay State Homo," while those of No. 301 and No. 303 bore the brand "Nashua Iron and Steel Co., Nashua, N. H." "Cast Steel 60,000 lbs.," and an encircled Indian's head. Mr. Gow in his report of the tests published in "Power" gives it as his opinion that these were among the first boilers to be made in this country of Siemens open hearth steel.

Boiler No. 302 was tested June 6, 1911. Pressure was applied gradually, and at 275 lbs., the manhole frame failed, tearing the adjacent sheet as shown in Fig. 2. A steel tape stretched around the boiler girthwise, showed a stretch of 3/16 inch in circumference just before the rupture, but on the release of the pressure, no permanent set was found, showing that the elastic limit of the plate had not been reached.

Boiler No. 303 was tested the following day, and in order to find if possible other sources of weakness, the manhole frame was removed, and the open-

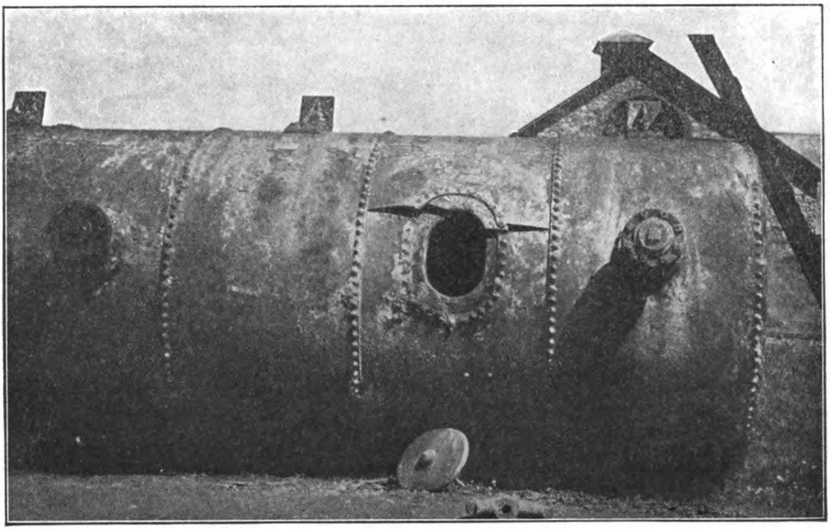


Fig. 2. Showing the Broken Manhole Frame of Boiler 302.

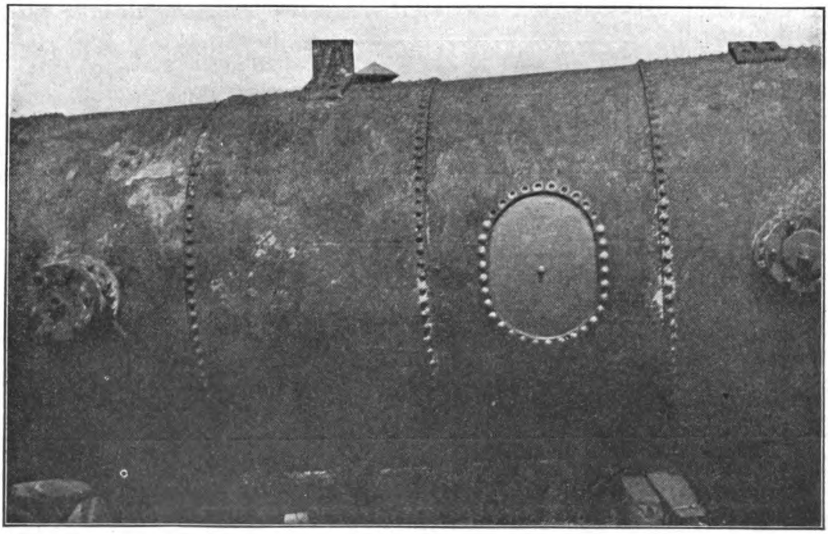


Fig. 3. Appearance of Boiler 303 After Testing.

ing patched with a ⅝ inch plate. This was secured to the shell with ¾ inch tap bolts tapped into the patch, and passing through the holes where the manhole frame had been riveted to the shell plate. Pressure was gradually applied as with the other boiler, and at 297 lbs., the limit of the hand pump used was reached, so that the pressure had to be released, and another source of pressure connected. No permanent set was recorded up to this point. When the pressure was resumed and carried up to the 300 mark, the leakage was so general that the pump had to be stopped to enable a patch bolt to be caulked, and several plugs to be tightened. Pressure was applied for the third time, and at 300 lbs., 13 patch bolts sheared, the beading at the tube ends started, the tube sheets showed distress, and a permanent set of about 1/16 inch in the circumference of the boiler was recorded. After the release of pressure, the patch was found to overlap the bolt holes about ½ inch. Its appearance after the test is shown in Fig. 3.

Boiler No. 301 was tested in its original condition, and failed through the manhole frame at a pressure of 260 lbs. A set of ⅛ inch in the circumference was noted, along with evidences of distress in the longitudinal seams.

Test specimens were cut from these boilers, at points exposed to the action of the fire, and also on the top. These were tested for strength and elongation, and also submitted to a chemical analysis, the results of which are shown in Table I.

TABLE I.

	Boiler No. 302.		Boiler No. 303.		Boiler No. 301.	
	Over fire.*	On top.	Over fire.	On top.	Over fire.	On top.
Tensile strength.	60,460 lbs.	70,145 lbs.	60,186 lbs.	56,400 lbs.	60,780 lbs.	61,680 lbs.
Elongation......	22.5%	20.12%	21.5 %	27.25%	26.5 %	19.75%
Reduction in area	53.7%	47.05%	54.52%	64.88%	61.62%	50.80%
Elastic limit....	36,690 lbs.	39,060 lbs.	38,280 lbs.	37,230 lbs.	33,100 lbs.	38,820 lbs.
CHEMICAL PROPERTIES.						
Carbon.........	0.13 %	......	0.17 %	0.25 %	0.13 %	0.18 %
Sulphur.........	0.026%	......	0.023%	0.121%	0.022%	0.022%
Manganese.....	0.27 %	......	0.29 %	0.37 %	0.20 %	0.28 %
Phosphorus.....	0.097%	......	0.097%	0.092%	0.105%	0.085%

* Bent cold to 180° without fracture.

These boilers had been designed for a pressure of 100 lbs., but owing to the low factor of safety which they would have at this pressure, due to the low efficiency of the longitudinal joints, they had been worked at a pressure of 80 lbs. At this pressure, the actual factor of safety, based on the pressure of 260 lbs. at which the manhole frame of boiler No. 301 failed was only 3.25.

The two old boilers tested at Providence by the Bureau of Standards were of a type very similar to those tested by Mr. Gow. They were also five course horizontal tubular boilers, 72 inches in diameter, by fifteen feet long between tube sheets, with the first course extending 12 inches at the front as a dry

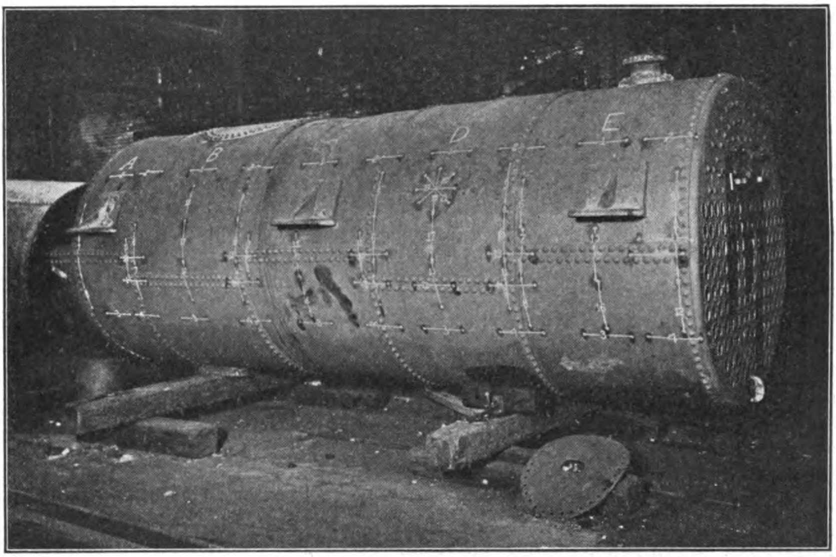


FIG. 4. BOILER 4092 PRIOR TO THE TEST. NOTE THE 10-INCH GAGED LENGTHS.

sheet. Their appearance prior to the test is shown by Fig. 4. The longitudinal joints were double riveted lap seams, ¾ inch rivets, pitched 2 inches, placed in punched holes. The plate thickness was ⅜ inch for the shell, and ½ inch in the heads. Both boilers contained 140 three inch tubes. Domes 2 feet 6 inches in diameter were provided on the second course, and cast iron man-hole frames and safety valve nozzles were fitted to the middle and rear courses, respectively. Both boilers were made at the shops of the Whittier Machine Co., Boston, Mass., in 1881, of "Benzon" steel. They were known as No. 4084 and No. 4092 on the HARTFORD'S records, and were designated by these numbers in the report of the test published in the November 1911 number of the Journal of the American Society of Mechanical Engineers.

In this series of tests especial attention was given to measuring the strains and deformations produced in the boiler sheets as the pressure was increased, because in this way a knowledge of the actual behavior of the boiler could be obtained, and so checked up with the strains which might be expected if the ordinary assumptions underlying calculations of boiler strength are justified. To this end small holes were drilled at different points in pairs, exactly ten inches apart as is shown in Fig 4. These were then reamed out with a conical reamer, so as to serve for centering two corresponding cone shaped points on a micrometer strain gage. This instrument could be applied to a pair of holes, and their exact distance apart compared to that between an exactly similar pair prepared at the ends of a carefully measured length in a standard bar. After a stress was applied to the boiler, the distance between any pair of holes could again be compared with the standard, and the difference between the two sets of readings would be the stretch. It was said that these measurements were known with a certainty of 0.0001 inch, which is about the stretch which we might expect to find in a bar of steel, 1 square inch in cross section and ten inches long, if it were subjected to a pull of 300 lbs. If we take the stress which will produce a given stretch in a piece of material 1 inch long, and divide this pull or stress by the resultant strain, we get a number known as the "Modulus of Elasticity." In the present case, a stretch of 1/10,000 inch in ten inches, would mean an increase of 1/10 of this, or 1/100,000 inch in a length of 1 inch, and if we were to divide the stress, 300 lbs., by this strain in a 1 inch length, 1/100,000, we should obtain the number 30,000,000 which is the modulus of elasticity for steel. (As a matter of fact the modulus must not be thought of as being obtained from these figures, for of course the pull to produce this stretch of 1/10,000 inch in ten inches was estimated from the modulus obtained by averaging a large number of tests, in which the length of the specimen, the pull applied and the resulting increase of length were carefully recorded.) Knowing the modulus then, we are in a position to predict the strain which ought to result from any given pressure applied to the inside of a boiler, and if in testing, the actual strains differ from these, we must look for the cause of the rigidity if the strains are too small, or of the yielding if they are too great, and see if the behavior of the metal can be attributed to any peculiarity in the boiler structure which causes a different distribution of stress from that expected. Having outlined the methods of investigation, we will not endeavor to review all the details of the measurements made, but refer the reader who desires to enter into these more fully to the published report, as we are concerned only with the results.

Boiler No. 4084 was tested first. At a pressure of 266 lbs., leakage along the longitudinal joint of the dome had become so great as to necessitate its removal. The shell was closed with a patch, double riveted, which made use of the same holes as had previously served for fastening the dome. At 270 lbs., the cast iron manhole frame ruptured across the middle of its length and a second patch, closing the opening, was applied in its place. When a pressure of 295 lbs. had been reached, 3-front head braces let go and the test was discontinued. The boiler was subsequently dismantled, in order to permit a detailed examination of its interior to be made. Certain regions of distress were revealed through the disturbance of the scale with which the metal was slightly incrusted. This distress was most evident in the dome, at its longitudinal seam, and also under the points of attachment of the lugs, by which the boiler had been supported during the test, and also when in service. Fig. 5 shows this disturbance under the lugs excellently, and also indicates the slip of the longitudinal joint.

The strain measurements were less comprehensive on this boiler than on No. 4092, and in general were very similar. One feature was noticed however, which was absent in the latter case. The gaged lengths, which spanned the longitudinal joints, and therefore measured their slip, decreased with great uniformity from the front towards the rear, suggesting that even though these seams were not directly exposed to the action of the fire, there was a greater range of temperature strain at the front than at the rear. This result is especially interesting in the light of the experiments, reported below, on a French boiler of considerable age, in which it was clearly shown that the deterioration of the metal was closely correlated to its position with respect to the direct action of the fire.

In the hope of attaining higher pressures, boiler No. 4092 was strengthened prior to the test, by removing the dome and manhole frame, and replacing them with patches. The safety valve nozzle was allowed to remain, but as the test progressed, it was found necessary to replace it with a soft patch, as it was impracticable to caulk the leaks occurring at its junction with the shell. Six 1 ¼ inch through stays were also added to give additional support to the segments of the heads above the tubes.

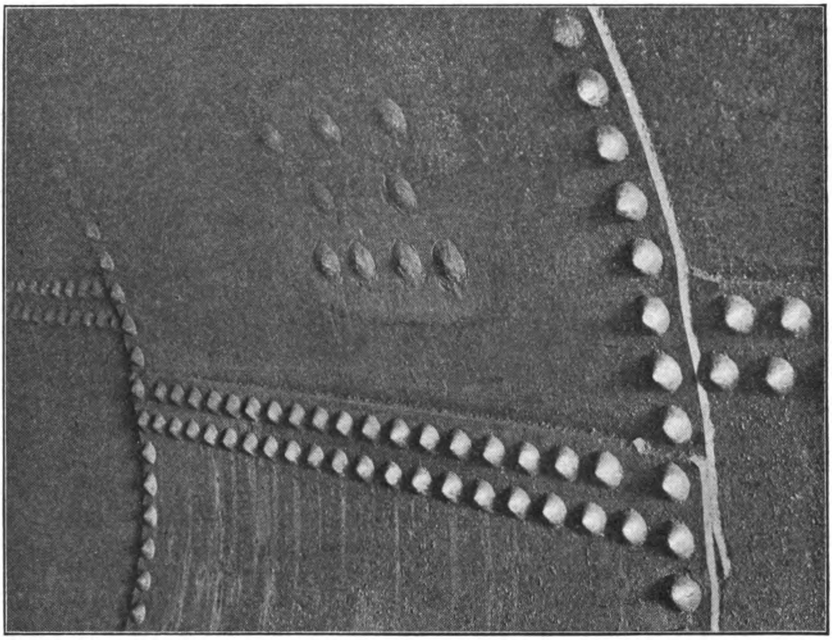


FIG. 5. SHOWING THE EVIDENCE OF DISTRESS UNDER THE LUGS AND AT THE LONGITUDINAL JOINT.

Pressure was raised, and at each increment of pressure, careful measurements of the various gaged lengths were made, in order to compute the strains. At 300 lbs. pressure, the safety valve nozzle had to be replaced, and at 335 lbs., the manhole patch failed, shearing its rivets, and tearing the sheet. A section of the sheet was cut out from girth seam to girth seam, and a double riveted patch inserted in its place. This patch was necessarily hand riveted, and at the time of publication of the results of these tests, higher pressures than 335 lbs., had not been attained due to excessive leakage at this patch.

The results of the strain measurements of which some 3,300 were taken, may be briefly summarized as follows: The well known stiffening effect of girth seams and heads were abundantly confirmed, as was the great weakness of the top center line of the boiler due to the presence of an opening in nearly every course. The double riveted lap joints, were found to give rise to an excessive slip, and the effect of this slip, in producing abnormal stresses in the solid plate abreast the ends of the seam were commented on. It was also evident that since the longitudinal seams in successive courses were only separated by three rivet pitches (6 inches), girthwise, a belt of great tangential weakness existed from end to end of the boiler, and on each side, through these seams.

If a plain cylinder is subjected to an internal pressure, the metal ought to contract in length, to make up for its tangential, or round-a-bout extension. Such a contraction occurred in the metal of the boiler shell, but was not uniform, indeed in the top part of the boiler, there was an actual extension. It is also obvious, that if a plain cylinder, like a boiler tube, is subjected to an external pressure, the tube should extend in length, to make up for the girthwise contraction. In the boiler tested, such an extension of the tubes was found, though it was modified to some extent, by the position of the tube in the shell. Those tubes situated in the center of the nest, were in every case extended more than those near the shell, as if the flanged head exerted a restraining influence. It was pointed out as a matter of fact, that this extension of the tubes, coupled as it was with a contraction lengthwise of the shell, imposed a considerable bending moment on the flanges of the heads.

Let us now, before attempting to form an opinion, or draw conclusions as to the results of these tests, pass on to a consideration of a series of tests of the second sort made with great care, in which samples of the material of some very old boilers of known antecedents were tested both physically and chemically. It is a point worthy of note that in these tests, especial care was taken to keep track of the part of the boiler from which the test specimens were taken in order that any peculiarity due to exposure either to extreme temperature conditions, or to unusual structural stresses might be observed.

These tests, made by Messrs. A. Olry, and P. Bonnet, form the subject of an extended report to the (French) Association of Owners of Steam Apparatus, at the 33d Congress of that society held at Paris in 1909.*

Their attention was called to this subject, by the fact that several more or less discrepant reports as to the effect of age on boiler plate, had been made from time to time, particularly, some tests on the material of very old boilers made by Walther-Meunier, and reported in 1903-1904, to the same Association. He had found some old plate so brittle that he was of the opinion that all boilers should be retired after from 30 to 35 years use, if worked 12 hours a day, and if worked 24 hours, he thought that a lower limit of useful life should be set, say 20-25 years. This raised a storm of protest and discussion among the French engineers, many of whom cited tests to the contrary, and the result was that his work came to be largely discounted because of lack of data as to the original condition of the material.

Olry and Bonnet were interested in this controversy and when they were presented with the opportunity of testing some old boilers whose history was available, they made the investigations which form the basis of the report we are considering.

La Société des Hauts Fourneaux, Forges et Aciéries de Denain et D'Anzin, a French steel works of considerable note, installed during 1873 and 1874, 14 boilers for use at their works. They were made by Schneider et Cie., at

* Comptes Rendus Des Séances Du 33e. Congrès Des Ingénieurs en chef Des Associations De Propriétaires D'Apareils A Vapeur. Tenu a Paris, 1909.

Creusot, and were of the type illustrated in Fig. 6, cylindrical, with internal furnaces and direct tubes, surmounted by a dome. The settings were such that the products of combustion passed first through the tubes, then returned under the right-hand side of the shell to the front, where they passed across, and back to the flue, under the left-hand side of the shell. A longitudinal baffle wall for this purpose was provided under the center line of the boiler as is indicated in Fig. 6. The boilers were designed for a pressure of 71 lbs., but were later tested and worked at 78 lbs. (5.5 kg. per sq. cm.). They had a heating surface of 1270 sq. ft., were oil fired, and forced day and night except Sundays, for more than 30 years. In 1900 the rate of firing, which is typical of the service they rendered throughout their life, was such as to consume about 150 kg. of oil per sq. meter of grate per hour, which is equivalent to 31 lbs. of oil per sq. ft. of grate per hour, a very high rate indeed. The evaporation obtained was about 6 lbs. of water per lb. of fuel. The material of which the boilers were constructed was Creusot wrought iron, designated by the following numbers: body of the boiler, No. 2; heads, lower furnace sheets, and domes, No. 4; upper furnace sheets and front tube sheets, No. 6. The entire battery was overhauled between 1905 and 1907, as the result of a general breaking down from old age, and has since been entirely replaced. This overhauling however gave the opportunity for obtaining test specimens, and the data given was obtained at this time.

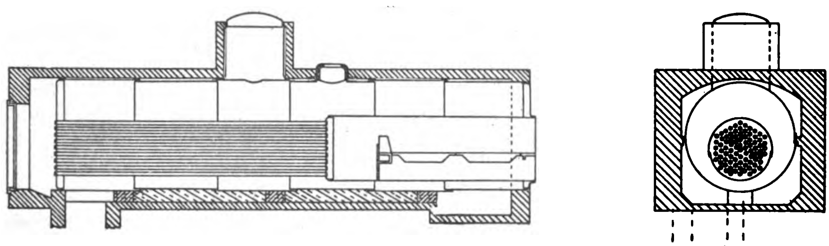


Fig. 6. Boiler Known as S-3.

The iron known as Creusot No. 2, was made to meet the following guarantee:

Tensile strength	47380 lbs. per sq. in. (Minimum.)
Elongation in 4 inches,	6.5%
Reduction in area,	6%

The original thickness of sheet was .55 of an inch.

In January 1905, a crack developed in one of the boilers, known as S-3, in the bottom of the third course, in the fourth girth seam, necessitating the removal of a portion of the sheet. Eight specimens for tensile test of standard (eight inch) size, were cut from this sheet and broken with the following average results:

Tensile strength, specimens cut lengthwise,	41700 lbs.
Elongation (4 ins.) " " "	3.1%
Tensile strength, specimens cut girthwise,	39000 lbs.
Elongation (4 ins.) " " "	1.7%

Fourteen specimens of the type and dimensions shown in Fig. 7 were also cut and tested for brittleness by the impact test, in which a ram or hammer, of known weight, is allowed to fall from a known height, striking the specimen fairly on its flat side, at the point of least breadth. As a sort of standard of comparison, by which one can gage the performance of the various specimens under this test, it may be well to state that a similar specimen of good modern boiler steel, ½ in. thick, is required by French standards, to withstand a blow from a ram of 28.7 lbs., falling 13.12 feet (13 kilograms, falling 4 meters). This means an expenditure of 374 foot lbs. of work without starting a fracture. These particular specimens were fractured on the average, by a blow from a 26.4 lb. ram, falling 19.7 inches, or with an expenditure of 43.8 foot lbs.

The deterioration of the material as indicated by these tests was so great, that another group of specimens was cut from the same shell, yielding the following average results:

Tensile strength	(long.)	38400 lbs.
Elongation, (8 in.)	"	2%
" "	(trans.)	Practically nothing.
Impact, complete fracture, 28.7 lbs., falling 19.7 in.		

A chemical analysis showed the following composition:

Carbon,	0.07%
Manganese,	0.05%
Sulphur,	0.046%
Phosphorus,	0.290%

This indicates rather more phosphorus than one would expect in first class boiler iron.

To see if this brittle condition extended to the entire battery, specimens from the same region were cut from three of the other boilers, and the results were so nearly like those given above, that it was not thought necessary to quote them specifically.

Specimens of the Creusot No. 4 iron, for testing were cut from both the front and rear heads of the boiler known as S-4. The original specifications for this iron called for the following properties:

Tensile strength	48800 lbs.
Elongation	14.6%
Reduction in area,	1.3%

The metal as tested from the front head of S-4, gave values for these quantities as indicated below:

Tensile strength	43400 lbs. 40700 " 41300 "
Average	41800 "
Elongation (4 in.)	10% 11% 18%
Average	13%
Reduction in area, average	2.2%

A weight of 37.45 lbs. falling 39.37 inches started a fracture, while modern steel of this thickness would be required to withstand the impact of a like weight falling 13.12 feet, without injury.

The specimens of the same (No. 4) iron from the rear head of boiler S-4, gave the following results:

Tensile strength	44500 lbs.
	43400 "
	45700 "
	46000 "
Average	44900 "
Elongation (4 in.)	17%
	13%
	11%
	10%
Average	12.75%
Reduction in area, average	1.42%

Subjected to the impact test, 3 out of 8 specimens failed under a blow from a ram of 44 lbs., falling 6.6 feet. Chemical analysis of the material showed its composition to be as follows:

Carbon	0.05%
Silicon	0.15%
Manganese, less than	0.10%
Sulphur	0.010%
Phosphorus	0.100%

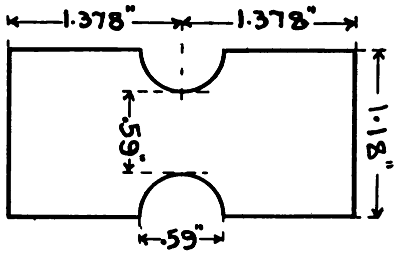


FIG. 7. IMPACT TEST SPECIMEN.

These tests indicate that the No. 4 iron, which was lower in phosphorus than the No. 2, had not deteriorated to so great an extent, although its condition was far from satisfactory. It is rather interesting however, in view of the tests of steel boilers reported later, to see that the front head, which in this case was always at a moderate temperature, since the boiler was internally fired, should have deteriorated more than the rear head, exposed as it was to contact with the hot gases from the tubes.

The authors state that they were unable to report the condition of the No. 6 iron, since, due to the many repairs which had been made to the furnaces from time to time, they were unable to positively locate any of the original iron of this grade.

In the consideration of these results, giving as they did such obvious evidence of impairment, the authors raised the question as to whether the iron might be made to regain some or all of its original ductility by reworking. To this end billets were made by piling up and welding small blooms from the scraps of test pieces of each sort of iron, the billets were rolled into bars, from which new test pieces of the reworked material were cut and tested. The results are tabulated below.

Reworked No. 2 iron.

Tensile strength	53500 lbs.
Elongation	23%
Reduction in area	2.8%

Impact test, 28.66 lb. ram, falling 4.88 feet, started fracture.

Bent cold through 135°.

Reworked No. 4 iron.

Tensile strength	51500 lbs.
Elongation	25%
Reduction in area	2.5%

Impact test, specimens cracked under blows from a 44 lb. ram, falling 12.3 to 13.12 feet.
Cold bend test, bent through 180° without cracks of any sort. These tables show that by reworking, a most astonishing improvement in ductility was produced. The No. 4 iron became a most excellent material, equal to good boiler iron, though somewhat inferior to the best boiler steel, while even the No. 2 iron showed properties sufficiently good for many purposes, though still rather brittle for boiler use.

The steel boiler from which specimens were tested was one of a battery of 22 fire tube boilers, with longitudinal bottom drums made by Carron-Delmotte at Anzin for the sugar refinery of C. Say, in Paris. The specifications called for Siemens-Martin basic steel with tensile strength greater than 51000 lbs. and not over 56000 lbs., elongation in 8 inches, not less than 26% nor more than 40%. The steel was made by Schneider et Cie. at Creusot, and branded "A. S. acier soudable." Acceptance tests of this steel were made by Cornut in 1887. For this work the specimens were heated up to a cherry red before they were broken, and in some cases quenched by plunging them in water. He found as an average value for the tensile strength, 53000 lbs., elongation in 8 inches, 31.6% when reheated simply, and 68000 lbs. and 18.7% respectively when reheated and quenched.

In reporting the results of the tests after the boilers had been in service, the authors classify their specimens in the same manner, that is, those untreated but tested just as they came from the boiler, those reheated to a cherry red, and those reheated to a cherry red and subsequently quenched by plunging them into water maintained at a temperature of 82° Fahr.

In 1908, the first two boilers of this battery were to be removed, and the owners gave the opportunity of testing the quality of the material, as they were anxious to see if the steel had deteriorated to such an extent as to render this removal unadvisable. They accordingly gave the lower or fire sheet of the right hand bottom drum of boiler No. 2 for the purpose. This sheet was cut up and tested through the courtesy of the steel works at Denain, who placed their equipment at the disposal of the authors. Fig. 8 will indicate the manner in which the sheet was divided, and will also serve to show how the specimens were placed with regard to the position of the sheet in the boiler.

These boilers had been in service 24 hours a day during the interval 1888-1908, with the exception of Sundays, and certain intervals for cleaning and inspection. No repairs of any moment were ever made. The records of the owner show that this particular boiler had been in service a total of 134172 hours, consuming 3898.13 metric tons of soft coal, and 13050.7 metric tons of coke. This gives for the average rate of combustion, 42 kilograms per square meter of grate per hour, or in the more familiar English units, 8.6 lbs. per square foot of grate per hour, certainly very moderate service. The averages of the tensile tests, classed in groups as to their location with respect to the fire, and also divided into the three sets mentioned above, depending on the treatment they received after cutting from the sheet, will be found in the following table.

TESTS OF STEEL FROM THE FIRE SHEET OF NO. 2 BOILER.

	Untreated Specimens.	Reheated Specimens.	Reheated and Quenched Specimens.
SPECIMENS FROM PORTION OF SHEET PROTECTED BY FRONT WALL.			
Tensile strength	53,500	53,900	none tested
Elongation	25.2%	26.5%	none tested
SPECIMENS FROM ABOVE THE GRATES.			
Tensile strength	53,500	53,800	70,000
Elongation	23.0%	27.1%	20.6%
SPECIMENS FROM OVER BRIDGE WALL.			
Tensile strength	51,300	52,900	70,700
Elongation	24.7%	26.5%	19.7%
SPECIMENS FROM BEHIND BRIDGE WALL.			
Tensile strength	51,400	51,500	68,700
Elongation	24.8%	30.2%	21.2%

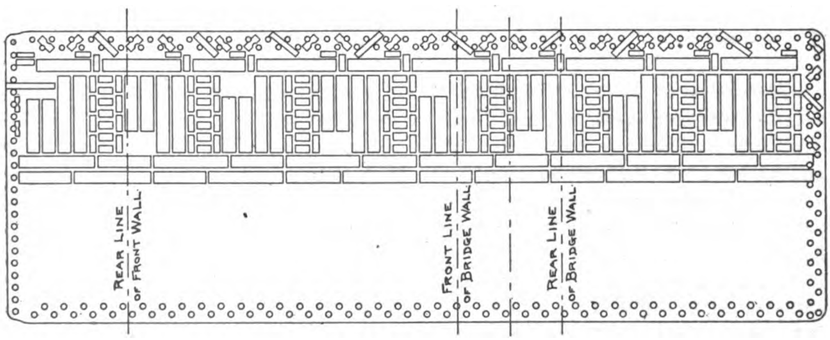


FIG. 8. FIRE SHEET OF C. SAY ET CIE. BOILER NO. 2. SHOWING THE LOCATION OF THE SPECIMENS WITH RESPECT TO THE FIRE.

Cold bend test of 38 specimens, fairly satisfactory. The real extent of the change in this boiler steel was not disclosed until the impact tests were made. 162 impact specimens were tested all told, but as 10 of these were in the nature of special tests, to determine the effect of various sorts of abuse on this steel, such for instance as hammering it violently when at a blue heat, they were not included in the averages, or percentages to follow. Out of the 152 tests considered to represent the real condition of the material, there were 122 in which the specimens were untreated. Out of this number, 58 specimens failed to pass the test expected of new steel of this class and thickness (7/16 inch) that is to stand without cracking, the impact of a 22 lb. ram, falling 13.12 feet. It was found however, that none of the reheated specimens, whether quenched or not, failed, or that in other words, although the steel was found to have grown brittle, it could be made to fulfill the conditions of the impact test by heat treatment. If we now calculate the percentage failure, we find that based on the whole number broken, 38.1% failed, but if we consider only the untreated specimens, the percentage is seen to be 47.5%. It is also of interest to see where these specimens were located with respect to the grate, the bridge wall, etc., and to see if there is any connection between the percentage of failures, which must be taken to represent the average brittleness of the material, and the sort of treatment it received as regards temperature and heat transfer. It will be seen from the table given that there is such a connection, that it is identical with the changes in the elongation with exposure to the fire, as shown in the table of tensile tests, and that as we should expect, the metal over the grate suffered most, that over the bridge wall next, the metal located behind the bridge less, and that in the front wall and therefore entirely protected from the direct action of the flames, the least of all.

UNTREATED IMPACT SPECIMENS GROUPED AS TO THEIR LOCATION IN THE FIRE SHEET.

Location.	In Front Wall.	Over Grate.	Over Bridge.	Behind Bridge.
Total number tested	17	45	14	46
No. of Failures	6	26	7	19
No. Intact	11	19	7	27
% Failures	35.5%	57.8%	50%	41.5%

The work of Olry and Bonnet shows pretty conclusively that boiler plate, whether of iron or steel, will deteriorate with use. It is also well known that tubes, tube cap bolts, and other materials used in boiler construction suffer the same sort of depreciation. Such a case was discussed in the July 1912 LOCOMOTIVE, giving the experience of one of our own chief inspectors with tubes and bolts which had become very brittle with use. In all the cases which have come to our attention, the metal which has deteriorated very rapidly has been high in phosphorus. Olry and Bonnet also found that the metal which showed the greatest loss of ductility was the highest in phosphorus, and was least improved by either reworking or annealing. They also showed that iron suffers more than steel, although our experience with brittle tubes indicates that steel if it contains an excessive amount of phosphorus will change very rapidly. Exposure to intense heat is shown to be a factor so that there is some justification for basing the condemnation of a boiler on the kind of service it has given, as well as on its life.

Passing now to the hydrostatic tests first considered, in which five very similar boilers all of which had seen some thirty years of service, were tested after they had been condemned for old age by the HARTFORD, it was found that all of them showed structural weaknesses, especially about the cast iron manhole frames, which gave abundant evidence of the wisdom of their retirement from service. It is interesting in this connection to recall that all three boilers which were permitted to fail at that point (no patches being used) did so at pressures surprisingly close together, namely, 265 lbs., 260 lbs., and 270 lbs. It has been said with some emphasis however in the engineering press, that none of these boilers had suffered any deterioration from age.

It is true that the boilers of the Oliver Iron Mining Co. proved to be made of a material whose properties were still excellent at the time of the test. Tests of the material of the other two boilers are not yet available for discussion. The facts of the case however which seem to need emphasis as showing the real reasons underlying such a retirement as these boilers present. are these. The art of boiler making and designing has progressed materially in say thirty years, and the boilers of that period, if of good material, do not compare especially well as to safety with the product of the present of equal grade. It is also a matter of record that boiler steel undergoes a slow but certain loss in strength and ductility. To be sure these changes are slower for good steel than for iron, but the presence of even a moderate excess of phosphorus hastens the process materially.

Add to this the other equally obvious fact, that such deterioration can be detected by none of the ordinary inspection methods, and that even tensile tests may fail to indicate the extent of the change completely, and it would seem that the justice of the position which makes for old age retirements, was established beyond controversy.

Instructions for Placing Heating Boilers in Commission.

We have gathered together a few simple hints and instructions for putting a heating system in commission which may prove of value. No originality is claimed for them but it is hoped that they may assist some who have not learned through experience what method of procedure is best fitted to accomplish the desired end.

1. Clean the boiler thoroughly on the fire side if it has not been done when laying up in the spring. Remove all rust and soot. This is particularly important in the case of cast iron sectional heaters as rust and corrosion will form between the sections, accumulating moisture in the summer season, and if not removed will eventually swell sufficiently with moisture to fracture the sections. If this cleaning is neglected too long, it may become necessary to dismantle the boiler in order to remove the deposit. Remove all dry or moist ashes from the corners of the grate and ash pits. If this discloses rust, strike the iron a few smart blows with a light hammer and see if it shells off. If the corrosion proves to be extensive, steps to repair the damage should be taken at once. Any rust spots found on the outside of the boiler, including the heating surface, should be carefully cleaned and painted with a mixture of red lead and boiled linseed oil to stop the spread of the corrosion. For this external cleaning a wire brush will be found of service.

2. Clean thoroughly the inside of the boiler. Remove all rust, scale and sediment. If the boiler is of such a form as to prevent ready access to its interior, wash it out as well as possible with a hose, using a good pressure if available. Then empty the boiler, introduce a few gallons of kerosene oil and fill with water very slowly, letting the oil float up on the surface of the water and so reach all portions of the interior surface. Introduce a few pounds of *dissolved* carbonate of soda (soda ash) with the water used for filling. When the boiler has been completely filled in this way, let the water run out until it stands at the ordinary steaming level, close the blow off, and build a slow fire under the boiler. This fire should be kept up for several days, never letting the pressure rise higher than a few ounces. This will loosen and throw down the scale and sediment, so that on cooling off, the boiler may be washed out practically clean with a hose. *It is especially important that the boiler be washed out after this treatment, and before it is put into service, as the loosened scale and mud, if allowed to gather on the heating surface of the boiler, will inevitably cause over heating, and perhaps failure of the metal.*

3. Look over all the boiler attachments. Wash out the water column and its connections, taking it down if necessary to make sure that it is free from rust and mud and that its connections with the boiler and the glass water gage are free. If the water column is not provided with a drip cock, so that it may be drained from time to time, allowing steam and water to blow through its connections to free them, and incidentally to prove that they are free, one should be installed. Look over the glass water gage. See that the rubber grommets or rings with which a tight joint is secured between the glass and its supporting fixtures are "alive." If the rubber is hard and brittle it should be renewed. (See the article on Gage Glasses, in the January, 1912, Locomotive.) See that the gage cocks are clean and tight. Be sure their opening to the boiler is not clogged. (Blow through them.) Overhaul the safety valve, see that it is clean and free from rust or dirt. All pipes leading to or from the boiler, such as the steam supply, drip return, blow off and feed pipes should be tested to make sure that they are clear. All stop or check valves in these pipes should operate freely and shut off tightly, without leaking at the stems. Any defects in these important fittings should be remedied before raising steam. The steam gage connection should be known to be free and clear.

4. Extend the inspection of pipes, valves and fittings to include the entire heating system. After pressure is raised for the first time, visit each radiator or coil, and make sure that its air cock is operating properly. It should be clean, and should promptly free the raditaor of air, but should not permit steam and hot water to drip. This will insure against dead radiators.

5. Look over the run of the piping, both steam and return — and this applies equally well to hot water systems — see that there are no pockets in the steam supply line which can fill with water of condensation at night, to be violently expelled in the morning as a slug, forming a water hammer, which may rupture pipe or fittings, or even a radiator section. One should be especially careful to see that there are no such pockets or indeed any piping in the system so exposed as to be liable to freeze solid. This will cause the boiler to build up an excessive pressure and in case the safety valve is too small, or fails to operate, an accident is certain to result. It may be said that this is one of the very common causes for heater failure.

6. When it becomes desirable to shut off communication between the boiler and the rest of the system, close the valve in the return pipe first, then the steam valve may be closed. Upon resuming operations, the steam valve should be opened first, after which the return valve should be opened. This order of procedure will prevent all trouble due to the formation of a partial vacuum in the heating system from the rapid condensation of steam. Since if the return valve is closed first and opened last, the vacuum which is almost certain to be formed cannot suddenly drain the boiler of water.

7. In starting up a new system for the first time, it is important that the condensed water which first comes back to the boilers be thrown away, and any loose scale and core sand coming with it from the pipes, fittings, and radiators washed from the boiler. If this deposit is allowed to remain, the boiler will foam badly, and the heating surface will become coated with the material.

8. The smoke pipe and damper should be cleaned and examined for rust and corrosion. The grates should not be so distorted and burned as not to lie flat, or as to interfere with the proper operation of the dumping or shaking mechanism. If this point is looked to at the beginning of the season much waste may be prevented from fuel dropping through the grates, or being hauled out, when the shaking gear fails to work, in the effort of an unskilled fireman to clean the fires. Doors, both fire, ash pit, and clean out, should be examined to see that they turn freely, and are not warped enough to prevent their closing. A partly opened door may result in impaired draft and combustion, which is always attended by a waste of fuel.

9. In firing up a cold heating boiler, especially a cast-iron section boiler, care should always be taken to build a slow fire, and give the heater a chance to warm up gradually. If this method is neglected, great strains, due to the unequal expansion of the metal, may be brought upon the structure, frequently many times greater than the ordinary working stresses, and cracks are almost sure to appear as the result.

On the Location of the Fusible Plug.

The following extract from an inspection report, and the letter which accompanied it to the home office, from a department manager, are self-explanatory.

"Our recommendation to put in a fusible plug in the No. 2 was carried out, but instead of placing it two inches above the tubes in the rear head, we find it below them in the same head about two inches from the bottom of the shell. This should be changed.

"I enclose copy of report ——— Milling Co., which shows what a man will do with a strong back and a weak head. The engineer remembered that the inspector told him to put the fusible plug two inches above something — he forgot just what — so he put it two inches above the bottom of the boiler."

The Locomotive
of
THE HARTFORD STEAM BOILER
INSPECTION AND INSURANCE CO.

C. C. PERRY, EDITOR.

HARTFORD, OCTOBER, 1912.

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THE LOCOMOTIVE OF THE HARTFORD STEAM BOILER I. & I. CO.

The season for starting the heater is at hand, and a word of caution and warning seems opportune to those who own or operate boilers for this purpose. Perhaps no class of steam apparatus receives less care, and yet is more deserving of thoughtful consideration. The general public seems so sure that a heating boiler is freed from all possibility of failure, because it is expected to operate at a low pressure, that it seldom stops to consider whether this immunity is borne out by statistics.

A study of the "explosion list" for 1911, and for the first five months of 1912 yields the summary below, and gives a striking angle from which to view this question. In 1911 there were reported 499 boiler failures, of these 56, or 12.2% were known to be either heating boilers or water heaters. In 1912, during the months from January to May inclusive, our list contains 248 explosions, of which 57, or 23%, are known to have been heaters. Taking January 1912, the mid-winter month, as representing the heating season at its height, we find 38 heater failures out of a total of 90, or over 42%! In this one month of January there were reported property losses amounting to $27,000 and injuries to six persons. What the total property loss would be, if we were able to evaluate such expressions as "the property was almost entirely destroyed," or "damages were estimated at several thousand dollars" is of course a matter of conjecture. Granting however that all the really large losses are given in the press accounts from which our list is of necessity very largely compiled, we would still expect a loss of say $250 to result on the average from each of the failures listed. On this basis, taking all the accidents for which no estimate of damage is given at $250, we get as a grand total $37,250 which may be accepted as a rough estimate of the damages resulting from the heating boiler casualties alone in this month. We are sure that these figures form sufficient evidence to enable any property owner to decide for himself whether he can afford not to place his heating plant under the skilled inspection service of an INSPECTION and INSURANCE Company.

Attention is directed to the instructions printed on another page of this issue which are intended to serve as a guide in placing a heating system in first-class order at the beginning of the season. As this important duty is often left to janitors and others whose knowledge of boilers and their appurtenances is somewhat limited it has seemed wise to enter into a considerable degree of detail. We believe however that these hints are worthy of the consideration of any one who has this work to perform.

We note with some surprise, in the July issue of a contemporary, published by a manufacturer of engineers' supplies, of excellent reputation, that one of our articles has been reprinted, without the slighest acknowledgment to the Locomotive, and used to exploit the wares of another concern.

We refer to the article on Gauge Glasses, from the January, 1912, Locomotive, by the Secretary of the Company, Mr. Charles S. Blake, which is printed with a paragraph added to call attention to the virtues of a particular brand of this important boiler accessory.

We are not opposed to the reprinting of Locomotive articles, but we must insist that proper credit be given for them, as they are protected by copyright, and we particularly dislike to have them appropriated without credit to exploit any particular article or brand of goods, as it is a well known fact that the Hartford does not, and indeed has never assumed to advertise any article of manufacture. It is the fixed policy of the Company never to favor the product of one firm over that of their competitors.

In the July issue we abstracted the finding of Chief Inspector Ensign concerning the probable cause of the exceedingly disastrous locomotive boiler failure which occurred last April in the Southern Pacific yards at San Antonio, Texas. It is of some interest in this connection, to note the recommendations now made to their locomotive boiler inspectors by the Inter-State Commerce Commission, which come as a direct outcome of this report. These instructions, for which we are indebted to the Locomotive Firemen and Enginemen's Magazine, follow.

"The latest instructions from the office of the General Boiler Inspector with regard to the setting of safety valves, as referred to in paragraph 35, page 9 of the Order of the Commission, are that two steam gages must be employed during the time that the safety valves are being set. One of these gages to be visible to the man adjusting the safety valves. Both gages must be tested and must correspond. The safety valves, however, must be set to the correct pressure to be carried as indicated by the gage permanently employed on the boiler. The second or temporary gage — that is the one visible to the man setting the safety valves — is simply to be used as a check or guard against over pressure in case the man in the cab, whose duty it is to inform the man on the boiler of the pressure indicated by the safety valves, should have his attention momentarily distracted from his duties. It will also be necessary hereafter although not so stated in the Order of the Commission, to see that the siphon pipe connected to the steam gage, together with the cock leading to the boiler and the shut off cock, are fully open, and that the pressure is not in any way obstructed by short kinks in the pipe, or partial stoppage of the cock or cocks. And where two cocks are used, the handles must both point in the same direction when the cocks are open or closed, preferably in line with the pipe when open, and across the pipe when closed."

Book Review.

PERKINS' TABLES. A few ready tables for the Calculation of the Safe Working Pressure on Boilers. Compiled by Lyman B. Perkins. 360 pages, printed on thin paper, with flexible leather binding, *published by the author at 38 Huntington St., Hartford, Conn. Price $5.00.*

This book consists of a most comprehensive set of tables for the assistance of those who have to calculate the various elements of boiler strength, such as the strength of seams, head bracing, stay bolting, the bursting pressure of drums, or the collapsing pressure of furnaces or flues. The tables are computed to include various values for the strength of plate and rivets, and are extended to cover the special forms of calculation made necessary by the Massachusetts, Ohio, and Detroit legislation. Their precision is of a high order. This work should prove of especial value to designers and inspectors, as much laborious computation may be saved by the use of the tables, and a thorough familiarity with the best method of utilizing the information they contain. The author, a graduate of the United States Naval Academy, has been connected with THE HARTFORD STEAM BOILER INSPECTION AND INSURANCE COMPANY for many years, and is particularly fitted to cope with the tremendous labor of calculation which such a work involves.

Boiler Explosions.

JUNE, 1912.

(249.)— The boiler at the saw mill of D. O. Pomeroy, near Creedmore, N. C., exploded June 1. The owner and two workmen were instantly killed, and one other fatally injured.

(250.)— On June 3, a cast iron header fractured in a water tube boiler at the Baltimore Hotel, operated by the Dean Hotel Co., Kansas City, Mo.

(251.)— An accident occurred to a boiler at the plant of the Akron Laundry Co., Akron, Ohio, on June 3.

(252.)— A tube ruptured June 3, at the National Plant of the American Sheet and Tin Plate Co., Monessen, Pa.

(253.)— A small portable boiler, used on construction work, by the International Contracting Co., exploded June 5, at Portland, Ore. Burt Webb, engineer, was seriously injured.

(254.)— On June 6, a boiler ruptured at Central Power Plant "A," of the Iola Portland Cement Co., Iola, Kans.

(255.)— The fur factory of Whitman and Krahn, at 406 Manhattan Ave., Brooklyn, N. Y., was destroyed by fire June 7, following the explosion of a boiler in the basement. Six men were seriously injured, and the property damage was estimated at $20,000.

(256.)— A number of cast iron headers ruptured June 9, in a water tube boiler at the plant of the Semet Solvay Co., Holt, Ala.

(257.)— The boiler of a traction engine, used in road construction, exploded June 10, in the town of Nasewaupee, Wis. Four men were injured, none fatally.

(258.)— A boiler exploded June 12, at the Gardiner Noble station in the Vinton oil field, near Lake Charles, La. No one was injured.

(259.)— A boiler at the plant of the Alexander Shingle Co., Elaine, Ark., exploded June 13. Chas. Carrier and William Jones were killed. J. N. Moore was seriously injured.

(260.)— A tube ruptured June 14, in a water tube boiler at the plant of the Tri-State Railway and Electric Co., East Liverpool, Ohio.

(261.)— On June 14, the boiler of a portable saw mill exploded at Ganado, Tex. John Schwartz was instantly killed, and C. F. Schneider, the owner, was badly scalded.

