SUPERHEATED STEAM AND BOILER FIRES.

A number of French naval officers were detailed some time ago to test the workings of the Bourdon system of injecting superheated steam above the incandescent fuel in boiler furnaces. Although the results they reached may be already known to some of our readers through the French publications, we note from a translation in the *Mining Journal* the following points: The apparatus was attached to two high pressure boilers, each consisting of three combined cylinders set in brick masonry, and was of the following description: An iron pipe of very small diameter carried the steam from the steam drum of the boilers to the front of the furnace, entering the latter near the side of its door at the level of the coal within, and delivering the steam into a faggot of tubes situated in the masonry of the furnace. From the faggot of tubes a second pipe led to a rectangular box of thick iron placed across the furnace above the top of its bridge-wall. In the side of this box facing the fire, is a large number of very small holes with diverging axes which spread out fan-like above the coal on the grate.

The steam taken by the pipe from the steam-drum of the boilers is first superheated in the faggot of the tubes lying in the hottest part of the masonry of the furnace, and is then carried to the box from which its pressure violently projects in fine streams over the whole surface of the incandescent fuel. Cocks, placed at proper points of the apparatus, control the admission of the steam, and drain off the water of condensation when the boilers go out of use.

According to Mr. Bourdon's theory, the superheated steam on coming in contact with the incandescent fuel, decomposes into oxygen and hydrogen, thus furnishing the furnace with a large contingent of pure combustible gas, having a maximum calorific power, whence results an extremely rapid and perfect combustion of all the combustible elements, with a total absence of smoke.

The Board found that Mr. Bourdon's apparatus did produce an extraordinary activity in the furnace; that the flame, instead of being long, undulating and more or less smoky, became, when the steam was injected, short, dazzling and darting like the jets from a blow-pipe; that the draft of the boiler was considerably increased, and that, finally, the furnace showed no trace of smoke, the gases of combustion escaping from the chimney being colorless and only visible, with difficulty, at the moment a fresh charge of coal was thrown in.

EDGE-LAID BELT.—A better plan of making a broad belt than the usual American *double* leather belting sewed together, is made with the greatest ease, of any thickness or width, perfectly equal in texture throughout, and alike on both sides. It is made by cutting up the hides into strips of the width of the intended thickness of the belt, and setting them on edge. These strips have holes punched through them about one-eighth of an inch in diameter and one inch apart. Nails, made of round wire, clinched up at one end for a head and flattened at the other, are used for fastening the leather strips together. Each nail is half the width of the intended belt, and after the strips are all built upon the nails, the ends of the latter are turned down and driven into the leather, thus making a firm strap, without any kind of cement or splicings. When the strap is required to be tightened, it is only necessary to take it asunder at the step lines of the splice, cut off from one end of the strap at each step what is required, and piece up again with wire nails or laces, going entirely through the strap. —*E. Leigh.*

PLATINUM PLATE.—For the coating of iron with platinum, M. Dode, of Paris, the well-known discoverer of the platinum mirrors, has patented a process in England which is described in the *Polytechnic*. The iron first receives a coating composed of lead and copper, and then the platinum is applied. The first coating is prepared by mixing 22 parts of borate of lead and 4½ parts of cupric oxide in oil of turpentine, and is applied by means of a fine brush. The platinum coating is prepared by converting ten parts of platinum into chloride and mixed with five parts of ether and permitted to evaporate in the air. The residium is mixed with a viscid combination of 20 parts borate of lead, 11 parts red lead, and some oil of lavender, and 30 parts of amylalcohol added to the whole. In this mixture the object to be platinized is dipped, allowed to dry in the air, and then heated to a moderate temperature.

FIRE PROOF CONSTRUCTION.—Capt. Shaw, head of the London Fire Brigade, writes: "No fireman has ever seen a stone stair escape when subjected to much heat, and no internal wall supported on iron can be relied on where there is much heat. At the present moment may be seen at the corner of two streets a new building supported entirely on iron columns without any wall, wood or brick work reaching to the ground along the whole line of the front. At the ordinary temperature of 600 to 700° Fahr., the whole building must inevitably fall, and such a temperature could easily be created by the combustion of a small quantity of furniture." The conclusion seems to be that brick or iron, covered with brick and plaster, which has been subjected to fire, are the only fire-proof materials really deserving the name.

