THE INFLUENCE OF INTENSE COLD ON STEEL AND IRON.

[Condensed from Nature.]

There has recently been a most interesting discussion at the Literary and Philosophical Society, Manchester, on the above subject.

The paper which gave rise to the discussion was by Mr. Brockbank, who detailed many experiments, and ended by stating his opinion that iron does become much weaker, both in its cast and wrought states, under the influence of low temperature; but Mr. Brockbank's paper was immediately followed by others by Sir W. Fairbairn, Dr. Joule, and Mr. Spence, which at once put an entirely new complexion on the matter.

Dr. Joule says:

"As is usual in a severe frost, we have recently heard of many severe accidents consequent upon the fracture of the tires of the wheels of railway carriages. The common-sense explanation of these accidents is, that the ground being harder than usual, the metal with which it is brought into contact is more severely tried than in ordinary circumstances. In order apparently to excuse certain railway companies, a pretence has been set up that iron and steel become brittle at a low temperature. This pretence, although put forth in defiance, not only of all we know, of the properties of materials, but also of the experience of everyday life, has yet obtained the credence of so many people that I thought it would be useful to make the following simple experiments:

"1st. A freezing mixture of salt and snow was placed on a table. Wires of steel and of iron were stretched, so that a part of them was in contact with the freezing mixture and another part out of it. In every case I tried the wire broke outside of the mixture, showing that it was weaker at 50° F., than at about 12° F.

"2d. I took twelve darning needles of good quality, 3 in. long, $\frac{1}{24}$ in. thick. The ends of these were placed against steel props, $2\frac{1}{8}$ in. asunder. In making an experiment, a wire was fastened to the middle of a needle, the other end being attached to a spring weighing-machine. This was then pulled until the needle gave way. Six of the needles, taken at random, were tried at a temperature of 55° F., and the remaining six in a freezing mixture which brought down their temperature to 12° F. The results were as follow:—

Warm Needles.			Cold Needles.		
64	ounces	broke	55	ounces	broke
65	"	"	64	"	"
55	"	"	72	"	"
62	"	"	60		bent
44	"	"	68	"	broke
60	"	bent	40	"	"
Average, $58\frac{1}{3}$			Average, $59\frac{5}{6}$		

"I did not notice any perceptible difference in the perfection of elasticity in the two sets of needles. The result, as far as it goes, is in favor of the cold metal.

"3d. The above are doubtless decisive of the question at issue. But as it might be alleged that the violence to which a railway wheel is subjected is more akin to a blow than a steady pull; and as, moreover, the pretended brittleness is attributed more to cast iron than any other description of the metal, I have made yet another kind of experiment. I got a quantity of cast iron garden nails, an inch and a quarter long and $\frac{1}{8}$ in. thick in the middle. These I weighed, and selected such as were nearly of the same weight. I then arranged matters so that by removing a prop I could cause the blunt edge of a steel chisel weighted to 4lb. 2oz., to fall from a given height upon the middle of the nail as it was supported from each end, $1\frac{1}{16}$ in asunder. In order to secure the absolute fairness of the trials, the nails were taken at random, and an experiment with a cold nail was always alternated with one at the ordinary temperature. The nails to be cooled were placed in a mixture of salt and snow, from which they were removed and struck with the hammer in less than 5″."

The collective result of the experiments, the details of which need not be given, was that 21 cold nails broke and 20 warm ones.

Dr. Joule adds, "The experiments of Lavoisier and Laplace, of Smeaton, of Dulong and Petit, and of Troughton, conspire in giving a less expansion by heat to steel than iron, especially if the former be in an untempered state; but this, would in certain limits have the effect of strengthening rather than of weakening an iron wheel with a tire of steel.

"The general conclusion is this: Frost does *not* make either iron (cast or wrought), or steel, brittle.

Mr. Spence, in his experiments, decided on having some lengths of cast iron made of a uniform thickness of $\frac{1}{2}$ in. square, from the same metal and the same mould.

He writes:—"Two of the four castings I got seemed to be good ones, and I got the surface taken off, and made them as regular a thickness as was practicable.