(262.)— A boiler burst June 14, at the Lautz Brothers' soap factory, Buffalo, N. Y. Two men were injured.

(263.)— On June 16, an accident occurred at the plant of the Inland Steel Co., Hibbing, Minn.

(264.)— A steam shovel boiler exploded June 17, on the Catskill Aqueduct Contract of the R. K. Everett Co. Edward Depew, fireman, was killed and Philip Grady, engineer, was seriously injured.

(265.)— On June 18, a blow-off pipe failed on a dredge belonging to the J. S. Packard Dredging Co., at Cuttyhunk, Mass. Michael Corcoran and Andrew Palo were injured.

(266.)— The boiler at a stone crushing plant near Bay Springs, Miss., exploded June 19, killing one man and seriously injuring five others.

(267.)— An accident occurred to the boiler at the plant of the Berger, Crittenden Milling Co., Milwaukee, Wis. Considerable damage was done to the boiler.

(268.)— On June 26, the boiler of Southern Pacific Locomotive No. 838 exploded near Hondo, Tex. E. F. Beaumont, engineer, was killed, and C. F. Connelly, fireman, was perhaps fatally injured.

(269.)— Three cast-iron headers failed June 27, in the Lower Union Mills of the Carnegie Steel Co., Pittsburgh, Pa.

(270.)— On June 28, the boiler of a locomotive exploded at Saltillo, Mexico. Sixteen persons were killed, and many injured.

(271.)— A tube ruptured June 29, in a water tube boiler, at the Bridgeport, Conn. plant of the United Illuminating Co.

(272.)— The boiler at the saw mill of the J. I. Monk Lumber Co., Headland, Ala., exploded June 29. No one was injured.

July, 1912.

(273.)— On July 1st, a blow-pipe failed at the "Champion Apartments," Atlantic City, N. J. Benjamin Fowden, night engineer, was injured.

(274.)— Several cast-iron headers failed July 2, in a water tube boiler at the works of the American Steel and Wire Co., Joliet, Ill.

(275.)— A tube in a water tube boiler ruptured July 4, in the plant of the B. F. Goodrich Co., Akron, O. J. D. Tkos, fireman, was injured.

(276.)— On July 6, a large fly-wheel burst, causing the failure of a small boiler, at the plant of the National Sulphur Works, Williamsburg, Brooklyn, N. Y. Fifteen men were injured, three fatally, by sulphur fumes in the fire which followed.

(277.)— A tube ruptured July 6, in a water tube boiler, at the Iowa State Hospital for the Insane, Cherokee, Ia.

(278.)— A boiler burst July 6, at the Ice, Light, and Water Plant of the Italy Water Co., Italy, Texas.

(279.)— On July 6, the boiler of a threshing machine exploded on the farm of the Misses Ward, near Little Creek, Del. William Boyd, Samuel Leat, and Elmer Harris were injured. Leat and Harris, if they recover, will be blind.

(280.)— A condemned boiler exploded July 7, at the Visalia Creamery, Visalia, Cal. Clyde Lisman was seriously, and perhaps fatally scalded.

(281.)— A boiler exploded July 8, at the plant of the Atlantic Ice and Coal Corp'n, Atlanta, Ga.

(282.)— A boiler in the Columbian Hotel exploded July 9, during the progress of a fire which swept Thousand Island Park, Alexandria Bay, N. Y.

(283.)— A tube ruptured July 9, in a water tube boiler at the Brunots Island power house of the Pittsburgh Railway Co., Pittsburgh, Pa. James McGreevy, boiler foreman, was injured.

(284.)— On July 10, a tube ruptured in a water tube boiler, at the plant of the C. A. Smith Lumber Co., Bay Point, Cal.

(285.)— On July 10, the boiler of Chicago and Alton locomotive No. 21 exploded near Normal, Ill. Joseph Orr was fatally injured, and several of the train crew received minor injuries.

(286.)—A tube ruptured July 11, in a water tube boiler at the 20th St. power house of the Pittsburgh Railways Co., Pittsburgh, Pa. Frank Weiher, William Reed, and John Enright, repairmen, were scalded. The damage to the boiler was small.

(287.)— A tube in a water tube boiler burst July 12, at the plant of the Philip Carey M'f'g Co., Lockland, O. Considerable damage was done to the boiler. Carey Spellman and Edwin Terell, firemen, were injured, the latter fatally.

(288.)— On July 12, the crown sheet of a locomotive collapsed at the State Phosphate Works of Swift and Co., Agricola, Fla. J. A. Oglesbee, engineer, was injured.

(289.)— A blow-off pipe failed July 13, at the plant of the Mariana Ice and Cold Storage Co., Mariana, Ark.

(290.)— A tube ruptured July 15, in a water tube boiler at the plant of the Columbia Chemical Co., Barberton, O.

(291.)— A steam pipe burst on a steam shovel, at the Potrero Gas Plant, San Francisco, Cal., on July 16. John Logue was fatally scalded, and John Vanni seriously burned.

(292.)— A saw mill boiler exploded July 17, at the mill of A. Foster, Waldo, Ark. Sid. Jackson, engineer, was killed.

(293.)— On July 18, a boiler exploded at the plant of the Peoria Stone and Marble Co., Peoria, Ill. John Molek and John Ruge were fatally scalded.

(294.)— A threshing machine boiler exploded July 18, at the Moon farm, near Culver, Kans. Arthur Atkinson, the owner of the machine was fatally injured.

(295.)— A tube burst July 18, in a water tube boiler, at the plant of Armour & Co., Sioux City, Ia. E. Lindgren, machinist, was injured.

(296.)— The boiler of locomotive No. 549, of the St. Louis, Brownsville, and Mexico Railroad, exploded July 20, near Bay City, Tex. Alfred E. Shiver, conductor, Daniel Fisher, engineer, and W. V. Shaw, fireman, were killed.

(297.)— A boiler ruptured July 22, at the plant of the Mississippi Glass Co., St. Louis, Mo.

(298.)— A hot water tank burst July 22, at the plant of the Union Gas and Electric Co., Cincinnati, O. James B. Hemphill, engineer, was fatally scalded.

(299.)— A fertilizer tank exploded July 23, at the plant of the Schmadel Packing Co., Evansville, Ind.

(300.)— The boiler at Daniel Bousman's rock crusher exploded July 23, at Rosedale, Mo. Frank Long was fatally injured, and James Clark very seriously injured.

(301.)— A boiler burst July 25, at the plant of the Maxinkuckee Lake Ice Co., South Bend, Ind.

(302.)— A boiler burst July 27, near Sharpsburg, Ky. Thompson Crockett was killed, Hal. Thompson fatally injured, and a negro helper seriously injured.

(303.)— On July 28, an accident occurred to the boiler of the Consumer's Ice M'f'g Co., Chester, Pa.

(304.)— The boiler of a peanut roaster exploded July 29, in Sigourny, Ia., almost instantly killing Chauncey Meyers, as he was entering an automobile.

(305.)— On July 29, a boiler ruptured at the plant of the Hays City Electric Light Co., Hays City, Kans.

(306.)— The boiler of the David Wiener saw mill, Joliet, Ill., exploded July 31. Thomas Carr, engineer, was almost instantly killed. The property damage was estimated at $15,000.

(307.)— A tube exploded July 31, at the plant of the Westinghouse Air Brake Co., Wilmerding, Pa. Mike Schmitt, water tender, was injured and died some six hours after the accident.

(308.)— On July 31, a number of cast-iron headers ruptured in a water tube boiler, at the plant of the Semet Solvay Co., Eusley, Ala. Considerable damage was done to the boiler.

August, 1912.

(309.)— On August 1st, a blowoff pipe failed at the plant of the Eldorado Electric and Refrigerating Co., Eldorado, Kans.

(310.)— On August 2, a cast-iron mud drum exploded at the power house of the Light and Traction Co., Fort Smith, Ark. The city was in darkness for two hours as the result of the accident, and a property loss of $4,000 is reported.

(311.)— A tube ruptured August 3, in a water tube boiler, at the plant of the New Orleans Railway and Light Co., New Orleans, La.

(312.)— On August 4, an accident occurred to the boiler of the American Coal Co., McComas, Allegheny, Co., W. Va.

(313.)— A steam pipe burst August 4, at the mill of the Menasha Paper Co., Ladysmith, Wis. S. McDonald and J. Olsen, firemen, were fatally scalded.

(314.)— On August 7, one of the flues of a dryer collapsed at the plant of Armour & Co., St. Joseph, Mo.

(315.)— A tube ruptured August 7, in a water tube boiler at the plant of the Lincoln Trust Co., Lincoln, Neb. Conrad Benner, fireman, was fatally injured.

(316.)— On August 9, a tube failed in a water tube boiler, at the Riverside Steam Laundry, Great Bend, Kans.

(317.)— An accident occurred to a water tube boiler at the Columbus Brewery, Columbus, Neb., on August 9.

(318.)— A tube failed August 12, in a water tube boiler at the Columbia Chemical Co.'s plant, Barberton, O.

(319.)— A threshing machine boiler exploded August 14, at the farm of John Marburger. Fire started in the barn and grain stacks as the result of the explosion, causing property damage estimated at $10,000. Three persons were injured.

(320.)— On August 14, a steam pipe burst at the plant of the Victor Talking Machine Co., Camden, N. J. One man was severely scalded.

(321.)— A boiler exploded August 17, at the ice plant of A. Eller and Sons, Greenville, O.

(322.)— On August 17, five sections of a cast-iron sectional heating boiler failed at the Clarke School for the Deaf, Northampton, Mass.

(323.)— A cast-iron sectional boiler failed August 18, at the "Fensmere" apartment house, owned by William Maynard, Boston, Mass.

(324.)— On August 20, four cast-iron headers failed in a water tube boiler, at Factory No. 2, of the Union Ice Co., Pittsburg, Pa.

(325.)— A steam header fractured August 21, at the power house of the Texas Light and Power Co., Waco, Texas. The accident resulted in the complete interruption of all electric service, light, power, and traction. One man, George Y. Bird, was scalded.

(326.)— An evaporator, for the conversion of salt water into fresh, burst August 21, at Sea Isle City, N. J. One man was slightly injured.

(327.)— A boiler belonging to the Kerbaugh Construction Co., exploded August 22, at Sand Patch, Pa. Four men were injured.

(328.)— A saw mill boiler exploded August 22, on the Provo River, fifteen miles from Kamas, Utah. Two men, W. S. Fuelling and H. G. Wade, were killed, and Mrs. Wade was seriously injured.

(329.)— A tube ruptured August 23, in a water tube boiler at the plant of the Dixie Portland Cement Co., Richard City, Tenn. Ben Jones, fireman, was killed. The property loss was small.

(330.)— A saw mill boiler exploded at the plant of the Pocahontas Consolidated Collieries Co., at the Jenkin Jones' operation on the Tug River, near Pocahontas, Va., on August 24. Four men were killed.

(331.)— A tube fractured in a water tube boiler August 25, at the plant of the Southern Iron and Steel Co., Alabama City, Ala. Joe Turner, fireman, was injured.

(332.)— A threshing machine boiler exploded on the J. J. Bush farm, Veteran, N. Y., August 27, injuring a boy.

(333.)— The boiler of a threshing machine exploded August 27 on the farm of Guy Ford, Witoka, Minn. August Waldo was killed, and Lynn Higgins seriously injured.

(334.)— A tube failed August 27, in a water tube boiler at the plant of the American Steel and Wire Co. of New Jersey. Waukegan, Ill.

(335.)— On August 27, a boiler burst at the plant of the Peoples Light and Ice Co., Ellsworth, Kans.

(336.)— A boiler ruptured August 27, at the flour mill of the Kill Milling Co., Vernon, Tex.

(337.)— The crown sheet of a traction engine boiler collapsed August 30, at Bay City, Tex. Bowie Ryman was seriously scalded.

(338.)— The boiler of a traction engine exploded August 31, on the W. F. Rankin farm, Tarkio, Mo. James Saylor and Fred Taylor were seriously and perhaps fatally injured.

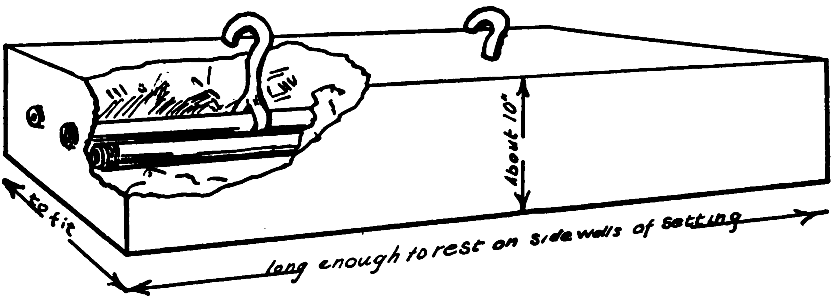

Fig. 1. Concrete Back Arch, for Horizontal Tubular Boiler. Corner Broken Away to Show Pipe Reinforcement.

A Useful Form of Concrete.

P. H. Repp, Inspector.

Quantities of broken fire brick are often seen about a steam plant, accumulating after repairs until they become a nuisance, when they are removed with the ashes and other refuse. This material may be far more valuable than it seems, for if broken up into pieces about the size of a marble, and mixed with an equal amount of neat portland cement (no sand), it will produce a form of refractory concrete which makes most excellent arches or furnace linings. Sufficient water should be used to thoroughly saturate every particle of the cement.

When it is necessary to renew the brick work over a furnace door, or the rear arch of a horizontal tubular boiler setting, a form of rough boards can be made, into which the concrete mixture may be rammed. If the boiler can be spared long enough for the cement to set properly, the work may be done in place, but in the case of a rear arch, it is a simple matter to cast the block in a form set up on the boiler room floor, and then it may be placed in position when ready, with very little loss of time.

For this purpose, a strong form should be prepared, long enough so that the completed arch will rest with a good bearing on the side walls of the setting. To give strength to the structure some lengths of old 1¼ or 1½ inch pipe should be secured in the form as indicated in Fig. 1, to serve as a reinforcement. Hooks may be forged up from round iron, and fastened in the mold so as to embrace the middle length of pipe, and will be found of service to secure lifting gear, when placing the block in position. Of course such an arch can be made in any shape necessary to meet local conditions, the only requirement being to so place the reinforcing material as to secure adequate strength.

Rear arches of this description have come under the writer's observation at plants in which soft coal is burned, and the boilers driven at a high rate. One in particular is in good condition after six years of such service, in a setting where the old form of brick work had given a great deal of trouble. Another difficult case was that of a brick arch over the furnace doors, in the setting of a horizontal tubular boiler, which seldom lasted as long as six months. Here the concrete was tried as a sort of forlorn hope. A form was arranged so that the work could be done in place, and an expansion joint, in the shape of a vertical space, was left in the center. No trouble with this construction has been experienced, and the concrete has been in place more than a year, with no signs of cracks, or other deterioration.

No particular novelty is claimed for this material, but the writer feels that there are many engineers to whom it is unknown, and who would be glad to avail themselves of it. He is sure that if the work is carefully done, the results will be both durable and reliable.

BOILER EXPLOSION AT SALTILLO, MEXICO. No. 270 IN JUNE LIST.

On the Value of Skilled Operatives.

The rather picturesque illustration which heads this paragraph, and incidentally furnishes the text for it, represents what was left of locomotive No. 591 of the National Railway of Mexico, after its boiler exploded June 28th at Saltillo, Coahuila, Mexico. The report which reaches us is to the effect that fifteen persons were killed, and much property destroyed. It is also said that the indirect cause of this and four other similar explosions, is to be found in the fact that the skilled American engineers and firemen had been replaced by unskilled and inexperienced Mexicans, and this brings us to the subject upon which we wish to touch.

There are in general, assuming proper design and construction, just two causes for boiler accidents, both of which may really be included under the one head, over pressure. The subdivision into two classes which we have indicated, would be to cover first, over pressure proper, that is a pressure in excess of the ordinary working pressure sufficient to rupture a sound boiler, and second, such a deterioration of the boiler, that the ordinary working pressure becomes in reality an over pressure, resulting in a more or less serious accident. We are well aware that we are stating no novel fact, and will gladly confess our guilt if you insist that this is a mere truism, but we wish to complete the statement with another truism, that such conditions are the result of direct or indirect incompetence in the boiler supervision.

No inspection service, whether by city, state, or insurance company, can prevent an incompetent or careless operative from doing serious damage as the result of perhaps but a few moments' misuse of the apparatus placed in his charge. It is not our intention however to censure the operator himself, but rather the penny-wise policy of steam users and boiler owners, which frequently makes it possible for him to assume a responsibility for which he is in no wise fitted. The moral question of responsibility for the life and property of others need not be brought to bear, as it is easy to show that a purely selfish desire to earn a fair return on the money invested in a steam plant should be incentive enough to induce any steam user to first assure himself of the safe condition of his apparatus through the skilled inspection services offered by a sound Inspection and Insurance Company, and then to secure proper maintenance by hiring competent men at a fair wage, to operate his plant.

Boiler Shell Damaged by the Vibration of a Steam Header.

Geo. H. Ward, Resident Agent.

Some years ago, the writer, then an inspector in the Boston Department, examined a boiler in South Gardiner, Mass., which had been removed to make way for one of larger proportions. This boiler had been insured and inspected by a competent inspector, and the report of its condition had always been good. It is the custom of the Hartford to class such boilers as second hand, and as the owners had a customer in view, this special examination was made.

A thorough internal and external inspection was made, and the boiler was found to be fairly clean, and free from visible defects. As it was of the double riveted lap construction, the hydrostatic test was applied, under which it seemed absolutely tight. In going over the various seams and plates with the inspector's hammer, while under pressure, no evidence of leakage or fractures at the seams was noted. But upon applying the hammer to the plate surrounding the forward nozzle, after a few strokes, a fine spray of water was visible coming through what appeared to be solid plate. This spot was then vigorously attacked, and soon a fine spray fountain was at work. The pressure was then allowed to drop, the boiler emptied and the manhole plate removed, permitting a close examination of this plate from the inside. It was found to be as smooth as the day it was rolled, but by drying it with bunches of waste, and using a magnifying glass, it was noted that the entire plate for a distance of about eight inches around the nozzle had been fatigued, the fiber of the metal had been broken off and the plate was full of fine, irregular hair cracks. The inspector condemned the boiler. An investigation was then made to determine the cause for this cracking of the shell.

It was found that the boiler had stood in a battery, and that it had been connected to the header, which was some twelve feet above the nozzle, by a riser. While the writer was present, this line with a similar riser from a boiler standing adjacent to the former position of the one tested, was vibrating considerably. The cracking of the plate was therefore attributed to the effect of this vibration, transmitted to the shell by the riser, which was long enough to secure a good leverage, and hence cause a considerable movement of the shell at each swing of the header.

The above failure is a striking illustration of the serious consequences which may attend an improper or poorly chosen pipe layout. Such vibrations are well known to result more often from the intermittent demand for steam of a high speed engine, than from the purely mechanical shaking of unbalanced machinery. The cure for such a condition is usually to be found in a separator or other form of reservoir, placed between the header and the engine, of sufficient size to equalize these pulsations in the steam flow, and incidentally, it may be said that separators are cheaper than boilers.

EDITOR.

Steam Engineering About Sixty Years Ago.

B. FORD, Chief Inspector.

In thinking over my experience as a steam engineer for the past sixty years, I recall my experience in operating two cylinder boilers — 38″ in diameter and 24′ long — that had none of the modern appliances for safety or convenience. They were fitted only with a lever safety valve, no steam gauge. The end of the lever was handled with a rod, and to determine the rise and fall of the steam pressure, you pushed up on the lever. The amount of force used to lift the valve was the only way to determine the pressure. There was no mud valve. In the front plate over the grates, on the bottom, an inch hole was drilled and fitted with a tapered plug, driven from the inside and extending through the plate generally about an inch. To empty the boiler for cleaning, you used the heavy fire poker and knocked the plug back into the boiler. Some care had to be taken in using the poker to work the fires, as on several occasions the plug was knocked out, the boiler emptied of water, and the works stopped. The steam outlet was at the front head, and the water supply connection was also in the front head, through an equalizing pipe connected to both boilers.

When we consider the old style of equipment as compared with the present with its steam gauges, pop safety valves, mud valves, and glass water gauges, these additional fittings should encourage us to look for greater safety in the operation of steam boilers, and engineers of steam boilers should be proud of being trusted with the responsible position of having charge of a boiler plant.

But I would say, boys, with all these new appliances for your guidance, don't forget to push in your gauge cocks and notice what comes out — water or steam.

The Hartford Steam Boiler Inspection and Insurance Company.

ABSTRACT OF STATEMENT, JANUARY 1, 1912.

Capital Stock, . . . $1,000,000.00.

ASSETS.

Cash on hand and in course of transmission,		$204,693.25
Premiums in course of collection,		263,453.33
Real estate,		91,100.00
Loaned on bond and mortgage,		1,166,360.00
Stocks and bonds, market value,		3,249,216.00
Interest accrued,		71,052.02
Total Assets,		$5,045,874.60

LIABILITIES.

Premium Reserve,		$2,042,218.21
Losses unadjusted,		102,472.53
Commissions and brokerage,		52,690.67
Other liabilities (taxes accrued, etc.),		47,191.65
Capital Stock,	$1,000,000.00	
Surplus over all liabilities,	1,801,301.54	
Surplus as regards Policy-holders,	**$2,801,301.54**	2,801,301.54
Total Liabilities,		$5,045,874.60

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S. F. Jeter, Supervising Inspector.
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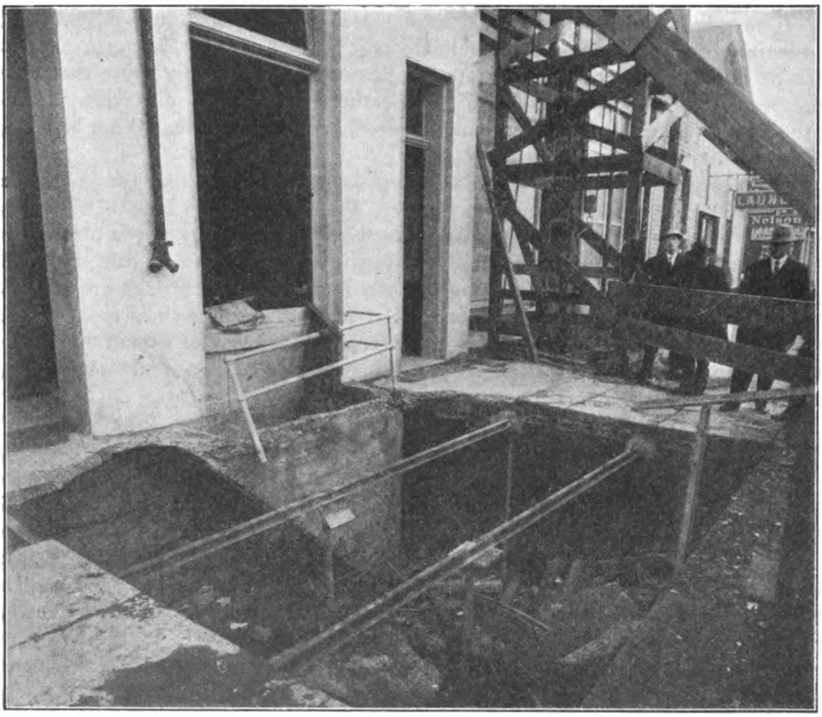
The Locomotive of The Hartford Steam Boiler Inspection and Insurance Co.

Vol. XXIX. HARTFORD, CONN., JANUARY, 1913. No. 5.



Heating Boiler Wreck.

Protection of Water Gauge Glasses

ALEX M. GOW.*

Under date of June 2, 1911 the Interstate Commerce Commission issued a set of rules and instructions relative to inspection and testing of locomotive boilers and their appurtenances. Rule No. 41 reads as follows:

> "All tubular water glasses and lubricator glasses must be equipped with a safe and suitable shield which shall prevent the glass from flying in case of breakage, and such shield must be properly maintained."

While the jurisdiction of the Interstate Commerce Commission in such matters extends only to locomotives operated by common carriers, nevertheless the precaution prescribed should be adopted by all users of all boilers whether they are upon locomotives engaged in interstate commerce or stationary boilers in power plants.

Glass tubes, when subjected to internal steam pressure on water gauges or lubricators will break. If the flying pieces of glass enter a man's eye the results are liable to be serious. That such glasses should be guarded, goes without saying. A general presentation of the question would appear, then, to be in order.

One of the causes that has been assigned for the breaking of glasses is "the inherent malevolence of inanimate objects." Against this cause all that can be done is to buy the best grade of glasses; the best being those that have the least "inherent malevolence." That there is a wide difference in the propensity to break of different makes, every engineer knows. What the best make is, the writer does not know.

Another, and very fruitful cause of breakage is the fact that the upper and lower connections are not true and in line. The result of this lack of alignment is that a sidewise strain is put on the glass where the packing glands are set up. Again, the gland nuts are necessarily set up with a wrench and a little too much pull will insure the breakage of a glass. In fact, when the fittings are too hot to touch, and the rubber ring is not a good fit, and the wrench is too big, and a leaky joint overhead is dropping hot water on the back of a man's neck, he is liable to have trouble getting the glass in just right. But if not put in just right, it will break again.

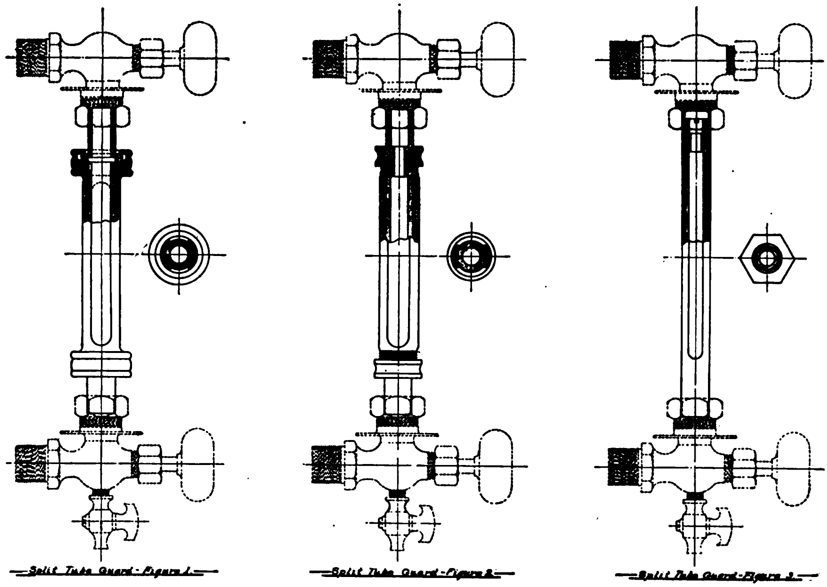
That the glasses have received improper and careless handling is another cause that accounts for many breakages. If the glaze or "fire polish" on the surface of the glass, inside or out, be scratched ever so slightly, the chances are that the glass will break. Speaking of this cause of breakage, Mr. Chas. S. Blake, in the January number of "THE LOCOMOTIVE," says: "All glasses are keenly susceptible to surface abrasions, even so minute as to be unobservable. If one receives the slightest scratch inside or out, it should not be used, and in handling or keeping them in stock, no matal of any nature should be allowed to come in contact with them. They are particularly liable to break if iron or steel touches them, and so should never be laid down even temporarily with tools, as is frequently done in preparation for a renewal.

"The great precaution is to keep the surface from being scratched, for, as every engineer knows, it requires but the slightest breaking of the skin of the glass in a circumferential way to cause it to almost fall apart. The peculiar

* Assistant Chief Engineer, Oliver Iron Mining Co., Duluth Minn.

phenomenon of the glass breaking which has lain next to iron or steel has never been explained to me, but I have a number of times, as an experiment, taken a glass, run a smooth rod of iron through it and put it away. Sooner or later it has been found shattered in many pieces."

The steam and water have a corroding action on the inside of the glass that tends to induce breakage. This action appears to be more active when the glaze or "fire polish" has been disturbed. For this reason it is thought best by some engineers to obtain glasses of exact length with fused ends, rather than to cut a long glass to the proper length, thus leaving a surface subject to the above-mentioned corroding action.

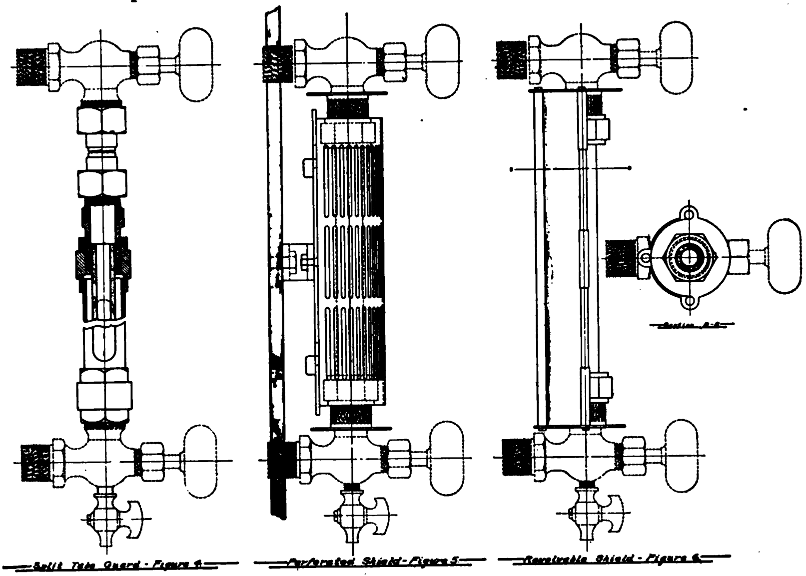


FIGS. 1, 2, AND 3.— SPLIT TUBE GUARDS.

Every engineer knows that he ought to close the top and bottom connections before attempting to tighten the stuffing box nuts. Occasionally a man has neglected this precaution and lost an eye in consequence. Every engineer knows, also, that after a new glass is put in the connections should be opened very slowly, to allow the glass to warm up. This is the time to guard the face and eyes.

For this purpose the shield shown in Figure No. 6 has been recommended, and is used on a great many boilers. It is a revolvable shield and can be brought around between a man's face and the glass when the valves are first opened, or after putting in a new glass. It also serves to protect a man in case any work has to be done on the water column or connections. The shield is made from a piece of light sheet steel and when not in use, is turned out of the way.

A modification of this idea is shown in Figure No. 7. Here the shield is made very large and substantial and runs in guides. When out of use it slides clear to the rear of the water column. It can be pushed into place from the floor of the boiler room by a long stick or any convenient poker. Neither of these shields protect a man from flying glass, except when he is working at the water column and has the shield in place. It is claimed, however, that inasmuch as that is the time when the danger is greatest and when most accidents happen, and furthermore, that the chance of a man on the boiler room floor being hit by a piece of flying glass is very remote, that this type of shield affords ample and sufficient protection.



FIGS. 4, 5, AND 6.—SPLIT TUBE, PERFORATED AND REVOLVABLE GUARDS.

Figure No. 5 shows a plain, perforated, metal guard. This type of guard has appeared in various forms and has the merit of cheapness. If the perforations are made small enough it offers an effectual resistance to flying glass. But most engineers will raise serious objections to the obstruction it offers to seeing where the water level is And this is certainly a serious objection.

Another type of guard with which every one is familiar is the plain, slotted tube placed over the gauge glass. The objection raised to this type of guard is that if the slot is large enough to clearly show the water, it is also large enough to permit the glass to fly. But there is much to be said in favor of the slotted tube type. If loose on the glass it can be turned as a shield, similarly to the first type mentioned. Ordinarily the slot may be turned in the direction least liable to cause a man to be hit by flying glass, and the amount of glass to fly is certainly reduced.

Four modifications of the slotted tube idea are shown in Figures Nos. 1, 2, 3 and 4. All of these designs incorporate one most excellent feature, that will to a great extent reduce breakages: The gauge glass is inserted in the split tube and the top and bottom packing glands set up tightly, before the tube is inserted into the top and bottom connections. This entirely removes one cause of breakage mentioned above, the lack-of-alignment of the fittings.

In Figures Nos. 1 and 2 the nuts that tighten the glands onto the rubber

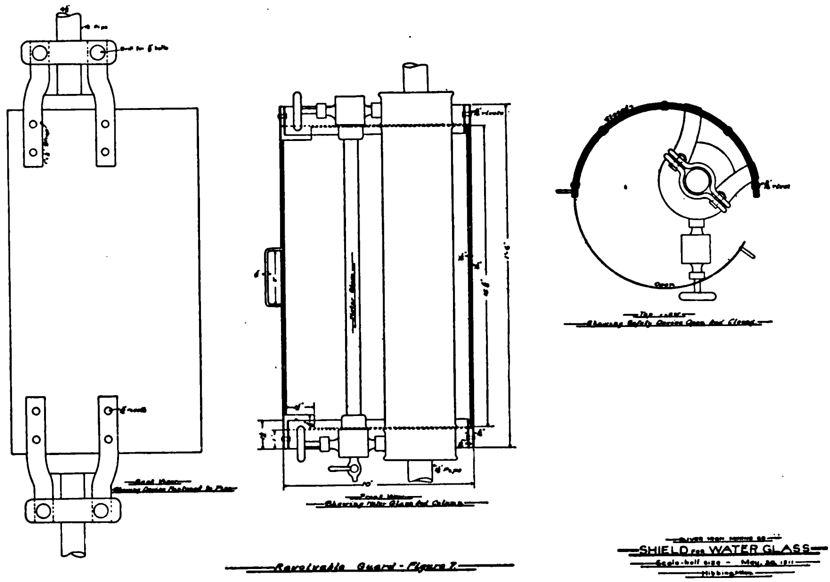


FIG. 7.— REVOLVABLE GUARD.

packing rings are knurled so that they may be screwed up by hand. In making connections to the top and bottom fittings on the water column a wrench can be used with impunity for no strain is put onto the glass by screwing up the packing nuts. The only essential difference in the designs of these two types is that in Figure No. 2 the glass is packed on the end while in Figure No. 1 it is packed in the usual way, on the outside.

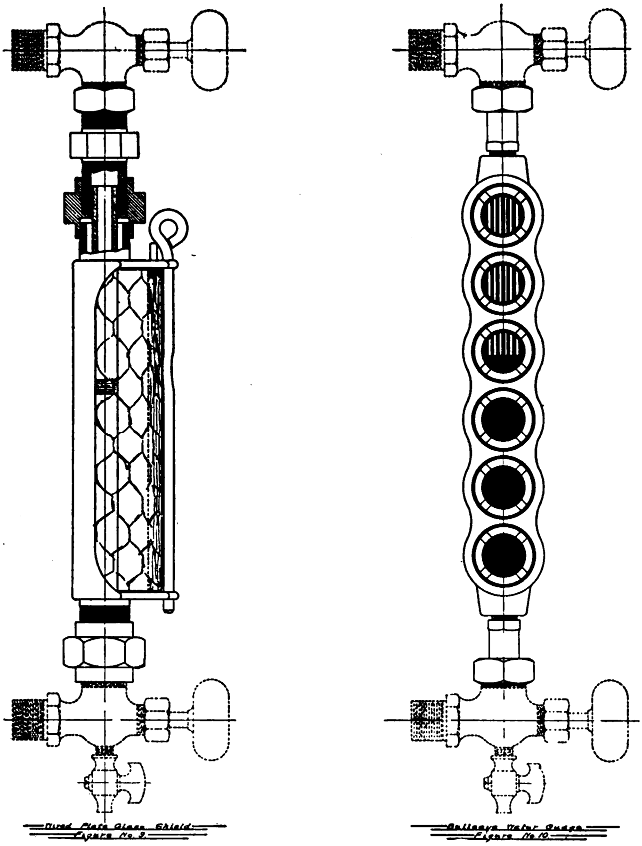
The claim made for the end-packing is that the glass is better protected from corrosion. This argument has little weight if glasses with fused ends are used. Objection can be made to packing on the end on the ground that the glass must be true and square and furthermore owing to the pressure required to make a tight joint, the glass cannot expand.

The writer considers all these objections more theoretical than practical and knows that this type of split tube guard saves a great many breakages. The slots are set parallel to the boiler fronts. The water is plainly visible. In case of breakage a man can go on a ladder to the front of the column with perfect impunity, and, having a spare guard and glass ready, put them in without danger, his face being protected by the uncut portion of the tube. Rarely will it be found necessary to increase the distance between upper and lower fittings to install this guard, as nearly always the glass is considerably longer than is required to cover the maximum variation in water level allowable.

In Figure No. 3 is shown a modified construction wherein the ends of the split tube are threaded on the inside and the packing nuts screwed down onto the glands that bear on the rubber packing ring, with a screw driver. This makes a very neat construction and is quite applicable where connections are short, as on lubricators.

Figure No. 4 shows a construction very generally used upon locomotives.

Another type of guard involves the placing of an auxiliary glass in front



FIGS. 9 AND 10.—WIRED GLASS SHIELD AND BULLSEYE WATER GAUGE.

of the glass tube. This idea has been worked out in various ways. This type of shield is particularly adapted to locomotive type boilers, where a fireman's face is necessarily in proximity to the water gauge.

In Figure No. 8 two heavy pieces of plate glass are set at right angles to each other in a hinged frame that may be thrown open either to replace the gauge glass or for cleaning.

In another form of this type of shield, light brass castings are fitted to the top and bottom connections and three pieces of heavy plate glass carried by these castings form a glass box, surrounding the gauge glass on three sides. The chances of the plate glass breaking would appear very remote, but to remove any doubt upon that score, wire glass has been used.

In Fig. 13 is shown a construction that any machinist can fabricate from a piece of sheet steel. The sheet steel is cut and bent so as to form a frame to hold three pieces of plate glass and the whole arrangement is then secured by the brass rods that are usually furnished with the top and bottom water glass connections. It is evident that this idea could be worked out to suit any particular case and is to be recommended for its simplicity.

Naturally, the use of flat pieces of heavy plate glass led to the use of one piece of heavy glass moulded to a semicircle. One form of this type of shield is shown in Figure No. 9. In this design the glass tube and the cylindrical glass guard are contained in a casting having screwed ends which make onto the top and bottom connections. In another form, light castings are secured to the top and bottom connections and support the cylindrical glass guard in the same way as the pieces of flat plate glass are supported in one of the guards previously described.

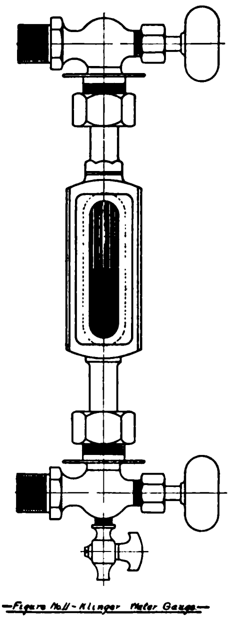


FIG. 11.— KLINGER WATER GAUGE.

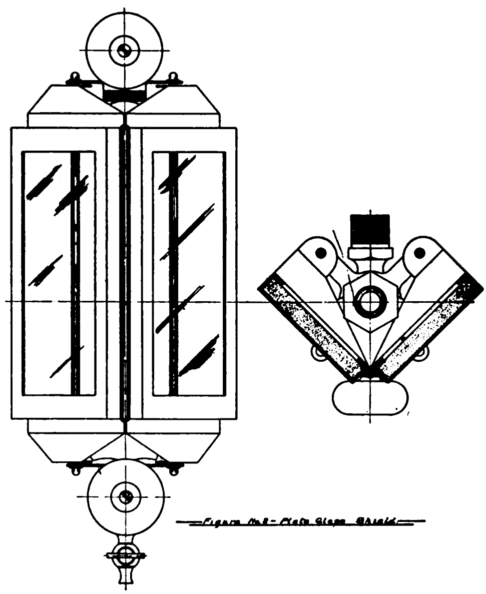
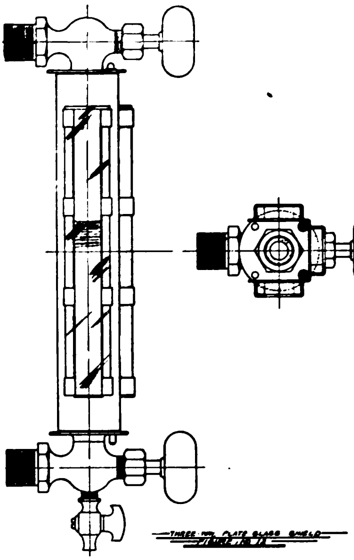


FIG. 8.— PLATE GLASS SHIELD.

The well known 'Klinger" or "Reflex" safety water glass is shown in Figure No. 11. The patent on this glass has expired. It consists of a brass casing having a plate glass front, the inner surface of the plate glass having upon it a series of prisms. Due to the refraction and reflection of the rays of light, the water shows black and the space above the water shows silvery. The glass does sometimes break, but rarely, if ever, flies. But the grooves get dirty and greasy and the glass corrodes, requiring the renewal of the glass. This is something of a job, necessitating the removal of a number of cap screws and the making of tight joints between the glass and the casing that contains it. The water level is not visible from the side and the observer must be nearly in front of the gauge to see the water clearly. The "Klinger" or "Reflex" idea is certainly a good one and its merits to a great extent offset its defects.

The use of glass bull's-eyes on lubricators in place of short glass tubes naturally suggested the use of bull's-eyes on water columns to take the place of the gauge glass. With the expiration of the "Klinger" patent which covered the use of the prism on the inside surface of the glass, there appeared the



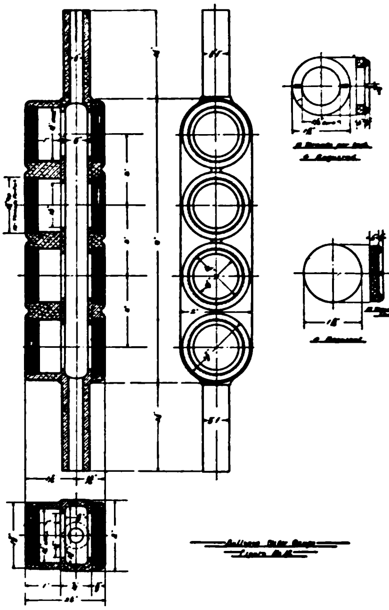


FIG. 13.— PLATE GLASS SHIELD. FIG. 12.— BULL'S-EYE WATER GAUGE.

arrangement shown in Figure No. 10. Here a series of bull's-eyes having prisms on their inner faces are set in a casing, similar to the "Klinger" or "Reflex" gauge. Objection has been made to this type of gauge on the ground that the exact water level, if it comes midway between two bull's-eyes, is not visible. As a matter of fact the exact water level is of very little consequence. Try cocks do not indicate the exact level. What the water tender wants to know is whether he has water or not, and about how much. The bull's-eyes will tell that.

A number of modifications of the bull's-eye construction have been proposed. When, as in locomotive practice, it is desirable that the water level be visible by both fireman and engineer, from opposite sides of the cab, two rows of bull's-eyes, staggered, and in a triangular shaped box, have been used. The prisms are prone to get dirty from the grease and scum that gathers in the water column and it is desirable that in the rear of the bull's-eyes should be located plugs to facilitate cleaning and removal of the bull's-eyes. Such a design is shown in Figure No. 12.

From the foregoing it will be seen that the matter of safety in connection with gauge glasses has been pretty thoroughly considered. What device or arrangement is the best in a particular case, is for the man in charge to decide. That the risk of knocking out a fireman's eye by flying glass can be reduced, there is no doubt. That the risk must be reduced to a minimum, goes without saying. The men who run the boilers and the men who own them must unite to this end. The guarding of glass gauges is just one little incident in the big safety movement that means much to employee and employer.

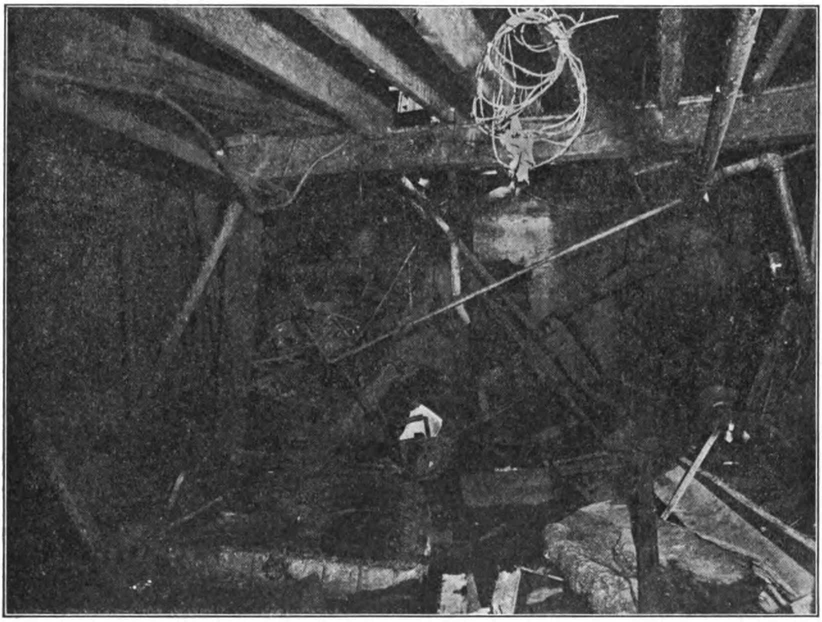


FIG. 1.— THE WRECKED BOILER ROOM, SALEM BANK AND TRUST COMPANY, SALEM, ORE.

Two Serious Explosions of Cast Iron Heating Boilers

A cast iron sectional heating boiler of a common and much used type exploded with great violence on October 29, 1912, in the basement of the Salem Bank and Trust Company's building, Salem, Ore. The explosion occurred about noon time. Three men, Mr. W. S. West, the cashier of the bank, Mr. Harry Ahler, the son of the bank's president, and Mr. J. B. Muchmore, were fatally injured, while two others, Mr. L. H. Roberts, and Mr. A. L. Brockman, were less seriously hurt. The circumstances leading up to the accident have been a matter of much mystery to the residents of Salem, so much so in fact, that the Coroner's Jury brought in a verdict of "explosion, cause unknown," but as is often the case in such casualties, when the facts are gathered and viewed in the light of experience gained by long familiarity with similar mishaps, their interpretation presents neither mystery or complication.