"I then fixed two knife-edged wedges upon the surface of a plank, at exactly nine inches distance from each other, with an opening in the plank in the intervening space, the bar being laid across the wedges, a knife-edged hook was hung in the middle of the suspended piece of the bar, and to the hook was hung a large scale on which to place weights.

"The bar was tried first at a temperature of 60° F.; to find the breaking weight I placed 56lb. weights one after another on the scale, and when the ninth was put on the bar snapped. This was the only unsatisfactory experiment, as 14 or 28lb. might have done it, but I include it among others. I now adopted another precaution, by placing the one end of the plank on a fixed point and the other end on to a screw-jack, by raising which I could, without any vibration, bring the weight to bear upon the bar. By this means, small weights up to 7lb. could be put on while hanging, but when these had to be taken off and a large weight put on, the scale was lowered to the rest, and again raised after the change was made. I may here state that a curious circumstance occurred twice, which seems to indicate that mere raising of the weight, without the slightest apparent vibration, was equal in effect to an additional weight. $3\frac{3}{4}$ cwts. were on the scale, a 14lb. weight was added, then 7lb., then 4lb., 2lb., 1lb., and 1lb., making 4cwts. and 1lb. This was allowed to act for from one to two minutes, and then lowered to take off the small weights, which were replaced by a 56lb. with the intention of adding small weights when suspended; the whole was then raised so imperceptibly by the screw, that the only way of ascertaining that it was suspended, was by looking under the scale to see that it was clear of the rest. As soon as it was half-an-inch clear it snapped, thus breaking at once with one pound less than it resisted for nearly two minutes.

"Six experiments were carefully conducted at 60° F., the parts of the bars being selected so as to give to each set of experiments similar portions of both bars; the results are marked on the pieces. My assistant now prepared a refrigerating mixture which stood at zero, the bars were immersed for some time in this, and we prepared for the breaking trials to be made as quickly as could be, consistently with accuracy; and to secure the low temperature, each bar, on being placed in the machine, had its surface at top covered with the freezing mixture. The bars at zero broke with more regularity than at 60°, but instead of the results confirming the general impression as to cold rendering iron more brittle, they are calculated to substantiate an exactly opposite idea, namely, that reduction of temperature, *cæteris paribus*, increases, the strength of cast iron. The only doubtful experiment of the whole twelve is the first, and as it stands much the highest, the probability is that it should be lower; yet, even taking it as it stands, the average of the six experiments at 60° F., gives 4cwt. 4lb. as the breaking weight of the bar at that temperature, while the average of the six experiments at zero gives 4cwt 20lb. as the breaking weight of the bar at zero, being an increase of strength, from the reduction of temperature, equal to 3.5 per cent."

Sir W. Fairbairn states: "It has been asserted, in evidence given at the coroner's inquest, in a recent railway accident, that the breaking of the steel tire was occasioned by the intensity of the frost, which is supposed to have rendered the metal, of which this particular tire was composed, brittle. This is the opinion of most persons, but judging from my own experience such is not the fact. Some years since I endeavored to settle this question by a long and careful series of experiments on wrought iron, from which it was proved that the resistance to a tensile chain was as great at the temperature of zero as it was at 60° or upwards, until it attained a scarcely visible red heat."

The immense number of purposes to which both iron and steel are applied, and the changes of temperature to which they are exposed, renders the inquiry not only interesting in a scientific point of view, but absolutely necessary to a knowledge of their security under the various influences of those changes. It was for these reasons that the experiments in question were undertaken, and the summary of results is sufficiently conclusive to show that changes of temperature are not always the cause of failure. Sir W. Fairbairn adds: "The danger arising from broken tires does not, according to my opinion, arise so much from changes of temperature as from the practice of heating them to a dull red heat, and shrinking them on to the rim of the wheels. This, I believe, is the general practice, and the unequal, and in some cases, the severe strains to which they are subject, has a direct tendency to break the tires."

OAK GRAINING IN OIL COLORS.

Condensed from the Building News.