Briefly the story is somewhat as follows. The building of the Trust Company was being remodeled, and at the time of the explosion, was unoccupied with the exception of the first floor, which contained the offices of the bank, and of Mr. Roberts, an insurance agent. The boiler, which had been purchased at second hand, was installed during the summer and stood directly under the office of Mr. Roberts. (This is the room the windows of which are shown on our front cover.) As only the first floor required steam, and

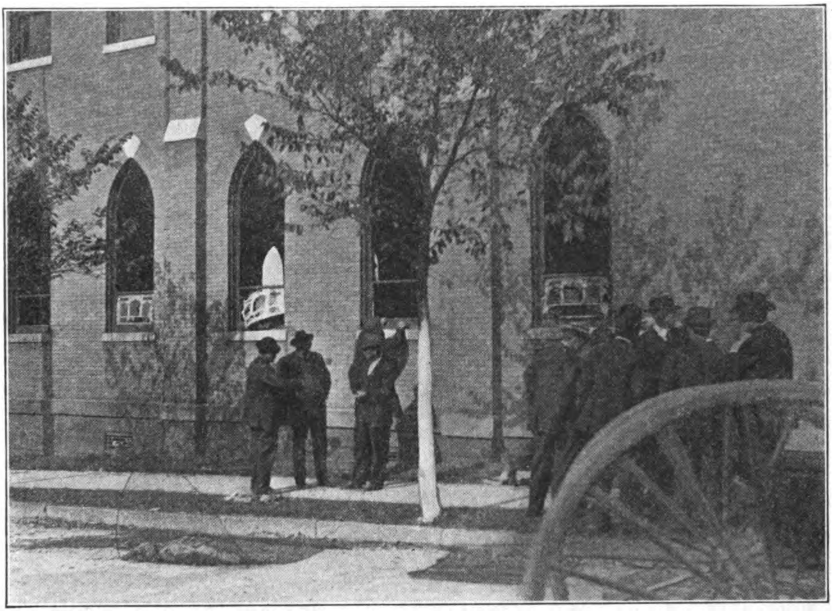


FIG. 2.— EXTERIOR OF CHURCH, SHOWING WRECKED MEMORIAL WINDOWS.

as the day was very warm, it is probable that many if not all the radiators were turned off. It is known that wood and other quick burning refuse were being burned in the boiler just before the failure. Mr. East and Mr. Ahler went to the basement to investigate a steam leak which was annoying the workmen, and arrived just as the explosion occurred. Both men were terribly scalded and mangled. Mr. Roberts, who was seated at his desk in the room above, was thrown out of the window, and landed in the débris between the two pieces of railroad iron, seen on the cover, which served to support the roof of the fuel room. Mr. Muchmore and Mr. Brockman were on the street directly above the fuel room. That the property damage was considerable is shown in the photographs. The sections of the heater were scattered. Some were thrown into the room above, while others remained in the basement. The steam drum lodged between the floor joists of Mr. Roberts' office. The fuel room, adjacent to the boiler room, and under the sidewalk, was entirely unroofed.

The cause of the explosion does not seem to be so very mysterious. It is well known that makers of heating boilers provide safety valves which are often entirely inadequate to relieve the boiler of steam as fast as it is formed. Makers of power boilers long ago realized that there should be relation between the size of a safety valve and the area of the grate, such that the valve would take care of all the steam which the furnace could produce, without a dangerous rise of pressure. With an inadequate valve, the other circumstances such as the closed radiator valves, and the hot quick fire, easily explain the rise of pressure which caused the explosion. Whether the steam leak which drew Mr. East and Mr. Ahler to the basement was due to a failure at a joint, or whether it was only the safety valve doing its best to relieve the situation, will of course never be known. Our representative, who was on the spot soon after the explosion, states that the sections showed no evidence of overheating but that the violence of the explosion pointed almost certainly to a condition of overpressure.

The other explosion occurred in the basement of a church at about 8 A. M. The boiler, also of a common type, is said to have been some ten years old, and to have seen service in a business block previous to its installation in the church. The janitor was killed by the force of the explosion.

Press accounts state that there were about 150 children at school on the second floor of the building, but they were fortunately uninjured. The church proper was badly wrecked. Our illustration, Fig. 2, showing the exterior with the memorial windows blown out, merely hints at the devastation inside, where the destruction of the interior and its furnishings was complete. In places the floor was raised some four feet from its former position.

We are told that a service was to have been held on this particular morning, but had been postponed because of the absence from the city of the parish priest. It seems certain that but for this fortunate circumstance there would have been a much greater loss of life.

We have been informed that closed valves were found in the connection between the boiler and the water column, but the violence of the explosion does not indicate any lack of water. A search for the safety valve is said to have proved fruitless, although the section to which it would ordinarily have been attached was found with a plugged opening, and seemed to have been in that condition for a considerable time. If this be true, and if in fact there was no other safety valve than an ordinary pipe plug, the cause of this explosion is not hard to conjecture.

These two explosions would seem to have been preventable had the boilers been subject to the inspection service of a boiler insurance company. Both resulted in loss of life. That only one man was killed in the second instance instead of scores either killed or terribly injured, was due solely to the fortunate absence from the city of the priest which prevented holding the scheduled service. We have had occasion, not longer ago than the October, 1912, number, to call attention to the danger of heating boilers which are improperly operated or installed. If that warning applies in general, with how much more force should it apply to the case of public or semi-public buildings, where the number of people exposed to an unsuspected hazard may be very great indeed.

On the Perversity of Inanimate Things

H. Converse, *Inspector*

There are times in the course of an inspector's work when he cannot but feel that his efforts to protect the Company's interest and the lives and property of the assured are a huge joke. It is rather discouraging to have a man tell you flatly that your theory and figures are at fault and then be able to prove it, not by more figures but by actually existing facts. The following may prove of interest, as representing such a case.

In the year 1889, one of the Hartford's inspectors condemned a boiler of the Horizontal Tubular type, and of double riveted lap seam construction, because of corrosion of the shell and weak, soft tubes, as well as grooving around the front head. At that time the boiler was in the neighborhood of twenty years old, and had seen very severe service.

As a result of the action of our inspector, the owner called in the representative of a competitor who at first accepted the risk and allowed some 75 lbs. working pressure. However, after about six months, another inspection was made by the new insurance company, with the result that the boiler was again condemned. The boiler was then thrown out and lay exposed to the weather, until this (1912) summer, when it was given to a man for hauling it away. Now this man has taken the boiler and with the aid of his son has cut the front head off and punched new holes for it, set it back a trifle so as to shorten the boiler, and inserted the same tubes. Today he is operating it at 150 lbs. working pressure. Now the former owner, a good friend of the Hartford, says "why don't it burst as you all say they do?"

We suppose that after all none of our readers will hesitate very long over the answer to the question propounded by the former owner of the boiler. We all know of instances in which a structure has been loaded to near the breaking point without instantly giving way. If we hang a weight on a string heavy enough to eventually cause the string to break, it does not follow that the failure will be sudden. What may actually occur is a gradual weakening and stretching of the string until it breaks at a time when it is least expected. So it is with boilers, because they are in an unsafe condition, does not imply that we can predict the exact hour and minute when the rupture will take place. We can, however, liken the operation of a boiler in the condition described by our correspondent to sitting at our desk, immediately under the heavy weight on its string; either case presents a hazard too dangerous to be undertaken knowingly. — EDITOR.

To Prepare a Boiler for Inspection

We have frequently had occasion to instruct boiler owners and attendants as to the best way to prepare boilers for inspection, but it seems necessary to reiterate these instructions from time to time. The whole substance of the matter may really be summed up in three statements: get the boiler reasonably cool, reasonably dry, and reasonably clean. A lack of information on the part of some of our assured as to the best method for attaining these three ends, as well as a desire to express exactly what we mean by "reasonably" are the excuses for bringing this matter again to the attention of our readers.

The best method for cooling a boiler is the one which we have often described before. First let the fire die down and burn out, or if the case is very urgent and time for burning down cannot be spared, haul the fire. Then close all doors and open the damper, allowing the boiler to remain in this condition until the gage shows no pressure. At this time the furnace should be cleaned of all ash, clinker or coal still remaining, in order that the brickwork of the setting may cool. It is very important that the water be allowed to remain in the boiler after the pressure has fallen to zero, while the brickwork is cooling to avoid danger of serious overheating of the boiler from the heat still in the brick. To cool the setting in the most effective manner, keep the damper open as above, and also open the ash pit doors, seeing that all other doors are closed. Under no circumstances open the front connection doors, as this will kill the draft, and interfere with the circulation of cool air through the setting. If the open damper interferes too much with the steaming of other boilers on the same stack, it may be necessary to partially close it, but it should remain as widely opened as possible. The length of time necessary for proper cooling, after the furnace is cleaned, and before blowing off, depends of course on the amount of brickwork which must cool. If the boiler has a light setting, three hours may be enough, but if the setting is massive, or if it is constantly receiving heat from adjoining furnaces, a longer time will be required. When a proper cooling has been attained the boiler may be blown down, and the hand and manhole plates removed. It should now remain with the doors and dampers exactly as before, as this arrangement will draw pure air into the upper manhole, and out through the hand and manholes which open into the setting, tending both to dry the interior, and to furnish pure air for the inspector to breathe.

As regards our second request that the boiler be reasonably dry, we need say very little if the cooling has proceeded in the manner we have suggested. It is a common practice to wash out a boiler as soon as may be after blowing down so that the mud and sediment may not bake on to form a hard scale, but if our directions have been carried out, the boiler will have been cooled slowly enough to permit washing out *after inspection* and so be dry enough for an inspector to really judge of its condition. Leaky stop valves on pipes leading to live boilers will keep a boiler very wet and uncomfortable, which might otherwise be excellently prepared for examination. It is also a fact, that if a boiler is quite warm, but dry and supplied with a good circulation of fresh air, it is in much better condition for inspection than if cooler and filled with vapor, as no man can remain in an atmosphere heavily charged with steam long enough to really do his work justice, unless he makes several trips into the boiler with a breath of air between, which is a tedious and exhausting procedure.

Our injunction to have the boiler reasonably clean was intended to apply particularly to the fire side. Rake the loose ashes from the back connection, or combustion chamber, so that the brick paving may cool. It is no real pleasure, as the writer can attest, to crawl over a foot or so of impalpable ash, when every time a hand or foot touches bottom, it encounters scorching hot brickwork. Then above all, do not forget to sweep the fire side of shells, heads, and exposed tubes with a broom. The inspector must examine these parts of a boiler minutely, and he is greatly impeded if he must brush soot and ashes off at the same time. This soot is frequently so charged with sulphurous acid as to be most irritating to the eyes, rendering good work very difficult.

So, to sum up in a word, we desire a boiler reasonably cool, which means sufficiently cool for a man to stay in it long enough to properly complete his examination without real difficulty, and as we have said the presence of vapor requires a boiler to be cooler than if it were dry. We desire a boiler sufficiently cleaned from ashes and soot, so that a careful examination of its vital parts can be made with eyes which are not irritated and inflamed, and last of all, the assured must realize that any preparation on his part which enables the inspector to do his work more comfortably and thoroughly, protects his interests to just as great an extent as it does the interests of the Company.

The Operation of Low Pressure Heating Boilers

In the October issue we published a short set of instructions for putting a heating system in commission. It is our purpose at this time to extend these instructions to cover the operation of such a system. We have tried as in the first instance to make our instructions clear and simple enough to be readily understood by any one who has this work in charge.

1. When starting a new fire, *raise steam slowly.* (See instruction 9 in the October 1912 LOCOMOTIVE.)

2. Open the steam valves first, and then the return valves, and in closing down a system, shut the return valves first, then the steam. (See instruction 6 in the October 1912 LOCOMOTIVE.)

3. On coming into the boiler room in the morning, the first duty of the fireman should be to make sure of the amount of water in his boiler. He should test this with the gauge cocks as well as by the water level shown in the glass. Both gauge glass connections and try cocks sometimes become plugged with rust and sediment. Trying the gauge cocks accomplishes two results in that it will keep the cocks flushed out clean, and also detect any discrepancy in the water level indicated by the glass. Then blow through both the glass and water column connections, by opening their drain cocks. One can tell whether the connections are clear by the behavior of the water level in the glass. If the top connection is plugged, the water will come back to a false high level, due to the condensation of the steam trapped above the column of water. A partial vacuum is formed which permits the water to stand at a higher level in the glass than in the boiler. If the bottom connection is not free, the water does not rise in the glass at once, but slowly accumulates from the condensation of the steam until it stands above the true water level, and indeed it will eventually fill the glass. Owing to the greater volume of the water column it will take longer for the water to return to its level, whether true or false, when the column drain has been opened, than it will if only the glass has been blown out. It is a good plan to blow out the glass alone first, to test its connection with the column, and then to blow down the column to test the connections with the boiler. The method given for detecting a plugged connection will apply in either case. If plenty of water is found, the fires may be brightened up, — or spread if banked and steam raised. When the boiler is steaming freely, there is still another indication of plugged connections about the water column or gauge glass. If all is clear, the water level is never entirely quiet, but surges slightly up and down. A perfectly motionless water line is a pretty good indication that something is stopped up, and the blowing out tests should be applied.

4. Try the safety valve cautiously while steam is being raised to make sure that it is free and operative. If it is found in good condition, it is advisable to cause it to open under pressure occasionally to make sure that it is correctly set. *Steam should never be kept on a boiler whose safety valve cannot be*

raised by hand to test its freedom, and this test should be made every day. In case the safety valve is found to be either jammed or corroded so that it cannot be raised, the boiler should be immediately cooled, the fires being first deadened with wet ashes or fresh coal and then drawn, after which the cooling may proceed in accordance with the instructions given elsewhere in this number for preparing a boiler for inspection. Under no circumstances should any attempt be made to repair the safety valve while even a slight pressure remains on the boiler, as serious scalding is almost sure to result from such a practice.

5. In case of low water, that is water level below the glass or the lowest try cock, at any time, the fire should be smothered with wet ashes at once, or if they are not available, with fresh coal. The ash pit doors should be closed and the fire doors open. *Under no circumstances should water be fed to the boiler, nor should the safety valve or any steam valve be touched.* When the boiler is quite cold, an inspector should be called to determine the extent if any of the damage.

6. See that the safety valve and damper regulator work at the proper pressures as indicated by the steam gauge. If the damper regulator fails to control the draft when the highest allowable pressure is reached, disconnect it from the damper and draft door. If it now operates freely the door or damper are sticking, and should be cleaned or repaired so as to turn more easily. If however, the damper when relieved of its load still refuses to work, or is sluggish, the chances are that the trouble will be found in a choked connection between the regulator and the boiler, or the regulator itself may need repair. If the gauge, safety valve, and regulator all work, but do not agree in their pressure indications, they should be tested by an inspector at once and the proper remedy applied.

7. Whenever leaks are discovered, they should be located at once and repaired at the earliest opportunity. No repairs, however, should ever be attempted until the boiler has been properly cooled off. If the leak should exist at a lengthwise, or longitudinal joint in a cylindrical drum or shell, whether the attendant thinks it is serious or not, the boiler should be immediately cooled down as described above, and an inspector called to determine the best course of procedure. This latter course should always be adopted whenever there is the slightest doubt as to the immediate safety of the boiler, as it is exceedingly unwise to take chances with a defective boiler, no matter how insignificant the defect may appear.

8. Whenever two or more boilers are operated together on a heating system it is best that they be provided with an equalizer to maintain a uniform water level, that is so that no one boiler shall rob the rest of the returning water of condensation. An equalizer is a large sized pipe connecting the steam spaces of the several boilers of a heating battery, entirely separate from the steam supply header. The equalizer should not be made use of to supply steam to any portion of the system. It should have as straight a run as possible, and should be provided with stop valves to enable its connection with any boiler being shut off if necessary.

The return pipes of the various boilers should be connected to a common return line, with stop valves for each boiler. A check valve should be placed in the return line on the building side of the branches to the boilers as shown in Fig. 1, to prevent water flowing back to the radiators and piping when the main steam valve is closed, as discussed in the October 1912 LOCOMOTIVE. There

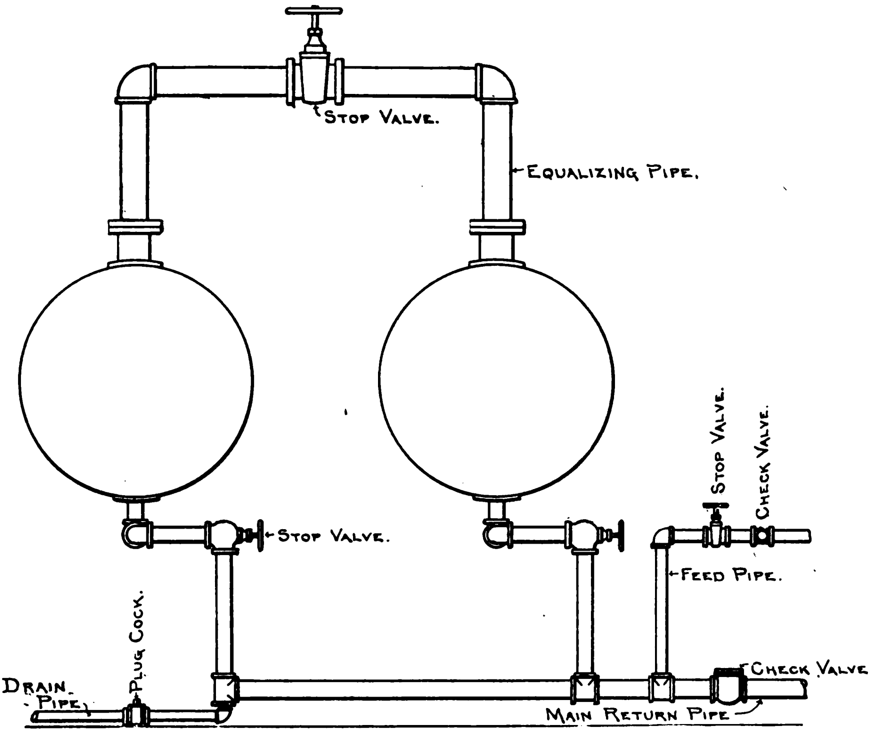


FIG. 1.—ARRANGEMENT OF RETURNS WITH EQUALIZING PIPE.

should not be any check valves in the branches to the boilers, since the return pipe acts as an equalizer below the water line and should afford a free connection between the boilers at all times unless the special condition described below exists, requiring the closing of the equalizer valves. *If only one of a group of boilers is working on the system, the equalizer must be shut off if the dead boilers are cut off from the steam and return lines. If, however, the dead boilers are still connected to the system whether or not their fires are burning, the equalizer (and return valve) must be open to prevent the dead boilers from filling with water at the expense of the one which is working.* This would probably result in serious over heating of the metal of the working boiler.

9. It is important that all surfaces exposed to the action of the fire or to the products of combustion, should be kept cleaned of all accumulations of soot and ash, by sweeping or other convenient means. Soot on the heating surface acts as a blanket, to retard the transfer of heat from the hot gases to the water in the boiler, and the work of cleaning will be well repaid by the resulting saving in coal.

10. To prevent pitting and corrosion, which are especially active in some heating boilers, it is well to keep the boiler water alkaline at all times. This can be accomplished by adding a few pounds (say five pounds to a boiler), of dissolved soda ash at the beginning of the season. This will be enough unless

the boiler is blown down and refilled before the end of the season, in which case the soda ash treatment should be again resorted to.

As a supplementary word of caution, in addition to the instructions already given in paragraph 3 above, we would like to emphasize the fact that sufficient water in a boiler in the morning, does not necessarily mean just enough to show in the gauge. When a large heating system is started in the morning there will be a large amount of condensation in the cold pipes and radiators, so that for a time the water level in the boiler will be steadily falling. Of course all this water will eventually come back, but in the mean time the boiler may have been left for some little time with entirely too little water in it. The man in charge of a heating plant must experiment for himself to determine how much water he must keep in his boiler, and he should be sure that he has enough so that the morning draft of steam will not take the water down below the bottom of his glass gauge.

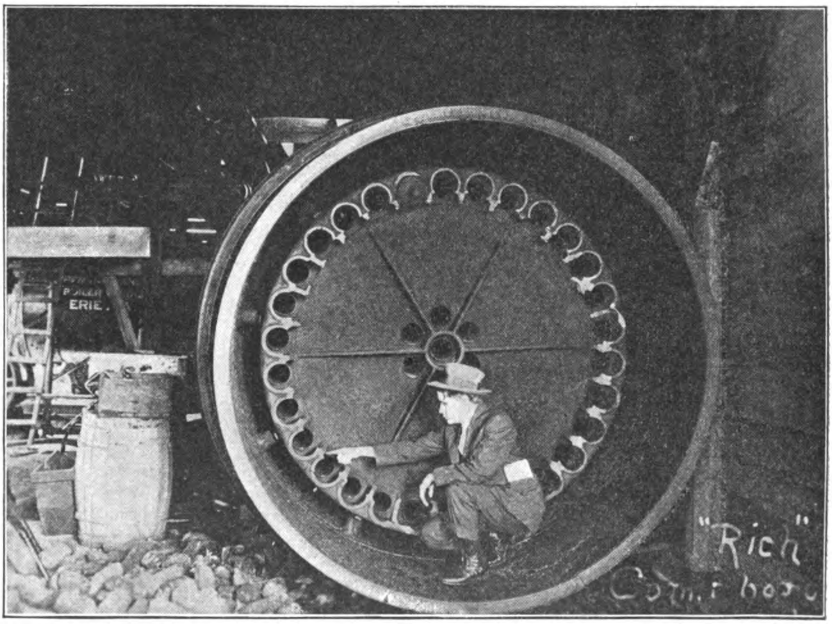


FIG. 3.—THE INSIDE OF THE EXPLODED DRYER HEAD.
THE MAN IS POINTING TO ONE OF THE OLD BREAKS.

The Explosion of a Rotary Steam Dryer

The accompanying photographs show the condition of a rotary drying cylinder after its explosion September 19, 1912, at the plant of the Wenig Feed and Stock Co., Coleman, Ill.

We are informed that the Wenig Feed and Stock Co., was a new concern formed for the purpose of manufacturing stock and chicken feed from spent

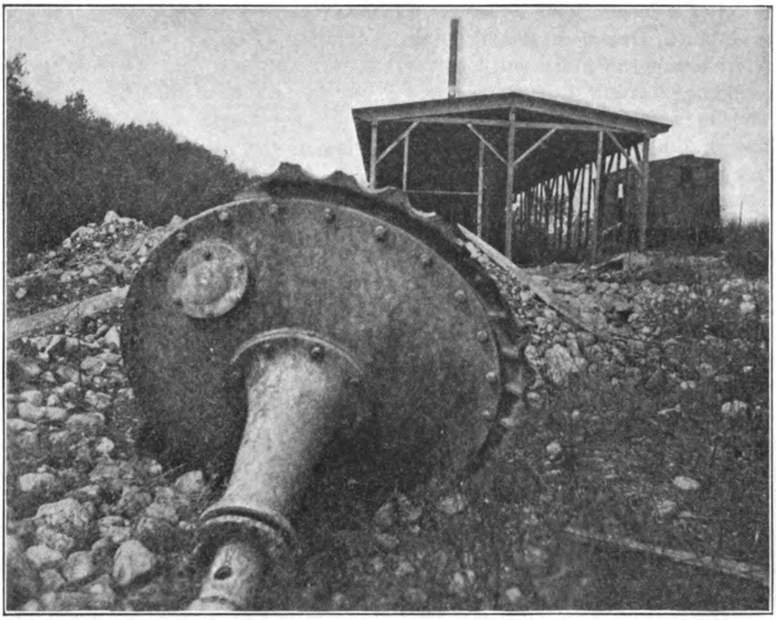


FIG. 2.— OUTSIDE VIEW OF OUTER HEAD.

malt and brewer's grain. The process consisted simply in drying the wet grain by means of the steam, the cylinder which exploded was made use of for this purpose.

The dryer consisted of a cylindrical shell closed by cast iron heads which were made in the form of hollow boxes or manifolds, and were connected together by boiler tubes. There appear to have been two sets of tubes, a row surrounding the central shaft, and another row lining the outer shell. Fig. 1 shows a view into the end of the dryer, and shows the inside of the outer head (the inside of the box, so to speak). The rows of tube ends are clearly seen, as are the ribs which were intended to stiffen and strengthen the large flat surfaces. The mode of operation seems to have been as follows: wet grain was placed in the shell between the cast iron heads, and in contact with the tubes. Then steam was turned into the tubes and heads so that they formed a large steam radiator. The shell of the cylinder proper, that is the space containing the malt, was not under pressure. Ordinarily such an apparatus is operated exactly like a radiator, steam being allowed to enter and circulate through the tubes and heads, while the water of condensation is removed as fast as it forms by a drain connection. Both the steam inlet and the water outlet or drain are carried through the central hub of the head which can be seen in Fig. 2, permitting the whole cylinder to be rotated so as to agitate the malt and hasten the drying process.

We are told that in this case, the dryer had been bought at second hand and without inspection. It had developed leaks at the tube ends a few days prior to the explosion which had been repaired by a boiler maker. It is also said that it was not provided with a pressure gage, reducing pressure valve, safety valve or proper drain connection. This would indicate several possible reasons for its failure. The fact that it was inadequately drained would have permitted it to fill with water up to the level of the central axis when idle, and when steam was turned on a violent water hammer might have been produced Then it could easily have been subjected to a severe and unknown over pressure, due to the absence of the ordinary safety devices. The very violence of the explosion, which killed three men and seriously injured a fourth, and which carried the heavy head seen in Fig. 2 a distance of 350 feet — the head was said to have weighed some 1200 lbs. — would indicate that the vessel must have contained considerable water which added its heat energy to that in the steam, when the explosion occurred. A number of old and deep cracks were found in the reinforcing webs which surrounded the tube ends in the outside row. The man seen in Fig. 1, is pointing to one of them.

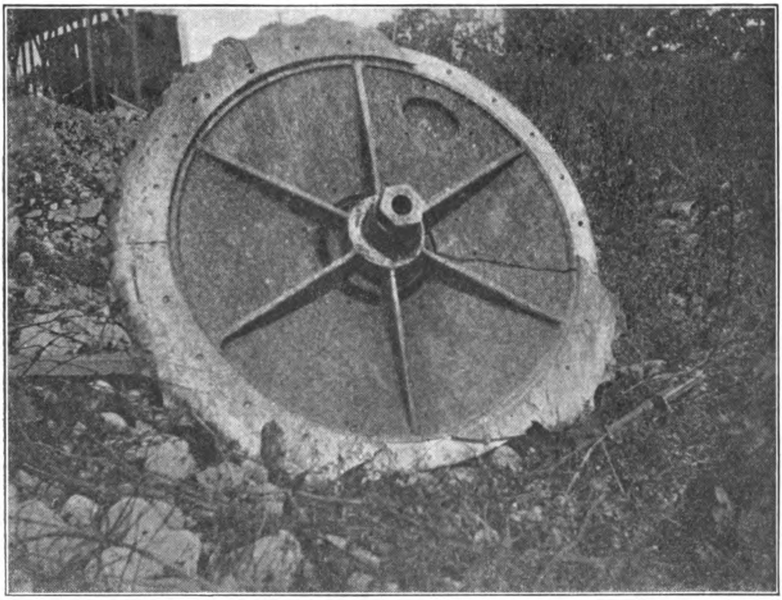


Fig. 3.— Reverse Side of Outer Head.

Cast iron is a treacherous material at best to use in vessels under steam pressure if it must carry any of the stresses involved. But the combination of cast iron, possible water hammer, and excessive pressure in an old and defective structure which had apparently been installed and operated without a knowledge of the precautions necessary for safety, proved, as was to have been expected, a very hazardous affair.

We can still furnish copies of our little book, "The Metric System." It is the best thing to be had, for comparing metric measures with our own. Bound in sheep, it costs $1.25. A special bond paper edition for $1.50.

The Locomotive of The Hartford Steam Boiler Inspection and Insurance Co.

C. C. PERRY, EDITOR.

HARTFORD, JANUARY, 1913.

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THE LOCOMOTIVE OF THE HARTFORD STEAM BOILER I. & I. CO.

Obituary

GEORGE BURNHAM

George Burnham of Philadelphia, for many years head of the Baldwin Locomotive Works, and the oldest director of the Hartford Steam Boiler Inspection and Insurance Co., died Tuesday, Dec. 10, 1912, at his home in that city, at the age of 95 years. His death came as the result of a general breakdown following an illness of about a year's duration.

Mr. Burnham was born in Springfield, Mass., on March 11, 1817. His early childhood was spent there, but at the age of fifteen he was taken to Philadelphia and found employment in the grocery store of a Mr. Simon Colton. It was while in that store that he first met Mathias W. Baldwin, who had some interest in Mr. Colton's business.

Shortly after Mr. Baldwin began the building of locomotives — as a result of the success of his initial engine, Old Ironsides, on the Philadelphia and Norristown Road,— he engaged Burnham as clerk and bookkeeper. From this beginning Mr. Burnham grew up in the financial and accounting side of the business and it was largely through his efforts that the business was preserved and developed through the panics before the war, when a single locomotive was a big contract.

After Mr. Baldwin's death in 1866, Mr. Burnham became a member of the firm, then known as M. Baird and Co. In 1873, on Mr. Baird's retirement, the firm name was changed to Burnham, Parry, Williams & Co., with Mr. Burnham as the senior partner. This firm, changed to Burnham, Williams & Co. on the death of Chas. T. Parry, continued until the incorporation of The Baldwin Locomotive Works in 1909.

In 1843 Mr. Burnham married Miss Anna Hemple, the daughter of Samuel Hemple, a Philadelphia merchant. Through his wife he became an earnest student of the works of Emanuel Swedenborg, and was instrumental in the erection of the beautiful church of that faith at the corner 22nd and Chestnut Streets. He was one of the early members of the Union League, a member of the Committee of One Hundred, and though seldom active in politics, was a generous contributor to reform and civic movements.

Mr. Burnham was elected to the Board of Directors of the Hartford Steam Boiler Inspection and Insurance Co., on Feb. 7, 1888, and served until his death, although for some years past, he had been unable to attend its meetings because of his advanced age.

Mr. and Mrs. Burnham had four children, William Burnham, George Burnham, Jr,. Mary A. Burnham, and Mrs. Theodore J. Lewis.

In the July, 1912, issue we announced the reinsurance of the steam boiler and fly wheel business of the Casualty Company of America by the Hartford Steam Boiler Inspection and Insurance Company. We remarked at that time that since the total amount of steam boiler and fly wheel business in the country was limited, and yet was divided between some 24 or 25 companies, we failed to see how all of them could continue to write this line, owing to the expensive inspection service required. In this number we reprint a news item from the "Hartford Times" of Monday, Dec. 16, 1912, giving the details of still another reinsurance of this character. In the present case the HARTFORD takes over the entire steam boiler and fly wheel business of the United States Fidelity and Guaranty Co., which retires from this field for exactly the same reason as that which influenced the Casualty Company of America. As is stated in the item referred to, this is the eighth instance in which the HARTFORD has underwritten the steam boiler line of other companies.

We trust that our readers will pardon the omission of the customary statistics of our inspection service from this number. It will be obvious, on a moment's consideration, that such statistics to be complete must be compiled after the beginning of the new year. It is therefore, necessary to choose between mailing THE LOCOMOTIVE on time and publishing the statistics. We have chosen the former alternative, as we deem it desirable to appear promptly, and so will print our statistics in the April number.

Messrs. Corbin, Goodrich and Wickham, general agents for THE HARTFORD STEAM BOILER INSPECTION AND INSURANCE COMPANY at Philadelphia, Pa., moved during the first week in December to their new offices in the new Fire Association building, corner of Fourth and Walnut Streets. The building is to be devoted entirely to insurance purposes. The four lower floors are to be occupied by the Fire Association, the fifth by the HARTFORD, and the sixth (top) floor by the Philadelphia Underwriters.

We are told that this building bids fair to become one of the show places of the city because of the simple beauty of its architecture, and feel that it is a matter of great good fortune that our Philadelphia Department is able to locate in such desirable quarters.

Personal

Mr. George H. Bartholomew, who has been connected with the drafting department of the Home Office for many years, left the Hartford on Dec. 1st to accept another position, in which we hope he will be most successful.

Hartford Steam Boiler Co. Takes on Another

Has Reinsured the Entire Steam Boiler and Fly-Wheel Business of the United States Fidelity and Guaranty Co.

It is the eighth instance

[From the Hartford (Conn.) Times, Dec. 16, 1912.]

The Hartford Steam Boiler Inspection and Insurance Company has reinsured and taken over the entire steam boiler and fly wheel business of the United States Fidelity and Guaranty Company of Baltimore, Maryland. From the insurance commissioner's report of 1912, it would appear that the United States Fidelity and Guaranty Company was one of the strongest and most prominent of the multiple line companies. It commenced business in August, 1896, and at the beginning of this present year it was credited with a paid-up cash capital of $2,000,000, a net surplus exceeding $1,022,000, and assets exceeding $6,798,000, while its total premium income pertaining to its various lines of insurance during the year 1911 exceeded $4,738,000.

Amounts to About $7,500,000

The number of boilers and fly wheels involved in this transaction is about 1,500 and the insurance liability taken over amounts to about $7,500,000. President Brainerd of the Hartford Steam Boiler Company stated that there was nothing surprising or strangely significent in this transaction, as it simply indicated that the management of the United States Fidelity and Guaranty Company recognized the fact, apparent to all dealing with the steam boiler and fly wheel line of insurance, that the entire amount to be had was too limited in volume to justify dividing it up among as many companies as are now engaged in writing this line of insurance, with any promise of profit.

What Could Be Done

It requires a substantial volume of business in each state to justify the maintenance of a proper organization and a thorough and efficient inspection service in order to conduct this line of insurance with any hope of profit, and with no less than twenty-five companies competing for a volume of premiums amounting annually to only a little more than $2,000,000, it becomes very difficult for any one company to obtain and control a sufficient volume to make this line of insurance profitable. As a matter of fact, the Hartford Steam Boiler Company could, with its present organization, take over and carry the entire steam boiler and fly wheel business done throughout the United States without materially increasing its present operating expenses, other than possibly adding here and there an additional inspector.

THE EIGHTH INSTANCE

In June last the Hartford Steam Boiler Company likewise took over the entire steam boiler and fly wheel business of the Casualty Company of America, of New York, which ranked as fourth or fifth company in point of volume, and in taking over the business of the Baltimore Company it is the eighth instance in which the Hartford Steam Boiler Company has taken over the steam boiler line from as many companies.

A Decision by the United States Court of Appeals

On October 25th, 1909, an explosion of three Munoz boilers took place at the power plant of the Pabst Brewing Company, Milwaukee, Wisconsin. The boilers were insured by The Hartford Steam Boiler Inspection and Insurance Company under a schedule form providing indemnity in the sum of $50,000 for any one explosion. The assured construed the contract to mean a coverage of that amount on each boiler which exploded notwithstanding that they had ordered the insurance to apply as $50,000 on one loss.

An unsuccessful effort to settle the loss amicably in accordance with the limits as understood when the insurance was placed, was followed by a jury trial in the United States Circuit Court. The plaintiff, the Pabst Brewing Company, sued under two counts; first on the contract, alleging that three explosions had occurred, and the second in tort, both in an endeavor to secure the amount of total loss, in case one count or the other failed.

The jury in the Circuit Court found for the plaintiff. The case was appealed by the Hartford Company and argued before the United States Circuit Court of Appeals at Chicago, Judges Seaman, Landis, and Kohlsaat sitting in the case. This court on October 15th, 1912, handed down a unanimous decision reversing the judgment of the Circuit Court and holding that there was but one explosion within the meaning of the policy and that the plaintiffs had not proved the tort.

This case has aroused considerable interest in insurance circles and the decision of the Appeal Court seems to be in accordance with the views of expert insurance men who have studied the questions involved.

Boiler Explosions

(Received too late for the August list.)

(335.) — On August 12, three men were badly scalded when the failure of a bolt on a hot press released a quantity of hot tankage at the disposal plant of the Michigan Central Railroad, Toledo, O.

(336.) — A threshing machine engine was wrecked by the explosion of its boiler August 31, at Webster, N. D. John Brennan, engineer, was instantly killed, and George Gibbs, fatally burned. The machine was being delivered to a new owner at the time of the accident.

SEPTEMBER, 1912

(337.) — The boiler of a traction engine exploded September 2, at Canal Dover, O. Albert Miller was killed, and Harry Boltz perhaps fatally injured.

(338.) — On September 3, a boiler exploded at the plant of the Williamston Electric Co., Williamston, N. C. Considerable damage was done to the boiler and boiler room, and Alfred Sherod was slightly injured.

(339.) — The boiler of a freight locomotive belonging to the Michigan Central Railway exploded September 4, near Dowagiac, Mich. Charles Murrell, fireman, was fatally injured, and Charles Parr, engineer, less seriously injured.

(340.) — On September 6, the boiler of a hoisting outfit belonging to the Spaulding Logging Co., exploded near Black Rock, Ore. Charles Olsen was killed and G. Reynolds seriously injured.

(341.) — A tube ruptured in a water tube boiler September 6, at the plant of the Tri-State Railway and Electric Co., East Liverpool, O. The property damage was small, but Andrew Pullnis, coal passer, was injured.

(342.) — A tube ruptured September 6 in a water tube boiler at the Toledo Storage and Ice Co., Toledo, O.

(343.) — On September 6, a tube ruptured in a water tube boiler at the plant of the American Steel and Wire Co., Donora, Pa. Considerable damage was done to the boiler, and Charles Fisk, fireman, was scalded.

(344.) — The boiler of a Rock Island freight locomotive exploded September 7, between Argenta and Lonoke, Ark. C. E. Delaney, fireman, and Fred Stelter, engineer, were injured.

(345.) — On September 7, a blow off pipe failed at the Cisco Oil Mill, Cisco, Tex.

(346.) — An accident occurred September 7 to a boiler at the plant of the Jansen Steel and Iron Co., Columbus, Pa.

(347.) — Six cast iron headers failed September 8, in a water tube boiler at the Juniata Company's power plant, Mifflin, Pa.

(348.) — A boiler ruptured September 8, at the plant of the Batesville Ice and Cold Storage Co., Batesville, Ark.

(349.) — On September 9, a hydraulic press exploded in the dye room of the Germania Hosiery Mills and Dye Works, Phila., Pa. Steam was being turned on the press at the time. One man was injured, and property damaged to the extent of about $1,000.

(350.) — On September 10, a boiler ruptured at the plant of the McNeal Marble Co., Marietta, Ga. The damage was small.

(351.) — One man was injured by the collapse of a crown sheet on Locomotive 30 of the Delaware and Hudson R. R., at Saratoga Springs, N. Y., on September 13.

(352.) — On September 17, a boiler ruptured at the plant of the Plano Milling Co., Plano, Tex.

(353.) —A boiler used in connection with the manufacture of sausage at M. G. Reigel's meat market, Phila., Pa., exploded September 17. The building in which the boiler was located was considerably damaged.

(354.) — On September 17, a boiler exploded at the plant of the Wenig Teaming Co., Coleman, Ill. Two men were instantly killed, a third was fatally injured, and one man was less seriously injured.

(355.) — Three cast iron headers ruptured September 18, in a water tube boiler at the Kennesaw Paper Company's mill, Marietta, Ga.

(356.) — On September 18, a boiler exploded at the oil pumping station of the Prairie Oil and Gas Co., Osage Junction, Okla. A. M. Coyle, engineer, was killed, and F. L. Gordon and J. C. Luckfield were seriously injured.

(357.) — About September 20, a small boiler used for dairy purposes exploded on the farm of Arthur Pierpont, near Waterbury, Ct. Mr. Pierpont was scalded so seriously that he died from the effects of his injuries.

(358.) — The home of Harry E. Oliver, Rutherford, N. J., was wrecked September 20, by the explosion of a copper hot water boiler. Property was damaged to the extent of $5,000, and a dog was killed.

(359.) — A boiler ruptured September 20, at the plant of the Belt Line Elevator Co., Superior, Wis.

(360.) — On September 21, a boiler exploded at the South Madison St. plant of the Bloomington Railway Electric and Heating Co., Bloomington, Ill. One man, a fireman, was injured.

(361.) — The boiler of a traction engine exploded September 23, on the farm of Henry McConnell, near Centerville, Iowa. Four men were injured.

(362.) — A freight locomotive belonging to the Chicago, Milwaukee, and Puget Sound R. R. was wrecked by the explosion of its boiler September 24, at Pacific City, Wash. Four men were killed, and the engine was a total wreck.

(363.) — On September 23, an accident occurred to a boiler at the power house of the Crompton Co., Crompton, R. I.

(364.) —A water tube boiler exploded September 24, at the rolling mill of the Southern Iron and Steel Co., Alabama City, Ala. G. W. Williams was injured. The property loss is estimated at about $3,500.

(365.) — Several cast iron headers ruptured September 24, in a water tube boiler at the power house of the Waterloo, Cedar Falls, and Northern Railway Co., Waterloo, Ia.

(366.) — On September 25, a tube ruptured in a water tube boiler at the packing house of Hammond Standish and Co., Detroit, Mich. Joseph Lafata, a fireman, was injured.

(367.) — On September 25, a tube sheet of a water tube boiler ruptured at the Allen County Court House, Ft. Wayne, Ind.

(368.) — A tube ruptured September 30, at the mill of the West Virginia Pulp and Paper Co., Tyrone, Pa. Jesse Walker, fireman, and George Diehl, pipe-fitter, were scalded.

October, 1912

(369.) — On October 1, two sections of a cast iron heating boiler fractured in a business block owned by Helen F. Bradford, Allston, Mass.

(370.) —A tube ruptured October 1, in a water tube boiler at the plant of the Narragansett Electric Lighting Co., Providence, R. I. Bernard Dolan, water tender, was injured.

(371.) — On October 1, a boiler belonging to a contractor, and located at 170th St., in the Bronx, New York City, exploded with great violence. Press reports state that the boiler explosion followed the theft of 65 lbs. of dynamite, and that this was used in producing the explosion. We are somewhat in doubt as to this theory, as the accident has some of the characteristics of a genuine boiler explosion, and so include it in our list.

(372.) —Lieut. Donald P. Morrison, U. S. N., was killed, and eight men injured, on October 1, by the explosion of a steam turbine casing on board the torpedo boat destroyer, U. S. S. Walke, off Brenton's Reef Light Vessel.

(373.) — On October 2, four sections of a cast iron heating boiler ruptured at the Densmore Hotel, Kansas City, Mo.

(374.) — A blow off pipe failed October 2, at the quarry of the Hercules Slate Company, Pen Argyle, Pa. Alfred Henessbeck, fireman, was injured.

(375.) — The boiler at the Lawton, Okla., electric light plant exploded October 2, seriously scalding the engineer and fireman.

(376.) — On October 3, the mud drum exploded on a water tube boiler at the mill of The Wardlow-Thomas Paper Company, Middletown, O. George Baird, fireman, was killed, and considerable damage was done to the boiler and setting.

(377.) — The boiler of Union Pacific locomotive No. 2833 exploded October 3, fifteen miles east of Imlay, Nev. N. L. Robinson, engineer, and C. C. Cool, fireman, were killed, and the engine was a total wreck.

(380.) — A blow off pipe ruptured October 3, at the mill of the Aldrich Paper Company, at Natural Dam, near Gouverneur, N. Y. James Minore, fireman, was fatally injured, and Amos Corey was less seriously injured.

(381.) — On October 4, several headers in a water tube boiler ruptured at the plant of The Winchester Repeating Arms Company, New Haven, Ct.

(382.) —A tube ruptured October 5, in a water tube boiler at the Leeds Ala. plant of the Standard Portland Cement Co.

(383.) — On October 6, a mud drum ruptured in a water tube boiler at the packing house of Schwartzchild and Sulzberger, Kansas City, Kans.

(384.) — A cast iron header ruptured October 6, in a water tube boiler at the plant of the Kansas City Flour Mills Company, Kansas City, Kans.

(385.) — A blow off pipe failed at The Fork Township Oil Mill, Townsville, S. C., on October 8. Frank Williams, fireman, was slightly injured.

(386.) — On October 9, a section of a cast iron heating boiler fractured at the hotel of H. N. Bain, and Ella K. Jewett, Poughkeepsie, N. Y.

(387.) — A tube in a water tube boiler ruptured October 9, at the power house of the Worcester Consolidated Street Railway Company, Worcester, Mass. Arnold S. Allen, Chief Engineer, was killed, and two firemen injured.

(388.) —A locomotive belonging to the Belt Line Railway Company Chicago, Ill., exploded October 9, resulting in the fatal scalding of J. H. Howell.

(389.) —A tube ruptured in a water tube boiler at the Lorain, O., mill of the National Tube Company of Ohio, on October 10.

(390.) — The boiler of a saw mill exploded October 11, at New Point, near Americus, Ga. No one was injured, and the property damage was slight.

(391.) — On October 12, the boiler of a threshing machine exploded at Burlington, N. J. Elmer Mingen and William Slack were seriously injured, and a boy, Paul Sholl, was badly burned.

(392.) — A boiler exploded October 13, at the ice cream plant of Larmore and Co., Davenport, Ia. The damage was slight.

(393.) — Three cast iron headers ruptured October 13, in a water tube boiler at the power house of The Ohio Electric Railway Company, Medway, O.

(394.) — On October 13, a tube ruptured in a water tube boiler at the electric lighting plant of The Central Hudson Gas and Electric Company, Poughkeepsie, N. Y. Five men, Elliot Thompson, asst. engineer, John Houston, supt. of the fire room, James Doyle, fireman, Clarence Decker, coal passer, and Richard Collins, dust man, were injured. The property damage was confined to the boiler itself.

(395.) — A tube ruptured October 13, at the plant of the American Steel and Wire Company, Donora, Pa.

(396.) — On October 14, four cast iron headers ruptured, in a water tube boiler at The New Battle House, Mobile, Ala. Richard Wooten, fireman, was scalded.

(397.) — A tube ruptured October 14, in a water tube boiler located in an office building owned by John A. Orlando, and M., and Chas. S. Harper, Pittsburg, Pa.

(398.) — A boiler exploded October 14, at Mill No. 1, The Henrietta Mills, Henrietta, N. C.

(399.) — On October 15, the boiler of the saw mill of D. W. Eagle, near Keyser, W. Va., exploded. Two men were killed, and two injured, one probably fatally.

(400.) —A blow off pipe failed October 15, at the plant of The E. H. Clapp Rubber Company, Boston, Mass.

(401.) — A cast iron header fractured on October 15 at the power house of the Ohio Electric Railway Company, Medway, O.

(402.) — A blow off pipe failed October 15, at The Belleville Copper Rolling Mills, Soho, N. J. Fred. Myers, chief fireman, was killed.

(403.) — A tube ruptured October 17, in the Trenton plant of the American Bridge Company, Trenton, N. J. John Barcon, laborer, was injured.

(404.) — On October 18, a feed pipe burst at the wood working plant of Glines and Stevens, Franklin, N. H. One man was badly scalded.

(405.) — Thirty-two cast iron headers failed October 18, in a water tube boiler at the plant of the Semet-Solvay Co., Tuscaloosa, Ala.

(406.) — On October 19, the crown sheet of a locomotive, which was in service on the grading contract of John T. Lee, collapsed at Rivaire, Ind.

(407.) — A boiler exploded October 19, at the plant of the Mutual Mining Company, Cannelburg, Ind. One man was probably fatally injured.

(408.) — A boiler exploded October 19, at the Sucker Flat Mine, near Webb City, Mo. Two men were killed, and a third narrowly escaped serious injury. The boiler was blown through a greenhouse roof, two blocks away.

(409.) — The pressure tank, used in connection with an hydraulic elevator at Hotel Wilkes-Barre, Wilkes-Barre, Pa., exploded October 21.

(410.) —A boiler ruptured October 21, in the basement of the S. S. White Dental Company's plant, Phila, Pa. Two men were so badly scalded that they afterwards died.

(411.) — On October 22, a copper hot water boiler failed in a café in New Bedford, Mass. The cause for the failure is said to have been an inoperative safety valve, and a check valve in the cold water supply line. The property loss is estimated at $5,000.

(412.) — Seven cast iron headers ruptured October 23, in a water tube boiler, at the plant of the Louisiana Distillery Company, New Orleans, La.

(413.) — A tube ruptured October 24, in a water tube boiler at the power house of the Northern Ohio Traction and Light Co., Akron, O. Aley George, ash wheeler, was scalded.

(414.) — A tube ruptured October 24, in a water tube boiler at the plant of the Virginia Portland Cement Company, Fordwick, Va. Marshall Jackson, coal wheeler, was injured.

(415.) — A fitting burst on a blow off pipe October 24, at the store of The Sage-Allen Co., Hartford, Ct.

(416.) — A cast iron sectional heating boiler exploded October 25, in the basement of the Church of The Holy Ghost, Knoxville, Tenn. One man was killed, and property was damaged to the extent of $7,000. (Described elsewhere in this issue.)

(417.) — A cast iron heating boiler failed October 25, at the St. Paul, Minn., plant of Armour and Company.

(418.) — On October 25, a water tube boiler ruptured at the Rankin Works of the American Steel and Wire Company, Rankin, Pa.

(419.) — Two tubes burst October 28, in a water tube boiler aboard of a steam cutter attached to the U. S. S. Utah, near Bedloe's Island, in New York harbor. One man was burned about the face.

(420.) — On October 28, an exhaust pipe burst in a factory building at 49-51 Elizabeth St., New York City. A considerable panic among the factory employees followed, but no one was injured.

(421.) — A boiler exploded October 28, at the saw mill of B. Thearmond, Iuka, Miss. Two men were killed outright, and three others injured, one perhaps fatally.

(422.) — A cast iron sectional heating boiler exploded with great violence October 29, in the basement of the Salem Bank and Trust Company's building, Salem, Ore. Three men were killed or fatally injured and two more less seriously injured. (Described in detail elsewhere in this issue.)

(423.) — The crown sheet of a locomotive type boiler failed October 30, at Lima, O. The boiler was the property of the Miles Tighe Contracting Company.

(424.) — The boiler of a logging locomotive exploded October 31 at the plant of the McGehee Lumber Co., Ocala, Fla. One man was injured.

Fly Wheel Explosions

(17.)— On June 10 a fourteen foot fly wheel burst at the plant of the Phœnix Cement Co., Nazareth, Pa. The property loss was estimated at $3,000.

(18.)— A fly wheel burst about June 20 at Trudell's saw mill, Chateaugay Lake, N. Y. One man was seriously injured.

(19.) — On June 22, a large emery wheel burst at the plant of the Art Stamping Co., Philadelphia, Pa.

(20)— A fly wheel burst in the basement of the National Sulphur Company's works, Brooklyn, N. Y. on July 6. The fly wheel in bursting struck a small boiler, which in turn exploded, and set fire to the works, containing a large amount of stored sulphur. Fifteen men were seriously injured by the fire and sulphur fumes, two of them fatally.

(21.)—A fly wheel burst July 16, at the Hull and Draper Flour Mill, Salem, Ill. The wheel was 10 feet in diameter, and normally operated at 75 R. P. M. The failure is attributed to the breaking of a governor belt.

(22.)—On July 17, the fly wheel of the main engine exploded at the plant of Muhs and Co., Passaic, N. J., causing a complete shut down of the plant.

(23.)—The fly wheel of a gasolene engine set used to light two moving pictures at Fort Worth, Tex., exploded August 24. The engineer was seriously and perhaps fatally injured.

(24.)—A fly wheel exploded August 26 in the Bayer Process Dept. of the Pennsylvania Salt M'f'g. Co., Natrona, Pa. The entire plant was shut down pending repairs to the engine and engine room.

(25.)—On September 24, a pulley burst at a saw mill on the Nuckolls Plantation, Russel Co., Ga. One man was killed.

(26.)—One man was injured on October 2, by the bursting of an emery wheel at the plant of the United States McAdamite Metal Co., Detroit, Mich.

(27.)—A fly wheel burst October 2, at the sawmill of Eugene Graves, at Factory Postoffice, some ten miles from Leonardtown, Md. Mr. Graves was instantly killed by a fragment of the wheel. The accident is said to have been caused by the running off of the governor belt.

(28.)—On October 19, a fly wheel burst at the mill of the Mississippi Lumber Co., Quitman, Miss. The property damage was estimated at $5,000.

(29.)—A fly wheel burst October 28 at the stone crushing plant of the American Lime and Stone Co., Union Furnace, Pa. The accident was caused by the failure of the governor.

(30.)—A fly wheel exploded November 19, at the International Paper Company's mill, Fort Edward, N. Y. The property loss is estimated at over $10,000.

(31.)—On November 22, the plant of the Sweetwater Light, Ice, and Power Co., was wrecked by the bursting of a fly wheel. The property loss was estimated at about $2,000.

Is Your Engine Equipped With a Throttle Valve Governor Operated From a Counter-Shaft?

Thomas Dowd, Inspector.

When conditions compel the use of a counter-shaft with an additional belt to drive a throttle valve governor, it is very important that precautions should be taken to insure free action of the automatic safety stop. So that it will stop the engine if either of the two belts should break. So many cases have come under our observation where no provision has been made for such an emergency, that it may be well to call attention to the proper way to connect up governors operated in this manner. Of course, it will be understood that reference is now made to the throttling governor with an automatic safety stop attachment. This safety stop is designed to be operated by an idler pulley, which rides on the governor belt, and is so arranged that should the belt break, the idler will drop to a lower position, thus tripping the safety latch, and allowing the throttle valve to close.

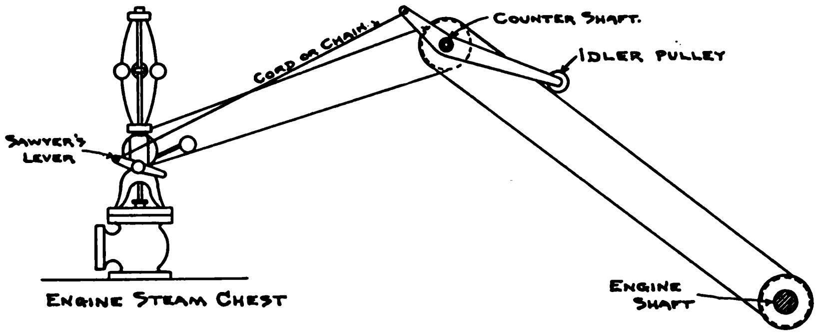

FIG. 1.— SAFETY DEVICE FOR A COUNTERSHAFT DRIVEN GOVERNOR.

When it is necessary to use two belts, as noted above, it is evident that the automatic safety stop on the governor will not operate if the belt that runs from the engine shaft to the counter-shaft should break. In this case, the governor would stop revolving and drop to its lowest position, allowing full steam admission to the cylinder, which would result in the engine racing. To obviate this danger, a second idler pulley similar to the one attached to the governor should be provided to operate on the belt leading from the engine to the counter-shaft, as shown in the accompanying sketch. This can be fitted with very little trouble or expense by the engineer or other mechanic about the plant, as the outfit only consists of the pulley and arm with cord or chain to attach to the Sawyer's lever on the governor, which also operates the safety stop. When thus connected, the governor can then be relied upon to stop the engine if either of the belts break.

Governors of this type are not always fitted with Sawyer's valve levers; but in nearly every case a point can be found where an attachment can be made which will produce the desired result.

Reuben, Reuben, I've bin thinkin'
What a glad world this will be
When them b'ilers cease their bustin'
And get safe for you an' me.

Laws don't seem to make us keerful,
Folks gits reckless jist ther same;
An' when we hev jined ther angels
Jury sez we was to blame!

—*Power.*

The Hartford Steam Boiler Inspection and Insurance Company.

ABSTRACT OF STATEMENT, JANUARY 1, 1912.

Capital Stock, ... $1,000,000.00.

ASSETS.

Cash on hand and in course of transmission,		$204,693.25
Premiums in course of collection,		263,453.33
Real estate,		91,100.00
Loaned on bond and mortgage,		1,166,360.00
Stocks and bonds, market value,		3,249,216.00
Interest accrued,		71,052.02
Total Assets,		$5,045,874.60

LIABILITIES.

Premium Reserve,		$2,042,218.21
Losses unadjusted,		102,472.53
Commissions and brokerage,		52,690.67
Other liabilities (taxes accrued, etc.),		47,191.65
Capital Stock,	$1,000,000.00	
Surplus over all liabilities,	1,801,301.54	
Surplus as regards Policy-holders,	$2,801,301.54	2,801,301.54
Total Liabilities,		$5,045,874.60

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FRANCIS B. ALLEN, Vice-President. CHAS. S. BLAKE, Secretary.
L. F. MIDDLEBROOK, Assistant Secretary.
W. R. C. CORSON, Assistant Secretary.

S. F. JETER, Supervising Inspector.
E. J. MURPHY, M. E., Consulting Engineer.
F. M. FITCH, Auditor.

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Incorporated 1866. **Charter Perpetual.**

The Hartford Steam Boiler Inspection and Insurance Company

ISSUES POLICIES OF INSURANCE COVERING

ALL LOSS OF PROPERTY

AS WELL AS DAMAGE RESULTING FROM

LOSS OF LIFE AND PERSONAL INJURIES DUE TO EXPLOSIONS OF STEAM BOILERS OR FLY WHEELS.

Department.	Representatives.
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BALTIMORE, Md., . . 13-14-15 Abell Bldg.	Lawford & McKim, General Agents. R. E. Munro, Chief Inspector.
BOSTON, Mass., . . 101 Milk St.	C. E. Roberts, Manager. Joseph H. McNeill, Chief Inspector.
BRIDGEPORT, CT., . No. 1 Sanborn Bldg.	W. G. Lineburgh & Son, General Agents. F. S. Allen, Chief Inspector.
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DENVER, Colo., . . Room 2, Jacobson Bldg.	Thos. E. Shears, General Agent & Chief Inspector.
HARTFORD, Conn., . 56 Prospect St.	F. H. Williams, Jr., General Agent. F. S. Allen, Chief Inspector.
NEW ORLEANS, La., . 833-835 Gravier St.	Peter F. Pescud, General Agent. R. T. Burwell, Chief Inspector.
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ST. LOUIS, Mo., . . 319 North Fourth St.	V. Hugo, Manager & Chief Inspector.
TORONTO, Canada, . Continental Life Bldg.	H. N. Roberts, General Agent.

The Locomotive of The Hartford Steam Boiler Inspection and Insurance Co.

Vol. XXIX. HARTFORD, CONN., APRIL, 1913. No. 6.

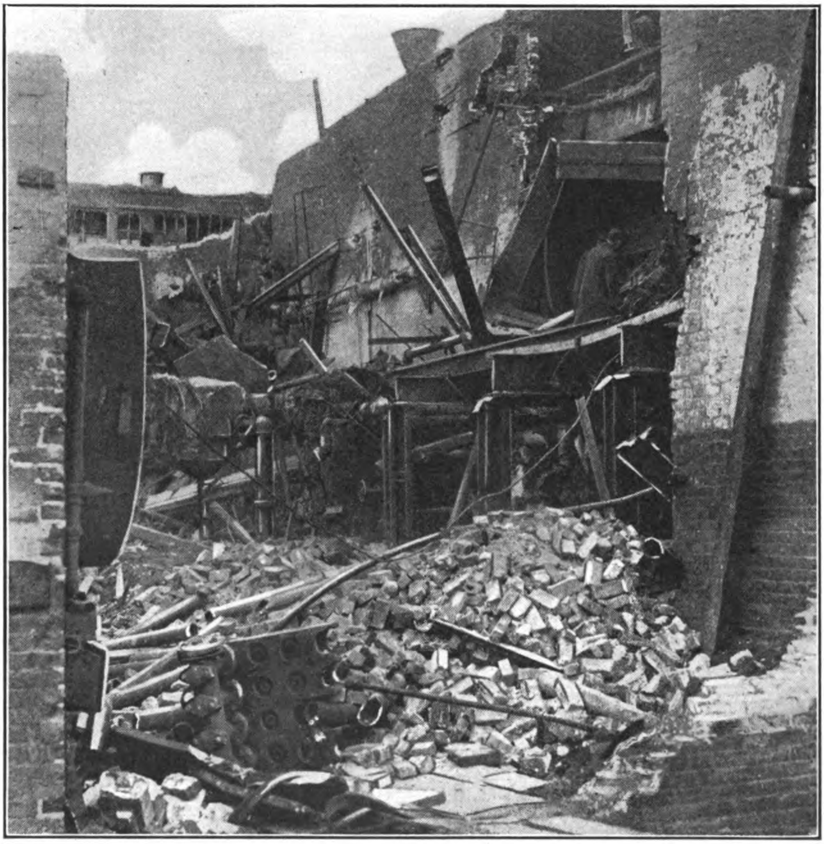


Fig. 5. A Near View of the Wreck. Economizer Explosion at Saylesville, R. I.

A Fuel Economizer Explosion

A fuel economizer exploded Tuesday, January 14, 1913, at the Glenlyon Dye Works, Saylesville, R. I. The accident occurred at about 3.50 o'clock in the afternoon. Beside destroying property to the extent of about $26,000.00, two men lost their lives, and some seven or eight others were injured more or less seriously.

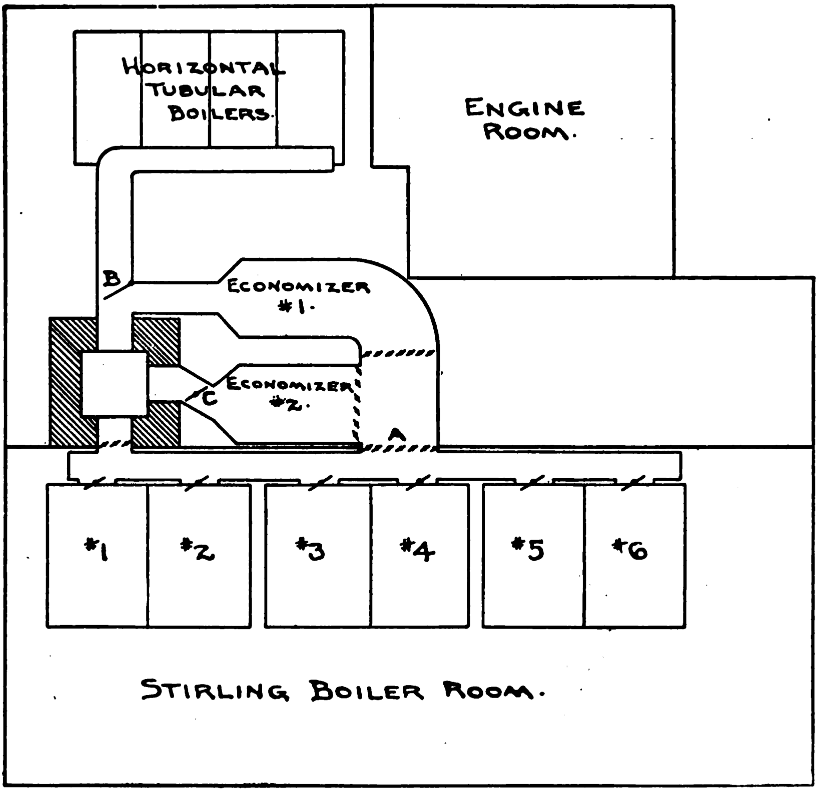


Fig. 1. Plan Showing Arrangement of Boilers and Economizers.

The arrangement of the boiler house and its equipment, as it existed before the accident, is shown in our sketch plan, Fig. 1. There were two boiler rooms, one containing six 325 horse-power Stirling boilers, and the other containing the stack, the economizers, and a battery of four horizontal tubular boilers, together with the feed heaters, pumps, fans, fan engines, and other boiler room auxiliaries. As will be seen, only the gases from the Stirling boilers could pass through the economizers, while those from the tubular boilers went direct to the stack. The economizers, two in number, were behind the stack, and side by side, parallel to the division wall. They rested on a platform about 10 feet above the floor. This platform consisted of longitudinal I beams, between which were turned brick arches, and these in turn rested on transverse I beams, supported on structural columns. A passage way separated the economizers lengthwise. Dampers were fitted as shown; dampers A, B, and C were operated by automatic regulators, while the others were only used when it became necessary to shut down and isolate an economizer.

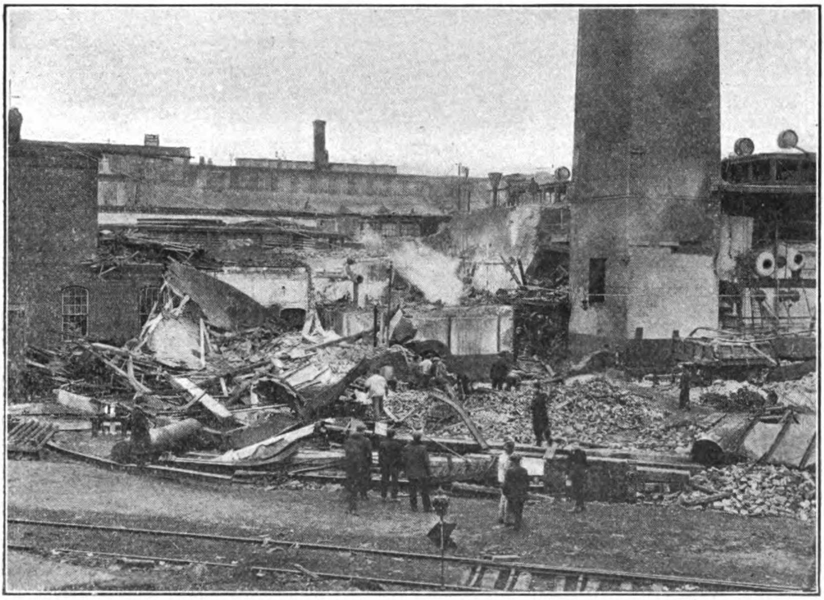


FIG. 2. GENERAL VIEW OF THE WRECKAGE.

The economizers were installed in 1903, and were therefore 10 years old. They were operated in the customary manner, with a closed feed water heater arranged to heat the feed to a moderate temperature before it entered the economizers. Two feed pumps were used, one controlled entirely by hand, the other controlled by a pump governor actuated by feed water regulators at the boilers. A mixture of four parts buckwheat to one part bituminous coal was used, hand fired, and burned with the aid of a forced (fan) draft on the ash pits. As high a draft pressure as 2" of water was carried at times of peak load.

On the Saturday preceding the accident, a small amount of moisture was noticed coming from the soot pit of the No. 1 economizer. A leaking tube was suspected, so the chief engineer ordered this economizer cut out of service at noon time, and sent word to the makers for a man to come and make any repairs which might be needed. The operation of cutting out and draining, seems to have been properly performed according to instructions at this time. On Sunday both economizers were out of service and cool. The assistant engineer filled No. 1 with water under the city pressure (90 lbs.) and entered the casing by way of the flue, to find the leak. He discovered a slight weep in one of the tubes, determined its location, and noting that a flange joint at the inlet valve leaked, sent for a pipe fitter to repack the joint, and drained the economizer so that he might work on it. When the joint was packed, city water was again turned into the economizer to test the work. It was found to leak, the vessel was again drained, and a second unsuccessful attempt made to fix up this stubborn joint. On again filling and testing, this flange still leaked, but as it was about 6 o'clock, and the men were anxious for home, the piper made no attempt to repack, as he expected opportunity to do so during the week, while waiting for the man to replace the leaking tube. Judging by the fact that the drain or blow-off valve of this economizer was found in a closed condition after the explosion, it seems unlikely that the vessel was drained out after this last trial of the joint. It was probably forgotten in the hurry to reach home. Nothing further appears to have been done to the economizer up to the time of the explosion Tuesday afternoon.

Just before the accident, the demand for steam had been excessive, and to better meet the demand, a larger proportion than usual of soft coal had been served out in front of the fires. A 2 to 1 mixture was first tried, and just

(Courtesy of The Providence Journal)

Fig. 3. 15-Inch "I" Beams Bent by the Force of the Explosion.

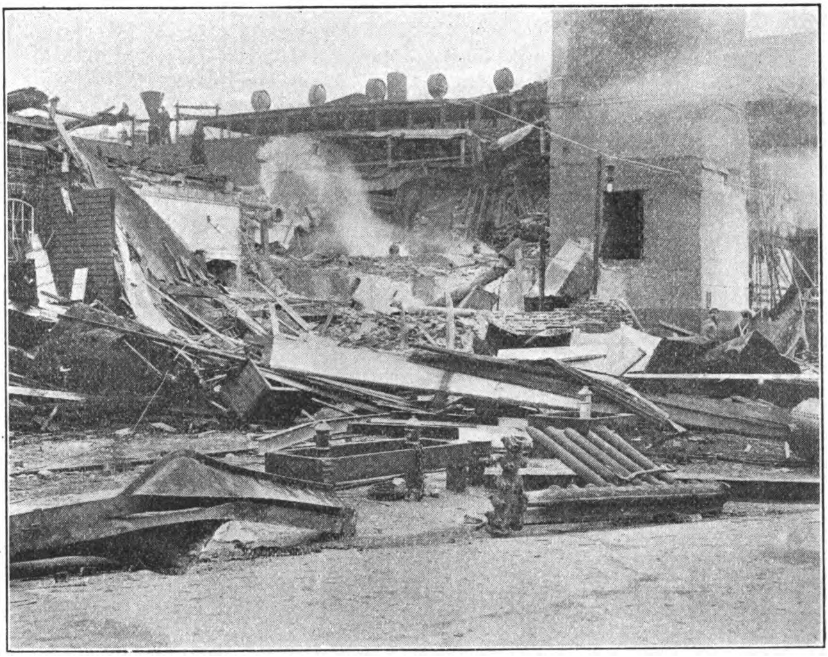
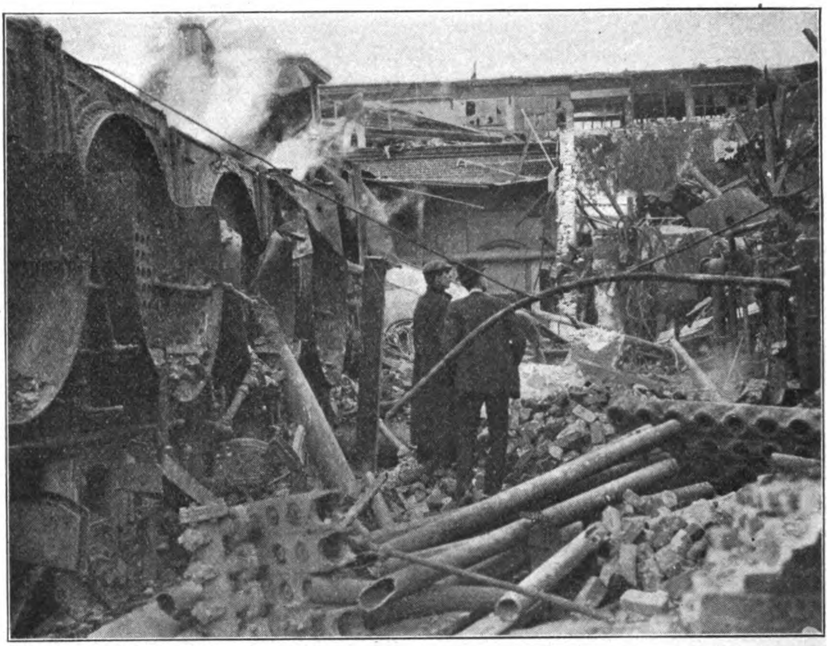


FIG 4. SHOWING PORTIONS OF THE NO. 2 ECONOMIZER STANDING ON ITS PLATFORM JUST BACK OF THE STACK.

before the accident this was further enriched up to half and half. Whether or not some one opened the dampers through the idle economizer, in an effort to help out the draft over this peak load, will of course never be known, as the flues and dampers were so thrown about by the force of the explosion that no definite conclusion could be drawn from them.

The force of the explosion is perhaps best shown in Fig. 2. The walls of the tubular boiler room were all either thrown down, or so badly shattered as to necessitate being torn down afterwards. The end of the Stirling boiler room toward the roadway was also nearly all blown out. The idle or No. 1 economizer was blown all over the premises. Small pieces shattered ventilators, skylights, monitors, and roofs over a considerable area, while the roof over this boiler room was completely demolished. The platform which supported the No. 1 economizer was entirely blown down. Fig. 3, which shows a pair of 15 inch I beams, that served as transverse supports for this platform, at about the middle of the length of the economizer, will indicate somewhat the force of the blow. No. 2 economizer, which was working at the time, was shattered so as to be a complete loss, but it remained on top of its platform, which latter was practically intact. This is well shown in Figs. 4 and 5. It seems to prove quite conclusively that No. 1 was the actual exploding vessel. Furthermore, the resistance offered by No. 2 to the explosion, while it wrecked it (No. 2) completely, undoubtedly saved the Stirling boilers. Aside from some damage to their flue,— and that of a character which was easily repaired,—



(Courtesy of The Providence Journal)

FIG. 6. DEBRIS IN FRONT OF TUBULAR BOILERS.

they were practically uninjured. The main blast of the explosion appears to have passed over the tops of the tubular boilers, so that, barring minor injuries to their fronts and attachments, they were undamaged. Their condition on the morning following the accident is shown in Fig. 6. A still further evidence that No. 1 was the actual exploding vessel, is offered by the fact that a large piece of top header, identified as belonging on the stack end of one or other of the economizers, was found in the coal pile across the railway track seen in Fig. 2. This fragment could not have reached its resting place from the No. 2 economizer without passing through the stack, or rising straight up in the air for a time, and then moving off sideways in direct defiance of the laws of falling bodies. It weighed 1177 lbs. and traveled horizontally about 160 feet.

It is very difficult when a cast iron structure is wrecked as completely as was this one, to determine the course of the explosion. Cast iron breaks with a clean fracture, and tells very little either as to the kind or direction of the blow. Steel boilers usually tell us a pretty direct story of what happens, but it was here impossible to tell from the fragments of the economizer, whether the explosion was caused by a source of energy *within* or *surrounding* the tubes. It was only from the evidence of the supporting structure that a conclusion could be drawn as to the cause of the explosion, and this seemed to point toward a steam pressure generated within the No. 1 economizer, a conclusion which is in accord with other known facts, notably the closed condition of the blow-off.

Explosion of Sulphite Digester

W. R. C. Corson.

On December 22, 1912, a sulphite digester at the plant of the Laurentide Company, Limited, at Grand Mere, P. Q., exploded with terrific violence. Three

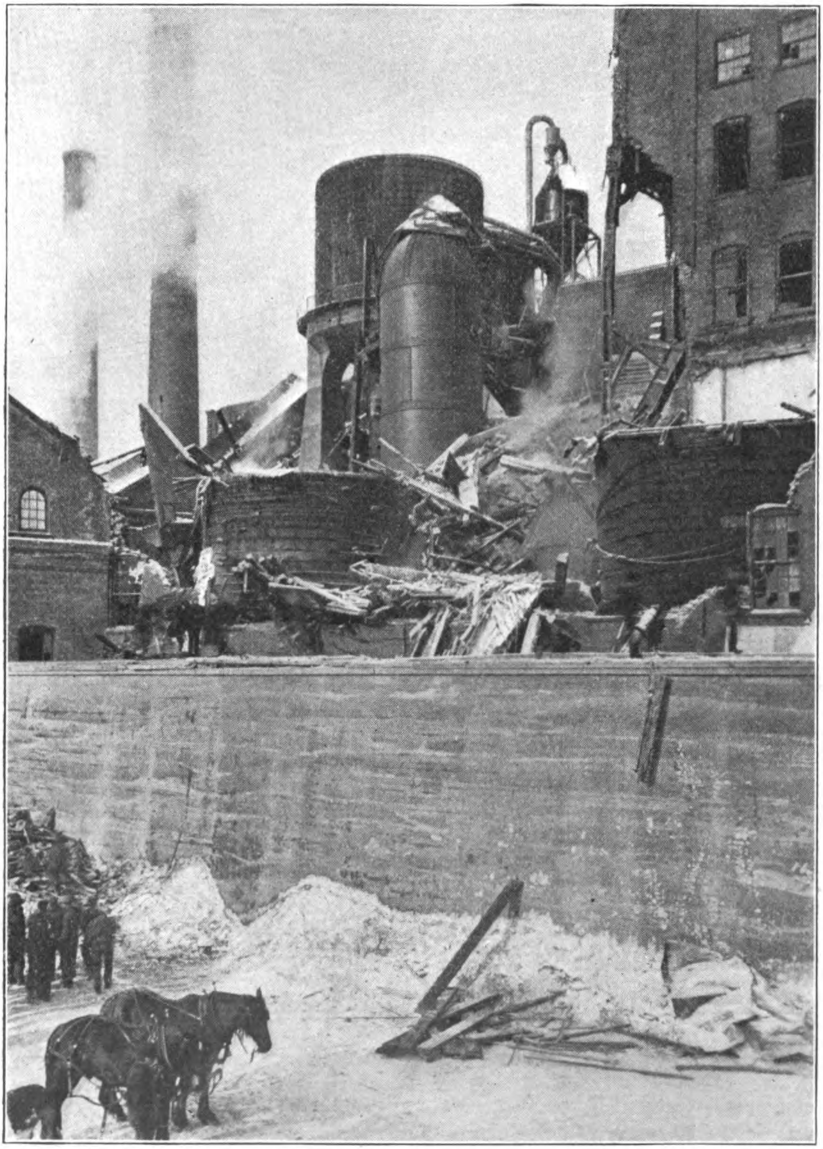


Fig. 1. General View of the Destruction at Grand Mere.

FIG. 2. VIEW LOOKING INTO THE WRECKED DIGESTER HOUSE.

employees were killed and two were more or less seriously injured and property was destroyed to the value of eighty thousand dollars. That greater loss in killed and injured has not to be recorded is due to the fortunate time of the occurrence,— on a Sunday evening when the number employed in the mills was at a minimum. Figs. 1 and 2 will give a general idea of the extent of the damage.

A Sulphite digester is a vessel especially designed for the production of wood pulp by the acid process. It consists essentially of a vertical steel shell, lined with brick and cement, which is filled with the wood chips from which the pulp is to be made. Sulphurous acid is introduced and then the mass of acid and chips is brought to a "cook" by the introduction of live steam,— the final pressure reaching from 80 to 100 lbs. per sq. inch. The fact that these vessels are subject to the action of the corrosive acid, should the lining leak, added to the great size of the vessels themselves and the consequent large amount of energy stored in them, has always caused the fear that the explosion of one would be a disaster indeed.

Such proved to be the case with the Laurentide Company's digester. It was one of three such vessels which were installed about fourteen years ago. It was 14 ft. in diameter and 45 ft. high, protected by an inside lining of lead against the shell with two layers of vitrified brick inside the lead lining.

As was customary on Sundays the vessel had been shut down and allowed to cool so as to permit the entrance of an attendant to examine and repair the brick lining. At about five o'clock in the afternoon it had been filled with chips and steam was turned on. The cooking process was proceeding as usual and had reached a point where the internal pressure was about 80 lbs. per square inch, when at about ten p. m. the vessel exploded.

The digester house in which the vessel was located was almost completely destroyed, as was the adjoin-

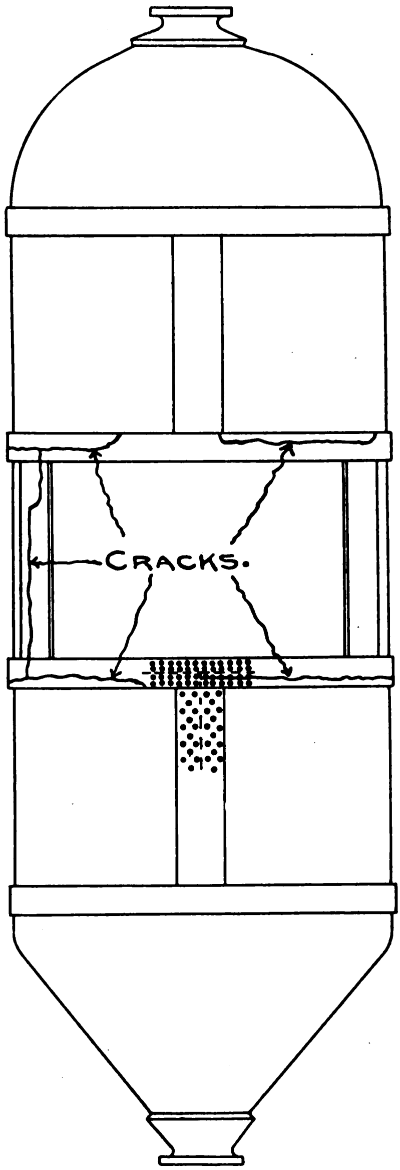


Fig. 3. Elevation of Digester Showing Location of the Lines of Failure.

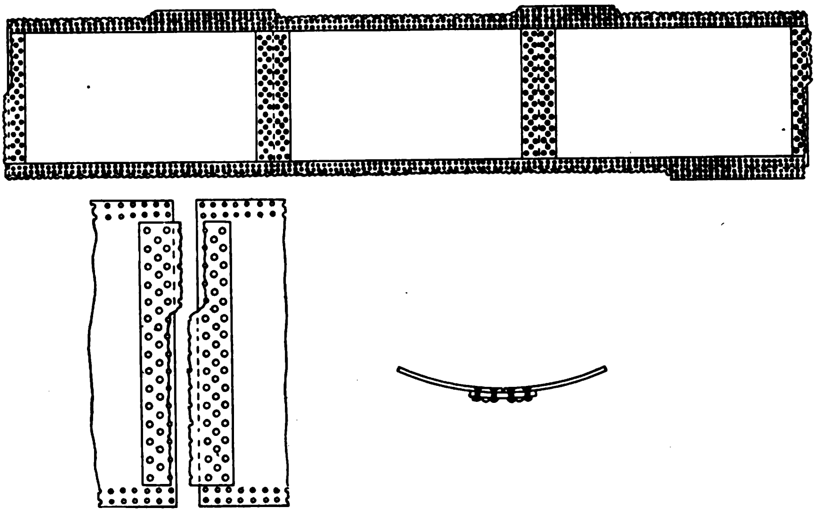


FIG. 4. DETAILS OF COURSE WHICH FAILED.

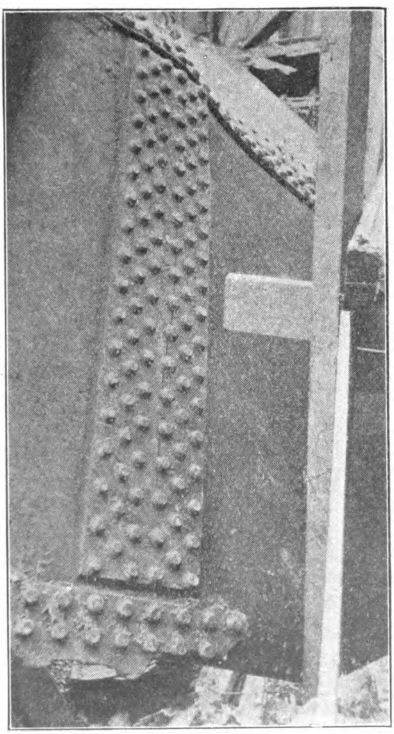


FIG. 5. CRACKED BUTT-STRAP.

ing blowpit house with its contents. Others of the mill buildings in the vicinity were more or less badly damaged. One of the two old digesters remaining had its supporting columns so broken that, while it did not fall, it threatened to do so for days after the accident. The second of the old digesters however escaped with slight injury and a new digester, the erection of which was not quite completed, fortunately received no damage.

A close examination of the parts of the wrecked digester gave evidence that the initial failure had occurred at the cover plate of a longitudinal seam on the center one of the three cylindrical courses. These digesters were all of a construction common at the period when they were installed. Because of the lead lining, it was regarded as essential that the inside surfaces should be flush. The joints were accordingly made by butting the sheets and with a single outside cover plate over the joints. In the exploded digester one of these cover plates had failed by cracking along the line of the rivet holes, and from the direction in which the exploded sheet was thrown, it was evident that this cover plate was the place of initial failure. In tearing from the other sheets, in every case cover plates failed while the sheets themselves did not. This is well brought out in Figs. 3 and 4, which show the way in which these cracks ran along the straps. As these plates were thicker than the sheets and should have been expected to withstand the greater strain, their failure to do so suggested an inferiority of material which an analysis has confirmed. Fig. 5 shows one other strap on this course which cracked but did not let go. Strangely enough the interior of the steel shell showed no corrosion. The lead lining, in this case at least, seems to have protected the steel thoroughly.

The fact that the cover plates of the joints gave way as we have described, and that a close examination discovered evidence of similar cracks in the straps of other digesters will arouse renewed apprehension in the minds of owners and insurance companies for digesters of a similar construction built from twelve to twenty years ago.

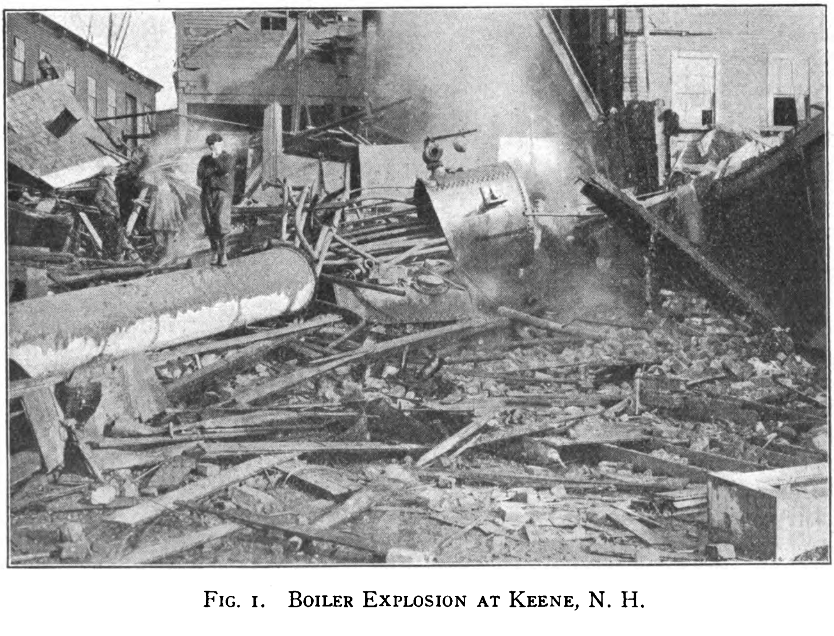


Fig. 1. Boiler Explosion at Keene, N. H.

Another Lap Seam Explosion

Our photograph shows the result of the explosion, on Friday, Dec. 6, 1912, of a boiler at the plant of the Keene Glue Company, Keene, N. H.

The boiler was of the horizontal return tubular type, in three courses 66 inches in diameter with tubes 16 feet long, and was made with double riveted lap seams for its longitudinal joints. We are told that there was plain evidence of an old lap crack, which extended nearly through the metal of the middle course, and which was located in solid plate, inside the inner row of rivets, but under the inner lap, so that it could not have been seen by either an internal or an external inspection. The boiler is said to have been otherwise in excellent condition for its age (twenty years) and to have been provided with the proper safety attachments in good order. The condition of the fusible plug, in conjunction with the violence of the explosion, confirms the statement of the fireman that there was an abundance of water.

The setting and boiler house, together with a frame addition to the mill were demolished, and a 42 inch steel stack was thrown down and considerably jammed. The boiler, however, did not move endwise, but dropped in its tracks as it were.

Press accounts state that the boiler was used only for heating, and that a pressure of 40 lbs. was carried at the time of the accident. The fireman had been called to another part of the mill to repair a belt, and probably owes his escape to this fortunate circumstance.

The report in the local paper states also that the boiler had been jacked up some six weeks previous to the accident so that repairs could be made to its setting. This may have had nothing to do with the explosion, but it is possible that a new distribution of stress on the supporting lugs, due to the resetting, may have opened up an old sore, and prepared the way for the explosion at this particular time.

Experience teaches that "second hand" lap seam boilers are, if anything, more given to explosions of this sort, than those which have been allowed to remain in their original settings. We are sometimes asked why we will permit an old boiler of this type to work at some stated pressure so long as it remains in place, but insist on a material pressure reduction if it is removed and reset. Our reason is a fear of the effects of just such a new distribution of stress as we have mentioned, and this position is abundantly supported by statistics.

Violent Boiler Explosion at Howland, Me.

On January 20, 1913, at about 8.30 A. M., two boilers exploded at the plant of the Howland Pulp and Paper Co., Howland, Me. The boilers which failed were Nos. 2 and 3 in a battery of five horizontal return tubular boilers used to supply steam both for power and pulp making. Two other boilers of the vertical fire tube type stood in an adjoining boiler room. At the time of the accident, boiler No. 2, which had been out of service, was being brought up to pressure to be cut in on the line. It is stated that its pressure was 65 lbs. a few minutes before the explosion.

The explosion destroyed the boiler house, pump house, electrical plant, and engine room. It knocked down two steel stacks, and did some damage to the ends of the acid and sulphur houses. In addition to the property loss two men were killed, and two others injured.

There is some doubt as to which of the boilers first gave way. Witnesses testified to a double report like two pistol shots in rapid succession. It is probable, from the appearance of the failures, that one of the boilers exploded first, and struck its neighbor a blow of sufficient violence to set it off. Both the exploded boilers were of lap seam construction, built in five courses with outside cast iron man-hole frames attached to the third course. Both of them failed through the man-hole frame, and each man-hole course was ripped longitudinally from girth seam to girth seam, through the center line of the man-hole open-

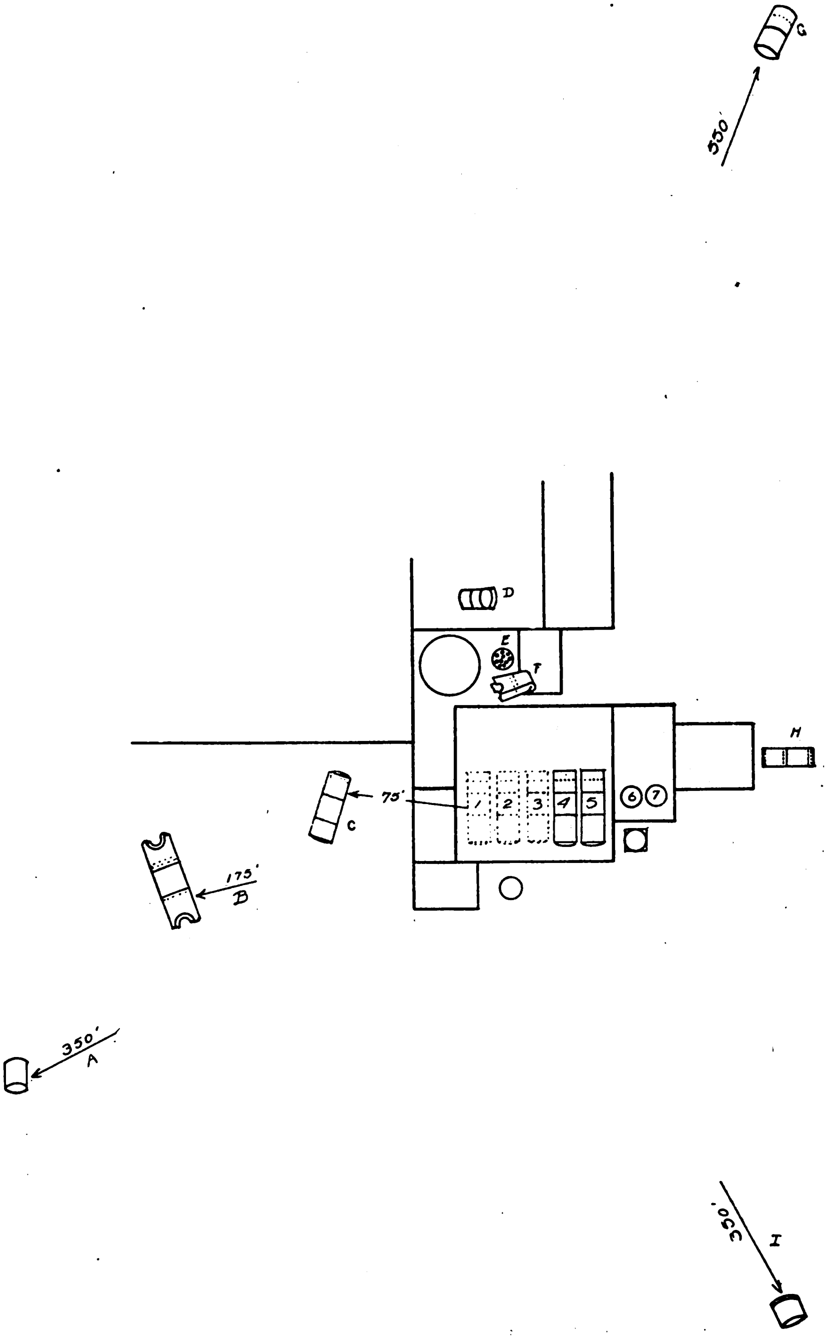


FIG. 1. PATHS OF PROJECTED BOILER COURSES.

FIG. 2. COURSE "E" AND ITS LOAD OF TUBES.

ing. The other courses were in large part separated each from the other by the shearing of the rivets. Indeed, with the exception of a small fragment which was torn out and left attached to one course, no portion of any other sheet than the man-hole courses mentioned above was torn in any way.

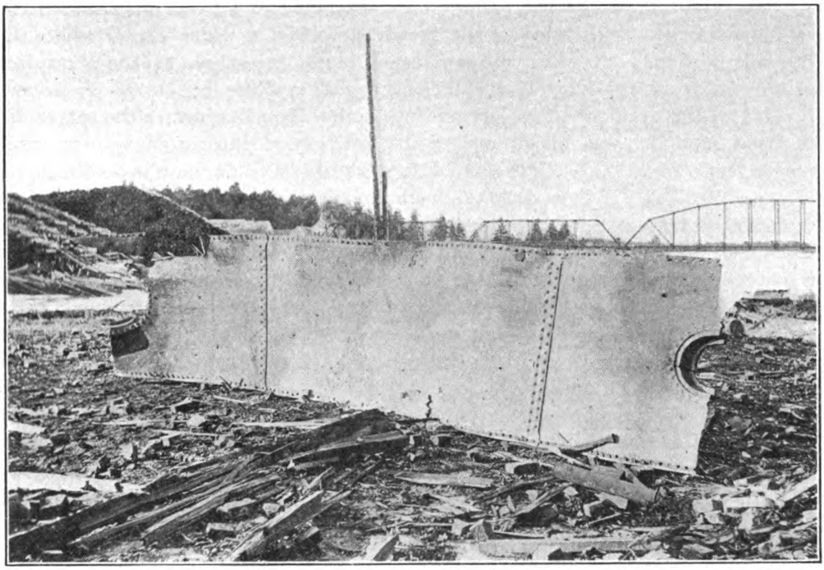


FIG. 3. RUPTURED MANHOLE COURSE "B."

FIG. 4. WRECKED BOILER HOUSE.

The extent to which the boilers were disrupted and thrown about will be best shown by a consideration of the sketch plan, Fig. 1, which shows where the different portions fell after the explosion, with reference to their original position. The dotted lines in the boiler house show the boilers as they were previous to the accident. "C" represents boiler No. 1, which, although it did not itself explode, was blown out of its setting and thrown bodily for some seventy feet. "I", "G", "F", and "E", were identified as the remains of boiler No. 3, while "A", "B", and "D", were the parts of boiler No. 2. It is not absolutely certain that the man-hole courses "B" and "F" are properly identified in the above list, since there were neither torn edges nor any other means of matching them to the remaining courses. The course marked "E" in the sketch is that shown in Fig. 2. It apparently started off in company with the portion marked "G", but was not very firmly attached to it. When "G" had gotten well under way in its rocket-like flight, this course seems to have dropped at the place indicated, and carried with it practically all the tubes of the boiler as the photograph indicates. Fig. 3 shows the man-hole course marked "B" in the sketch plan. It gives an excellent idea, both of the way in which these man-hole courses failed and of the cleanness with which the girth seam rivets sheared. Fig. 4 shows the ruined boiler room, with boilers 4 and 5 under the debris of their settings, as well as the vertical boilers 6 and 7 still in position. One of the fallen stacks is seen in the foreground.