There is a charm and feeling about work executed by the hand, which gives it a value no mere machine work can possess. Machine work, from its very nature, necessitates a repetition of pattern, which cannot be avoided. Hand-work, on the contrary, can imitate every variety, and follow nature so closely that no two pieces need be alike. There is also in hand-work a wide scope for the inventive faculty and the exercise of good taste (both in form and color) and skillful workmanship. As a rule, strong contrasts between the ground and the graining color should be avoided. The figure and grain should of course be seen clearly, but only so clearly as to be distinct, without interfering with the general and uniform quietness of tone necessary to fulfil the conditions required by the laws of harmony and good taste. Violent contrasts and gaudy coloring are always vulgar, brilliancy and richness of color are not necessarily vulgar; it is the absence of the guiding power of knowledge and pure taste in their arrangement which degrades them to the rank of vulgarity. We have before spoken of the importance of good combing, and of the various kinds of combs used; we now proceed to describe how the work is done. The graining color is brushed over the work, in the ordinary manner, with a pound-brush, care being taken not to put too much color on, or else it is very liable to be dirty. A dry duster is now used to stipple with, which, if properly done, will distribute the color evenly; it is now ready for combing. In the real oak it will be found, as a rule, that the grain is invariably coarser on one side of the panel than on the other; this arises from the very nature of the growth of the tree; it is, therefore, well to imitate this pattern, and in order to do so we take first a medium or coarse cut gutta-percha comb, and draw it down one side of the panel; then use a finer one to complete it. This comb will leave the marks of the grain in clear unbroken lines from top to bottom of the panel. We now take a fine steel comb and go over the whole of the previous combing, moving it in a slanting or diagonal direction across the previous grain, or with a quick and short wavy motion or curl; both the former and the latter motion will break up the long lines, left by the gutta-percha comb, into short bits, which of course represent the pores or grains of the real wood. There are several other motions of the comb having the same end in view; and by using the gutta-percha or cork combs, in conjunction with the fine steel, an infinite variety of grain may be produced. Steel combs, with one or more folds of thin rag placed over the ends of the teeth are a style of comb which has nothing to recommend it. A natural variation in the grain may be produced by one comb alone, according to the manner in which it is held. For instance, if we take a coarse or broad-toothed gutta-percha comb, and commence at the top of a panel, with the comb, placed at its full width: if drawn down in this position it will leave a grain of the same width as the width of the teeth: but if we start with the full width, and gradually turn the comb or slightly incline it to one side—that is to say, on its edge, we thereby graduate the grain from coarse to fine at pleasure, and by holding the comb at a certain inclination we may actually make very fine the coarse comb. A very important point is the formation of the joints in the wood, as much of the effect of otherwise good work is lost in consequence of neglect in this respect. In looking at a real oak door, the joints of the stiles and rails are clearly and sharply defined, not by any defect of workmanship, but by the difference in the run of the grain, the stiles being perpendicular, and the rails horizontal. The rails being cut sharp off by the stiles, show a perfectly straight line. The light also acts differently upon the two, simply because the grain or fibre of the wood is exposed to its influence under different aspects. This also tends to produce a difference in the depth of the color of rails and stiles, and panels also. It will be evident that no imitations can be considered really good except they include these seemingly unimportant points.

It is a common practice for grainers to imitate a broad piece of heart or sap of oak, upon the back rail of almost every door they do, and many of them are not even content with that, but daub the stiles over from top to bottom with it also. There is nothing so vulgar or in such bad taste. It should only be done upon those parts of the work on which it would appear on a real oak door, namely, on the edges of the doors and on mouldings. There is a vulgar pretentiousness about what we may call the sappy style of work which is very undesirable. The figures cross the grain more or less abruptly and of course are of different shapes, sizes, and forms, a knowledge of which can only be acquired by study of the real wood. The figure may be wiped out with a piece of soft rag, held tight over the thumb nail. This should have two or three folds over the nail, the superfluous rag being held by the other hand to prevent it hanging down and smearing the grain; and every time a figure is wiped, the rag should be moved slightly, so that the same part of the rag will not be used twice, thus insuring clean work. It will often happen that the thumb-nail will get broken, or is too weak to stand the work; in these cases, or, in fact, in any case, a good substitute or artificial thumb-nail may be made of gutta-percha, thus: A piece of thin sheet gutta-percha is put into warm water, and, while soft, is wrapped around the end of the thumb up to the first joint. It is then pressed with the hand, so as to fit and take the shape of the thumb and nail. This cannot be done at one heating, but will have to be put into the hot water again, and the end pinched and squeezed into form to the shape of the nail, and to fit easily upon the thumb. When this gets hard, it may be trimmed into perfect form with a penknife. This artificial nail will answer the purpose admirably if properly made; and even when the natural nail is good, the gutta-percha will serve to save it from injury. Good figuring may also be done by using the blank end of the steel comb with a rag folded over its edge. We have also used a piece of gutta-percha to take out the lights. This should be square-ended, about one inch wide, and three or four inches long, and will do successful work of a certain class, but not of the best. Many grainers use a piece of thin horn, in shape something like a spatula, about three or four inches long and three quarters of an inch wide, with rounded ends, and quite flexible. With this tool the figure is cut or scooped out—a sort of quick, side-long motion, very difficult to describe, and requiring a very considerable amount of practice before it can be worked with any success. There is, however, the same objection to this tool as may be urged against the gutta-percha for figuring, namely, that neither of them take the color clean away, but leave an accumulation of color on the edge of the figure, which is fatal to good work; and therefore we cannot honestly recommend the use of any method but the wiping out with the thumb-nail or its substitute. When the figure is wiped out it will require to be softened. By softening, we mean the imitation of those half shades seen upon and about the figures in the real wood. Between and around the lights or figure in oak, there is always a lighter tint of color; this is imitated by doubling a piece of rag into a small roll, and with the side of this the grain is partially wiped away, but not to the extent of taking off the whole of the grain. A recent but most admirable system of graining oak, by means of over-combing, is worked exactly the reverse of any of the foregoing methods; that is to say, the figure is first wiped out, and the combing or grain is done afterwards, when the graining color is dry, in this wise: The graining color is mixed somewhat thinner than for ordinary graining, and is brushed over the work sparingly, leaving it just sufficiently strong to show a clear distinction between the ground and the color. The light or figure is then softened by drawing the end of a flat hog-hair fitch, or a small thin mottler, across each figure, and slightly softening with the badger-hair softener. The figure is broken up a little with fine lines across it in parts, such as may be seen in the real wood; but previous to wiping out, the figure, streaks of light should be wiped out and softened on one side of the panel or across the stiles, in imitation of the reflective lights seen in oak. The color should also be partially wiped off the rails or stiles at their junction; this tends to define the joint. The color is is now let to dry hard, when it will be ready for over-combing—that is, combing or graining over the figure (hence its name), and this will have to be done somewhat differently to the ordinary combing. As thus: The color is rubbed in as before, and combed solely with the gutta-percha combs, but these are specially cut for the purpose; they are best about 2 in. wide. The first must be cut with teeth about three-sixteenths of an inch in width, the next one-eighth, and the third about one-sixteenth. The broad-toothed comb is first used, and must be drawn down the panel, with a wavy motion, in short or long curls; either will answer our purpose now. The next size of comb is then drawn straig it down—the straighter the better. This has the effect of breaking the wavy combing into short and long straight bits, similar to the pores or grain of the real wood. Both the first and second combing may be varied by holding the comb in a slanting direction, and may be fine or coarse, according to the width of the combs used; now take a soft rag folded, and with this partially clear off the grain which runs over the figure, leaving only a sufficient quantity crossing the light or figure, to be just distinguished, exactly as it appears upon the figure in real oak. The grain is also wiped off in parts on the plain spaces between the figure, in order to break it up and take away any formality. If this method be well and probably done, a thoroughly deceptive imitation may be produced; and except this end be kept in view, no really good work will result.

KNOTS AND SPLICES.