The safety valve of No. 2 boiler was found after the explosion, and was in good working order. It is also known that boiler No. 3 was connected with the rest of the battery, and that the safety valves were blowing freely a short time before the accident. These two facts seem to render any theory of over-pressure untenable. No thoroughly satisfactory explanation has yet been offered, and we doubt if the exact cause of the accident will ever be known.

On Laying Up a Heating Boiler for the Summer

During the summer season, the only enemy a heating boiler need face is corrosion. This enemy is, however, particularly active at that time, and must be fought vigorously, both inside and out.

On the fire side, soot and ash should be thoroughly removed. It is not sufficient to hit the high places with a shovel, but the whole external surface of the boiler should be swept clean with a broom, and this treatment should extend to the furnace, the ashpit, and if the boiler is set in brick, to every nook and cranny of the setting. The boiler surface itself should, in addition, receive a good brushing with a stiff wire brush, to remove all soot and ash, together with any loose iron rust, right down to the surface of the metal. The reason for this treatment is that soot and ash are great absorbers of moisture from the air, and have an excellent opportunity to do this in a cool cellar during the spring and summer. On damp days, the cool metal sweats exactly as a pitcher of cold water sweats in a warm room. This moisture, condensed from the air, is at once absorbed by the soot and ash, and in either case the result is a solution which is very corrosive to iron or steel. The corrosive action, begun in this way, will continue throughout the season, unless the cause is removed in the manner we have indicated.

The inside surfaces of boilers are also subject to corrosion in the summer time. If a boiler is left with the water at the steaming level, just as it was when the fire died out, corrosion will be much more active than it would be under steam, because the water is absolutely at rest, and little pits of rusting, once started, continue without interruption. It has been frequently stated that a boiler full of water will be free from corrosion. This statement, if confined to the inside surface, and applied to a boiler quite full of pure, air free water, is perhaps true. The difficulty, however, with a boiler laid up in this fashion, is the greatly increased tendency toward sweating which it exhibits, owing to the fact that a large body of water does not readily follow the fluctuations in the air temperature, and so remains for much of the season, not only colder than the air but colder than an empty boiler would have been. In this way a full boiler will be much more subject to external corrosion than if empty. So the safest method of procedure seems to be to first empty the boiler, propping open the safety valve, then leave the blow off open, and if there is any doubt as to the tightness of the feed valve, that is, if there is any danger of water getting back into the boiler from the city mains, it is perhaps best to make sure of this point by disconnecting the feed line. The boiler should be as carefully drained as possible, and in the case of a tubular boiler, the hand and man hole covers should be removed, because if small pools of water are allowed to remain in the bottom, corrosion will be especially active, from the fact that the water has, relatively, so great a surface exposed to the air, that it can dissolve up more air as fast as its supply is exhausted by combination with iron.

It is desirable for the man operating a heating system to go carefully over his valves, piping, and radiators, while still under steam near the end of the season in order that he may mark the location of all defects and leaks, so that new valve stem packings, new parts, leaking joints, etc., may be repaired during the summer and unpleasant delays avoided in the fall when, on some cold morning, the heater is wanted in a hurry.

Inspection Service Rendered During 1912

The tables below give, as is usual at this time of the year, the total number of visits of inspection, the total number of boilers inspected and other similar statistics gathered from our inspection records, for the year 1912. These figures are worthy of consideration, inasmuch as they show something of the frequency with which one may expect to find the various defects listed among any representative number of American boilers. These results are gathered from so many boilers, and these so distributed over the country, that the effects of local conditions largely disappear in the totals.

A glance at the table on page 178 will yield some interesting information. For example, in 17/18 of all the visits made, a defect was found which was deemed of sufficient importance to report. Further, of the 164,924 defects reported, 18,932, or just over 11%, were considered dangerous at the time of the inspector's visit. As we have shown many times before, by far the most frequent troubles have their origin in the feed water, or the method of using it, a fact which is evidenced by the large number of instances in which scale or sediment and corrosion are found.

SUMMARY OF INSPECTORS' WORK FOR 1912.

Number of visits of inspection made	183,519
Total number of boilers examined	337,178
Number inspected internally	132,984
Number tested by hydrostatic pressure	8,024
Number of boilers found to be uninsurable	977
Number of shop boilers inspected	10,098
Number of fly wheels inspected	14,567
Number of premises where pipe lines were inspected	4,200

SUMMARY OF DEFECTS DISCOVERED.

NATURE OF DEFECTS.	Whole Number.	Dangerous.
Cases of sediment or loose scale	26,299	1,553
Cases of adhering scale	40,336	1,436
Cases of grooving	2,700	252
Cases of internal corrosion	15,403	823
Cases of external corrosion	10,411	895
Cases of defective bracing	1,391	331
Cases of defective staybolting	1,712	345
Settings defective	8,119	768
Fractured plates and heads	3,288	510
Burned plates	4,965	517
Laminated plates	445	55
Cases of defective riveting	1,816	405
Cases of leakage around tubes	10,159	1,607
Cases of defective tubes or flues	11,488	4,780
Cases of leakage at seams	5,304	401
Water gages defective	3,663	816
Blow-offs defective	4,429	1,398
Cases of low water	447	151
Safety-valves overloaded	1,349	380
Safety-valves defective	1,534	419
Pressure gages defective	6,765	568
Boilers without pressure gages	633	102
Miscellaneous defects	2,268	420
Total	164,924	18,932

GRAND TOTAL OF THE INSPECTORS' WORK FROM THE TIME THE COMPANY BEGAN BUSINESS, TO JANUARY 1, 1912.

Visits of inspection made	3,312,922
Whole number of inspections (both internal and external)	6,750,765
Complete internal inspections	2,651,906
Boilers tested by hydrostatic pressure	307,876
Total number of boilers condemned	22,597
Total number of defects discovered	4,152,904
Total number of dangerous defects discovered	428,971

SUMMARY OF INSPECTORS' WORK SINCE 1870.

Year.	Visits of inspection made.	Whole number of boilers inspected.	Complete internal inspections.	Boilers tested by hydrostatic pressure.	Total number of defects discovered.	Total number of dangerous defects discovered.	Boilers condemned.
1870	5,439	10,569	2,585	882	4,686	485	45
1871	6,826	13,476	3,889	1,484	6,253	954	60
1872	10,447	21,066	6,533	2,102	11,176	2,260	155
1873	12,824	24,998	8,511	2,175	11,998	2,892	178
1874	14,368	29,200	9,451	2,078	14,256	3,486	163
1875	22,612	44,763	14,181	3,149	24,040	6,149	216
1876	16,409	34,275	10,669	2,150	16,273	4,275	89
1877	16,204	32,975	11,629	2,367	15,964	3,690	133
1879	17,179	36,169	13,045	2,540	16,238	3,816	246
1880	20,939	41,166	16,010	3,490	21,033	5,444	377
1881	22,412	47,245	17,590	4,286	21,110	5,801	363
1882	25,742	55,679	21,428	4,564	33,690	6,867	478
1883	29,324	60,142	24,403	4,275	40,953	7,472	545
1884	34,048	66,695	24,855	4,180	44,900	7,449	493
1885	37,018	71,334	26,637	4,809	47,230	7,325	449
1886	39,777	77,275	30,868	5,252	71,983	9,960	509
1887	46,761	89,994	36,166	5,741	99,642	11,522	622
1888	51,483	102,314	40,240	6,536	91,567	8,967	426
1889	56,752	110,394	44,563	7,187	105,187	8,420	478
1890	61,750	118,098	49,983	7,207	115,821	9,387	402
1891	71,227	137,741	57,312	7,859	127,609	10,858	526
1892	74,830	148,603	59,883	7,585	120,659	11,705	681
1893	81,904	163,328	66,698	7,861	122,893	12,390	597
1894	94,982	191,932	79,000	7,686	135,021	13,753	595
1895	98,349	199,096	76,744	8,373	144,857	14,556	799
1896	102,911	205,957	78,118	8,187	143,217	12,988	663
1897	105,062	206,657	76,770	7,870	131,192	11,775	588
1898	106,128	208,990	78,349	8,713	130,743	11,727	603
1899	112,464	221,706	85,804	9,371	157,804	12,800	779
1900	122,811	234,805	92,526	10,191	177,113	12,862	782
1901	134,027	254,927	99,885	11,507	187,847	12,614	950
1902	142,006	264,708	105,675	11,726	145,489	13,032	1,004
1903	153,951	293,122	116,643	12,232	147,707	12,304	933
1904	159,553	299,436	117,366	12,971	154,282	13,390	883
1905	159,561	291,041	116,762	13,266	155,024	14,209	753
1906	159,133	292,977	120,416	13,250	157,462	15,116	690
1907	163,648	308,571	124,610	13,799	159,283	17,345	700
1908	167,951	317,537	124,990	10,449	151,359	15,878	572
1909	174,872	342,136	136,682	12,563	169,356	16,385	642
1910	177,946	347,255	138,900	12,779	169,202	16,746	625
1911	180,842	352,674	140,896	12,724	164,713	17,410	653
1912	183,519	337,178	132,984	8,024	164,924	18,932	977

The Locomotive of The Hartford Steam Boiler Inspection and Insurance Co.

C. C. PERRY, EDITOR.

HARTFORD, APRIL, 1913.

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Victor Hugo

It is with deep regret that we record the death of Victor Hugo, manager of the Southwestern Department of our Company, which occurred on January 31st, 1913, at his home in St. Louis, Mo., after a brief attack of pneumonia. The news of this event when it reached us was so sudden and unexpected — many of us had his unanswered letters on our desks — as to leave us profoundly shocked and stunned and without full realization of the loss we had suffered. Now that a few weeks have passed we are better able to appreciate the void that has been made in our organization and the personal loss that those of us have sustained who were privileged to enjoy his friendship.

Mr. Hugo was born at Kingston, Ontario, on November 20th, 1873. He was the son of T. W. Hugo, who in 1881 moved with his family to Duluth, Minn., where he is, as he has been for many years, the valued representative of our Company. Victor Hugo received his education in the public schools of that city and at the University of Minnesota, from which he graduated in 1896, with the degree of Bachelor of Mechanical Engineering. He entered the Chicago inspection force of the HARTFORD Company in 1898. Late in the following year he was transferred to St. Louis and shortly after was appointed Chief Inspector of that Department. On January 1st, 1905, he was promoted to the position of manager.

Punctuality, order and unreserved loyalty were Victor Hugo's prominent characteristics and made for efficiency in his management of affairs. His education and experience were along engineering and mechanical lines and his ability and thorough acquaintance with the practice and technique of steam engineering made him especially valuable in his work for our company. But Mr. Hugo was not merely a technically trained man. He knew and enjoyed much of the best of art and literature and thus added the charm which we call culture to his more fundamental characteristics. In manner he was reserved but gave himself freely to those who were admitted to his friendship. He possessed a quaint humor which frequently found expression in his conversation and letters, and which was a delight to his friends and hearers.

Mr. Hugo was a member of the American Society of Mechanical Engineers and an active member of the Public Recreation Commission of St. Louis, where his advice and counsel was of the greatest value. He was married to Miss Virginia Magoffin in April, 1899, who with two children survives him.

At the time of the year when legislatures are in session, all business interests are subject to the caprice or deliberate attack of any one who can write out a bill and hand it for introduction to some member of a legislature. Some of these bills slip through without opportunity to the parties most affected, for a hearing, or a chance to have their side of the case properly presented before the members of the legislature who are not of a committee specially appointed to represent a particular interest.

The matter of the inspection of boilers is one that vitally affects every person or corporation using steam, whether for power or heating purposes, as well as persons employed with or in the vicinity of boilers. Every boiler should be inspected by a competent inspector. That is fundamental and obvious. Laws for this purpose have been passed in a number of states. Most of them recognize as sufficient an inspection by an insurance company that is authorized to insure and inspect boilers in the state. We feel that such recognition should be universal. Those who are familiar with boiler inspection, especially the owners of large boiler plants, know that the service of the insurance companies is beyond comparison with that rendered by the inspectors of the average state or city department, subject as they are to political selection and influences. The political inspector, whose efficiency is not influenced by the commercial necessity of his employer, is not obliged to work nights, Sundays, or holidays, and so, plants which he inspects are subject to the inconvenience of a shut down during business hours, or to a substantial addition to the statutory fee for such an inspection if it is made at a more convenient time.

It would seem that an interesting rivalry exists between associations of stationary engineers and boiler makers over the securing of boiler inspection legislation. The main difference between the bills introduced is that those presented by the engineers provide that the state inspectors shall have had many years' experience in the state as stationary engineers, while the bills put forward by the boiler makers make a similar limitation confining the appointees practically to boiler makers. The editor of the "Boiler Makers' Journal" says in the February number: "Boys get busy! Act at once, and let the editor know what action you have taken and the replies you get from the legislature;" "the engineers' society will continue their efforts and we may see the spectacle of an engineer trying to inspect boilers in this state!"

Many of The Hartford Steam Boiler Inspection and Insurance Company's inspectors and mechanical experts are or have been members of these several organizations. The Locomotive does not wish to appear as taking sides in this rivalry, nor as attempting to discourage efforts to secure the passage of proper inspection bills. We do feel, however, that an *additional* inspection of *insured* boilers by state inspectors, serves no proper purpose, places unnecessary trouble and expense on the boiler owners, and would be the cause of needless loss of time on the part of the employees of such establishments; and that the only unselfish object of any such legislation — the safeguarding of boiler operation,— would be best obtained by the rival interests laying aside their petty differences over the creation of lucrative positions for their members. They should act together, and with other interested business men and employees exert themselves for the passage of inspection bills which will best serve the interests of the whole community, and for the appointment to such positions as will necessarily be created thereunder of men whose recommendation is efficiency, and not membership in any particular organization.

Personal

We announce the appointment of Mr. C. D. Ashcroft to the position of manager of the St. Louis department. Mr. Ashcroft joined the forces of the Hartford as special agent in the Louisville, Ky., office in 1907. From there he went to the managership of the Pittsburg department in 1911 and now leaves to take charge of the Southwestern territory.

Mr. J. J. Graham, who has been connected with the Cleveland department since 1906, first as inspector and later as special agent, will succeed Mr. Ashcroft as manager of our department at Pittsburg.

In the St. Louis department, Mr. J. P. Morrison, who has served there as inspector since 1901, becomes Chief Inspector, a position for which his long field experience fits him admirably.

Summary of Boiler Explosions for 1912

We print in this issue, our usual summary of our explosion list for the year 1912. This list is made up from press clippings, and from our own loss files. It should not be considered, however, that these explosions are all of them from boilers that we insure, for, quite to the contrary, the majority of the violent explosions are the result of conditions which might have been foreseen had the boiler received regular and thorough inspections. We endeavor to make this list as complete and as accurate as possible, each item is considered in the light of all the information available, and an effort made to get at the real facts. In computing the number of persons killed and injured, we have, as heretofore, considered the fatally injured as killed, and wherever the statement is made in a press account that "several were injured" we have considered "several" to mean three. This number was arrived at some years since, as the average number injured in an explosion, and as our other lists have been based on this assumption, we have continued on that basis, so that our statistics will be comparable from year to year.

SUMMARY OF BOILER EXPLOSIONS FOR 1912.

MONTH.	Number of Explosions.	Persons Killed.	Persons Injured.	Total of Killed and Injured.
January	90	19	44	63
February	47	11	22	33
March	47	56	57	113
April	39	28	36	64
May	25	11	18	29
June	24	27	30	57
July	36	21	30	51
August	30	12	16	28
September	30	13	21	34
October	56	23	38	61
November	47	23	34	57
December	66	34	46	80
Totals	537	278	392	670

Boiler Explosions

NOVEMBER, 1912.

(425.) — On November 2, an accident occurred to one of the boilers on the U. S. S. Vermont, near Norfolk, Va. Two men were killed, and four others seriously scalded.

(426.) — Four sections of a sectional heating boiler ruptured at the armory owned by U. A. Woodbury, Burlington, Vt., on November 2.

(427.) — A traction engine exploded November 4, at Indianapolis, Ind. John O'Donnell, the engineer, was fatally injured, and one other was badly bruised. Three houses are said to have been damaged by the explosion.

(428.) — On November 4, an accident occurred to a boiler at the Chagrin Falls, O., power plant of the Cleveland, Youngstown, and Eastern Ry. Co.

(429.) — A severe accident occurred November 4 to a boiler at the mill of the West Yellow Pine Co., Olympia, Ga. Three men, P. M. Dorman, watchman; R. C. Wetherington, oiler; and Lucius Johnson, fireman, were injured.

(430.) — About November 5, an accident occurred to a cast iron sectional heating boiler at the Polish Catholic School, New Britain, Ct.

(431.) — A tube ruptured November 5, in a water tube boiler at the plant of the Baldwin Locomotive Works, Philadelphia, Pa. The damage was small.

(432.) — A boiler exploded November 6, at the saw mill of B. B. Saunders, Pine Bluff, Ark. The owner and Arthur Ray, fireman, were killed, while three others were injured.

(433.) — A tube failed November 6, at the plant of the Charleston Water and Light Company, Charleston, S. C. No one was injured, but the city of Charleston was left without water for a short time.

(434.) An escape valve ruptured November 7 at the State Normal School, Bridgewater, Mass. Some of the girls became panic stricken, but no damage was done.

(435.) — A boiler exploded November 8, at the Chickasha Gin, owned by the Chickasha Gin Co., Headrick, Okla. Two men were seriously injured, and considerable damage was done to the buildings and plant of the Gin.

(436.) — On November 9, a section cracked in a cast iron sectional heater in the office building owned by Mary S. Tuttle, Greenville, S. C.

(437.) — Three sections fractured November 9, in a cast iron sectional heating boiler at the store and apartment building of Samuel M. Samuels and Isaac Weinstein, New York City.

(438.) — Three tubes ruptured November 10, in a water tube boiler at the plant of the Carsten Packing Co., Tacoma, Wash.

(439.) — A tube ruptured November 11, in a water tube boiler at the plant of the Illinois Steel Co., Joliet, Ill. Mike Cervenok, fireman, was scalded.

(440.) — A boiler exploded November 11, at the mill of the Milltown Lumber Co., Milltown, Ga. The property damage was about $6,000. Two men were killed and five injured.

(441.) — On November 12, a tube ruptured in a water tube boiler at the Eureka Colliery, No. 36, of the Berwind White Coal Mining Co., Windber, Pa.

(442.) — The crown sheet of a locomotive type boiler collapsed November 12, at the Round House of the Great Northern R. R., Sioux City, Ia.

(443.) — A boiler ruptured November 12, at the plant of the Norcona Mill and Gin Co., Norcona, Tex. The damage was confined to the boiler.

(444.) — The boiler of Freight Locomotive No. 469 of the Virginian R. R. exploded November 15, near Lafayette, Va. Two men were killed, and one other seriously injured.

(445.) — On November 16, a tube ruptured in a water tube boiler at the plant of the Gutta Percha and Rubber Mfg. Co., Brooklyn, N. Y.

(446.) — On November 16, four tubes pulled out of a drum in a water tube boiler at the Auxiliary Power Plant of the Utah Light and Railway Co., Salt Lake City, Utah. Serious damage was done to the boiler, requiring expensive repairs.

(447.) — A boiler exploded November 18, in the wood fiber mill of Albert Widdis, East Tawas, Mich. Two men were killed, and two others seriously injured.

(448.) — Three sections ruptured November 18, in a cast iron heating boiler at the Theatre of the Utica Hippodrome Amusement Co., Utica, N. Y.

(449.) — Three cast iron headers ruptured November 19, in a water tube boiler at the Collinsville, Ill., plant of the National Lead Co.

(450.) — On November 19, a tube ruptured at the plant of The Connecticut Web and Buckle Co., Bridgeport, Ct.

(451.) — Locomotive No. 6378 of the Big Four was wrecked by the explosion of its boiler November 19, at Anderson, Ind. Three men were injured.

(452.) — A heating boiler exploded in the basement of the jewelry store of V. J. Pekor, Columbus, Ga., on November 19. There were no serious personal injuries, but the property loss was considerable.

(453.) — The boiler of a locomotive belonging to the Ten Mile Lumber Co., exploded November 19, near Gulfport, Miss. Four men were killed.

(454.) — On November 19, a boiler exploded at the plant of the Warren Dried Fruit Co., San José, Cal. No one was injured.

(455.) — A tube ruptured November 20, in a water tube boiler at the plant of the American Steel and Wire Co., Waukegan, Ill.

(456.) — A tube ruptured in a water tube boiler, on November 20, at the plant of the Minnising Paper Co., Minnising, Mich. Considerable damage was done to the boiler, and Michael Micholik, fireman, was injured.

(457.) — A boiler is reported to have exploded near Mobile, Ala., on November 20. Four men were said to have been killed. We have been unable to obtain any more specific information than this concerning this particular accident, but include it in the list, as the information comes from several sources.

(458.) — On November 22, a tube ruptured in a water tube boiler at the plant of the Aurora, Elgin, and Chicago Electric Ry. Co., Batavia, Ill. D. S. Stafford, laborer, was injured.

(459.) — A cast iron header ruptured November 22, in a water tube boiler at the plant of the Plankington Electric Light and Power Co., Milwaukee, Wis.

(460.) — A boiler exploded November 22, in the municipal power plant at Neosha River, belonging to the city of Iola, Kans. One man was injured, and the city was in darkness for several hours.

(461.) — A boiler ruptured November 23, at the plant of the Minneapolis Water Co., Minneapolis, Kans.

(462.) — On November 25, a section fractured in a cast iron sectional heater in the apartment building of M. Koblenzer, 136th St., New York City.

(463.) — A boiler exploded November 25, at the Hazelwood Sanatorium, Hazelwood, near Louisville, Ky. No one was injured, but there was a property loss of about $2,000.

(464.) — A boiler exploded at the Gas plant, at Pittston, Pa., on November 26. One man was injured, and considerable damage was done to the plant and to surrounding property.

(465.) — A boiler exploded November 26, in the grain elevator of L. R. Sellers, Blackburn, Mo. Mr. Sellers was killed and the elevator was destroyed.

(466.) — A tube ruptured on November 26, in a water tube boiler at the beet sugar plant of Charles Pope, Riverdale, Ill. H. Hampka, coal passer, and W. Hein, water tender, were scalded.

(467.) — On November 27, the crown sheet of a locomotive boiler collapsed at the plant of the American Steel and Wire Co., Worcester, Mass.

(468.) — A blow off pipe failed November 28, at the plant of the St. Croix Paper Co., Woodland, Me.

(469.) — A boiler exploded November 29, in a grist mill at Olive Hill, Ky. Three men were killed, one fatally injured, and three less seriously injured.

(470.) — On November 30, two tubes ruptured in a water tube boiler at the plant of the Scoville Mfg. Co., Waterbury, Ct.

(471.) — On the same day — November 30,— two tubes ruptured in another boiler at the plant of the Scoville Mfg. Co., Waterbury, Ct.

(These are separate and distinct accidents.)

Boiler Explosions

DECEMBER, 1912.

(472.) — A boiler exploded December 1, at the plant of the Bristol-Myers Co., Brooklyn, N. Y. Two men were injured, one of them perhaps fatally.

(473.) — A heating boiler exploded December 2, in a garage belonging to Charles A. Sale, Victor, N. Y. No one was injured, but considerable damage was done to the building.

(474.) — The crown sheet of a locomotive collapsed on the Southern Railway, at Whittle's Station, Va., on December 2. George Robinson, the engineer, was fatally scalded.

(475.) — On December 2, two cast iron headers ruptured in a water tube boiler at Stern and Co.'s furniture store, Philadelphia, Pa.

(476.) — A tube failed in a water tube boiler on December 3, at the plant of the Southern Iron and Steel Co., Gadsden, Ala. R. L. Barnes, fireman, was injured.

(477.) — On December 4, a section ruptured in a cast iron heating boiler at the High School, Watertown. Mass.

(478.) — The Bristol Opera House, Bristol, Conn., was destroyed by fire December 4, said to have started from the explosion of a heating boiler.

(479.) — A boiler exploded December 4, in the lumber mill of J. Spragins and Sons, Fenwick, Miss. The property loss was estimated at $5,000, and four men were injured.

(480.) — Four sections fractured December 4, in a cast iron sectional heating boiler at the apartment house owned by the estate of J. D. W. Joy, Huntington Ave., Boston, Mass.

(481.) — On December 5, a boiler ruptured at the plant of the Sargent Coal Co., Newburg, Ind.

(482.) — A boiler exploded in a saw mill December 5, near Wilsondale, W. Va., killing five men. The only surviving member of the saw mill force fled from the scene, and according to press accounts has not been heard from since.

(483.) — A blow off pipe failed December 5, at the Wallingford, Ct., plant of the International Silver Co.

(484.) — On December 6, a boiler exploded with considerable violence at the plant of the Keene Glue Co., Keene, N. H. No one was injured, but the property loss was estimated at about $10,000.

(485.) — A cast iron sectional boiler ruptured December 9, at the Holyoke Club, Holyoke, Mass.

(486.) — On December 9, a boiler ruptured at the plant of the Hocking Valley Fire Clay Co., Nelsonville, O.

(487.) — On December 9, a cast iron header ruptured in a water tube boiler at The New York Mills, New York Mills, N. Y. Three men were injured.

(488.) — A boiler exploded December 9, at the plant of the Metal Stamping Co., Long Island City, N. Y. One man was seriously scalded.

(489.) — A heating boiler exploded December 10, in the basement of the Y. M. C. A., Knoxville, Tenn. The damage was practically confined to the boiler.

(490.) — A portable boiler exploded near Station 10, on the A. B. C. Ry., near Cleveland, O., on December 10. The boiler was the property of the Lake Drilling Co. One man was fatally injured.

(491.) — A boiler exploded December 10, at the construction camp of Hugh & Spaulding, a few miles south of Paris, Ky. One man was killed.

(492.) — A blow off pipe failed December 10 at the plant of the Farmers Oil and Mfg. Co., Blacksburg, S. C. Two men were injured.

(493.) — A cast iron header failed in a water tube boiler at the plant of the Semet-Solvay Co., Dunbar, Pa., on December 10.

(494.) — A cast iron header fractured December 11, in a water tube boiler at the plant of the Bath Portland Cement Co., Bath, Pa.

(495.) — A traction engine boiler, belonging to D. Newton Henson, a contractor, exploded December 11, near Hagerstown, Md. No one was seriously injured, but property was damaged to the extent of about $900.

(496.) — On December 11, a blow off pipe failed at the bending works of Scott Bennet, Medina, O.

(497.)— An eight inch steam pipe pulled out of the flange at the boiler, on December 11, at the plant of the Carnegie Steel Co., Greenville, Pa. One man was badly scalded.

(498.) — On December 12, an accident occurred to a water tube boiler at the plant of the Menasha Woodenware Co., Menasha, Wis.

(499.) — A blow off pipe failed December 13, at the Boston City Hospital, Boston, Mass.

(500.) — On December 13, a tube split in a water tube boiler at the power station of the Greenfield Electric Light and Power Co., Greenfield, Mass. H. W. Metzler, fireman, was injured.

(501.)— On December 14, a threshing machine boiler exploded, while threshing peanuts near Claremont, Va. Three men were injured, one fatally, and property damage to the extent of $1,000 was done.

(502.) — A blow off pipe failed on December 14, at the candy factory of The Wm. Lawther Co., Dubuque, Ia.

(503.) — On December 14, a cast iron sectional heater failed at the apartment house of The Associated Trust Co., Brookline, Mass.

(504.) — A tube ruptured December 14, in a water tube boiler at the Claypool Hotel, Indianapolis, Ind.

(505.) — A blow off failed December 14, at the Holler & Shepard contract on the Barge Canal, Ft. Edwards, N. Y.

(506.) — On December 15, a boiler ruptured at the Hartline Mill and Elevator Co.'s plant, Hartline, Wash.

(507.) — Two sections ruptured in a cast iron sectional heating boiler December 16, at District School No. 32, Morrilton, Ark.

(508.) — A tube failed December 16, in a water tube boiler at the plant of the Pickands Mather Co., Toledo, O.

(509.) — A tube ruptured December 17, in a water tube boiler at the plant of the National Tube Co., Benwood, W. Va. One man was killed.

(510.) — A boiler exploded December 17, at the Scott Sausage Factory, Jacksonville, Ala. One man was killed, and two others seriously injured, beside a considerable property damage.

(511.) — On December 17, a furnace flue collapsed in a boiler at the Y. M. C. A., Dallas, Tex.

(512.) — A boiler exploded December 18, in the saw mill of J. P. Germany, at Neshoba, Miss. The owner and one other were instantly killed, and several others were injured. The saw mill was completely demolished.

(513.) — A boiler exploded December 18, at a saw mill on the farm of Mrs. Lucy Dugas, Edgefield, S. C. Two men were killed, and four injured.

(514.) — Three cast iron headers ruptured December 18, in a water tube boiler at the plant of the American Steel and Wire Co., Waukegan, Ill.

(515.) — A saw mill boiler exploded December 20, at the plant of the Rust Lumber Co., Many, La. One man was killed, and several others injured. The mill was considerably damaged.

(516.) — A boiler exploded December 20, at the water works plant, Centralia, Mo. No one was injured.

(517.) — A boiler ruptured December 20, at the light and water plant of the village of Hibbing, Minn. The damage was small.

(518.) — On December 21, a boiler burst at the plant of the Ft. Worth Power and Light Co., Ft. Worth, Tex. One man was injured.

(519.) — On December 21, a boiler exploded at the mine of the Prospect Coal and Coke Co., Searight, Pa. The property damage was large.

(520.) — The lower tube sheet of a vertical boiler, pulled off the tubes at the plant of the Salmen Brick and Lumber Co., Slidell, La., on December 22.

(521.) — A tube ruptured December 22, in a water tube boiler at the St. Charles Hotel, New Orleans, La.

(522.) — A sulphite digester exploded December 22, at the pulp mill of the Laurentide Co., Grand Mere, Province of Quebec, Canada. Four men were killed, several injured, and property was damaged to the extent of about $80,000.

(523.) — A steam pipe burst at the paper mill of F. W. Bird and Son, East Walpole, Mass., on December 23. Two men were killed, and seven others injured.

(524.) — On December 23, ten sections of a cast iron heating boiler ruptured at the apartment house of Ida L. Higginson, Commonwealth Ave., Boston, Mass.

(525.) — Three cast iron headers ruptured Dec. 23, in a water tube boiler at the plant of the American Steel and Wire Co., Waukegan, Ill.

(526.) — On December 24, a cast iron sectional heating boiler ruptured at the University of Pittsburg, Pittsburg, Pa.

(527.) — On December 25, an accident occurred to a water tube boiler at the plant of the Mishawaka Woolen Mfg. Co., Mishawaka, Ind. The boiler was seriously damaged.

(528.) — On December 25, a large hot water tank exploded in the basement of the Coeur d'Alene Bank and Trust Co. building, Coeur d'Alene, Idaho. There were no serious personal injuries, but considerable damage was done to the building.

(529.) — On December 26, an accident occurred to a water tube boiler at the plant of the Morton Salt Co., Ludington, Mich.

(530.) — A tube ruptured December 26, in a water tube boiler at the plant of the Nichols Copper Co., Newton, Long Island, N. Y. Two men were injured.

(531.) — A boiler exploded December 27, in the saw and grist mill of O. M. Schultz, Wadesville, Va. Two boys were probably fatally injured, and a horse was killed.

(532.) — A boiler exploded December 28, in the round house of the Seaboard Air Line, at Raleigh, N. C. Nine were killed, and a large property damage resulted. Locomotives, machine shop equipment, and buildings suffered severely.

(533.) — A tube ruptured December 27, in a water tube boiler at the plant of the Montreal Mining Co., Hurley, Wis.

(534.) — On December 27, four sections of a cast iron sectional boiler cracked at the Hoffman and LaRoche Chemical Works, New York City.

(535.) — The boiler of a rotary snow plough exploded with great violence on the Great Northern R. R., near Seattle, Wash., on December 30. Five men were injured, and traffic was delayed for several hours.

(536.) — On December 31, a tube ruptured in a water tube boiler at the plant of the Doge Mfg. Co., Mishawaka, Ind.

(537.) — A mud drum ruptured December 31, in a water tube boiler at the plant of Schwarzchild and Sulzberger, Kansas City, Kans.

Boiler Explosions, 1913

January, 1913.

(1.) On January 1, a furnace mouthpiece, attached to a boiler at the plant of The E. T. Burrows Co., Portland, Me., exploded.

(2.) — A heating boiler exploded January 1, at the Portuendo cigar factory, Perkasie, Pa.

(3.) — An accident occurred to a boiler at the Dover, Del., light and water plant, on January 1. One man was injured.

(4.) — An elevator pressure tank burst January 2, in the Winston Building, Utica, N. Y.

(5.) — A compressed air tank exploded at the granite quarry of Reed and Vendret, Quincy, Mass., on January 2. Mr. Reed and an employee, Mitchell Lavoie, were killed, while Armand Vendret, the other partner, was seriously injured. This was a case of repairing a vessel under pressure.

(6.) — The boiler of a traction engine exploded January 2, on the farm of T. J. Hess, near Waller, Pa. One man was killed.

(7.) — A saw mill boiler exploded January 3, near Lawrenceburg, Tenn. One man was killed, and property was damaged to the extent of about $1,000.

(8.) — A tube ruptured January 4, in a water tube boiler at the Glen Allen Oil Mill, Glen Allen, Miss. One man was badly scalded.

(9.) — On January 5, the boiler of a Detroit and Toledo Shore Line locomotive exploded at Detroit, Mich. One man was killed and six others seriously injured.

(10.) — A heating boiler exploded January 5, in the basement of the residence of Dr. H. C. Mueller, Marshaltown, Ia. No one was injured, and the property damage was small.

(11.) — A water front exploded in a range at the Commercial Hotel, Gennesee, Idaho, on January 6. The explosion was due to the freezing up of the connections. The property damage was considerable, the rear of the hotel being completely wrecked.

(12.) — A hot water boiler attached to a kitchen range exploded January 6, in the home of a Mr. Humphrey, Oklahoma City, Okla. Mr. Humphrey was so severely injured that he lived but an hour after the accident. The trouble was due to frozen connections as in the case above.

(13.) — On January 6, a boiler ruptured at the plant of the Niagara Alkali Co., Niagara Falls, N. Y. One man was injured, but the property damage was confined to the boiler.

(14.) — A boiler exploded at the Pulaski Flour Mill, Anna, Ill., on January 7. This accident is also laid to a frozen pipe connection.

(15.) — The heating boiler at the Tivy High School, Knoxville, Tenn., burst January 7. The school was closed pending the installation of a temporary heating system.

(16.) — A blow off pipe failed January 8, at the plant of the Victor Lamp Co., Cincinnati, O. Chas. Weber, engineer, was injured.

(17.) — A saw mill boiler exploded at the mill of T. E. Smith near Augusta, Ga., on January 8. One man was killed and one injured severely.

(18.) — A boiler exploded January 8, at the plant of the Keystone Driller Co., New Castle, Pa. Five men were injured, one fatally.

(19.) — A boiler exploded January 8, in the refinery of the Kansas Oil Refining Co., Coffeyville, Kan. One man was slightly injured, and property damage to the extent of several thousand dollars was done owing to the fact that a large amount of valuable oil and gasolene was burned by fire as the result of the explosion.

(20.) — On January 9, a blow off pipe failed at the office building of the Spitzer Building Co., Toledo, O. One man was injured and considerable damage was done to the building.

(21.) — Two cast iron headers ruptured January 9, in a water tube boiler at the plant of the Salt Lake Tribune, Salt Lake City, Utah.

(22.)— On January 8, an accident occurred to a boiler at the plant of the American Locomotive Co., Schenectady, N. Y. A. Birdsey, engineer, was scalded.

(23.) — Three cast iron headers failed January 9, in a water tube boiler at the Marion Hotel, Little Rock, Ark.

(24.) — The river steamer James T. Staples was destroyed by the explosion of its three boilers January 9, on the Tombigbee River, three miles from Blanden Springs. Nineteen are reported killed, and twenty-two injured as the result of the accident.

(25.) — A heating boiler exploded in a garage in Rochester, N. Y., on January 9. The damage is estimated at several hundred dollars.

(26.) — On January 10, two cast iron headers ruptured in a water tube boiler at the plant of the Semet-Solvay Co., Eusley, Ala.

(27.) — A tube ruptured January 10, in a water tube boiler at the State Institution for the Blind, Columbus, O. Thomas Cranly, fireman, was injured.

(28.) — A boiler ruptured January 10, at the electric light and water works plant of Valley City, N. D.

Owing to lack of space, the January, 1913, List of Explosions is incomplete, but will be concluded in our next issue.

The Hartford Steam Boiler Inspection and Insurance Company.

ABSTRACT OF STATEMENT, JANUARY 1, 1913.

Capital Stock, . . . $1,000,000.00.

ASSETS.

Cash on hand and in course of transmission,		$186,187.28
Premiums in course of collection,		285,163.53
Real estate,		90,600.00
Loaned on bond and mortgage,		1,193,285.00
Stocks and bonds, market value,		3,506,178.40
Interest accrued,		75,600.51
Total Assets,		$5,337,014.72

LIABILITIES.

Premium Reserve,		$2,211,732.44
Losses unadjusted,		94,913.83
Commissions and brokerage,		57,032.71
Other liabilities (taxes accrued, etc.),		47,740.86
Capital Stock,	$1,000,000.00	
Surplus over all liabilities,	1,925,594.88	
Surplus as regards Policy-holders,	**$2,925,594.88**	2,925,594.88
Total Liabilities,		$5,337,014.72

LYMAN B. BRAINERD, President and Treasurer.

FRANCIS B. ALLEN, Vice-President. CHAS. S. BLAKE, Secretary.

L. F. MIDDLEBROOK, Assistant Secretary.

W. R. C. CORSON, Assistant Secretary.

S. F. JETER, Supervising Inspector.

E. J. MURPHY, M. E., Consulting Engineer.

F. M. FITCH, Auditor.

The Locomotive of The Hartford Steam Boiler Inspection and Insurance Co.

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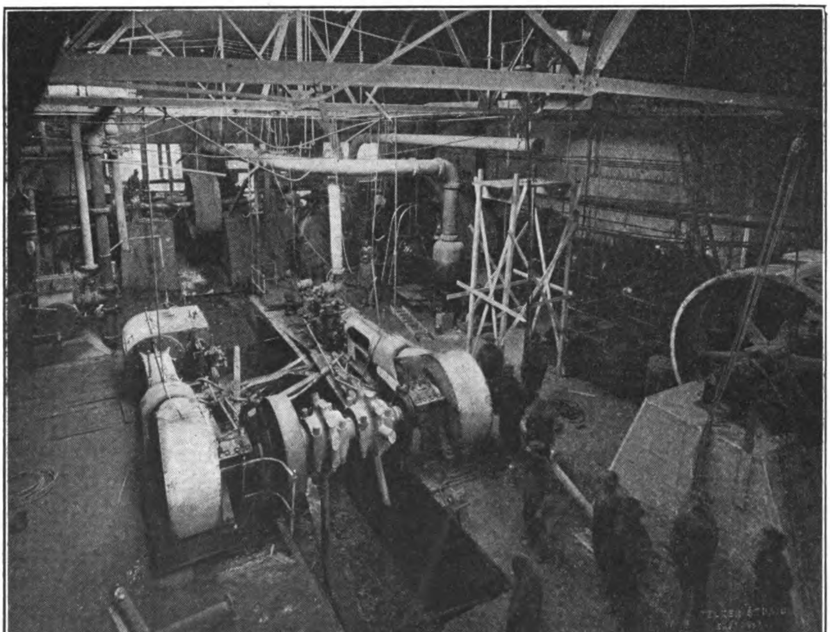
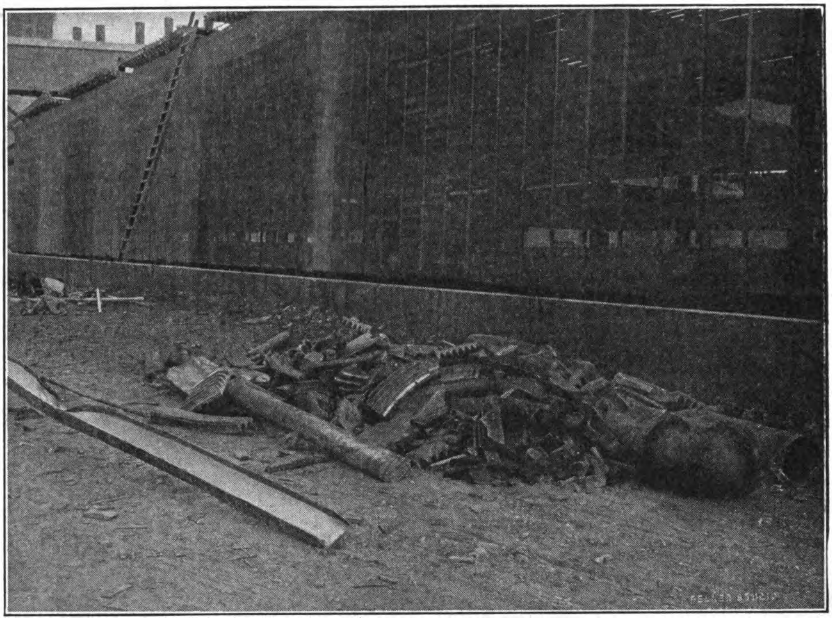


Fly-Wheel Wreck, Alpha, N. J.



THE REMAINS OF THE FLY-WHEEL, ALPHA, N. J.

Fly-Wheel Explosion at Alpha, N. J.

A fly-wheel attached to a 750 horse power cross compound condensing engine, of the shaft governed, or automatic type burst June 9, 1913, at the plant of the Alpha Portland Cement Co., Alpha, N. J. The fly-wheel or rather wheels, for two wheels were used side by side to secure a wide face with two sets of arms for the better distribution of the load in a rope drive, were cast in halves and joined at the rim by flanges bolted together. In addition the two wheels were bolted to each other at their rims. The engine beside having a shaft governor, was equipped with an independent over-speed stop of approved design and construction.

We are told that about 2 A. M. on June 9, the night engineer was attracted to this engine by something abnormal. Just exactly what happened is unknown though the engineer is said to have attempted to bring his engine to rest. The wheel exploded tearing holes through the roof and sides of the building, and wrecked the engine as the photographs show. Two men received fatal injuries, the night engineer and an oiler, the latter died almost instantly while the night engineer lived but a few hours. Both these men received their injuries from escaping steam.

The wreck presents very interesting complications when an attempt is made to reconstruct the circumstances which preceded the explosion. There is excellent evidence that the governor operated, as the weights were thrown so forcibly against the rim of the governor case as to make deep and obviously fresh imprints in the crust of oil and cement dust with which it was lined. Moreover the over-speed stop appears to have operated, though whether it tripped automatically or was tripped by the engineer in an unsuccessful attempt to stop his engine is unknown.

It is known that the stop was tested and in good working order a few days before and the valve controlled by it was found closed after the accident. All this would seem to point to some agency disrupting the wheel during the beginning of a race which the control mechanism might have conquered if the wheel had remained intact. Perhaps the driven pulley failed first, then the engine relieved of its load would start to race. If in addition to this the fly-wheel was injured by fragments of the driven wheel it might have exploded at a speed far below that at which it should have failed if uninjured.

Here is another case of a destructive fly-wheel wreck on a shaft governed engine, fitted with a modern over-speed stop, and representing a typical installation of the sort popularly supposed to be outside the pale, so to speak, and quite immune to such a disaster. The present instance merely confirms the position we have taken so many times in The Locomotive, that no type of engine, no matter how well equipped, can be considered incapable of tremendous damage, when the necessary conditions for such an occurrence exists.

Fuel Economizers.

A fuel economizer may best be considered as an extension of the heating surface of a boiler, used so that the feed water may take up heat from the flue gases which would otherwise be wasted up the stack. This heat which the economizer transfers to the feed water is not always a total loss, as it furnishes of course, the motive power to drive the spent flue gases out of the stack when natural draft is used. Indeed, in many cases an economizer will so reduce the stack temperature that there is not enough of this motive power left to produce a satisfactory draft, and fans must be installed either to force cold air into the ash pits — forced draft — or to pull the flue gases through the furnace, boiler and economizer, expelling them up the stack — induced draft.

That there should be any economy in so reducing stack temperatures with an economizer that a fan becomes necessary for the production of a proper draft is due solely to the fact that a chimney is perhaps the poorest that is, the least efficient heat engine which is commonly used in engineering. To put the same statement in another way, a good steam engine or better yet, an electric motor, can produce a given draft for the expenditure of less heat than will be used to produce the same results at the furnace with a chimney It is the difference between the heat necessarily left in the flue gases to produce a stack draft, over that required in the form of steam energy or electric energy to drive the fan, which an economizer can save to do useful work in the power plant. It must be understood, however, that in both cases we are dealing with the available heat in the gases, that is, the heat which they can be made to give up by cooling them to the temperature at which the feed enters the boiler or, as a matter of fact, to a temperature as near that at which the feed enters the boiler as our economizer may be made to work, for all the heat energy left in the gases when cooled to this temperature is no more available to do work for us than is the energy in the water of a mill race after it has fallen to a level below that of the draft tube from the water wheel.

In the form commonly used, an economizer consists of a bank of vertical tubes connected at top and bottom by suitable headers and placed in the flue between the boilers and the stack. The commonest arrangement places the tubes in rows of say ten, connected at top and bottom with a cross box to form a unit not unlike one section of a large steam radiator. These units are then stacked up — again somewhat like a radiator — and connected together top and bottom by headers placed lengthwise of the flue, with outlets to take the ends of the top and bottom cross boxes. As many units are connected together as are required to furnish the desired amount of heating surface. Of course, variations exist between the designs and methods of installation of the different makers, but there are certain features in common, and as it is the purpose of this article to treat economizers in general and not the product of any particular maker, these differences will be neglected. We do not believe there will be any difficulty in applying the suggestions we propose to any ordinary economizer.

The method of operation usually adopted is for the feed to enter at the stack or cool end of the bottom longitudinal header, whence it is permitted to circulate through the tubes and headers, becoming hotter as it passes along, until it finally leaves at the boiler or hot end of the top longitudinal header. In a few cases, economizers have been designed to permit of a circulation which is up through the tubes of one part and down through those of another, or even up in one tube and down in the next. While these special arrangements require a different arrangement of top and bottom connections, they need not be specially considered at this time.

The material ordinarily used in economizer construction is a high grade of close-grained cast iron. This material is necessary because whatever corrosive elements a water may contain are liberated, as a rule, by heating. Therefore, that part of a boiler or feed water heating system in which the water is first heated to a temperature approximating that of the boiler will suffer most severely. As is well known, cast iron is much less affected by the various forms of corrosion than wrought iron or steel, so that it is practically the only material which may be used for the purpose. It is of course true that steel feed water heaters are widely and successfully used, but there is this important difference between them and economizers, that the water in the latter is heated to temperatures far higher than those attained by ordinary feed water heaters. Indeed, temperatures up to 350° F. are not uncommon.