[*See Engraving on First Page.*]

1. Turn used in making up ropes.

2. End tapered for the purpose of passing it readily thro gh a loop. To make this, we unlay the rope for the necessary length, reducing a rope diminishing in diameter towards the end, which is finished by interlacing the ends without cutting them, as it would weaken the work; it is lastly "whipped" with small twine.

3. Tapered end, covered with interlaced cordage for the purpose of making it stronger. This is done with very small twine attached at one end to the small eye, and at the other to the strands of the rope, thus making a strong "webbing" around the end.

4. Double turn used for making rope.

5. Eye splice. The strands of the cable are brought back over themselves, and interlaced with their original turns, as in a splice.

6. Tie for the end of a four-strand rope.

7. The same completed; the strands are tied together, forming loops, laying one over the other.

8. Commencement for making the end by interlacing the strands

9. Interlacing complete, but not fastened.

10 and 11. Shell in two views used in No. 65, showing the disposition of it at the throat. This joining is advantageous, as it does not strain the cords, and it prevents them from cutting each other; so that the rings pass one into the other, and are joined outside the intermediate shell.

12. Interlacing in two directions.

13. Mode of finishing the end by several turns of the twine continued over the cable.

14. Interlacing commenced, in one direction.

15. Interlacing finished, the ends being worked under the strands, as in a splice.

16. Pigtail commenced.

17. Interlacing fastened.

18. Pigtail with the strands taut.

19. Dead eye, shown in two views.

20. Pigtail finished. We pass the ends of the strands, one under the other, in the same way as if we were making a pudding splice: thus bringing it in a line with the rope, to which it is seized fast, and the ends cut off.

21. Scull pigtail; instead of holding the ends by a tie, we interlace them again, as in No. 16, the one under the other.

22. Pigtail, or "lark's nest." We make this to the "pennant" of a cable, which has several strands, by taking the requisite number of turns over the pudding, in such a manner that the strands shall lay under each other. This "pigtail" forms a knot at the end of the rope. It thus draws together two ropes, as shown in No. 32, forming a "shroud" knot. In these two pigtails, the strands are crossed before finishing the ends, so that the button, *a*, is made with the strands, *a*, and, *b*, with those of the rope, *b*.

23. Slip clinch to sailors' knot.

24. Slip clinch, secured.

25. Ordinary knot upon a double rope.

26. Bowline knot for a man to sit in at his work.

27. Called a "short splice," as it is not of great length, and, besides, can be made quickly.

30. Long splice. This extends from *a* to *b*. We unlay the strands of each of the ropes we intend to join, for about half the length that the splice will be, putting each strand of the one between two strands of the other.

31. Simple fastening on a rope.

32. A "shroud" knot.

33. The ends of the rope are prepared for making the splice (No. 29) in the same manner as for the "shroud" knot in No. 32. When the strands are untwisted, we put the ends of two cords together as close as possible, and place the ends of the one between the strands of the other, above and below alternately, so as to interlace them as in No. 29. This splice is not, however, very strong, and is only used when there is not time to make a long splice, which is much the best.

34 and 35. Marline spikes. Tools made of wood or iron, used to open out a rope to pass the strands of another through it.

36. Shows strands arranged as described in No. 30.

37. Fastening when a lever is used, and is employed when hauling upon large ropes, where the strength of several men are necessary.

38. A "pudding splice." This is commenced, like the others, by placing the rope end to end, the turns of the one being passed between those of the other; having first swelled out the yarns by a "rat's-tail," we put them, two by two, one over the other, twisting them tightly, and opening a way for them with the marlinspike. The inconvenience of this splice is, that it is larger in diameter than the rope itself; but when made sufficiently long, by gradually reducing the size of the strands, it has great strength.