The construction usually adopted for attaching the tubes to the top and bottom cross headers is a pressed or friction joint. The tube ends are machined to a true tapered surface, given a fine finish and then pressed into corresponding tapered holes in the headers. The joints by which the cross headers are united to the type of longitudinal top and bottom connection which happens to be employed are either flange joints, bolted up and made tight with some form of gasket, or else of pressed construction similar to that described for the tube ends. The top headers are provided in practically all cases with openings opposite the tube ends, large enough for the removal of a tube when one must be replaced. These openings also serve to gain access to the interior for cleaning and inspection. They are closed by internal covers having a tapered metal to metal joint, which are held tight by the internal pressure and pulled into place by some form of yoke and drawing bolt. One end of each top or bottom cross box is ordinarily closed, but the other end, where it is joined to the longitudinal connection, may usually be reached by some form of hand hole cap, secured by bolts, so that it may be opened for cleaning and inspection as well as the top ends of the tubes.

It has been found that the temperature or expansion strains at the junction between the longitudinal and cross headers are very severe if too many units are assembled rigidly together. To overcome this difficulty, it is customary to use sections of longitudinal header short enough to reduce the expansion strains to a safe value, and then these are connected end to end by "U" bends to give the desired flexibility, thus making one whole economizer of a number of little economizers connected in series.

The setting of an economizer is really an extension of the flue. It may be made of brick or steel, and must serve three purposes. First, it must furnish a satisfactory support for the economizer. Secondly, it must supply a tight path for the flue gases from the boiler to the stack, around the economizer tubes, so that excessive leaks may not dilute the hot gases, using up heat in raising the temperature of the leakage air which should go into the feed water. In the third place, the setting must act as a non-conducting shell to cut off as far as is practical losses by radiation. The setting must be so formed as to offer as little friction to the passage of the gases as is consistent with its other requirements, and to provide a pit into which the accumulations of soot may be scraped by the scrapers to be described later.

Whatever the type of construction adopted for the side walls of the setting, it is customary to make use of a layer of some insulating material such as asbestos or mineral wool as a roof over the top headers. To this end the top headers are generally so designed that when in place they make a continuous cover, touching each other and resting on the side walls at their ends, so that the addition of the non-conducting layer mentioned above is all that is necessary to make this setting roof conform to the conditions we have already outlined. Moreover, with the top headers covered in with an easily removed lagging, the top tube caps are readily reached for all purposes. If the sides of the setting are of steel, the usual arrangement consists of plates insulated with asbestos, and joined to each other by means of angle iron flanges, bolted together. Sometimes a combination setting is arranged, having a brick wall on one side with a sectional steel casing on the other, which gives greater accessibility than an all brick setting. In any case, clean-out doors to the soot pit are provided and access doors are fitted to the flue.

Mention has been made of the soot scraper gear. This consists of cast iron scrapers encircling each tube, arranged to be slowly moved up and down their full length, and ordinarily arranged to scrape on the up stroke. The scrapers on a group of neighboring tubes are fastened together in a frame and the whole frame is slowly pulled up and down by chains. Such a chain would pass up from one frame, over an upper sprocket wheel and down to a similar frame so spaced that when one frame is ascending the other is falling, reaching the ends of their strokes at the same time. In this way the driving gear is relieved of the weight of the scraping mechanism, and is only called upon for the actual work of soot removal. The sprockets are driven by gearing through an automatic reversing clutch which trips at the end of each stroke. The drive can be obtained from any convenient motor, engine, or line shaft. It is important that the scrapers be kept continuously at work, for if they stop for any appreciable time a deposit of soot gathers on the tubes, which not only cuts down the efficiency of the apparatus, through retarded heat flow, but which is liable to bake on in the form of a hard cake or incrustation, stalling the scrapers when they are next set to work. To rid the lower part of the structure of soot as fast as it is removed by the scrapers, the lower cross boxes are made enough narrower than the top ones so that a good passage is left between each pair to the soot pit below. Soot pits are generally provided large enough to hold from one to two months' accumulation, and of course the length of the interval between successive clean outs must be governed by the rate at which coal is burned.

For safety and convenience in operation, an economizer must be fitted with various valves and attachments. The arrangement which we describe has been chosen after a good deal of study and thought, and while it may differ in some respects from the general practice, we feel that it is worthy of very serious consideration. A stop valve, and frequently a check valve, are provided at the economizer outlet to the feed line. In ordinary operation, the stop valve is unnecessary, *and should be locked open.* Its only purpose is to permit repairs to the check and for this use it should be placed between the check and the boiler.

A stop valve should be provided at the inlet end, so that the vessel may be isolated for inspection and repairs, the boilers being fed meanwhile by a by-pass line direct from the pump. This by-pass connection must never be opened when the gases are passing through the economizer casing. A case has come to our attention where an economizer in normal operation began to show an unusually high temperature on the thermometer inserted in the flue at the stack end. The engineer tested his safety valve, and found that steam issued instead of water. On looking over the valves and connections he found that the by-pass had been opened, but that all the other valves and the dampers were as for ordinary operation. The pump of course, forced the water to the boilers by the easiest path, which in this case was through the by-pass. The economizer, when the circulation through it was so reduced, acted as a steam generator, and like any other water tube boiler the upper portion filled with steam forcing some of the water out into the feed line.

Under such circumstances there is a danger due to the difference in temperature between the top boxes and the tubes, that the pressed tube end joints will be loosened and the boxes blown off, starting a violent explosion, perhaps at a pressure equal to or less than the ordinary working pressure.

A blow-off or drain valve should be provided at the hot end of the lower longitudinal header. This valve should be placed in an accessible position, and piped so that it may be used daily when the apparatus is in operation, for the removal of sludge and scale matter while still soft and easily blown out, as well as for draining the economizer whenever it becomes necessary to open it for inspection or cleaning. As in the operation of boilers, much of the matter which if allowed to remain will eventually form a hard scale, difficult of removal as well as detrimental to the transfer of heat, may be blown out while still soft if the blowoff is operated frequently. A vent pipe of ample size, the end of which is opened to the air should be led from the highest point of an economizer in as direct a manner as possible to some place in the boiler room where it is easily visible. It should be provided with a valve at the open end. This vent will permit the entrance of air when draining the economizer, and its expulsion on refilling. Moreover, if a practice is made of opening this vent as soon as the pressure on the economizer has fallen to nothing, after cutting out of service, and if it is left open until it is desired to start the feed pump through the economizer again, a full economizer will have a relief to the atmosphere which it could only get otherwise by the generation of an internal pressure great enough to cause the safety valve to lift. With this in view, it should be made an absolutely inflexible rule that the economizer should never be left out of service, whether full or empty, unless this vent is opened as soon as the pressure has fallen to zero, and is left so until the vessel is wanted again.

The most important attachment for any pressure vessel is its safety valve, and this is especially true of economizers. We believe that in all large economizers, say of more than 3,000 square feet of heating surface, there should be *two* safety valves, one at either end. The valve at the inlet end may be a water relief valve, but at the outlet end a steam safety valve is preferable. These valves should be of the spring-loaded type, with lifting gear attached, as it is important that they be tested from time to time to make sure that they are not choked or set fast by scale. If in addition they are provided with a good secure "lock-up" attachment, so that their setting may not be tampered with, we feel that an additional safeguard is provided. These valves must be set to operate at a pressure slightly above that at which the boiler safety valves lift, because a slight excess over the boiler pressure must be carried on the economizer and feed line to overcome the friction offered by them to the water flow. This excess need not be over 10 or 15 pounds. That is, if the boiler safety valve is set at 150 pounds per square inch, the valves on the economizer should lift at 160 to 165 pounds. Difficulty has been experienced in keeping this excess within such narrow limits, and for this reason. It is a well-known fact that a relief valve on a hot-water line is a trouble maker, because it is so prone to leak. It is a common experience for some boiler-room employee to set down on the adjusting spring when a leak occurs, and to repeat this treatment from time to time in a vain attempt to cure it. His object is of course to save the hot water, and so lighten his labor at the fires. Such treatment is well known to be futile, but as the grinding in of an economizer safety valve is an unpleasant dirty job, which requires the shutting down of the vessel, it is only too frequently practiced. It requires but a moment's consideration of the causes for leaks in a safety valve to show the uselessness of attempting to correct them by an increase of the spring tension. A safety valve seat consists of one or more conical or flat surfaces, to which corresponding surfaces in the disk have been fitted by grinding. The tightness of the valve depends on the perfection of this contact, that is upon the accuracy with which the disk meets the seat throughout the entire bearing area. The purpose of the valve spring is to put a load on the valve disk equal and opposite to the load it will receive when acted on by the maximum internal pressure which the vessel is to carry. The spring load affects the tightness of the valve to only this extent, that it permits the seat and disk to remain in contact at pressures lower than this maximum. When a valve begins to leak, it does so from one of two simple causes; either there is a bit of foreign material lodged between the disk and seat, preventing closing, or else one or both surfaces have been injured by cutting. This results from water or steam passing through the orifice at high velocity, perhaps aided by some abrasive material, and is similar to the action of a sand blast. The presence of an abrasive substance is not necessary in the case of a valve opening to relieve the pressure within a vessel containing very hot water, because hot water will immediately turn to steam when its pressure is lowered to that of the atmosphere, if its temperature is above 212° F. The jet of fluid then, which we should expect to find flowing from the relief valve of an economizer, would be a jet of very wet steam, at least at the valve seat, before it has a chance to condense on the surfaces of the relatively cool escape pipe. We need go no further than the experience gained in the operation of steam turbines, for a proof of the fact that a stream of very wet steam, flowing at a high velocity will cut the surfaces of the blades and passages at a rapid rate. In the light of this reasoning, let us consider for a moment what takes place when some one attempts the monkey wrench cure for a leaking safety valve. If the leak has been caused by the pressure of some foreign substance, it will be either embedded in the seat, or crushed, depending on its hardness, and the only result to be expected from an increased spring tension, is that permanent damage may be done where none existed before. If the leak has resulted from cutting, the hole will remain, regardless of the spring tension, unless sufficient pressure can be brought to bear to squeeze the seat and disk into contact again, a process that could scarcely fail to ruin the valve, even if it were possible with the average valve spring. The proper treatment in the first instance, would have been, to lift the valve, allowing it to relieve freely for a short time, which would have washed the seating clean in all probability, allowing the valve to close properly. If the seat has been injured by embedding some foreign particles or by cutting, the only way to make it tight again is to re-grind it until it makes contact over the whole seating area. An overloaded spring, then, can have but one effect, that is to increase the possibilities of damage to property and of personal injury by permitting an over-pressure which is directly determined by the extent of the overloading.

The escape pipes of economizer safety valves, also need scrutiny. As in boiler practice, we feel that a safety valve is best installed when it need have no escape pipe at all. Nevertheless, since it is very important that water should not enter an economizer casing and produce external corrosion, some type of escape pipe is necessary for most economizer reliefs. It is essential that the escape pipe be the full size of the valve outlet. It should be as short and straight as possible, and it may well be installed so that the flow of water from it will be definitely *in the way*. This is the surest means of calling attention to a leaking valve, and in addition serves to impress on the minds of the attendants the fact that the relief valves operate. It is an undesirable practice, indeed it may be very dangerous, to pipe the escape pipe outlet to a sump, tank, or hot well, where the flow if any passes unnoticed. A tight valve is the safest way to save hot water.

The flues leading to and from an economizer casing should be provided with some form of tight-fitting shut-off damper. These dampers should be separate from the regulating dampers, and should not be used for draft control, either by an automatic regulator, or by hand adjustment. They should be of such a type that they will work easily and when closed they must be tight. It is quite important that the form of damper installed be such that it will retain both its ease of working and its tightness after long-continued service, so that it may be depended upon in an emergency. Whenever the shut-off dampers are closed the soot-pit doors should be opened immediately to prevent pocketing an explosive gas mixture in the casing.

Certain general principles may be applied to the care and operation of an economizer which will make for its safety and long life. The casing and external surfaces must be kept dry if external corrosion is to be avoided. Moisture may get to the outside surface of the tubes and headers in three ways: by leakage from within through tube ends or cracked and pin-holed tubes; by leakage from above of caps, pipe joints, safety valves, or even roofs; or by the sweating of the vessel when water is introduced at too low a temperature. To avoid sweating, some form of heater which will deliver water to the economizer at a temperature above 100° F. is required. In the absence of such a heater, it is possible to send back through a by-pass connection, a small amount of water from the hot end of the economizer, allowing it to mix with the cold water in the inlet pipe, and so regulate the inlet temperature to a point above 100°. When moisture does get at the external surfaces, the resultant corrosion is serious, for both soot and flue gas give rise to corrosive acid solutions when mixed with or dissolved in water.

When an average boiler water is heated in an economizer, it deposits a muddy sludge composed of the various scale-forming impurities contained in the water. Some of the sludge may bake on to the tubes and form a scale. It is not uncommon to find the tubes in an economizer which has been running for some time, coated with over an inch of soft sludge and scale. Under this material, the tubes may appear at first to be sound and of full thickness. A closer examination however, will generally show that the iron has undergone a change. It will be found spongy and soft, easily cut with a knife or scraper, and this condition may extend from a few 64ths of an inch to half the thickness of the tube or more. This decomposed iron, when freshly cut, has about the appearance and consistancy of the graphite "lead" in a lead pencil, and is, of course, the well-known spongy material to be found in most cases of cast iron corrosion. It is a slow process as compared to the corrosion of steel or wrought iron under similar conditions, and as we have said above, only cast iron can satisfactorily resist the corrosive action in an economizer, at least among the materials which are mechanically or commercially adapted to the service. When the interior surfaces of the economizer become coated over with corroded iron overlaid with sludge the action is greatly retarded, if not stopped. On the other hand this sludge layer retards the flow of heat into the water and so cuts down the efficiency of the vessel. A practice has prevailed among engineers of cleaning the tubes with the same sort of turbine-boring tools that are used for the tubes of water tube boilers.

If the boring process could be carried out without disturbing the layer of spongy, corroded iron, no harm would result, and the increased efficiency would warrant the treatment, but unfortunately this corroded layer is very easily detached and wherever it becomes loosened so that the water may penetrate to the freshly exposed surface of sound iron, active corrosion in the form of pitting will be found.

We feel that except in extreme cases, and where great care is taken with the work, this form of tube cleaner is not to be encouraged. It seems better to use some form of scraper similar to the scrapers used for soot removal in the tubes of fire tube boilers. We know of many plants where they are used with success, and a very satisfactory degree of heat efficiency may be retained in the apparatus, without any marked increase in the rate of corrosion. Of course, it is obvious that frequent internal washings with a hose will remove a large part of the soft material before scraping or boring are needed.

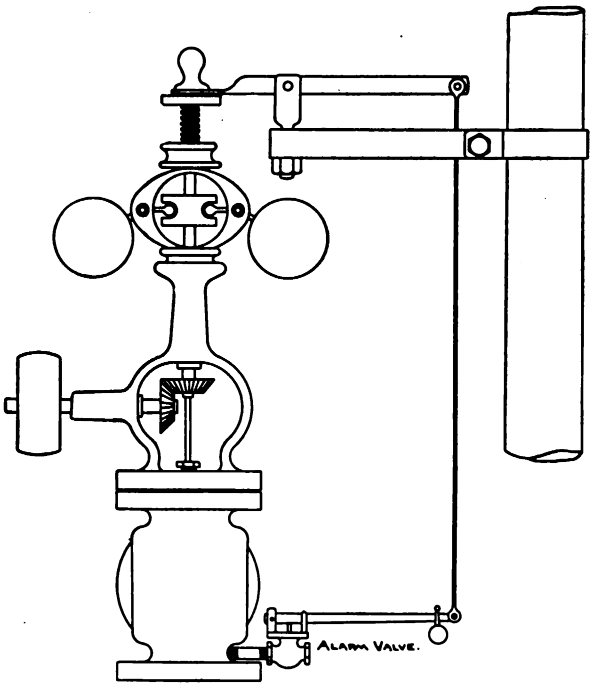
In conclusion, we desire to call attention to the fact that nearly every economizer explosion which has been brought to our notice has taken place in a vessel which was supposed to be out of service, and therefore was due to some abnormal condition, or set of conditions. The lesson to be learned from this fact would seem to be this, that it is of the utmost importance that economizer owners assure themselves that their vessels are provided with the right safety appliances, in good working order, and that the men in direct charge of the vessels be so thoroughly instructed in their work, and held so responsble for the details of manipulation, especially in cutting out of service, replacing in service again and making repairs, that these abnormal conditions will be made just as nearly impossible as the human factor will permit.

Safety Alarm Attachment for Throttle Valve Governors.

THOMAS DOWD, Inspector.

A type of throttle valve governor is in use which while not equipped with an automatic safety stop in the strict sense of the word will nevertheless stop the engine if the belt breaks or runs off provided the engineer has not forgotten to set it in the "safe" position after starting his engine. With governors of this type before the engine can be started it is necessary for the engineer to screw down the small knurled nut which is at the extreme top of the governor. This operation lifts the throttle valve from its seat and holds it in this position, admitting steam to the engine. When the engine has attained its normal speed the nut should be screwed back again. The governor is then at "safety" and will operate to stop the engine if the belt breaks or runs off. Should the engineer forget this and the governor belt break while the nut is screwed down the engine would run away, which would probably result in a wrecked fly-wheel, with consequent damage to the building and its contents.

When inspecting engines equipped with governors of this type a small safety or alarm valve has been recommended to be attached to the throttle valve chamber at a point below the valve seat. From the lever of the alarm valve a connection is made to a second lever which is provided with a forked end to hook under the knurled nut on the governor as is shown in the accompanying sketch.



SKETCH OF THE ALARM VALVE AND GOVERNOR.

This little device has given satisfaction wherever it has been installed as directed. It prevents the engineer from forgetting to set the governor in its safe position while his engine is running, for when he screws down the nut on top of the governor it opens the alarm valve from which steam continues to flow until the nut is set back again to the safe position.

An Unusual Explosion.

C. R. SUMMERS, Inspector.

We have had boiler explosions ever since the steam boiler was invented. Sometimes steam pipes explode or blow-off pipes rupture and even gases explode in the furnace or combustion chamber, as many a singed fireman can attest, but we would never have suspected an ash pit of having concealed within it the ability to blow up and do things to the plant.

Two 60 in x 16 ft. horizontal tubular boilers were recently set up in the basement of an office building. The settings were up-to-date in every particular and unusual care was taken to get a perfect installation. Only one boiler is used at a time, so on a certain day boiler No. 2 was fired up and took the load off the old boilers, which are to be abandoned. All went well until about four o'clock in the afternoon, when a terrific upheaval took place, all doors about the boiler setting were blown open and fire scattered all over the boiler room floor.

No time was lost investigating, but No. 1 was immediately gotten under way and about four o'clock the next morning, just to show that No. 2 had nothing on No. 1, another upheaval took place, though not nearly so violent as that of No. 2, and No. 1 was continued in service.

No. 2 had cooled down sufficiently by this time so that an investigation could be made and it was found that the concrete bottom of the ash pit had blown up, the grates being lifted off the bearing bars and piled up indiscriminately in the bottom of the furnace. Following this clue it was found that seepage from the outside had found its way under the concrete floor of the ashpit, which was about six inches thick, and since no water was intentionally put in under the grates, in the course of ten or twelve hours the concrete bottom had become hot enough to generate steam under it, with the result that when sufficient pressure had accumulated the bottom came up with remarkable force.

The same thing occurred with No. 1 in about twelve hours after it was fired up, only the concrete was not blown out to such a depth, only about an inch, and the fire was not seriously disturbed.

Who can tell that the insurance companies will not soon be requiring safety valves on our ash pits?

The Explosion of an Oxygen Tank, in Nürnberg, Germany.

Translated from the German by H. J. VANDER EB.*

An oxygen tank exploded last September in a boiler and machine shop in Nürnberg, Germany, where autogenous welding was used for repairing tanks, and to some extent on boilers. The oxygen was manufactured in the shop itself by means of an electric current, and stored in the upper drum of a cylindrical boiler in which the openings to the lower drum were closed by riveted patches. The boiler was buried so that only the upper drum to which the oxygen connections were fitted was above ground.

The explosion took place while welding was in progress, with appalling results. Six persons were injured, three of them seriously, while parts of the shell were thrown 200 feet.

The cause of the accident is attributed (by the Bayerischen Revision-Verein) to the following: Some weeks previous to the accident the commutator of the dynamo which furnished the current for generating the oxygen had been trued up. To do this the wiring connections were taken down. When the job was done, the connections were replaced incorrectly by some mistake, causing a reversal of polarity in the dynamo, so that the electrode which had previously given off oxygen, was generating hydrogen. This hydrogen then mixed with the oxygen still in the tank and formed an explosive mixture. It is further assumed that the flame of the welding torch, striking back through an imperfectly filled water seal, ignited the explosive gas within the tank. It appears, therefore, that even in a case of this kind, a part, at least, of the trouble can be blamed to the proverbial "low water."

Zeitschrift des Bayerischen Revisions-Vereins.

Concerning Stay Bolts Which are not Square With the Sheets They Support.

In submerged tube boilers, locomotive type fire-boxes, and in general wherever stay bolts are used to tie two sheets together whose surfaces are not parallel, it frequently becomes necessary to drill the stay bolt holes out of square with one or both sheets. If this lack of squareness exceeds a certain amount, then threads which start on one side of the hole leave the plate incomplete as is shown in Fig. 1. The difficulty with this sort of work is not so

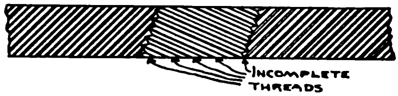


FIG. 1. INCOMPLETE THREADS.

much that it lacks strength as its tendency to leak. The interrupted threads cannot be made steam tight and so, unless several perfect threads can be secured, a permanent leak in the boiler results. With this in view we have worked out for several sizes of stay bolts, made with "V" threads twelve to the inch, the least angle that a stay bolt may make with a plate of given thickness and secure either two, three or four perfect and complete threads.

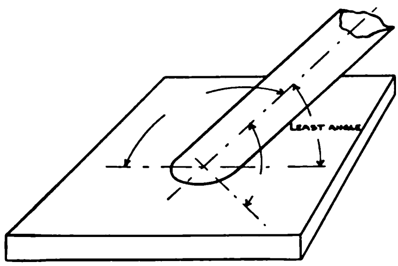


FIG. 2. ILLUSTRATING THE LEAST ANGLE BETWEEN THE BOLT AND THE SHEET.

The tables are nearly self explanatory, but perhaps a word is required to make clear what we had in mind as the "least angle." It is clear that if a stay bolt pierces a plate at any angle other than 90°, there is one least angle between it and the plate, while on the opposite side of the bolt from this least angle is a greatest angle. At any intermediate point the angularity of the bolt to the plate is somewhere between these limits, as is shown in Fig. 2. In every case the least angle has been used in making up the tables. In finished work, if it were accessible, this least angle would be the smallest angle that could be taken off with a carpenter's "bevel" held so as to touch both the bolt and the sheet fairly.

TABLES OF THE LEAST ANGLE A STAY BOLT MAY MAKE WITH A PLATE TO SECURE A GIVEN NUMBER OF FULL THREADS. — V THREADS — 12 PER INCH.

TABLE I. *4 Full Threads.*

Thickness of plate.	Diameter of Stay Bolt.							
	½″	⅝″	¾″	⅞″	1″	1⅛″	1¼″	1⅜″
¼ inch	....	....	....	....	....	....	......	......
5/16 "	....	....	....	....	....	....	......	......
⅜ "	....	....	90°*	....	....	....	......	......
7/16 "	90°	89°	88.5°	89.5°	89°	87°	90°	90°
½ "	83°	84°	83°	84°	84°	85°	85°	87°
9/16 "	76°	78°	78°	81°	84°	83°	83°	85°
⅝ "	54°	68°	71°	75°	77°	79°	80°	82°
¾ "	....	48°	56°	64°	68°	71°	73°	77°
⅞ "	....	....	28°	51°	60°	64°	67°	72°
1 "	....	....	....	30°	48°	61°	60°	64°

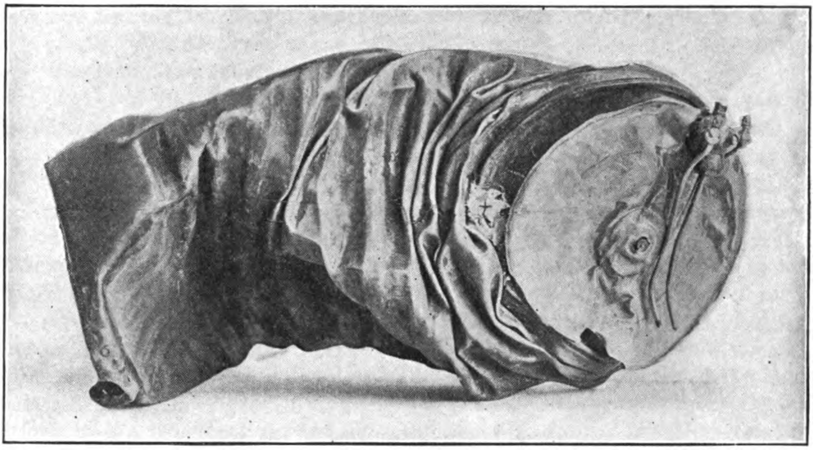
TABLE II. *3 Full Threads.*

Thickness of plate.	Diameter of Stay Bolt.							
	½″	⅝″	¾″	⅞″	1″	1⅛″	1¼″	1⅜″
¼ inch	....	....	....	....	....	....	......	......
5/16 "	....	90°*	90°	....	....	90°	90°*	......
⅜ "	87°	85°	85°	88°	88°	86°	89°	90°
7/16 "	80°	80°	82°	84°	85°	83°	85°	88°
½ "	70°	72°	75°	79°	80°	80°	83°	85°
9/16 "	62°	66°	71°	75°	78°	78°	80°	82°
⅝ "	....	55°	63°	69°	71°	71°	77°	78°
¾ "	....	....	46°	59°	64°	65°	70°	73°
⅞ "	....	....	....	43°	55°	58°	65°	68°
1 "	....	....	....	....	42°	48°	57°	61°

TABLE III. *2 Full Threads.*

Thickness of plate.	Diameter of Stay Bolts.							
	½″	⅝″	¾″	⅞″	1″	1⅛″	1¼″	1⅜″
¼ inch	....	....	90°*	90°	90°*	90°	90°	......
5/16 "	85°	85°	86°	86°	87°	85°	87°	88°
⅜ "	78°	78°	81°	81°	84°	82°	84°	87°
7/16 "	69°	73°	75°	78°	80°	79°	82°	83°
½ "	57°	65°	69°	72°	74°	75°	78°	81°
9/16 "	48°	60°	64°	68°	72°	73°	75°	77°
⅝ "	....	44°	55°	60°	66°	67°	73°	76°
¾ "	....	....	36°	50°	57°	61°	67°	69°
⅞ "	....	....	....	35°	48°	53°	60°	64°
1 "	....	....	....	....	35°	44°	52°	57°

An * signifies that the specified number of threads will be scant.



AN EXPLODED PEANUT ROASTING BOILER.

The Explosion of a Peanut Roaster.

Explosion No. 304 in our list for July, 1912, referred to the failure of a peanut roaster in Sigorney, Ia., on July 29 1912. The roaster stood in front of a restaurant on one of the principal streets of the town. Just before the explosion, Chauncey E. Meyers of Washington, Ia., drew up to the curb in an automobile, and entered a store to make some trifling purchase. As he was returning to the machine, he passed in front of the peanut roaster at the instant when it exploded. The boiler hit him, breaking his back and rendering him unconscious, a condition from which he did not revive. The photograph which we print shows the boiler after the explosion, and at "X" is seen a portion of Mr. Meyers' clothing.

Peanut roasters, like many other small steam containers, are not usually classed as dangerous affairs, and yet we recorded in the Oct., 1911, LOCOMOTIVE (page 241) a similar accident, which took place in Newark, O., and which resulted fatally to two people. If a mere peanut roaster possesses enough explosive energy to burst with fatal results, as in the two cases mentioned above, where is the power or heating boiler so insignificant and harmless that its insurance is unwarranted?

Fly-Wheel Explosions, 1912.

To complete the 1912 list.

(32.) — On October 31, a five ton fly-wheel exploded at the plant of H. S. Williams and Co., Wauseon, O. The damage was largely confined to the engine.

(33.) — The fly-wheel on a gasoline engine exploded November 8, on the ranch of John Laird, near Great Falls, Mont. Mr. Laird was instantly killed.

(34.) — A fly-wheel exploded November 20, at the Queen City Tannery, New York city. · There was considerable property damage, but no one was injured.

(35.) — On November 28, a fly-wheel burst at the sawmill of Poutt and Foreman, Titusville, Pa. One man was seriously injured.

(36.) — A fly-wheel exploded November 29, at the Crystal Mine, Tilden, Ill. One man was injured.

(37.) — A fly-wheel burst at the plant of S. G. Flagg, Reading, Pa., on November 30. One person was seriously injured.

(38.) — On December 3, the governor belt slipped off on an engine at the plant of the Woodland Clay Company, Watseka, Ill. The engine raced, exploding its fly-wheel.

(39.) — A fly-wheel, and a wooden driven pulley both exploded December 6, at the plant of the William Coleman Co., barrel manufacturers, Jackson, Tenn. The accident was caused by the breaking of the governor belt. One man, Mr. E. P. Wray, was instantly killed.

(40,) — Albert Schultz was seriously injured on December 19, at North Tonawanda, N. Y., by the bursting of the fly-wheel on a gasoline engine used for cutting corn stalks.

(41.) — On December 23, a fly-wheel cracked on a gasoline engine belonging to the Lone Star Amusement Co., Fort Worth, Texas.

(42.) — A fly-wheel burst, December 26, on a five ton coal truck, gasoline driven, in New York city. A bystander was fatally injured.

Fly-Wheel Explosions, 1913.

(1.) — On January 7, a fly-wheel burst at the plant of the Southern Seating and Cabinet Co., Jackson, Tenn.

(2.) — A pulley exploded January 9, at the Peck plant for reclaiming copper from copper slimes, at Anaconda, Mont. W. M. Young was killed.

(3.) — The fly-wheel on a direct connected generator set exploded January 9, at the Clyde Coal Company's mine near Fredericktown, Pa. Martin Williams was killed.

(4.) — On January 17, a fly-wheel flew off at the power house of the Tacoma Railway and Power Co., Tacoma, Wash. Two persons were injured, one of them fatally.

(5.) — A fly-wheel fractured January 30, at the plant of the Hartselle Stave and Harding Co., Hartselle, Ala. One man was injured.

(6.) — On February 3, a fly-wheel exploded at the Gilbon quarries, Lambertville, N. J. One man was seriously injured.

(7.) — Several rim bolts failed February 3 in a fly-wheel at the Arlington Mills, Lawrence, Mass.

(8.) — On February 14, a large fly-wheel burst at the power house of the Charlottesville and Albemarle Ry. Co., Charlottesville, Va. The accident was due to racing of the engine when the governor belt broke, and was made possible by the failure of the governor to operate in its low safety position, through lack of adjustment. The property loss was estimated at $15,000.

(9.) — A fly-wheel exploded February 21, at the plant of the American Metal Wheel and Auto Parts Co., Toledo, O. The wreck was due to a deranged governor, injured through the bursting of a driven pulley on a line shaft.

(10.) — On March 1, a fly-wheel rim fractured at the plant of the Peoples Gas and Electric Co., Mason City, Iowa.

(11.) — The fly-wheel on an oil well engine burst March 4, near Butler, Pa. One man was killed.

(12.) — A fly-wheel burst March 6, at the mill of the West Yellow Pine Co., Olympia, Ga. The cause is given as an inoperative governor.

(13.) — A gas engine fly-wheel burst during a test on March 7, at Oakland, Cal. A machinist, engaged in testing the outfit, was instantly killed.

(14.) — On March 19, the fly-wheel of a variable speed engine driving a paper machine burst at the plant of the New Haven Pulp and Board Co., New Haven, Conn. The engine and paper machine were badly wrecked, the loss totalling about $6,000.

(15.) — During a storm which unroofed the buildings of the National Rolling Mill, at Vincennes, Ind., on March 21, the belts were stripped from two eight foot fly-wheels by the falling debris. The engine when relieved of its load ran away, and exploded both wheels. Two men were seriously injured.

(16.) — A fly-wheel burst April 18 at the Glens Falls, N. Y., plant of the International Paper Co. The wheel is 14 feet in diameter.

(17.) — On April 30, the fly-wheel on a small gasoline engine used for domestic purposes and owned by Joseph Havir, at Plattsmouth, Neb., exploded. Mr. Havir was instantly killed.

(18.) — A gas engine fly-wheel burst May 2, at an oil well on Morrison's Run, near Warren, N. Y. No one was injured.

On Fusible Plugs.

We have many inquiries from time to time concerning fusible plugs. These inquiries run all the way from requests for advice as to methods and materials for filling, to questions as to the best location in some particular type of boiler. The Locomotive has had little or nothing to say on this subject for many years and although we must admit that there is little that is novel to offer at this time, still it is possible that a general review of the subject may be of interest to some of our readers.

Fusible plugs are often misrepresented. Their true function is not to save a boiler in which the water has gotten dangerously low, but to act as a low water alarm, calling the matter to the attention of the boiler attendant, who can then take the necessary steps to save his apparatus.

Fusible plugs are ordinarily made of brass with a hexagonal head at one end to permit of their being screwed in with a wrench, and threaded with a standard tapered pipe thread. They are either inside plugs or outside plugs depending upon whether they are designed to be screwed in from the water or fire side of the sheet or tube they are to protect. A tapered hole is drilled through the center of the plug, from end to end, with the large end toward the water side of the sheet when the plug is in place. The tapered hole is then filled with a fusible metal, which will be crowded tightly into it by the boiler pressure. The operation of the plug when in good condition is about as follows: As long as the inner end of the plug is covered by water, it will remain at a temperature essentially the same as the water, or about at the boiling point corresponding to the pressure carried. The exact temperature will depend of course upon the cleanliness of the boiler, for there will be a much greater temperature difference between the metal and the water in a badly scaled boiler than in a perfectly clean one. When the water level falls low enough to expose the plug, the steam can no longer take heat away from the metal as fast as it is supplied by the hot gases with the result that the temperature rises and when the melting point of the fusible material is reached it softens and is promptly blown out by the steam pressure. Steam issuing from the orifice will tend to lower the boiler pressure somewhat, and will perhaps effect a slight deadening of the fire if the plug is located so that the jet can blow back into the furnace, but the principal effect as we mentioned above is to warn the boiler attendants that something is wrong in time for remedial measures to be adopted.

It will be seen that for prompt and certain action a fusible plug must be filled with a material whose melting point is but slightly above the temperature of the water in the boiler at its working pressure, allowing leeway enough for a moderate and quite safe rise in temperature of the metal above the water temperature when the boiler is somewhat scaled. Many different alloys are available for such a use, and nearly any desired melting point may be obtained by a proper mixture of metals. These alloys have been very carefully studied by the manufacturers of automatic sprinkler heads for fire protection, so that sprinklers may be had to fuse at almost any temperature which is thought desirable as a protection against incipient fires. There is one important difference however between the action of an alloy in a sprinkler head and in a fusible plug, namely that in the plug the metal is constantly exposed to the chemical action of the flue gases on the one hand, and the scale forming and corroding properties of the boiler water on the other. The result is that almost all metals when used as fusible plug fillers undergo a slow change. On this account most of the fusible alloys soon become worthless in service and reach a state of decomposition where it is practically impossible to melt them at all. This being true, and because a pure metal is much more stable and dependable under such conditions than any alloy, it has become the custom to fill all plugs with pure Banca tin. This metal will remain in serviceable condition longer than any other material whose melting point is at all suitable. It may be depended upon to melt promptly at about 449 degrees F. which corresponds to a pressure of about 365 lbs. gauge. Since tin will melt long before steel will be injured, but will remain solid at temperatures well above those corresponding to any ordinary steam pressure, it will serve in practice as a universal filling material, and it is required by law in many states, as well as by the United States Steamboat inspectors. One must not rest under the impression however that a tin filled plug will undergo no deterioration in service, for we frequently find cases in which the metal has become hard and crystalline with a thick coating of oxide at the ends, and in this condition the melting point may be very high indeed. Because of this fact, it is important that the plug be so placed that it is accessible both from the steam and fire side of the boiler at inspection, so that the boiler inspector or the engineer in charge may frequently observe if the metal is changing. So long as the metal is clean, and seems soft and malleable when struck with a light hammer, no serious trouble need be anticipated.

There is another reason, quite as important as the first why a fusible plug should be placed in an accessible location. It is the inborn tendency of some men to neglect or actually dispense with any attachment which is hard to replace. We have found fusible plugs with wrought nails driven in to take the place of the metal which had run out rather frequently, and many instances have been brought to our attention in which an ordinary pipe plug was found by the boiler force to be a ready substitute for the more useful trouble maker. A case in point is the location of the plug in a vertical tubular boiler. In all such boilers except the submerged head type, the plug if it is to be of service must be located in a tube. A hand hole is usually placed in the shell opposite the plug which must be screwed into one of the tubes in the outer row. With the tubes commonly used, a very small plug is required, and the boiler must be quite cold and empty to below the hand hole level before a plug can be replaced. We do not wish to reflect upon those laws, in force in many states, which require a plug in this type of boiler, but we do desire to show that its use is at least a debatable question.

As to the location which we would recommend with various types of boilers, we must first state definitely that wherever legal requirements have been adopted bearing on this important question, they should be accurately followed as a failure to do so may involve the boiler owner in serious difficulty. This is especially true in the event of an accident occuring to a boiler which is not equipped in strict compliance with the law. A general rule would be to place the plug at that level below which the water line should never be allowed to fall, even in an emergency, when there is a fire on the grate. Place it in the most accessible location which will satisfy the first requirement, and by accessible we mean easily reached from both the fire and water sides if possible. The third and last requirement is that the plug be as near the furnace as it may, so that it may be heated to the fusing point in the shortest possible time after being uncovered. Perhaps it may be well to illustrate this rule with a few typical plug locations in familiar types of boilers. In internally fired boilers of the Locomotive, Cornish, or Lancashire type, the plug is usually located in the furnace crown at the highest point, and it ordinarily projects through the crown about an inch, so that it will be uncovered before the crown sheet is entirely dry. In Scotch marine boilers of the wet back type, the plug would be located in the top of the combustion chamber, while in the dry back type of Scotch boiler, the plug is placed in the back tube sheet two inches above the top row of tubes. In the horizontal tubular type, the plug is placed in the rear tube sheet or head, two inches above the tube tops. In water tube boilers the plug is placed if possible in the steam drum at the lowest permissible water level, and if possible in the first pass of the gases. An access door in the setting opposite the plug is of great assistance in this case. With those water tube boilers in which vertical or nearly vertical tubes terminate in an upper drum, the fusible plug is usually placed in the lower head of this upper drum. Special cases of course require special treatment, but we believe that by intelligently applying the general rule which we have given, a satisfactory location may be arrived at for nearly every boiler type. One additional caution is necessary in the case of water tube boilers with regard to the level at which the plug should stand. In many of these vessels the tubes terminate in the upper drum, and are secured to it by a rolled or expanded joint. In such cases the fusible plug should be high enough so that the tube ends will still be covered when the plug operates, for if these tube ends are overheated, all the tubes in the boiler may be ruined.

The Locomotive of The Hartford Steam Boiler Inspection and Insurance Co.

C. C. PERRY, EDITOR.

HARTFORD, JULY, 1913.

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THE LOCOMOTIVE OF THE HARTFORD STEAM BOILER I. & I. CO.

The policies of all companies writing steam boiler insurance express in some way a provision which exempts the insurer from liability for loss due to the explosion of a boiler, the safety-valve of which is adjusted to blow at a pressure in excess of that approved for it by the Company and recorded either by the policy or otherwise. This is obviously a necessary condition of such an insurance contract for the setting of the safety-valve normally determines the limit of pressure which the boiler will carry, and a limitation in pressure to that at which the insurer is willing to undertake the risk, is but proper and just. It is generally so recognized and accepted.

But occasionally an incident arises which shows that while the right of the insurer to limit the pressure is admitted, there is a misunderstanding of what influences should determine the value recorded as the limit of that pressure. This misunderstanding arises with boiler owners,— and sometimes, too, with boiler underwriters, who should know better,— because of a failure to identify the recorded pressure as that of the *maximum safety-valve setting,* as distinguished from the pressure which the insuring Company might approve as within the limitations of safety for a particular boiler structure. Usually, it is true, the strength of a boiler, its condition or the character of its construction determines the pressure at which its safety-valve should be set, but this is by no means always the case. Very frequently it is the strength or condition of some other boiler that is the limiting factor. For the pressure in a number of boilers connected together is of course the same in all, and if one of them for any reason is weaker than the others, the pressure on all must be limited to that which that weaker boiler may safely sustain. To limit the pressure, the safety-valve must be adjusted to blow at not higher than that pressure and thus in accordance with the policy provision a pressure, less than the structure of some of the boilers would warrant, is recorded as approved. Other considerations, too, lead to the same result. For instance, a boiler may be strong enough for a pressure of one hundred pounds per square inch but the purposes of its operation may be best attained at 15 lbs, per sq. inch. Under such a condition the insuring company may feel it advisable that the safety-valve be set for twenty pounds, not because a higher pressure is unsafe, but because if set at a higher pressure the valve would seldom if ever operate under pressure, and it should occasionally be raised by pressure to demonstrate its condition. Under such circumstances it is the twenty pound pressure which the policy should record as approved.

All this, of course, is to show that an assured, under a steam boiler policy, should not feel himself aggrieved that some higher pressure is not recorded in his policy for a boiler which, he is confident may safely carry it, until he has learned the reason for the limitation. It will usually be found that there is a reason, and a sound one, too.

There seems to be still a strongly rooted feeling among engineers and engine owners that shaft-governed engines are free from fly-wheel accidents due to over speed. This notion is no doubt based on the supposition that since the governor is more nearly an integral part of the engine than the belt or gear driven pendulum type, it is unlikly to become deranged. Of course this is true as far as it goes. That is, a shaft governor is simple and positive. It is free from the menace of broken or displaced belts and it will shut down the engine in the event of many of the casualities which may occur to it. But shaft governors do go wrong in ways which permit the engine to race and as we have shown before the imprisoned weights may even cause a fly-wheel to disrupt if a break in the confining springs or linkage allows them to strike a heavy blow upon the inner surface of the wheel rim. Some engine builders have overcome this difficulty by placing the governor in a separate wheel or governor case, as they call it, which is attached to the crank shaft alongside the fly-wheel. This is unquestionably a step forward and yet the wreck illustrated on another page was on just this very type of engine.

The moral of all this is, that *all* engine wheels should have insurance protection. We do not for a moment desire to be construed as discrediting the value or desirability of stops and governors. Provide them by all means, get the best the market affords and keep them in first class order by utilizing to the fullest the expert knowledge available through an insurance company's inspection service. But do not lose sight of the *insurance* value of a fly-wheel policy for just these "impossible cases" and do not think that a special providence. surrounds your particular engine with a sort of mysterious halo of safety.

Joseph R. Ensign was elected a director of the Hartford Steam Boiler Inspection and Insurance Company at a meeting of the board of directors held Friday, June 27, 1913, to fill the place made vacant by the death last December of George Burnham of Philadelphia. Mr. Ensign is a resident of Simsbury, Ct., and is the vice-president of the Ensign-Bickford Company of that place, manufacturers of safety blasting fuses.

Mr. Ensign was graduated from Yale University with the class of 1889 and received the degree of M.A, from that institution in 1891. In addition to his connection with the Ensign-Bickford Co., he is a director of The Arlington Company, Arlington, N. J., The Tariffville Lace Company, Tariffville, Ct., The Standard Fire Insurance Co., Hartford, Ct., and is a trustee of the Hartford Seminary Foundation. He represented the town of Simsbury in the legislative session of 1910-1911.

Boiler Explosions.

JANUARY, 1913 (concluded from the April LOCOMOTIVE).

(29.) — A tube ruptured January 10, in a water tube boiler at the plant of the Inland Steel Co., Indian Harbor, Ind.

(30.) — On January 10, four sections of a cast iron sectional heating boiler ruptured at the plant of the Hunt Spiller Mfg. Corporation, South Boston, Mass.

(31.) — Several tubes failed on a locomotive attached to Bessemer and Lake Erie passenger train No. 21, at East Pittsburg, Pa., on January 10. Two men were slightly injured.

(32.) — A saw mill boiler exploded January 10, near Brinkhaven, O. One man was fatally injured, and several others less seriously injured.

(33.) — A header connecting two boilers burst January 10, at the Atlas Distillery, Peoria, Ill. No great damage was done.

(34.) — A tube ruptured January 11, in a water tube boiler at the plant of the Dixie Portland Cement Co., Richard City, Tenn. One man was injured.

(35.) — On January 11, a tube failed, and four cast iron headers ruptured in a water tube boiler at the plant of the Grasselli Chemical Co., Grasselli, Ind.

(36.) — On January 11, a tube ruptured in a water tube boiler at the plant of the John B. Stetson Co., Philadelphia, Pa.

(37.) — A greenhouse boiler exploded January 11, at the North Side Greenhouse, Minneapolis, Minn. Julius Rieck, the fireman, was pitched from his cot into a cellar, as the result of the accident, but he fortunately escaped with but slight injury.

(38.) — A tube ruptured January 12, in a water tube boiler at the Brand Brewery of the United States Brewing Co., Chicago, Ill. H. Buesing, fireman's helper, was killed.

(39.) — On January 13, a boiler exploded at the plant of the McMillan Lumber Co., Pine Barren, Fla. One man was killed, one injured, and the plant badly wrecked.

(40.) — On January 14, a boiler ruptured at the Buckeye Clay Pot Co.'s plant, Toledo, O.

(41.) — A fuel economizer exploded January 14, with great violence, at the Glenlyon Dye Works, Saylesville, R. I. Two men were killed, seven or eight injured, and property was damaged to the extent of about $26,000.

(42.) — A heating boiler burst in a school at Vidalia, La., on January 14.

(43.) — A heating boiler exploded January 15, in the basement of Joseph Harper's dry goods store, in the Bronx, New York City. One person was slightly injured.

(44.) — A cylinder head was blown from the main engine at the Farrel Foundry and Machine Co.'s plant, Waterbury, Ct., on January 15. Two men were severely scalded and bruised.

(45.) — A boiler exploded January 16, in a saw mill at a lumber camp a few miles from Booneville, Miss. One man was killed, and four others injured.

(46.) — On January 17, a water tube boiler failed at the University of Wooster, Wooster, O.

(47.) — Two boilers exploded January 17, at the north shaft of the Home-Riverside Mine, Leavenworth, Kans.; 150 miners were isolated in the mine for four hours, until spare boilers could be put in operation, and the hoists set working again.

(48.) — A tube ruptured January 18, in a water tube boiler at the plant of the American Water Works and Guarantee Co., Connelsville, Pa. One man was injured.

(49.) — A tube ruptured January 18, in a water tube boiler at the plant of the Miller Lock Co., Philadelphia, Pa.

(50.) — A water back in a range exploded January 18, in the home of Mr. J. A. Gray, Fort Collins, Kans. Mr. Gray was painfully injured by the explosion, which is said to have been due to the freezing of the pipe connections.

(51.) — Two men were killed and several injured, by the explosion, January 20, of a fuel economizer, at the Arragon Mills, Arragon, Ga. The property loss was estimated at $10,000.

(52.) — Two boilers exploded January 20, at the mill of the Howland Pulp and Paper Co., Howland, Me. Two men were killed and three injured, while the property loss was in the neighborhood of $18,000.

(53.) — A tube burst January 21, in a water tube boiler at the silk mill of A. G. Turner, Willimantic, Ct. The boiler was seriously injured through overheating, as the fire could not be hauled after the accident.

(54.) — A tube failed January 23, in a water tube boiler at the Lower Union Mills of the Carnegie Steel Co., Pittsburg, Pa. One man was injured.

(55.) — An air receiver exploded in the Pennsylvania R. R. yards at Youngswood, Pa., on January 24. A cap, blown from the receiver, broke a steam main, with the result that two men were seriously scalded, one of them probably fatally.

(56.) — A boiler exploded January 24, at an oil pumping station, near Bradford, Pa. One man was fatally injured.

(57.) — A tube ruptured January 25, in a water tube boiler at the plant of the American Steel and Wire Co., Waukegan, Ill.

(58.) — On January 28, a tube ruptured in a water tube boiler at the mill of the Lehigh Portland Cement Co., Mitchell, Ind.

(59.) — A boiler exploded January 29, at the Cleveland, O., plant of the Upson Bolt and Nut Co., injuring four men.

(60.) — A tube ruptured January 31, at the plant of the Allen and Wheeler Co., Troy, N. Y. William Lawade, engineer, and H. McAlpine. fireman, were injured.

(61.) — On January 31, a tube ruptured in a water tube boiler at the Glen Allan Oil Mills, Glen Allan, Miss.

FEBRUARY, 1913.

(62.) — On February 1st, a blow-off failed at the saw mill of T. A. Foley, Paris, Ill. C. O. Willison, the assistant engineer, was scalded.

(63.) — A boiler ruptured February 3, at the cotton mill of the Aiken Mfg. Co., Bath, S. C. The damage was confined to the boiler.

(64.) — A boiler ruptured February 4, at the plant of the Albert Hansen Lumber Co., Garden City, La.

(65.) — Twelve sections in a cast-iron heating boiler ruptured February 4, at the Elizabeth School, Worcester, Mass.

(66.) — On February 5, three sections fractured in a cast-iron heating boiler at the Lincoln and Maple Ave. School, District 95, Cook County, at Brookfield, Ill.

(67.) — On February 5, a cast-iron sectional heater failed at the warehouse of the Pittsburgh Plate Glass Co., Boston, Mass.

(68.) — A tube ruptured February 6, in a water tube boiler at the Congress Hotel, Chicago, Ill.

(69.) — On February 6, a blow-off failed at the plant of the Fort Henry Mining Co., Buhl, Minn.

(70.) — A boiler exploded at the saw mill of T. R. Ritchey, near Rusk, Tex., on February 6. Two men were killed and five others injured, while considerable damage was done to the mill property.

(71.) — A tube ruptured February 7, in a water tube boiler at the plant of the Scoville Mfg. Co., Waterbury, Conn. Joseph Paul, fireman. was injured.

(72.) — A tube rupured February 7, in a water tube boiler at the plant of the New Orleans Railway and Light Co., New Orleans, La.

(73.) — On February 8, a section cracked in a cast iron sectional heater at the Central Hotel, H. B. Dougherty, prop., Maysville, Ky.

(74.) — A blow-off pipe failed on February 9, at the plant of the West Virginia Pulp and Paper Co., Williamsburg, Pa. Considerable damage was done to the boiler.

(75.) — A heating boiler exploded February 10, at an apartment house located at 2117 Guilford Ave., Baltimore, Md. The building was badly wrecked both by the explosion, and the fire that followed. No one was injured, though several had rather narrow escapes.

(76.) — A fuel economizer exploded February 10, at the mill of the Jackson Fibre Co., Bemis, Tenn. Two were killed, and five or six others injured. The property loss was estimated at $25,000.

(77.) — On February 11, five cast-iron headers ruptured in a water tube boiler at the plant of the Ehret Magnesia Covering Co., Fort Kennedy, Pa.

(78.) — A boiler ruptured February 12, at the stone mill of W. McMillan and Son, Bedford, Ind.

(79.) — A tube ruptured February 12, in a water tube boiler at the plant of the Columbia Railway Gas and Electric Co., Columbia, S. C.

(80.) — A boiler exploded February 12, at the Star Mills, Eau Claire, Wis. Owing to the fact that the boiler was carrying but a low pressure at the time, the damage was slight.

(81.) — A boiler exploded February 12, at the mill of the Menominee White Cedar Co., Menominee, Mich. The property damage was estimated at $500, but the engineer and watchman were both badly scalded.

(82.) —A boiler ruptured February 13, at Wharf No 2. of the Maine Central R. R. Co., Portland, Me. The damage was confined to the boiler.

(83.) — On February 13, a tube ruptured in a water tube boiler at the plant of the Allegheny County Light Co., 13th St.. Pittsburgh, Pa. Marion Dilacombo and John Farr, ash wheelers, were injured.

(84.) — On February 13, the blow-off pipe attached to the No 5 boiler failed at the Protestant Episcopal Hospital, Philadelphia, Pa.

(85.) — A section in a cast iron sectional heating boiler failed February 12, in the basement of the Trinity Reformed Church, West New York, N. J.

(86.) —A boiler ruptured at the power house of the Edison Works, East Orange, N. J., on February 13.

(87.) — On February 14, the blow-off pipe attached to the No. 4 boiler failed at the Protestant Episcopal Hospital, Philadelphia, Pa. (This accident is distinct from No. 84, which took place to the blow-off of the No. 5 boiler the day before.)

(88.) — On February 14, eight sections of a cast-iron sectional heating boiler failed in the business block of the Snow Association, 105-107 Federal St., Boston, Mass.

(89.) — A boiler ruptured February 15, at the Sargent Coal Co., Newburg, Ind.

(90.) — A tube ruptured February 15, in a water tube boiler at the plant of the Studebaker Corporation, Carriage Works, South Bend, Ind.

(91.) — A boiler exploded with considerable violence on February 15, at the saw mill of C. R. Cummings, Wallisville, Tex. Four men were killed, five others seriously injured, and the property loss was estimated at $10,000.

(92.) — A tube ruptured February 16 in a water tube boiler at the plant of the Crescent City Stock Yard and Slaughter House Co., New Orleans, La.

(93.) — A boiler exploded February 17, at the saw mill of James Nevill & Son, Gaithersville, Ark. The plant was destroyed, but no one was injured, as the accident occurred just after the help had left for the night.

(94.) — On February 17, the boiler of a Delaware and Hudson locomotive exploded in the railroad yards at Mechanicsville, N. Y. Two men were badly injured, and the boiler was projected about 200 feet.

(95.) — A tube ruptured February 17, in a water tube boiler at the power house of the New Orleans Railway and Light Co,, New Orleans, La.

(96.) — On February 19, a boiler ruptured at the plant of the Milwaukee Western Malt Co., Milwaukee, Wis.

(97.) — The crown sheet of a locomotive type boiler collapsed February 19, at the plant of the Bridge Pasteurized Milk Co., Wichita, Kan.

(98.) — A section ruptured February 19, in a cast iron sectional heater at the Cleveland School, Special School District of Camden, Camden, Ark.

(99.) — A boiler exploded February 19 at the plant of the Carnick Junk Co., Oil City, Pa. The boiler, which was an old one, had been undergoing repairs, and was being tested under steam at the time of the accident. One man, Samuel Blythe, was on top of the boilers making repairs to a steam valve (according to press accounts) and was very seriously, and perhaps fatally injured. He was projected about 75 feet, receiving many broken bones, beside severe scalds and burns.

(100.) — On February 19, a heater exploded in the apartment house belonging to Annie Shaffer, Holyoke, Mass. One of the tenants in the building has brought suit for $1,000 for damage resulting from the explosion.

(101.) — An extracting machine exploded February 19 at the Park Woolen Mills, Chattanooga, Tenn. One man was killed and two others injured as a result of the accident, which was said to have been due to an over pressure of steam.

(102.) — On February 21, a boiler ruptured at the plant of the Jupiter Coal Co., Denver, Col.

(103.) — A boiler used for pumping out oil wells exploded February 21, at the wells of the South Penn Oil Company, near Unity, Pa. One man was seriously injured.

(104.) — A tube ruptured February 22 in a water tube boiler at the mill of the Piermont Paper Co., Piermont, N. Y. Steve Pauko and Brome Barfiero, firemen, were injured, while considerable damage was done to the boiler.

(105.) — On February 22, a tube ruptured in a water tube boiler at the blast furnace of the Pickand Mather Co., Toledo, O.

(106.) — On February 24, a boiler ruptured at the Brush Light and Power Co.'s power house, Brush, Col.

(107.) — A boiler ruptured at the mines of the Munro Iron Mining Co., Iron River, Mich., on February 25. The damage was small.

(108.) — On February 25, a tube collapsed in a vertical tubular boiler at the plant of the Pittsburgh Plate Glass Co., Crystal City, Mo. Three men were injured.

(109.) — A boiler, the property of the Henry C. Clark estate, coal dealers, ruptured February 25, at Providence, R. I.

(110.) — A tube ruptured February 28 in a water tube boiler at the plant of the Mahoning and Shenango Ry. and Light Co., Youngstown, O. Mike Murphy, water tender, was injured.

(111.) — A hot water boiler burst February 29, in the workshop of Nathan Somers, hat manufacturer, Philadelphia, Pa. One man was injured, and some damage resulted to the building.

MARCH, 1913.

(112.) — A tube ruptured March 1, in a water tube boiler at the Waukegan, Ill., plant of the American Steel and Wire Co.

(113.) — On March 1, a tube ruptured in a water tube boiler at the plant of the Northern Texas Traction Co., Handley, Texas.

(114.) — A boiler ruptured March 2, at the wood alcohol plant of Riefler and Sons, Honesdale, Pa. S. Kisner, fireman, was injured, and the boiler was considerably damaged.

(115.) — On March 3, a boiler ruptured at the plant of the Western Cartridge Co., Alton, Ill.

(116.) — A tube ruptured March 3, in a water tube boiler at the plant of the Atlantic Ice and Coal Corp., Chattanooga, Tenn. Jesse Thomas, fireman, was injured.

(117.) — A boiler exploded March 3, in the cellar of the store occupied by the Robert Schmitt Co., Nyack, N. Y.

(118.) — A boiler exploded March 3, at the Moore saw mill, Gladewater, Tex. Two men were killed and three others were injured, probably fatally. The mill was badly wrecked.

(119.) — The boiler of a Pennsylvania R. R. locomotive, drawing a special train loaded with troops on the way to the presidential inauguration, exploded March 3, at East Rahway, N. J. The engineer was killed and the fireman so severely injured that his recovery was considered doubtful. The engine was a complete wreck.

(120.) — A cast iron header ruptured March 4, in a water tube boiler at the plant of the Voight Milling Co., Grand Rapids Mich.

(121.) — A boiler exploded March 4, in the plant of the Milwaukee Lithographing Co., Milwaukee, Wis. The damage was estimated at $3,500.

(122.) — Charles Denton, a 14-year-old boy, was severely scalded March 4, at Old Alton, Tex., by the explosion of a toy boiler which he had made. The small boiler is said not to have had any safety valve.

(123.) — A boiler exploded on March 4, in the greenhouse of J. S. Polland, Cedar Rapids, Ia. The damage was largely confined to the boiler and chimney.

(124.) — A blow-off pipe failed March 5, at the Omaha General Hospital, Omaha, Neb.

(125.) — On March 5, a tube ruptured in a water tube boiler at the plant of the Nichols Copper Co., Laurel Hill, L. I., N. Y. Paul Smegel, fireman, was injured.

(126.) — On March 5, a tube failed in a water tube boiler at the Helmbacher Forge and Rolling Mill Plant of the American Car and Foundry Co., St. Louis, Mo. Three men were injured.

(127.) — Ten cast iron headers ruptured March 6, in a water tube boiler at the plant of the El Dorado Light and Water Co., El Dorado, Ark. The boiler was seriously damaged.

(128.) — On March 6, a tube ruptured in a water tube boiler at the Isabella Furnace of the Carnegie Steel Co., Etna Boro, Pa.

(129.) — A boiler exploded March 6, at the plant of the Solvay Process Co., East Syracuse, N. Y. The explosion caused the destruction of a large caustic conveyor, and much damage was done by the caustic liberated.

(130.) — A water front in a kitchen range exploded March 7, at the home of William H. Gallagher, New Britain, Conn. The range was wrecked, and slight damage resulted to the house furnishings.

(131.) — A boiler using the waste heat from a steel furnace exploded March 7, at the Wilkes Rolling Mill, Sharon, Pa. Thirteen men were injured, three of them fatally.

(132.) — A tube ruptured March 8, in a water tube boiler at the plant of The J. S. Brill Co., car builders, Philadelphia, Pa. One man was injured.

(133.) — On March 10, an accident occurred to the boiler of a locomotive at the plant of the Fordyce Lumber Co., Fordyce, Ark.

(134.) — A boiler ruptured March 12 at the plant of the Princess Furnace Co., Glen Wilton, Va.

(135.) — A tube ruptured March 13, in a water tube boiler at the plant of the American Sheet and Tin Plate Co., Cambridge, O.

(136.) — On March 15, a tube ruptured in a water tube boiler at the Colorado Springs Light, Heat and Power Co. plant of the United Gas and Electric Corp., Colorado Springs, Col.

(137.) — A tube ruptured March 16 in a water tube boiler at the plant of the Plainville Mill and Elevator Co., Plainville, Kan.

(138.) — On March 16, a cast iron heating boiler ruptured at the Imperial Hotel, Atlanta, Ga.

(139.) — A cast iron sectional heater failed March 16, in the Price building, Florence, Neb.

(140.) — A blow-off pipe failed March 18, at the Hotel Montrose, operated by the Cedar Rapids Hotel Co., Cedar Rapids, Ia.

(141.) — On March 18, a cast iron sectional heater failed at the apartment house of Samuel Harris. 113-115 Leonard St., New York City.

(142.) — On March 20, a cast iron cross box failed in a water tube boiler at the plant of the Standard Roller Bearing Co., Philadelphia, Pa.

(143.) — The crown sheet of a boiler at the plant of the American Equipment Co., near Lebanon, Pa., failed March 21. One man was painfully burned, and the plant was shut down pending repairs.

(144.) — A boiler used for heating the Christian Church, Normal, Ill., failed March 22. The damage was slight.

(145.) — Two cast iron headers ruptured March 24, in a water tube boiler at the Friedman Mfg. Co. plant of Armour & Co., Union Stock Yards, Chicago, Ill.

(146.) — On March 24 a tube failed in a water tube boiler at the plant of the Ashaway Line and Twine Co., Ashaway, R. I.

(147.) — A boiler ruptured March 24, at the plant of the Worcester Salt Co., Ecorse, Mich. The boiler was badly damaged.

(148.) — A tube ruptured March 25, in a water tube boiler at the plant of the Tonawanda Board and Paper Co., Tonawanda, N. Y.

(149.) — On March 27, two sections of a cast iron heating boiler failed at the Irving School, Salt Lake City, Utah.

(150.) — A blow off failed March 27, at the plant of the Yolande Coal and Coke Co., Yolande, Ala. One man was scalded.

(151.) — A boiler ruptured March 29, at the Vinita Electric Light, Ice and Power Co. plant of the Middle West Utilities Co., Vinita, Okla.

(152.) — A locomotive boiler exploded on the Texas and Pacific R. R., between Fort Worth and Handley, Tex., on March 29. One man was killed and two others were seriously injured.

(153.) — A boiler burst March 31 at the plant of the Dominion Cloak Co., Toronto, Can.

APRIL, 1913.

(154.) — On April 1, a blow-off pipe failed at the laundry of Tiffany Bros., Aberdeen, S. D.

(155.) — The boiler of a Chicago, Milwaukee and St. Paul locomotive exploded April 1, near Franksville, Wis. Three men, the engineer, fireman and a tramp, were injured, the tramp fatally.

(156.) — A tube ruptured April 2, in a water tube boiler at the plant of the Crescent Portland Cement Co., Wampenn, Pa. Three men were injured, but the property damage was small.

(157.) — On April 5, a blow-off pipe failed at the plant of the Spring Perch Co., Bridgeport, Conn.

(158.) — On April 7, a tee in a steam pipe line failed at the plant of the Florsheim Shoe Co., Chicago, Ill. Ben Franklin, fireman, was injured.

(159.) — A tube ruptured April 8, in a water tube boiler at the plant of the Duquesne Light Co., Pittsburgh, Pa. Martin Flaherty, fireman, was injured.

(160.) — Two cast iron headers ruptured April 9, in a water tube boiler at the plant of the Alpha Portland Cement Co., Martins Creek, Pa.

(161.) — An ammonia boiler exploded April 10, at one of the plants of the Moore Ice Works, Pensacola, Fla. Four men were killed and the plant was demolished.

(162.) — A number of tubes failed April 11, in a water tube boiler at the plant of the Crescent City Stock Yards and Slaughter House Co., New Orleans, La.

(163.) — A kitchen boiler burst April 13, in the home of Frank W. Huff, Philadelphia, Pa. The accident is attributed to starting a fire in the range when the water supply to and from the boiler had been shut off. The cook was so badly injured that she was not expected to live.

(164.) — On April 13, a boiler ruptured at the plant of the Lovegren Lumber Co., Cherry Grove Ore.

(165.) — A boiler exploded April 13 on the property of the Barnsdall Oil Co., near Bartelsville, Okla. The boiler was attached to a well drilling outfit, and was completely demolished. One man was painfully, but not seriously injured.

(166.) — A boiler ruptured April 14 at the brewery of C. F. Bach, Sebewaing, Mich.

(167.) — On April 14, a boiler ruptured at the plant of the Indianapolis Abattoir Co., Indianapolis, Ind.

(168.) — A tube ruptured April 15, in a water tube boiler at the power house of the Terre Haute and Eastern Traction Co., Indianapolis, Ind.

(169.) — A blow-off cock failed April 16, at the plant of the Border City Ice and Cold Storage Co., Fort Smith, Ark.

(170.) — On April 17, a blow-off pipe failed at the power house of the Lake Erie and Western Railway Co., Lima, O. One man was scalded.

(171.) — On April 17, two men were trapped and severely scalded by the failure of a steam pipe in a manhole where they were working, at the plant of the New York and Philadelphia Package Co., Paulsboro, N. J.

(172.) — A man was seriously scalded April 17, by the bursting of a steam pipe in the boiler room of the American Ice Co., Philadelphia, Pa.

(173.) — On April 19, a tube failed in a water tube boiler at the Washington Hotel and Improvement Co.'s building, Seattle, Wash.

(174.) — A boiler exploded April 19 which was used for oil well drilling near Venice, Pa. Two young boys were killed, and two men seriously but not fatally injured.

(175.) — A boiler used for irrigation pumping near Selma, Cal., exploded April 19. Frank Rouch, the owner of the outfit, was instantly killed and his son was very seriously injured. The boiler was an old one which had formerly seen service on a traction engine.

(176.) — A steam boiler exploded April 21, on an oil lease at Tuna, Pa. One man was seriously injured.

(177.) — On April 22, a boiler exploded at the Thompson brickyard, Mount Pleasant, Mich. Four persons, one of them a nine-year-old girl, received injuries from which they died, while several others were more or less severely injured. The property damage was considerable.

(178.) — A tube ruptured April 22 in a water tube boiler at the plant of the Charleston Consolidated Railway, Light and Power Co., Charleston, S. C.

(179.) — A boiler exploded April 23, at the saw mill of A. E. Frankford, Columbia, Pa. Mr. Frankford and Henry Stotz were seriously injured, and the property loss was estimated as in the neighborhood of $1,000.

(180.) — A boiler rupured April 26, at the Monroe Mine of the Oliver Iron Mining Co., Hibbing, Mich.

(181.) — On April 28, a tube ruptured in a water tube boiler at the Trenton plant of the American Bridge Co., Trenton, N. J.

(182.) — On April 28. a cast iron sectional heating boiler failed at the Imperial Hotel, Atlanta, Ga.

(183.) — On April 30, a section in cast iron heater No. 1 ruptured at the Sixth Street School, Louisville, Ky.

(184.) — On April 30, a section in No. 2 cast iron heating boiler ruptured at the Sixth Street School, Louisville, Ky. (Two separate accidents on the same day.)

(185.) — A boiler exploded April 30, at the saw mill of George Rowsey, near Danville, Ky. The plant was completely wrecked, and two men were seriously injured.

THE HARTFORD STEAM BOILER INSPECTION AND INSURANCE COMPANY is now issuing to its policy-holders its "Vacation Schedule" for 1913. Like those of previous years, this schedule affords a most convenient form for arranging and recording the holiday period allotted to each of the clerks or other employees of an institution. From it at a glance may be determined how many and what members of the force will be absent on any given date and thus by a little foresight and care the assignment of the same days to those whose simultaneous absence would cause inconvenience may be avoided.

Copies may be obtained by our policy-holders on application to the nearest of the offices listed on the last page of this issue.

The Hartford Steam Boiler Inspection and Insurance Company.

ABSTRACT OF STATEMENT, JANUARY 1, 1913.

Capital Stock, . . . $1,000,000.00.

ASSETS.

Cash on hand and in course of transmission,		$186,187.28
Premiums in course of collection,		285,163.53
Real estate,		90,600.00
Loaned on bond and mortgage,		1,193,285.00
Stocks and bonds, market value,		3,506,178.40
Interest accrued,		75,600.51
Total Assets,		$5,337,014.72

LIABILITIES.

Premium Reserve,		$2,211,732.44
Losses unadjusted,		94,913.83
Commissions and brokerage,		57,032.71
Other liabilities (taxes accrued, etc.),		47,740.86
Capital Stock,	$1,000,000.00	
Surplus over all liabilities,	1,925,594.88	
Surplus as regards Policy-holders,	**$2,925,594.88**	2,925,594.88
Total Liabilities,		$5,337,014.72

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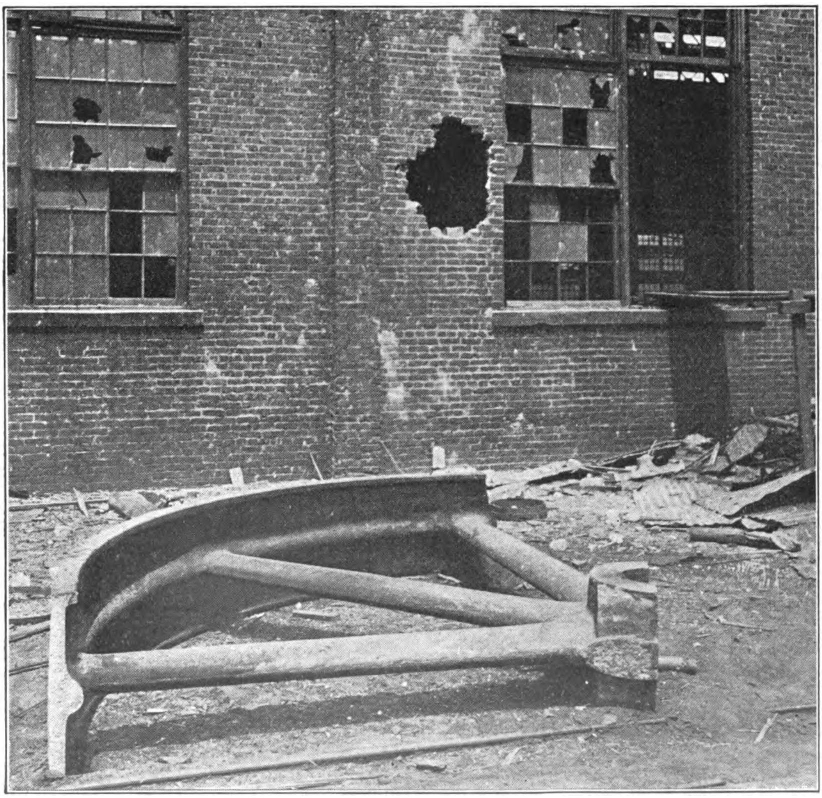
The Locomotive
of
THE HARTFORD STEAM BOILER INSPECTION AND INSURANCE CO.

Vol. XXIX. HARTFORD, CONN., OCTOBER, 1913. No. 8.



An Unusual Fly-Wheel Break. Birmingham, Alabama.

Fly-Wheel Explosion at Birmingham, Alabama.

A large fly-wheel burst Aug. 20 at the plant of the Payne and Joubert Machine and Foundry Co., Birmingham, Ala. The wheel, which was 15 feet in diameter, with a 26 inch face was of the split type, cast in two sections. It was joined at the rim by bolted flanges, and by the usual bolted construction at the hub. There were eight arms. The wheel served to transmit the load from an 18x36 inch Corliss engine to a generator, by means of a 24 inch belt. The speed was controlled by a fly ball governor of usual type, with a link type safety knock out, arranged for automatic operation in the event of governor belt breakage. The normal speed was 75 R. P. M.

We are told that a considerable peak load on the generator caused the circuit breaker to operate, relieving the engine very suddenly. The subsequent racing was noticed by the fireman and he called to the engineer who had stepped out of the engine room. The engineer, realizing what had happened, ran for the throttle, but only succeeded in getting in the path of one of the larger fragments of the wheel. He was instantly killed.

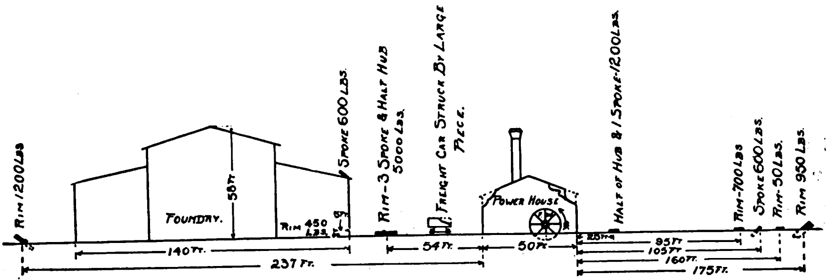


FIG. I. SHOWING THE COURSE OF THE FRAGMENTS.

Portions of the wheel were thrown both in front and to the rear of the engine, as is shown in detail in our sketch, Fig. 1. The roof and walls of the engine room were badly wrecked, though the roof had been repaired when the photograph Fig. 2 was taken. One large piece passed completely through a gondola car that was standing on a siding alongside the engine room, as our sketch shows.

Perhaps the most unusual feature of this wreck is shown on the front cover. One large portion of the wheel composed of a section of the rim, three spokes and half the hub is seen to have remained intact. It is very unusual for a hub to leave the shaft in wrecks of this kind, indeed this is the first instance of such behavior which has come to the writer's attention.

The following explanation for this curious behavior has been suggested, and we believe that it is the most plausible view so far advanced. Let us suppose that the rim flanges were the weakest elements in the wheel's construction, and this is in line with the results obtained when wheels of this type have been speeded to destruction experimentally. Their failure might result in portions of rim adjacent to the flanges, with perhaps a spoke or so, leaving the wheel. If this should happen without wrecking those parts of the rim between two or three spokes, as in this instance, the whole stress due to the centrifugal force of the remaining material, would be transferred from the rim, which had carried it

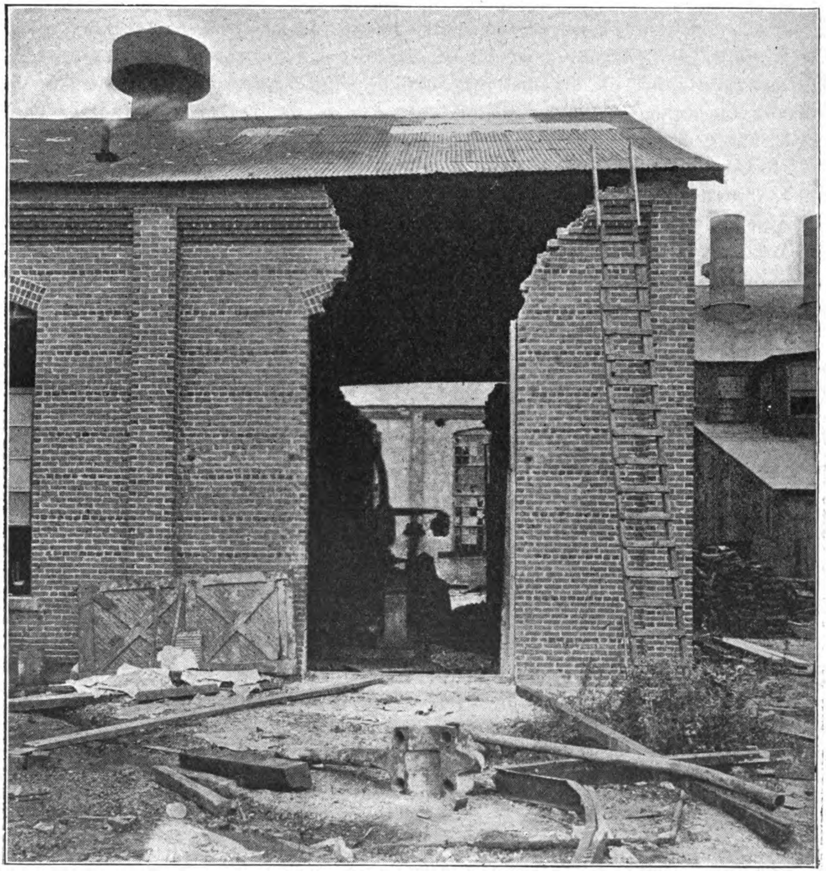


FIG. 2. THE WRECKED ENGINE ROOM.

like a stretched hoop so long as it was unbroken, to the hub bolts. This would have the effect of stressing these bolts far in excess of their ordinary working load, and they might be expected to fail in tension, as these particular bolts evidently did, permitting the fragment of the rim with its attached spokes and half hub to be projected as a unit. Of course, it is difficult to see why the failure of the rim flanges did not wreck the entire rim, shearing the spokes and leaving the hub in place on the shaft, which is the ordinary mode of failure, but to this we can only offer the photographic evidence that in the present instance this did not happen. Perhaps some of our readers can suggest a more reasonable explanation.

Autogenous Welds for Boiler Work.

We are constantly requested to approve boiler repairs of various forms that have been accomplished by means of autogenous welding of the parts, and while we feel that there are many kinds of repair to which this process is admirably adapted, we have consistently refused to approve such repairs where the strength of the repaired part is of vital necessity to the safety of the boiler. We are not alone in our distrust of this method of joining metals for the purpose of boiler repairs or manufacture under the present condition of the art of autogenous welding.

Professor Theodore Kautny of Nürnberg, who is considered one of the leading authorities of the world on this subject, is using his influence to prevent the autogenous welding of boiler shells until some reliable method can be devised for ascertaining the probable strength of a weld without destroying it. We also understand that the United States Government does not approve of acetylene welding for boiler repairs where the parts welded are subjected to tensile strain.

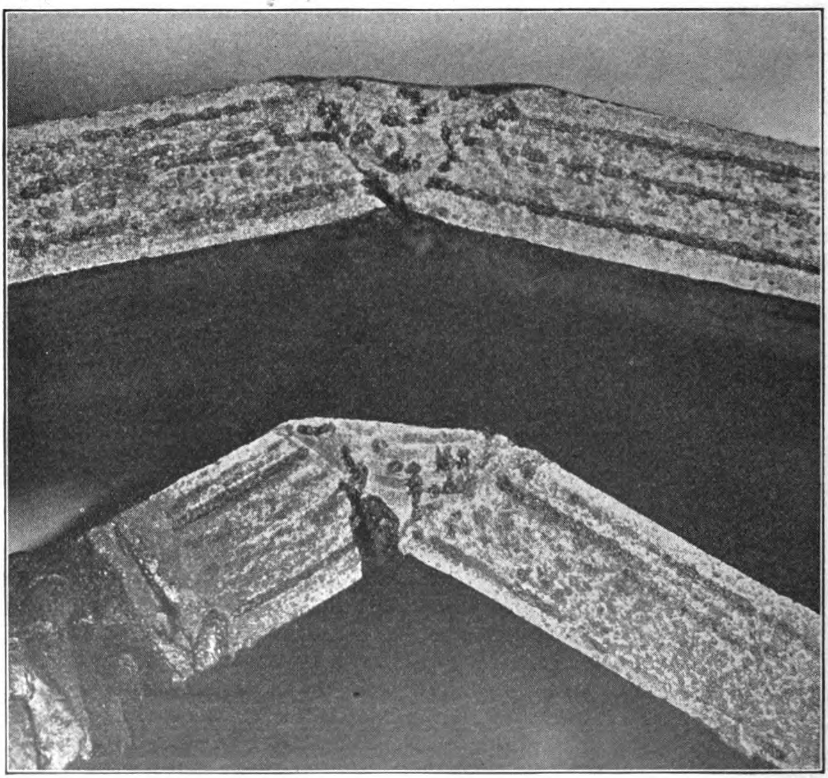


FIG. 1. (Upper.) ETCHED SECTION OF LONGITUDINAL SEAM.
FIG 2. (Lower). ETCHED SECTION OF WELD BETWEEN HEAD AND SHELL.

One of the most important companies doing general autogenous welding in this country advocates the licensing of equipment, operator and company where engaged in boiler repairing, to the end that greater skill may be brought to bear in making such repairs. There are so many conditions surrounding the making of a safe weld by this process that it hardly seems possible that all the improper ones can be guarded against except possibly in a few cases presenting difficulties of a fixed nature. In the oxy-acetylene process it is first necessary to obtain the right mixture of gas. If too much oxygen is present, the material is oxidized and the weld is left brittle and weak. Impurities in the oxygen used may also have a bad effect on the strength of the weld. If storage tanks are used as a means of supplying acetylene and the draught of gas from these tanks is too rapid, some of the absorbent liquid may be drawn through the connections to the burner and produce defects. A flame too rich in acetylene may also cause injury to the steel. The expansion of the parts adjacent to the weld, due to the heat necessary to make it, may leave tremendous internal stresses in the plate or other part that is welded which cannot even be estimated. This is such a variable factor that only the nicest judgment could be of any value in determining whether a given repair may be made with safety or not.

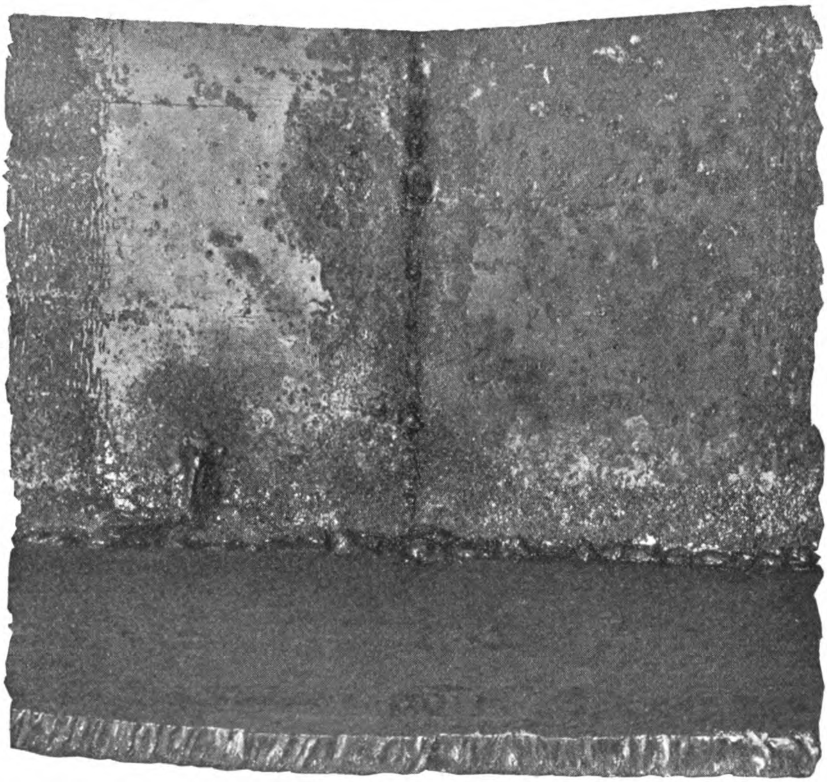


FIG. 3. WELDING OF HEAD TO SHELL. NOTE THE ROUGH CHARACTER OF THE WORK.

In a few instances, we have sanctioned the autogenous repair of cast iron sectional boilers used for very low pressures where the nature of the structure surrounding the defective part would seem to indicate that no severe local strains might be set up in the act of welding. However, our experience with this kind of repair has been very discouraging, for while the welding has held in most cases, subsequent breaks have developed which were produced by shrinkage strains at the weld.

One of the worst specimens of autogenous welding that has come to our notice was through the failure of a receiver separator connected to a turbine. While this cannot be taken as a fair sample of welded work, still it shows how poorly such work can be done, and aside from the poor design of this vessel, there was nothing to definitely show that the welding was not what it should be. For while the welds were roughly made, this does not always indicate that the surfaces are not properly joined. This receiver had been formed entirely by means of the autogenous welding process, the longitudinal seam, head seams and nozzles all being welded. The general dimensions of the vessel were 30" in diameter by 5' long, with 3-8" shell and heads. The accident was due to the lower head of this receiver blowing out, the receiver operating in a vertical position, and after an examination of the parts the only wonder that it had ever remained together.

Figure 1 shows a section across the longitudinal seam which has been etched. By examining this section it will be seen that there is a line of holes at each side of the V representing the surfaces of the plate and there was very little sound metal bonded together along this seam. It will be seen from Figure 1 how poorly the contour of the cylinder was maintained at the joint, for by placing a rule on the cut, the shell will be seen to be perfectly straight, and while the cut only extends two inches across the seam, this flat space was five inches each side of the weld. With this misshapen seam and lack of bond between the parts, the only explanation that can be advanced to show why it held together at all (which it did for two years) is that the draft of steam was steady.

Figure 2 shows an etched cross section of the connection between the upper head and the shell of the receiver, the head being on the left-hand side of the figure. A close inspection of the weld at this point will show that there was almost no sound contact between the welding material and head at this point. It is evident from Figure 2 that the head was only dished and that no attempt was made to flange down the edges so as to bring the points of maximum bending stress away from the weld.

Figure 3 is a view of the inside of the separator showing a portion of the top head (at the bottom of the figure) and the longitudinal seam. Some idea of the roughness of the welding can be gained from this view but the parts themselves looked much worse than the cut shows.

Figure 4 shows a general view of the receiver with the top head lying towards the observer. On the ground at the left is seen the bottom head which was blown out. This head was dished outwards the same as the upper one, but when it failed, the force of the pressure forced it down over a pipe standard that supported it from the floor. The nozzle on the left-hand side of the receiver, which was stripped off by the explosion, was of 10" size. This nozzle was made up of a flange butt welded to a short section of 10" pipe and instead of flanging the opposite end of the pipe in order to attach it to the shell, a sheet steel collar was welded on, which in turn was welded to the shell of the receiver. The head and longitudinal seams on this vessel were bad, but the nozzle seams were worse. The welded on collars did not fit the contour of the shell, and numberless shims and many nails were used in filling the voids between the shell and collar on the nozzle. If Figure 4 is examined carefully, some of these shims may be seen around the opening on the left-hand side.

Such work as this is more likely than anything else to retard the progress of autogenous welding, which we believe has a real field of usefulness even in boiler work, but we are not yet ready to approve it for repairs where the safety of the boiler is directly affected.

Fig. 4. The Wrecked Separator.

Boiler Explosions in Great Britain.

We compile and publish as complete a list of boiler and fly-wheel accidents for the United States as possible, but the list is incomplete and to a certain extent in error because we are forced to take much of the information from the daily press, a source noted for its inaccuracy where technical matters are concerned. Furthermore, a great many minor accidents never reach the newspapers because they are not attended with personal injuries, and therefore have no especial "news" value unless the property loss is considerable. In marked contrast with this are the statistics gathered in Great Britain by the Board of Trade. Under the Boiler Explosions Acts of 1882 and 1890 every boiler casualty, no matter how trivial, even so small an occurrence as the leaking of a single rivet, becomes as much a case for official investigation as though accompanied by injury or death. The Board of Trade is required by this act to investigate fully every such accident and make a public finding as to its cause which must fix the responsibility for it. These inquiries extend not only to boiler accidents, but cover as well every type of steam containing apparatus, including piping. They include also all accidents occurring on ships of British registry. The effect of this act, is to reduce boiler accidents to a minimum, for all parties concerned, whether owners, operatives, manufacturers, designers, or those responsible for the inspection of the apparatus realize that the extent of their responsibility will be fixed without fear or favor.

The report of the Board of Trade for the year ending June 30, 1912, is at hand, and is particularly interesting in that it gives in addition to the statistics for the years 1911-1912, comparative figures for the thirty years during which the Act has been in force. Of these statistics we will reprint such of the summaries as seem to be of interest to our readers.

During the year ending June 30, 1912, there were 106 explosions. Of these 60 resulted in loss of life or personal injury. Thirty persons were killed, and 75 injured. The 30 deaths were caused by 14 explosions, 9 on land and 5 on ships. In 20 out of 27 explosions aboard ship no one was injured, while in the remaining 7 accidents 13 were killed and 4 injured. The number of deaths for the year is above the average for thirty years (26.3 per year), but this is largely due to two explosions in each of which six were killed. It is interesting to note that out of a total of ten accidents to heating apparatus, nine were caused by the freezing of pipes.

Classification of the Causes of Explosions, and the Types of Boilers which Exploded 1911-1912.

Causes.	No.
Deterioration and Corrosion	29
Defective Design, and Undue Pressure	17
Water Hammer Action	8
Defective Workmanship, Material, or Construction	16
Ignorance or neglect of attendants	24
Miscellaneous	12
Total	106

Types of Boilers.	No.
Horizontal Tubular	15
Vertical	7
Lancashire and Cornish	4
Locomotive	2
Water Tube	6
Tubes in Steam Ovens	10
Heating Apparatus	10
Steam Pipes, Stop Valve Chests, etc.	24
Hot Plates, etc.	4
Economizers	4
Calenders and Drying Cylinders	4
Steam Jacketed Pans	4
Rag Boilers, Kiers, Stills	4
Miscellaneous	8
Total	106

STATISTICS 1882-1912.

Year	No. of Explosions	Personal Injuries		
		Lives Lost	Injured	Total
1882-83	45	35	33	68
1883-84	41	18	62	80
1884-85	43	40	62	102
1885-86	57	33	79	112
1886-87	37	24	44	68
1887-88	61	31	52	83
1888-89	67	33	79	112
1889-90	77	21	76	97
1890-91	72	32	61	93
1891-92	88	23	82	105
1892-93	72	20	37	57
1893-94	104	24	54	78
1894-95	114	43	85	128
1895-96	79	25	48	73
1896-97	80	27	75	102
1897-98	84	37	46	83
1898-99	68	36	67	103
1899-00	59	24	65	89
1900-01	72	33	60	93
1901-02	68	30	55	85
1902-03	69	22	67	89
1903-04	60	19	45	64
1904-05	57	14	40	54
1905-06	54	25	21	46
1906-07	77	28	65	93
1907-08	73	23	50	73
1908-09	93	12	53	65
1909-10	103	14	62	76
1910-11	100	13	61	74
1911-12	106	30	75	105
Totals	2,180	789	1,761	2,550
Average of 30 years	72.7	26.3	58.7	.85

Extraordinary Damage to Pipes of a Superheater.

(Reprinted from Vulcan, published by the Vulcan Boiler and General Insurance Company Manchester, England.)

Many thousands of steam superheaters are in use, and in almost every case it is found that the pipes will work for long periods with a negligible amount of loss or depreciation in the material. In ordinary cases this is steel of the highest quality and degree of maleability which is not found to suffer appreciably by contact with steam at a less temperature than 1100 deg. Fah. As this temperature is far above those which occur in ordinary practice, risk of damage on this account is most exceptional. We have, however, met with a case in which tubes which were exposed to steam of extraordinarily high temperature on both sides were therefore converted into black or magnetic oxide of iron.

An experiment has been practiced for probably the greater part of a century in which steam is passed through an iron tube which is heated to redness, or, say, to a temperature of 1300 deg. Fah. Under these conditions the steam suffers decomposition, and this method is sometimes adopted for the production of hydrogen. When the iron is used in a fine state of division, as in filings, the chemical action is sufficiently rapid to cause combustion and increased temperature. For 100 parts of iron lost 138 parts of magnetic oxide are produced, the chemical symbol for which is Fe_3O_4.

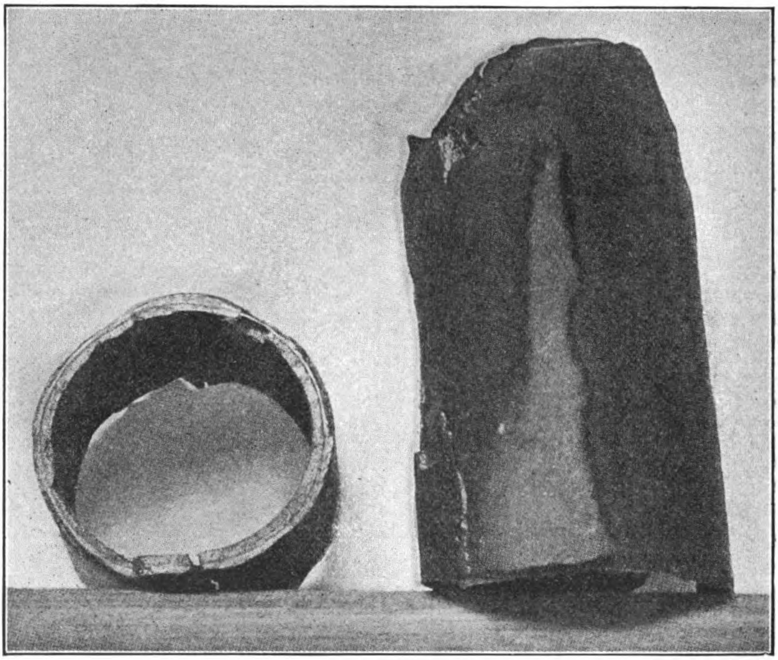


FIG. 1. FIG. 2.

In the case in question, the original thickness of the tubes was .080 in., equal to No. 14 standard gauge (B. W. G.) in a section shown in Fig. 1, the thickness of the remaining metal is .012 in. on one side and on the opposite side the metal has entirely disappeared. The thickness of the oxide is .047 on the outer side and .065 on the inner side. The total maximum thickness of the oxide and the residue of metal is .124 in., which it may be observed is considerably greater than the original thickness of the metal, the difference being due to the expansion of iron and steel in the process of oxidation. Therefore 80 to 100 per cent. of the metal has been converted into oxide, and 15 to 20 per cent. remains in its original condition. Fig. 2 shows the irregularity of the oxidized surface, probably due to the current of steam. Fig. 3 shows the black oxidized surface of the metal after the removal of the principal coating of oxide.

In the present case the boiler was heavily worked, and consequently the temperature in the downtake was high. (This refers of course to a Lancashire or Cornish boiler, where the gases pass *down* to the return flues. Editor.) Also only about one-third of the total amount of steam produced was passed through the superheater. By each of these conditions the temperature of the steam as delivered from the superheater would be increased, and in the combined result the temperature of the steam has been raised beyond the point of safety, as shown by the chemical change produced.

The case is a most instructive one, and imperatively shows that superheaters should not be made so large as to involve any risk of causing excessive temperature in the steam, which obviously is attended with grave danger in direct regard to superheater, pipes and engine; also indirectly in regard to the boiler.