39. This shows two strands, *a* and *b*, of the ropes, A B, knotted together, being drawn as tight as possible; we unlay the strand, *a'*, of the rope, A, for half the length of the splice, and twist the strand, *b'*, of the rope, B, strongly in its place, tying *a'* and *b'* together tightly. The same process is again gone through on the rope, B, the strand, *a''*, of the rope, A, being knotted to the strand, *b''*, of the rope, B. When all the strands are thus knotted together, we interlace them with the strands of the cable. Thus the strands, *a a' a''*, are interlocked by being passed alternately above and below the turns of the cord, B, the ends being also sometimes "whipped." In the same manner the strands, *b b' b''*, pass alternately over and under the strands of the rope, A, and are in like manner "whipped." It is important that the several inte lacings and knots should not meet at one point; we reduce the size of the strands towards the end, so that they loose themselves in the body of the splice, cutting off such parts as may project. This splice is employed for joining the ends of a rope when a chafed part has been cut out, and is quite as strong as the rope itself.

40. Belaying-pin opened to serve as a button; these are used where it is necessary to stop or check velocity.

41. Chain knot, or fastening.

42. Variable or regulating lashing. By laying the piece, *a f*, horizontally, it can be slipped along the rope, *b*; by raising or lowering this, we shall raise or depress the weight, *c*, the cord, *b*, running over the two pulleys, *d*, from the piece, *a f*, in the direction shown in the figure. The friction of the cord, *b*, passing through the hole, *e*, sufficiently fixed the piece, *a f*, and holds the weight, *c*, securely.

43. Cleet, with three ties.

44. Cleet, showing the mode of belaying the cord.

45. The piece, *a f*, of No. 42.

46. Fair leader.

47. Cleet to be fixed to a stay.

48. Loop for slipping other lines.

49. A "bend" which is only used for fear of the stoppers snapping.

50. Bastard loop, made on the end of the rope, and whipped with yarns.

51. Tie to pins: *a*, the pin; *b*, small cords fixed by a cross tie.

52. Cleet, fixed to the "rail," either with screws or nails, to which the lines are belayed.

53. Waterman's knot.

54. Fair leader.

55. Tie, or l end to pier.

56. Simple fastening to tie.

57. Fastening by a loop. This can be tied or untied without loosening the loop itself. It is made by following, towards the longer loop, the direction as numbered 1, 2, 3, 4, 5, and is terminated by the loop, 6, 7, 6, finally passing it over the head of the post, A. This knot holds itself, the turns being in opposite directions. To unite it, we slack the turns of the cable sufficiently to again pass the loop, 6, 7, 6, over the post, A, and turn the ends in the contrary direction to that in which they were made (as 5, 4, 3, 2, 1).

58. Iron "shell," in two views.

59 and 60. "Wedding" knots; *a b*, eyelets; *c d*, the join; *e*, the fastening.

61. Lark's-head fastening to running knot.

62. A round turn; the cord, *a*, is passed through the bight of the cord, *b*, over the button, *c*, where it is secured by an ordinary knot.

63. Belaying-pin splice. The cord, *b*, "stops" the pin, *e*, its end being spliced upon itself, and "served" with yarn; this rope, with its pin, is passed through the spliced eye, *f* of the line, *g*.

64. Round button.

65. Joint by a spherical shell, each loop, *a* and *b*, being made by ties and splices, and surrounding the shell, *c*.

66. Belaying-pin, shown separately, before being stopped.

67. Fastening to shears.

68. Square mooring. When the cable is round the post, A, and the piece, *c*, without being crossed, it lays in the section 1, 2, 3, 4, 5, 6, 7, and the end is fastened by tying.

69. Wooden shell in section.

70. Crossed fastening. The turns of the cable, passing in front of the post, B, are crossed at the back of C, in the direction 1, 2, 3, 4, 5, 6, 7, 8, the end, 8, being secured to the cable.

71. Wooden shell.

72. Double-chain fastening.

73. Lashing for "ram" block, or "dead-eye." The ram blocks, *a* and *b*, are strapped by the cords, *e*, which hold them; the small lanyards, *d*, pass through the holes to make the connection, and as they are tightened give the requisite tension to the cordage; the ends are fastened to the main rope. Usually one of these dead-eyes is held by an iron strap to the point where it is required to fix and strain the cordage, which is ordinarily a shroud.

74. Chain fastening.

1'. Simple band, showing the upper side.

2'. The same, showing the under side and the knot.