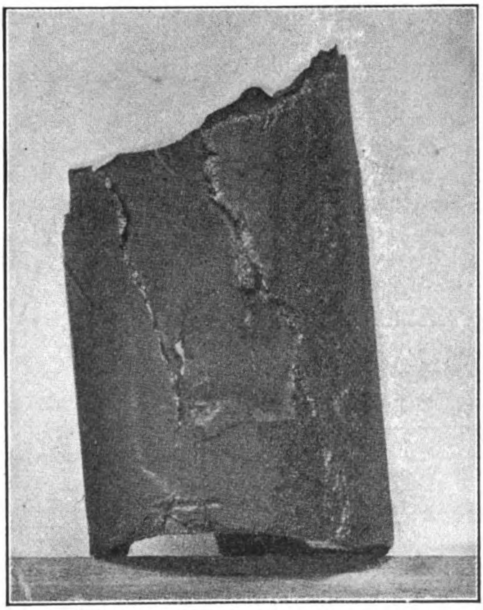


FIG. 3.

Special caution is also required in cases where only one portion of the steam is superheated. Danger is incurred when a large demand for saturated steam occurs simultaneously with a total absence of demand for superheated steam. It is also conceivable that the maximum degree of danger would arise when a large demand for saturated steam coincides with a relatively small but continuous call for superheated steam.

It may also be noted that in some cases superheaters are fitted with a by-pass arrangement, and that this arrangement will allow a portion of the steam supplied to the engine to be in the saturated condition and thereby reduce the amount of steam passing through the superheater. This by-pass arrangement may be operated so that the entire supply to the engine passes the by-pass valve and the superheater is left to soak in the full temperature of the downtake, by which the superheater may suffer damage beyond possibility of restoration. Therefore, whenever steam is shut off from the superheater, the whole apparatus should be lifted out of the downtake, and steam supplied by temporary means to suit the case.

A Tank Explosion in an Iowa Laundry, with the Story Which it Inspired.

On August 11, a return tank or receiver exploded at the Sanitary Laundry, Mason City, Ia. No one was injured, but there was some property damage, no details of which escaped the efficient local news sleuth.

The tank itself was a lightly constructed affair some 3 ft. in diameter by 6 ft. high, built we are told of 1-8 inch plate. It served to collect the hot water returned by the traps attached to the various laundry machines, and as a receptacle for the necessary make up feed of cold water. The feed pump suction was connected directly to it. An ample vent pipe, leading to the atmosphere was provided, but at the time of the accident it was closed by a stop cock, and it is probable that a by-passed or defective trap permitted the entrance of steam so that a dangerous over-pressure could accumulate.

We do not wish, however, to detract from the freshness of the local story which we reprint in full from The Mason City Daily Times. We confess that we are frequently at a loss to express ourselves when confronted with the necessity of "writing up" an explosion. We cannot command such a wealth of glowing expression as our western friend, although we suspect that that familiarity which is the proverbial breeder of contempt may have taken something of the keenness from the sharp edge of our imagination.

Condenser in Laundry Hits High Places.

N. C. KOTCHELL'S SANITARY LAUNDRY SHOOK TO FOUNDATIONS BY CONCUSSION.

BOILER TEARS THROUGH ROOF 500 FT. TO STRAYER HOUSE.

Residence on Fifth Street Damaged When Huge Missile Strikes Gables on Roof and Rebounds to Street Missing Every Person Near in Its Flight — All Glass in Windows Shattered — No one is Hurt.

The condenser apparatus of live steam returning from the machines on the floor of the Sanitary laundry blew up at 4 o'clock yesterday afternoon, wrecking the condenser room addition, twisting the deep well pump, breaking many windows, but not so much as scratching a person. The iron pellet shot straight from the roof 200 feet in the air. The condenser has a six foot receptacle three feet in diameter for the returning steam. It is claimed there is no stop cock valve to let off steam when the pressure increases. Evidently the cold water was shut from the condenser. No one is held liable for blame in the matter. The K. P. building suffered $25 damage, two bricks hurtling through an upper window, a gas pipe was flung northwest in exactly the opposite direction as the course of the flying condenser and landed near the Tiss Drug store. Men standing near spoke of the sheet of glass bursting from the windows like fine snow. Seven inch walls crumpled up. The story would be ordinary was there a death list. As it is, it is one of the most extraordinary chronicles in Mason City's history.

BY HAROLD CLARK.

A condenser in the boiler room addition of the Sanitary laundry, N. C.

Kotchell, proprietor, located on the southeast corner of State and Michigan, blew up at 4 o'clock yesterday afternoon, wrecking the compartment in which it stood, and shattering about every window in the entire building, with the exception of those facing Michigan avenue on the east wall of the laundry proper. The body of the exhaust steam condenser spouted up through the roof as if the latter were made of tissue paper, and soared a hundred feet in the air, much like a shot from a coast defense mortar battery, directing itself southeasterly and hitting the roof of the J. A. Strayer residence, corner of Fifth and Michigan, in the next block east.

The missile struck the west foot of the second gable, tearing away the cornice to the peak, then dropped to the front gable of the dwelling, leaving a deep imprint in the shingles; caromed to the porch, cutting a gash in its roof; bounded to the sidewalk, the rim cutting through and rolled finally from the curb across the street resting in front of the residence of Mrs. Nancy Graves, directly opposite the Strayer residence.

Mrs. Strayer at Home.

Mr. Strayer is a railroad conductor on the Milwaukee and was not home at the time. Mrs. Strayer, an invalid, was present in the house, as was Miss T. Anderson. Neither lady realized what had happened until they were appraised of the part their house had played in the freakish turn of events.

Fate had kept a tight grip on the reins, steering the hurtling bricks and flying débris free of any person in the radius of the accident, contriving by subtle means, as remarkable as the average person lives to experience, that not one life was snuffed out and not even a scratch or splintered human bone left its scar on the story to relate. The natural consequence would have been a morgue filled with maimed and bleeding bodies, a hospital pregnant with suffering and a new supply of crape. Mason City wears a horseshoe collar.

The damage will amount to little when compared with the force expended in the explosion, and probably $1000 will leave a margin around the edges.

Prior to the Explosion.

The laundry had settled down to the quiet part of the day. Few of the machines were working and not many of the girls were on the floor. The building faces the north. The front is made up of medium sized glass windows. The office takes up a space about twenty-five feet square in the northeast corner. The machine department runs past the office on the west, having a partial frontage on State street, and runs back clear to the boiler and condensing room additions. The partitions around the office and that connecting the boiler room, are filled with glass paned windows. Engineer William Edgington had been up ten minutes from the boiler apartment, reached by a short flight of steps, and had thrown some coal under the 100-h. p. boiler and attempted to connect the belt on the deep well pump which supplies the laundry with water. Foreman Nels Hansen was walking toward the door leading down into the boiler room, and was within a step of it. Everything appeared running in the usual routine and there had been no sign of danger.

The Concussion.

A deep, rumbling report rolled out and reverberated through the building, mixed with a staccato of splintered tingling glass. It broke swiftly into a muffled roar as the sound was torn from the confined space, and as if a bomb had burst asunder, the walls of the boiler room split into fragments while a patch of roof opened and from its sagging cavity a steel balloon soared majestically a hundred feet skyward, finally alighting on the Strayer residence. Clouds of steam puffed out and the roaring of broken valves and escape vents made the wrecked pit a replica of charnel house indeed, from which a large crowd, drawn by the detonation, expected to see mangled bodies carried out. There was many a sigh of relief when it was whispered about that no one was hurt.

The Pit Found a Wreck.

The pit was a wreck. The walls of the condenser room were built of four inch hollow tile and a two and a half inch brick facing. The two outer sides were razed to a ragged edge. The roof, framed with lumber and covered with a felt waterproofing, sagged two feet — what was left of it. The boiler room's south wall was gouged with a hole, 8 by 6 feet, and the entire side was sprung. The boiler and condenser addition measured near 40 by 20 feet. The condenser stood close to the main building partition and shot straight up. The pump on the deep well was twisted sharply around and may be seriously damaged. None of the machinery on the main floor sustained injury.

A Glass Snow Storm.

Four windows in the partition between boiler and machine floor were smashed, four along the east wall were shattered, seven were broken in the front facing the machine room, five were splintered in the south partition of the office and four big ones in the office display on State were pounded to bits.

When the explosion occurred at the rear, there followed a puff outward, then a strong suction which drew part of the glass in. The floor from end to end was carpeted with fine particles. The first puff of air carried a sheet of fine glass over the front walk. A. O. Height, merchant policeman, was standing on the corner of the Tiss drug store and says the flying glass dusted out like a mist of snow. Mr. Height broke down hanging fragments which would prove dangerous.

The proprietor says they felt a little jar in the main office, and no one knew of the seriousness of the blast until they found themselves in the midst of a wreckage of glass.

Condenser Top Missed Buchanan.

There were many narrow escapes. James Buchanan, a plumber employed by the Boyd plumbing company, was working at the rear of the K. P. Building adjacent east. When he felt brickbats driving his way he dove through a cellar window of the new building. The top of the condenser three feet in diameter flew past his head, missing him by a scant ten inches.

Broke Through K. P. Windows.

Two bricks crashed through the last window facing west on the south side of the K. P. structure, tearing down an $18 electric light fixture within. Last Saturday Garfield Breese and family moved from the flats. The room in which the bricks lodged was the dining parlor. A couple other windows were broken in this building, the damage amounting to $25.

Team Not Frightened.

A team of grays hitched to a farm wagon stood facing the seat of the explosion, not thirty feet distant, and outside of prancing around a bit they were unmoved by the occurrence.

Tar Kettle Lost Stovepipe.

A tar kettle abutting the building used by a crew working for Mr. Stoddard at the K. P. building, lost its stovepipe. Luckily the men had just left the spot loaded with supplies.

A six foot, two inch gas pipe was flung northwest over the building lots and landed on the sidewalk just a step east of the Tiss drug store on State street. It hit the sidewalk and on the rebound deeply dented a steel signboard. This pipe flew 250 feet on a straight line.

An Eye Witness's Version.

Fred Eggers, of the Republican Printing company, in the basement of the building across the alley, saw the condenser shoot up from the building and says it was a most remarkable twist of good luck that no one was injured.

What the Condenser is.

Engineer Edgington says the condenser is really an exhaust device. The boiler keeps live steam in the wash tub, dryers and other apparatus of the business. This steam has an exit in the condenser, into which cold water is forced to turn the steam back into water. From some unknown cause the live steam did not condense building up a pressure which the contrivance was unable to withstand.

Explanation.

Those seeming to know, give the opinion that through some reason the cold water had been accidentally shut off, which would give the condenser the same pressure almost as was in the boiler. Its diameter was three feet with a length of six feet. Its weight would probably scale 175 pounds.

Men seated in the park claim the spiral ascension of the iron airship was plainly visible to them.

A Farmer's Luck.

A farmer whose team he held standing at the corner of Fifth and Michigan, when the explosion came, turned his frightened horses east on Fifth, when the condenser, caroming from gable to peak of the Strayer house, struck the curb and rebounding several feet high, leaped toward his team in big jumps. He got out of the way by turning short in on the Graves lawn and around the trees.

The condenser was of 14 gauge material, riveted with about three-quarter inch rivets an inch apart. Mechanics stated that it had not much more body to it than a rusty stovepipe.

Obituary.

EDWARD J. MURPHY.

Edward J. Murphy, for many years consulting engineer for The Hartford Steam Boiler Inspection and Insurance Company, died Tuesday morning, September 2nd, after a lingering illness. He had been in failing health for the last two or three years, suffering from heart trouble, but his hopeful disposition, and indomitable will had helped him to rally and get out many times, even to the extent of resuming his active work whenever he was able to make the trip from his home to the office.

Mr. Murphy was born February 5, 1829, in the province of Ulster, Ireland. He was educated in the private schools of Dublin. He studied drawing under the Royal Art Society of Dublin and afterwards was graduated from the Fanning Engineering Institute of the same city. His training was that of a civil engineer and he graduated with honor.

Mr. Murphy was predisposed by family history and environment to lung trouble and in consequence of this and his own impaired health was ordered by his physician to take an ocean voyage. He sailed for this country on the Cunarder America and after a two weeks' voyage from Liverpool he arrived at Jersey City somewhat improved in health. He then went to Canada and spent the first winter, that of 1849-50 with friends there.

In the year 1850 he made surveys in Ohio for a Philadelphia map publishing concern, later performing the same kind of work in the central part of New York. He was engaged in this work until the close of the year 1852. In 1853 he was brought in touch with the city surveyor of New York and was made first assistant under him during which time he assisted in laying out the street car routes of the city.

In 1854 he was married to Jane Major Cassolani at the residence of her brother, Henry Brougham Major, at Yonkers, N. Y. Soon after this he severed his relations with the Engineering Department of the city of New York.

In 1855 the Woodruff & Beach Iron Works were in need of a chief draftsman and Mr. Murphy was recommended in the highest terms. He came to Hartford in that year and although the work was somewhat different from civil engineering, he gave the best of satisfaction from the first. This engagement continued until the dissolution of the firm. Woodruff & Beach, as it is well known, did some of the most important work for the government that was transacted during the War. Beginning with 1861 Mr. Murphy was identified with the U. S. Navy Department at these works during the construction of boilers for U. S. S. Kearsage, Manitou, Minnetonka, and Piscataqua.

After this engagement he went West to further recuperate his health which had become impaired by too close application to business. He was placed at the head of a surveying party by a large company having a land enterprise in process of development. He crossed the plains by wagon train, braving the dangers of those days and at one time was obliged to have the protection of U. S. cavalry as a guard from hostile savages. Upon his return he spent six weeks in an open boat descending the Missouri River to civilization. In this manner he recovered his health and, though frequently given up for dead at the hands of savages, returned to Hartford in health and safety.

Mr. Murphy was secretary and treasurer of the Hartford Foundry & Machine Company from the year 1872 until the close of its existence. From 1872 to 1878 he was a member of the Board of Fire Commissioners a position in which he was specially useful by reason of his acquaintance with machinery, machine designing and the executive management of details. He was largely instrumental in obtaining for the city the first self-propelled fire engine ever made and used in this country if not in the world. The late Chief Eaton, then chief of the Fire Department, was also a strong advocate of the self-propelled engine and was of considerable assistance to Mr. Murphy in carrying through the plans for such an apparatus. In the latter part of 1878 he was chosen president of the Board of Water Commissioners and remained in the position two years when he resigned to accept the appointment of supervising engineer of the Colt's Patent Fire Arms Manufacturing Company. Here he remained until June, 1889 when he resigned to become the consulting engineer of the Hartford Steam Boiler Inspection and Insurance Company, which position he held until his death.

EDWARD J. MURPHY.

Mr. Murphy was honored with many places of public and private trust during his fifty-seven years of residence in Hartford and aside from his presidency of the Water Board and membership of the Fire Board he was a State's Prison director from 1887 to 1893. He was also trustee of St. Peter's Church Corporation and a director of St. Francis Hospital. He was a member of the American Society of Mechanical Engineers and an associate of the American Society of Naval Engineers, taking a lively interest in the activities of both organizations. In addition to the professional work already noted he was identified with the design and construction of large pumping engines used at Brooklyn, N. Y., and St. Louis, Mo., and the engines of the U. S. Cruiser Mohican and the sloops of war Pequot, Nipsic and Cayuga.

W. M. BOASE.

W. M. Boase, an inspector in the Baltimore Department of The Hartford Steam Boiler Inspection and Insurance Company, died August 16, at St. Elizabeth's Hospital, Richmond, Va. His death came at the end of a long illness, and followed a critical operation, from which he was unable to rally.

Mr. Boase had been in the employ of the Hartford for about nineteen years, and was exceedingly well liked by the men with whom he came in contact. He was capable and energetic, and his loss will be keenly felt in the department.

Mr. Boase was born in the Sicily Islands, England, in 1861, and before coming with the Hartford, followed the sea, as an engineer. He held papers as a chief engineer of ocean going vessels from the British Board of Trade. He is survived by a widow and four daughters.

The Care and Lubrication of Air Compressors.

(Abstracted from an article in The Compressed Air Magazine.)

It is a fact that air compressors frequently pollute the mine air with dangerous gases, and sometimes explode, causing damage to persons and property. In either case the same may be generally attributed to the excessive heating in the presence of compressed air of the oil and foreign substances that have collected in the cylinder, discharge pipes and air passages and especially in and around the valves. Volatilization and ignition of oil and other carbonaceous matter occurs very rapidly in the presence of highly heated air.

It is therefore, important:

First. To keep the compressed air, while being compressed, at as low a temperature as possible.

Second. To prevent oil and other carbonaceous substances from collecting in any part of the machine or in the discharge pipes.

All ports and air passages should be as large as practicable and should be kept free from obstructions and incrustations. In addition to partly closing the ports, incrustation often causes the valves to stick resulting in disastrous consequences.

To avoid incrustation and collecting of oil and foreign substances in the machine and discharge pipes, high grade non-carbonizing oil may be used and should be properly fed into the cylinder. Petroleum oil, especially free from volatile carbon, with flash point of not less than 625 degrees F. is recommended. The oil should not be too dense nor contain animal or vegetable oil. Do not, in any case, use ordinary steam cylinder oil. Why? Because the heat in the steam cylinder is moist, and the surplus oil is washed out, whereas, the heat in the compressor cylinder is dry, thus causing the oil to stick and cake. For the above reason, and also on account of the difference in the character of the proper lubricant and the work it has to perform, the proper feeding of oil to the compressor cylinder, is very different from the oil fed to a steam cylinder. Too much oil causes incrustation. A surprisingly small quantity of good oil will give sufficient lubrication to air compressors. Watch your compressor and cut the amount of oil down to the minimum of its requirements. Oil should not be allowed to collect in the machine. In case it does, it should be drawn off immediately.

Even when using the best oil, properly fed to the cylinder, the machine should be cleaned frequently or when needed.

Do not use kerosene for cleaning! It is very dangerous. Kerosene has a flash point of about 120 degrees F. and the temperature of the compressed air may at any time reach 300 to 450 degrees F. and cause an explosion. The best and safest method of cleaning is to feed into the air cylinder, soapsuds, made of one part soft soap to 15 parts clean water. Feed a liberal amount of this solution into the cylinder instead of the oil for a few hours or even for a day, if necessary. The accumulation of this water and oil should be drained off from time to time during the process by opening the blow-off valve at the receiver.

To prevent rusting, it is necessary to run the machine and feed oil into the cylinder for an hour or so after the cleaning process is completed and the water drained off, so that the valves and all parts connected with the cylinder will become coated with oil before shutting down the machine.

The temperature of the discharged air should never exceed 250 degrees F. The machine should be watched and if the temperature exceeds the above it should be shut down and cooled. If possible the cause of overheating should be eliminated before starting up again.

The temperature increases as the pressure increases; therefore it would be well to equip all air compressors with an automatic pressure or temperature regulator, which will allow the compressor to run idle as soon as the pressure or temperature in the receiver reaches a predetermined limit and likewise bring the compressor into action again as soon as the pressure or temperature falls below this limit. There are regulators on the market which apply to compressors coupled direct to the engine, driven by electric motors, by belt or otherwise.

As an extra precaution a fusible plug may be placed in the discharge pipe near the compressor. This plug should be made to fuse and blow out at a temperature of between 325 and 350 degrees F.

The Locomotive of THE HARTFORD STEAM BOILER INSPECTION AND INSURANCE CO.

C. C. Perry, Editor.

HARTFORD, OCTOBER, 1913.

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The Locomotive of The Hartford Steam Boiler I. & I. Co.

The subject of boiler specifications is always of interest to the boiler insurance company. Indeed the extended use of specifications in boiler work has come about very largely from the practice of boiler insurance companies making specifications for new boilers for their assured in order that they may secure safer and better construction, with better workmanship and materials of known properties. The Hartford has followed this practice from a very early date and has done much pioneer work in the struggle for better and safer boilers. It is therefore, with special interest that we read the reports of the recent convention of the American Boiler Makers Association, held Sept. 1-4, at Cleveland, O., devoted as it was so largely to a discussion of this question.

We regret that we have been able to read Mr. Durham's paper on Uniform Boiler Specifications only in the abstract as yet. In his suggestions for uniform specifications, he advocates many of the measures long insisted on by the insurance companies, and which have heretofore served to distinguish between a "specification", and a "commercial" boiler, such as a minimum factor of safety of 5, with rigid requirements as to the reaming of rivet and tube holes, the planing of caulking edges, and the calculation of the safe load upon weldless braces and through stays based on a maximum stress of 7,500 lbs. per square inch. He also advocates very properly, the universal use of the double butt strapped joint.

Further, we are rather inclined to agree with him that in branding plate, the use of such numbers as will serve to definitely identify the mill test report of each individual plate is of more consequence than the designations "flange" or "firebox". (Assuming of course that the tensile strength stamping would be retained as at present.) For it is, after all, the definite physical and chemical properties of tensile strength, ductility, and freedom from injurious sulphur and phosphorus within sharply defined limits which we want, and if a plate fulfills the requirements for a particular use, it matters little from which pile it is taken so long as we are prepared to assert beyond peradventure that it actually does possess the desired properties. On the other hand, we are inclined to take issue with him in recommending 60,000 lbs. as the minimum value to be taken for the tensile strength of boiler steel. We believe that a degree of ductility and freedom from brittleness under shock can be obtained in steels of lesser tensility which will far outweigh the advantage in cost accruing to the boiler maker from the possibility of using slightly thinner plate. We feel sure that steel of from 55,000 to 60,000 lbs. tensile strength is still the best available material for boiler construction.

It has been our pleasant duty several times recently, to record the acquisition by the Hartford, of the steam boiler and fly-wheel business of other companies. This business, principally from multiple line casualty companies, has in each instance come to us because these companies could not afford to maintain the necessarily expensive machinery of inspection in the face of the small volume of business written. In this issue, we again reprint a news item from the *Hartford Times,* giving the details of two more transactions of this sort. The Locomotive is glad to extend a welcome to these new members of the family of Hartford assured.

The question of the probable behavior of boilers and steam containing apparatus in the event of fire is always one of interest. We have recorded in these columns from time to time, instances both of the failure and the survival of such vessels. That a serious explosion may be produced by a fire, especially if the vessel is not provided with adequate means of relieving itself from an undue pressure, or if its material is of such a nature as to be seriously affected by exposure to a high temperature is self evident.

A striking illustration of this comes to our attention just as we go to press, from the columns of *Safety Engineering.* On August 20th, Jersey City, N. J., was swept by a conflagration, starting in a collection of cooper shops, which resulted in a property loss estimated variously at from $500,000 to $1,000,000. One of the buildings consumed was a soap works, and in it was a rendering tank said to have been constructed of 3/8 in. plate, and to have been 4 ft. in diameter, by 9 ft. high. As is usual with this type of vessel, the bottom course was conical in shape, and was provided at the bottom with a cast iron nozzle, closed with a cast iron door. The tank was not however provided with a safety valve. On the morning of the fire, the tank was charged as usual. When the fire reached the building, the tank, subjected as it was to an intense heat, accumulated a high pressure of steam. In addition, the cast iron door and nozzle became so weakened by the high temperature, that they failed sooner than the steel plate of which the body of the tank was built. As a result the contents of the tank were expelled through the bottom, on the failure of the door, and the tank was projected, sky rocket fashion, some 100 ft. in the air landing about 400 ft. from its starting point.

Two important facts are forced upon our attention by this failure, first, that in spite of the knowledge which is in the possession of designing and operating engineers, there are still many vessels in daily use, operating under an internal steam pressure, with no effective provision to limit that pressure to a safe value. The other is the general unreliability of cast iron as a material for use in boilers where it may be subjected at the same time, to high temperatures and the stresses produced by high pressures. Of course cast iron in a rendering tank cannot be criticised from this standpoint, for rendering tanks are by no means designed to withstand conflagrations. The fact remains however, that there are many vessels in use where cast iron subjected to high pressures, is at the same time forced to suffer the consequences of high temperatures, and the failure of these cast iron parts furnishes all too great a proportion of the accidents recorded in our explosion lists.

One of the things that goes to make up Hartford service is the making of specifications and drawings for new work contemplated by our assured. The purpose of course is to secure for the purchaser, the best and safest boiler that he can get for his money. The specification helps him to secure this much desired result by supplying him in a usable form with the digested and applied experience of our specialists in the boiler field. A further benefit to the purchaser arises through the knowledge that all the makers bidding on the specification are competing for the building of the same identical job, which they know will be inspected, and must meet the specified standards of material and workmanship. This fact while it may not reduce the bids to the lowest figure at which *a* boiler might be purchased, will on the other hand secure the best terms for a *specification* boiler.

If, as is usually the case, he submits the specifications to several manufacturers for bids and finally lets a contract based on it, the specification becomes a part of that contract or agreement between the purchaser and the boiler maker. Our interest in the proceeding is over except in so far as we may be called upon by the terms of the contract to inspect and pass upon the workmanship and materials. In that event, our interest is strictly confined to seeing that the contract, already made, is properly fulfilled.

If the boiler is built and delivered in strict compliance with the specifications all goes well. Frequently however the makers will suggest changes either in the boiler itself or its attachments, and then a misunderstanding may arise as to our position in the transaction. Boiler makers very often refer these proposed changes to us, asking us to permit them or approve them, when really they are a matter between the makers and the purchaser only. If the purchaser is willing to permit alterations in the terms of the contract, that is his business, not ours. We can of course advise him as to our views of the value of the proposed substitution, but the decision must rest with him.

It is undoubtedly true that changes in a specification are often desirable, particularly when some substitute method or design, better suited to the maker's shop equipment may be used with no sacrifice in safety or strength, and with a gain in economy. On the other hand, the changes suggested are sometimes such as will result in a much inferior product, and any saving in cost may be dearly bought. But in any case, whether the changes are desirable or not, we wish to make it very clear that the matter is entirely between the maker and purchaser, that when we have given our best judgment as to what seems to us the proper construction, by drawing specifications, and if desired, seeing that they are carried out by inspection, we have fulfilled our entire part in the proceeding.

Personal.

Mr. James P. Hagarty, who was appointed a special agent in 1910, and who has very successfully devoted a portion of his time to soliciting since then, has now given up his work in the mechanical department, and will give his entire attention to the selling end of the business as special agent in the Hartford Office.

Hartford Steam Boiler Gets Tenth Acquisition.

Takes Over Business of Kansas City Casualty Co. For Which There Had Been Keen Competition.

SECOND WITHIN FEW WEEKS.

[From The Hartford (Conn.) Times, Sept. 3, 1913.]

It is understood that the Kansas City Casualty Company of Kansas City, Mo., has just closed a reinsurance contract with The Hartford Steam Boiler Inspection and Insurance Company, of this city, under which the Hartford company takes over and assumes all the Kansas City company's liability under its various outstanding steam boiler policies.

DESIRABLE BUSINESS.

President Brainerd of the Hartford Steam Boiler company confirms this statement and explains that while the volume taken over is not large, there has been keen competition between the companies to secure it, as it is of a very desirable character, compact and well located. The Kansas City company began business in 1910 and started with a paid up capital of $250,000, and undertook to do a steam boiler business in connection with its other various casualty lines, numbering some ten or a dozen of the more prominent ones. It stood well at home and was popular throughout the territory in which it operated, and its other lines will now be relieved of the burden of carrying the steam boiler line which in the absence of volume cannot be conducted with profit.

Another Only Few Weeks Ago.

It was only two or three weeks ago that the Hartford Steam Boiler took over the steam boiler business of The United Casualty and Surety Co., of Memphis, Tenn. This last acquisition makes the tenth company that has reinsured its entire steam boiler business with the Hartford company, and a part of the steam boiler business of two other companies has likewise been taken over quite recently. The Hartford Steam Boiler company makes a specialty of inspecting and insuring steam boilers, and of late the taking over of the steam boiler business of other companies has seemingly become a prominent feature of its business, as the steam boiler business of no less than seven companies has been taken over during the last six or seven years.

Fly-Wheel Explosions, 1913.

(19.) -- A large fly-wheel burst May 9, at the saw mill of the Crookston Lumber Co., Bemidji, Minn. One man was killed, and considerable damage done to the mill property.

(20.) — An engine and its fly-wheel were wrecked May 23, at the plant of the Bay State Brick Co., Indian Orchard, Mass. No one was injured, but the plant was shut down pending repairs.

(21.) — A fly-wheel burst June 9, at the plant of the Alpha Portland Cement Co., Alpha, N. J. Two men were killed, and the property damage was large. A detailed account of this wreck was published in the July issue of the Locomotive.

(22.) — A centrifugal extractor exploded June 20, in the laundry department of the shirt factory belonging to the Rice-Stix Dry Goods Co., St. Louis, Mo. One man, the operator of the machine was instantly killed, while six others, four of them girls were very seriously injured. One of the girls had her shoulder literally torn from her body and was not expected to recover.

(23.) — A gear failed June 30, at the plant of the Scoville M'f'g Co., Waterbury, Ct.

(24.) — A fly-wheel, and another belt wheel exploded July 19, at the plant of the Davis County Canning Co., Syracuse, Utah. No one was injured, but the plant was forced to close at the height of the canning season, losing a large amount of perishable stock which they could not save.

(25.) — A. L. Reim, a farmer was killed July 22. by the explosion of a rotary ensilage cutter which he was operating. One of the knives is said to have been propelled with such force as to sever a tree.

(26.) — A fly-wheel fractured July 23, at the plant of the Cooks Linoleum Co., Trenton, N. J.

(27.) — An extractor burst July 24 at the Home Laundry, Passaic, N. J. Three men were injured.

(28.) — An extractor exploded Aug. 2, at the works of the Bangor Steam Laundry Co., Bangor, Me. One girl was killed, and three others hurt by the explosion.

(29.) — A fly-wheel exploded August 20, at the plant of the Payne and Joubert Foundry and Machine Co., Birmingham, Ala. One man was killed, and the property loss was considerable. (A complete description of this accident will be found elsewhere in this issue.)

(30.) — A fly-wheel attached to a sausage grinder burst August 28, at the butcher shop of Breitenbach Bros., Escanaba, Mich. One man was injured.

(31.) — A large fly-wheel, 22 ft. in diameter, exploded September 6, at the Liberty Mills, South Nashville, Tenn. One man was killed, three were injured, and a property loss sustained estimated at $5,000. The cause of the accident is said to have been the running off of a governor belt, allowing the engine to race.

Boiler Explosions, May, 1913.

(186.) — A boiler exploded May 1 at the planer of the Castleberry-Flewellen Co., Longview, Tex. Two men were seriously injured in addition to a considerable property damage.

(187.) — A slight accident occurred to a boiler at the power house of the Liberty Electric Light and Power Co., Liberty, Mo., on May 2.

(188.) — A tube ruptured May 3, in a water tube boiler at the plant of the King Paper Co., Kalamazoo, Mich.

(189.) — On May 3, a boiler exploded at the saw mill of G. W. Guthrie, Pine Creek, Va. Two men were killed, one critically injured, and the mill was a total wreck as the result of the accident.

(190.) — On May 4, the crown sheet of Missouri Pacific locomotive No. 93 blew down, near Tipton, Mo. Two men, the fireman and a brakeman, were injured.

(191.) — On May 5, a tube failed in a water tube boiler at the electric lighting plant of the City of Kalamazoo, Kalamazoo, Mich. Chas. Weisenberg, night watchman, was injured.

(192.) — Two flues burst in a boiler at the coal yard of Brewster and Abbott, Troy, N. Y., on May 6. The property was somewhat damaged by fire as a result of the explosion.

(193.) — A serious and unusual triple explosion occurred May 6, at the plant of the Lapeer Gas and Electric Co., Lapeer, Mich. The accident resulted from handling gasolene in some way so that its vapor passing over the boilers, exploded. This was followed in succession by the explosion of the boilers and a gas storage tank. One man was fatally injured, and property was damaged to the extent of some $60,000.

(194.) — The North Monroe Steam Mill Company's plant at Monroe, N. H.. was wrecked May 6, by the explosion of a boiler. One man was injured.

(195.) — A cast iron sectional heating boiler ruptured May 8, in the apartment house of Alva Seybolt, Saratoga Springs, N. Y.

(196.) — A boiler exploded May 8, at the saw mill of Price and Kinslow, Glasgow, Ky. Three men were seriously injured, while the mill was badly wrecked.

(197.) — A boiler exploded May 10, at the grist mill of Thomas Mattingly, near Lebanon, Ky. Mr. Mattingly was seriously scalded, while the mill was badly wrecked, being unroofed by the explosion.

(198.) — On May 10, the bottom head of a vertical rendering tank blew off at the plant of the Smith Bros. Packing Co., Denver, Colo. J. Agarth, night engineer and tankman was fatally scalded.

(199.) — A tube ruptured May 10, in a water tube boiler at the plant of the Standard Steel Co., Alabama City, Ala. The damage was slight.

(200.) — An accident occurred May 10, to a boiler at the ice plant of Chas. R. Haskins, Winden, Ga.

(201.) A tube ruptured May 11, in a water tube boiler at the plant of the Standard Steel Co., Alabama City, Ala. (See item No. 199.)

(202.) — On May 11, a steam separator on the main steam line exploded at the Buckingham Ave. plant of the Public Service Corporation of New Jersey, Perth Amboy, N. J. M. Burke, oiler, was slightly injured, and the property damage was in the neighborhood of $2,000.

(203.) — A tube ruptured May 14, in a water tube boiler at the Orkin Bros. department store, Omaha, Neb. Three men were injured, one fatally.

(204.) — Three cast iron headers fractured May 14, in a water tube boiler at the plant of the Sandusky Gas and Electric Co., Sandusky, O.

(205.) — A boiler exploded May 14, on the lease of the Cash Oil Co., Humble, Tex. One man was killed.

(206.) — On May 15, a hot water heater exploded in the basement of the building occupied by the Boston Protective Co., Purchase St., Boston, Mass.

(207.) — A steam pump exploded May 17, on a boat belonging to the Western Kentucky Coal Co., Paducah, Ky. Two men were killed.

(208.) — A tube ruptured May 19, in a water tube boiler at the Bordentown Light Station of the Public Service Corporation of New Jersey. Bordentown, N. J.

(209.) — On May 19, a tube ruptured in a water tube boiler at the Oak Park Power Co. plant of the General Motors Co., Flint, Mich.

(210.) — On May 20, an accident occurred to a boiler at the planing mill of the Brooks Scanlon Co., Kentwood, Ga. Extensive repairs were necessary to the boiler.

(211.) — A tube ruptured May 20, in a water tube boiler at the N. Delaware Ave. plant of the Philadelphia Rapid Transit Co., Philadelphia, Pa.

(212.) — A boiler ruptured May 24, at the plant of the W. H. Glover Co., Rockland, Me.

(213.) — A tube ruptured May 24, in a water tube boiler at the plant of the American Steel and Wire Co., Waukegan, Ill.

(214.) — On May 29, a tube ruptured in a water tube boiler at the mill of the Minneapolis Malt and Grain Co., Minneapolis, Minn.

(215.) — A cast iron header ruptured May 31, in a water tube boiler at the plant of the Ohio Electric Railway Co., Lima, O.

JUNE, 1913.

(216.) — A boiler exploded June 1, on the farm of Eugene Houssiere, Pine Prairie, Tex. Henry Davis, engineer, was fatally injured, while Robert Hamilton, fireman, was less seriously injured.

(217.) — A boiler exploded June 3, at the plant of the Brooklyn Range and Boiler Co., Long Island City, L. I., N. Y. One man was injured, probably fatally.

(218.) — On June 3, a boiler ruptured at the plant of the Leonard Ice and Coal Co., Leonard, Tex. The damage was confined to the boiler itself.

(219.) — A tube ruptured June 6, in a water tube boiler at the plant of the Elmira Cotton Mills Co., Burlington, N. C.

(220.) — Two tubes ruptured June 6, in a boiler at the plant of the Berlin Brick Co., Berlin, Ct.

(221.) — On June 6, a tube ruptured in a water tube boiler at the South Jersey Gas, Electric and Traction Co. plant of the Public Service Corporation of New Jersey, Trenton, N. J. Eugene Holet, water tender, was injured.

(222.)— A blow-off pipe failed June 7, at the plant of the Lancaster Milling Co., Lancaster, Tex.

(223.) — On June 7, a tube pulled out of the tube sheet of a water tube boiler at the pulp and paper mill of the Thos. Phillips Co., Akron, O.

(224.) — A tube ruptured June 10, in a water tube boiler at the plant of the Pennsylvania Water Co., Nadine Station, Pa. Frank Sarretti, fireman, was scalded.

(225.) — A tube failed June 10, in a water tube boiler at the plant of the Great Southern Lumber Co., Bogalusa, La.

(226.) — A boiler exploded June 10, in the basement of the Beth Israel Hospital, New York City. A fire which followed the explosion created a panic among the patients. One man was killed in the fire.

(227.) — A boiler exploded on the coal steamer E. M. Peck, at Racine, Wis., on June 11. Six were killed and seven or eight seriously injured, while many more received minor injuries. The ship was a complete wreck.

(228.) —On June 12, a boiler ruptured at the plant of the Manhattan Ice, Light and Power Co., Manhattan, Kans.

(229.) — Three cast iron headers ruptured June 13, in a water tube boiler at the plant of the Princess Furnace Co., Glenn Wilton, Va.

(230.) — A cast iron header failed June 14, in a water tube boiler at the Northern Hospital for the Insane, Logansport, Ind.

(231.) — A tube ruptured June 16, in a boiler at the power house of the Municipal Water, Light and Power Co.. Mackinac Island, Mich.

(232.) — On June 16, a header failed in a water tube boiler at the plant of the Miller Lock Co.. Philadelphia, Pa.

(233.) — On June 16, the crown sheet of a locomotive collapsed on the dam construction work of J. G. White and Co., Stevens Creek, Ga.

(234.) — A tube ruptured June 16, in a water tube boiler at the plant of the King Paper Co., Kalamazoo, Mich. Two men were scalded, but the property loss was practically confined to the boiler.

(235.) — A 10 horse power boiler used for wood sawing exploded at the home of Frank Owen, at Swifts Mills, N. Y., on June 16. No one was injured, though five persons are said to have been gathered about the boiler just prior to the accident.

(236.) — A bleaching kier exploded at the James Thompson mosquito netting mill, Valley Falls, N. Y., on June 17. Two men were injured somewhat, and property was damaged to an extent estimated at from $5,000 to 310,000.

(237.) — A boiler tube burst June 19, in a boiler at the Rugby Distillery, Louisville, Ky. Three men were injured, one fatally.

(238.) — A large air tank exploded June 20, at the garage of T. J. Kennedy, Batavia, N. Y. One man was slightly injured, and the building was badly damaged.

(239.) — On June 20, a tube ruptured in a water tube boiler at the plant of the Brier Hill Steel Co., Youngstown, O.

(240.) — A boiler ruptured June 20, at the plant of the Burlington Sanitary Milk Co., Burlington, Ia.

(241.) — A tube ruptured June 20, at the plant of the Standard Steel Co., Alabama City, Ala.

(242.) — On June 20, a boiler ruptured at the bleachery and cotton mill of the Great Falls Mfg. Co., Somersworth, N. H.

(243.) — The boiler of an El Paso and Southwestern R. R. locomotive exploded June 21, at Fairbanks, Ariz. Two men and two women were injured.

(244.) — A tube ruptured June 21, in a water tube boiler at the plant of the Omega Portland Cement Co., Jonesville, Mich.

(245.) — One June 23, a cast iron header ruptured in a water tube boiler at Factory No. 2 of the Union Ice Co., Pittsburg, Pa.

(246.) — A small boiler exploded June 24, at the plant of the Good Luck Polish Co., Louisville, Ky. The damage was small, as the boiler is said to have been of but six horse power.

(247.) — On June 28, a tube ruptured in a water tube boiler at the Coal St. station of The Public Service Corporation of New Jersey, Newark, N. J.

(248.) — On June 29, a boiler ruptured at the ice and brick plant of Chris. N. Elling, Brush, Colo.

(249.) — A header was blown off the tubes in a water tube boiler June 30, at the lumber mill of C. L. Willey, Chicago, Ill.

JULY, 1913.

(250.) — On July 1, a steam heated retort exploded at the Ainsworth and Dunn Cannery, Blaine, Wash. The vessel was being tested under steam for the first time when the explosion occurred, killing two men. From press reports we are lead to believe that the accident was due to an effort to tighten the clamping bolts of the door, while under pressure.

(251.) — A tube ruptured July 2, in a water tube boiler at the Allegheny Steel Co's. plant, Brakenridge, Pa.

(252.) — A boiler ruptured July 2, at the plant of the Alacuky Lumber Co., Conasanga, Tenn.

(253.) — On July 6, a boiler ruptured at the Marion Brick Works, Montezuma, Ind. It was necessary to replace the boiler with a new one.

(254.) — A boiler exploded July 7, at the St. Clair County Gas and Electric Company's power house, Belleville, Ill. One man was injured, probably fatally.

(255.) — On July 8, a tube pulled out of the tube sheet of a water tube boiler at the plant of The National Lock Co., Rockport, Ill., doing considerable damage to the boiler.

(256.) — A tube ruptured July 10, in a water tube boiler at the plant of the Central Ice and Cold Storage Co., New Orleans, La. The damage was small.

(257.) — On July 11, a blow-off pipe failed at the Satinet Mill of the Aldirch Mfg. Co., Charlton City, Mass. Peter Jorgenson, engineer and fireman, was scalded so severely that he died the following day.

(258.) — On July 11, a tube ruptured in a water tube boiler at the plant of the Minneapolis Malt and Grain Co., Minneapolis, Minn.

(259.) — A tube ruptured July 12, in a water tube boiler at the plant of the Standard Steel Co., Alabama City, Ala.

(260.) — On July 13, a cast iron header ruptured in a water tube boiler at Factory No. 2 of the Union Ice Co., Pittsburg, Pa.

(261.) — A boiler exploded July 13, on the oil lease of the National Pacific Oil Co., Maricopa, Cal. One man was very severely scalded, though he is expected to live.

(262.) — A slight accident occurred to a boiler at the plant of the W. F. & John Barnes Mfg. Co. Rockford, Ill., on July 14.

(263.) — Through an accident to a boiler used for heating and pumping the city supply of road oil, July 15, Mayor Horwege of Petaluma, Cal., who was at the plant at the time, was very severely scalded.

(264.) — A valve blew out July 15, in the dynamo room of the U. S. S. Nebraska, at the Charleston, Mass., Navy Yard. Two men were scalded, one fatally.

(265.) — On July 16, a cast iron header ruptured in a water tube boiler at the plant of the Sandusky Gas and Electric Co., Sandusky, O.

(267.) — On July 16, an accident occurred to a boiler at the plant of the Polar Ice Co., Indianapolis, Ind.

(268.) — A boiler ruptured July 17, at the plant of Swift and Co., Clinton, Ia.

(269.) — Two men were killed and a third badly injured, July 17, as the result of an explosion in the boiler room of the British freight steamer Fair Mead, at Pier No. 3, Constable Hook, N. J.

(270.) — The boiler of a locomotive on the Texas and New Orleans Railroad, exploded July 18, between Beaumont and Houston, Tex. The engineer and fireman were instantly killed, and several passengers are said to have been injured.

(271) — A boiler exploded at a grist and saw mill near Trinity, Ala., July 18. Two people including the proprietor of the mill were killed outright, two were fatally injured, and a fifth was injured so severely as to make his recovery a matter of doubt. The mill was completely demolished.

(272.) — A large air compressor exploded July 18 at the plant of the Americus Automobile Co., Americus, Ga. No one was injured.

(273.) — A boiler ruptured July 18, at the plant of the Water Works Co., of Seneca Falls, N. Y.

(274.) — On July 18 a tube ruptured in a water tube boiler at the plant of Jacob Dold Packing Co., Wichita, Kans.

(275.) — A blow-off pipe failed July 20, at the plant of the Lake City Ice Co., Cleveland, O.

(276.) — On July 21, three cast iron headers failed in a water tube boiler at the plant of the Trenton Street Railway Co., Trenton, N. J. The damage to the boiler was considerable.

(277.) — A boiler ruptured July 22, at the mine of the National Fuel Co., Aguilar, Colo.

(278.) — A threshing machine boiler exploded July 22, near Bedford, Ky. Two men were badly injured.

(279.) — A valve failed on an Iron Mountain locomotive July 23, near Leola, Ark. Both the engineer and fireman were painfully scalded.

(280.) — A tube ruptured July 23, in a water tube boiler at the Suburban Plant of the American Gas and Electric Co., Scranton, Pa.

(281.) — On July 24, a tube ruptured in a water tube boiler at the power house of the Public Service Corp'n of Northern Illinois, Blue Island, Ill. Two men were injured.

(282.) — On July 25, a tube ruptured in a water tube boiler at the plant of the American Beet Sugar Co., Oxnard, Cal. Cecil Morgan, fireman, was killed and J. Sandoval, boiler cleaner, was injured. The property damage was small.

(283.) — Two cast iron headers ruptured July 25, in a water tube boiler at the plant of the Railway Steel Spring Co., Latrobe, Pa.

(284.) — Five cast iron headers ruptured July 25, in a water tube boiler at the licorice factory of the McAndrews and Forbes Co., Camden, N. J.

(285.) — A serious fire resulted from the explosion of a boiler at the New England Dyeing and Cleansing Co.'s plant, Malden, Mass., on July 26.

(286.) — A boiler ruptured July 30, at the plant of the United States Cast Iron Pipe and Foundry Co., Columbus, O.

(287.) — A water heating boiler burst July 30, at the Y. M. C. A. building, Dixon, Ill.

(288.) — On July 31, a tube ruptured in a water tube boiler at the plant of the Hamilton Otto Coke Co., Mamilton, O.

(289.) — A boiler exploded at the plant of the Briscoe Lumber Co., Grand Mound, Wash., on July 31. One man was killed, and two others seriously injured.

(290.) — A boiler exploded July 31 on the oil lease of the Sun Oil Co., near Tiffin, O. One man was perhaps fatally injured.

The Hartford Steam Boiler Inspection and Insurance Company.

ABSTRACT OF STATEMENT, JANUARY 1, 1913.

Capital Stock, . . . $1,000,000.00.

ASSETS.

Cash on hand and in course of transmission,	$186,187.28
Premiums in course of collection,	285,163.53
Real estate,	90,600.00
Loaned on bond and mortgage,	1,193,285.00
Stocks and bonds, market value,	3,506,178.40
Interest accrued,	75,600.51
Total Assets,	$5,337,014.72

LIABILITIES.

Premium Reserve,		$2,211,732.44
Losses unadjusted,		94,913.83
Commissions and brokerage,		57,032.71
Other liabilities (taxes accrued, etc.),		47,740.86
Capital Stock,	$1,000,000.00	
Surplus over all liabilities,	1,925,594.88	
Surplus as regards Policy-holders,	**$2,925,594.88**	2,925,594.88
Total Liabilities,		$5,337,014.72

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L. F. MIDDLEBROOK, Assistant Secretary.

W. R. C. CORSON, Assistant Secretary.

S. F. JETER, Supervising Inspector.

F. M. FITCH, Auditor.

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The Hartford Steam Boiler Inspection and Insurance Company

ISSUES POLICIES OF INSURANCE COVERING

ALL LOSS OF PROPERTY

AS WELL AS DAMAGE RESULTING FROM

LOSS OF LIFE AND PERSONAL INJURIES DUE TO EXPLOSIONS OF STEAM BOILERS OR FLY WHEELS.

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