3'. Tie, with crossed ends, commenced; a turn is taken under the strands, to hold the ends of the cord.

4'. The same, completed.

5'. Bend with crossed strands, commenced, the one end being looped over the other.

6'. The same, completed.

7'. Necklace tie, seen on the upper side.

8'. The same, seen underneath. The greater the strain on the cords, the tighter the knot becomes.

9' and 10' are similar splices to 7' and 8' with slight modifications.

11' shows the commencement of 13', the legs in elevation; 12' being a front view. An ordinary band, made by several turns of a small rope, is lapped round them and hauled taut, and then interlaced at the ends. This done, the legs are shifted into the shape of a St. Andrew's cross. Thus the lashing is tightened, and, for further security, we pass the line several times over the tie and between the spars, knotting the ends.

13'. Portuguese knot. This is a lashing for shear legs and must be tight enough to prevent the spars slipping on each other; the crossing of the two legs gives a means of securing the knot.

14'. For binding timbers; *a*, knot commenced. Take several turns round the timbers, and fasten the ends by passing them under the turns; *b*, knot completed. The end of a round stick, *m n*, termed a packing stick, should be passed under the knob, the cord being slack enough to allow of this. By turning the stick, the turns can be tightened to any extent; when tight, we fasten the longer arm of the lever to some fixed point, by a rope, *p q*, so that it cannot fly back. Care must be taken not to turn the stick too far, or the rope may be broken. As the timber dries and shrinks, the lever may be used to make all taut again.

The Hartford Steam Boiler Inspection and Insurance Company.

The Hartford Steam Boiler Inspection and Insurance Company makes the following report of its inspections in January, 1871:

During the month, there were 522 visits of inspection made, and 1,030 boilers examined—853 externally and 363 internally, while 106 have been tested by hydraulic pressure Number of defects in all discovered, 431, of which 163 were regarded as dangerous. These defects were as follows: Furnaces out of shape, 24—3 dangerous; fractures, 47—25 dangerous; burned plates, 29—14 dangerous; blistered plates, 54—10 dangerous; cases of sediment and deposit, 97—18 dangerous; cases of incrustation and scale, 70—24 dangerous. To show how little attention is paid to the internal condition of boilers by incompetent engineers, we copy the following from a letter of one of our inspectors:

"In one tubular boiler I found sediment in the back end, eight inches deep, and extending forward more than four feet. It seemed to be an accumulation of fine scale cemented together, so that it was necessary to break it up with a hammer and chisel before it could be removed. The engineer said *he had cleaned the boilers only three days before*, and objected to my making another examination. This is one of the many cases we find, where the proprietor trusts everything about his boilers to his engineer, supposing him to be reliable."

With such accumulation of sediment and deposit, is it any wonder that sheets are burned? A careful engineer will understand, if the feed water be impure, that he must blow down two or three inches every day, or oftener, that the sediment may be removed as it accumulates, and then an internal examination once in two weeks, or once a month, will insure a clean boiler.

Cases of external corrosion, 26—10 dangerous; cases of internal corrosion, 17—5 dangerous; cases of internal grooving, 28—11 dangerous; water gages out of order, 50; blow-out apparatus out of order, 15—7 dangerous; safety valves overloaded, 40—12 dangerous; pressure gages out of order, 54—6 dangerous, varying from —15 to +8 pounds. (We have found several gages entirely ruined from being frozen). Boilers without gages, 4; cases of deficiency of water, 5—1 dangerous; broken braces and stays, 31—7 dangerous; boilers condemned, 2—both dangerous.

Two engineers were found drunk on duty, and promptly discharged. There were 9 serious explosions during the month, by which 99 persons were killed, and 6 wounded. Eighty-seven of the killed were passengers on the ill-fated steamer *H. R. Arthur*, on the Mississippi River. Many were drowned, and some burned, but the origin of the calamity was the bad quality of the boilers, which a careless management was unable to detect. The upper and fore part of the boat was blown away by the exploded boilers, and, to add to the horror, what remained took fire.

None of these exploded boilers were under the care of this company.

FIVE ore-roasting furnaces are in full blast in Nevada