FIRE-PROOF JOIST.—An ingenious kind of fire-proof joist, recently introduced, consists of a slip of wood five inches wide by five-eighths of an inch thick, belted between two flanged strips of quarter-inch iron, making a beam quite as strong as those of wood ordinarily employed. The iron sides, in addition to affording strength, it is claimed, render the joist substantially fire-proof, while the center of wood affords the means of putting down floors and nailing of laths in the usual manner. The impediment to the manufacture of these joists heretofore has been the difficulty of rolling the flanged iron sides, but this has now been successfully overcome.

COAL PLANTS.

On the 8th ult., Prof. L. C. Miall gave a lecture at Leeds, England, on coal plants. He said the coal plants were preserved in a great variety of forms, sometimes flattened out as thin as a sheet of paper between layers of hardened mud or shale and sometimes the whole structure of the plant was found in a thoroughly recognizable state. The most important of these plants, from many points of view, and one of the most common, was the *Lepidodendron*. It was a tree of considerable size, having a tall upright stem and at the top many branches, which were distinguished from those of many coal plants by the fact that they continually forked or broke up into two, and this again and again. After referring briefly to several other coal plants—the sigillaria, the calamite and the coniferous ferns—the lecturer proceeded to explain the structure of the *Lepidodendron*. In its general features the stem of the *Lepidodendron* resembled that of a common tree. It had the pith in the center, then a ring of wood and then the bark outside. When examined closely it was found that the pith in the center was very large, then immediately outside the pith there was a sort of cylinder or sheath of the pith, made up of vessels which served for the transmission of air from one part of the plant to another. The four main trunks broke off into smaller ones and these again gave off numerous rootlets. The roots, instead of becoming smaller and smaller as they extended, and as was usual in common trees, broke off abruptly. They were distinctly articulated and there was another sort of joint at the point of union, a peculiarity not known in any living plant. Another peculiarity was that the four main trunks were divided from one another by distinct lines. He then explained the nature of the spores which were found in all the better coal in common use in this country. Certain parts of plants were selected for preservation, all the rest disappearing. The difficulty was not to explain how so much had disappeared, but how some parts should ever have been preserved. The lecturer said that researches into the plants of the coal-measures had not yielded a single new type of vegetation.

MOVEMENT OF AIR BUBBLES IN LIQUIDS.

In a paper in the *Bulletin* of the Belgian Academy of Sciences, Prof. Van der Mensbrugghe discusses the causes of the seemingly spontaneous movements of bubbles of air in levels and of vaporous bubbles in the microscopical cavities of minerals, these researches being part of those into the tension of surfaces of liquids. Prof. Mensbrugghe explains these movements, as Mr. Hartley also does, by changes of tension in the surfaces of liquids produced by changes of temperature; when the temperature of the liquid at one end of the bulb becomes, for some reason, higher or lower than at the other end, however small the difference, the tension of the surface decreases at the warmer end, and the bubble moves toward it. But, a thin film of water remaining on the glass, the surface of the liquid is enlarged at the warmer end, and diminished at the opposite end, and this, says *Nature*, according to experiments of the author, lowers the temperature and increases the tension at that end; so that if the temperature now ceases to rise, the motion of the bubble is not only stopped, but the bubble also returns backward. Thus each displacement of the bubble immediately gives rise to such forces as tend to produce a motion in an opposite direction; and the variations of tension produce the more obvious motions the smaller the masses of liquid in which the bubble is swimming. The same explanation may be applied also to the movements of bubbles in microscopical cavities of minerals filled with liquids. In that case, the bubble being produced by the vapors of the liquid, its movements are yet more rapid, as every change of temperature is followed by further evaporation of the liquid, or by condensation, both which alter the dimensions of the surfaces of the liquid and their tension. The author supposes also that the Brownian motions of powders suspended in liquids may be explained in the same way, and that those powders which absorb most gas will best display this kind of motion.

MICROSCOPICAL EXAMINATION OF WATER.—W. L. Scott, in the London *Microscopical Journal*, says that often when the result of a chemical examination of a water makes it passable, a microscopical examination furnishes evidence upon which the water should be condemned. To assist in the microscopical examination of waters, he filters them through papers, the center of which is rendered impervious by being coated with a mixture of 35 parts of vaseline and 65 parts of ozokerite. The living and dead suspended matter is thus concentrated within a small volume, and microscopical examination then reveals the number and varieties of organisms in a definite quantity of the water under examination. Mr. Scott says he has employed this method of procedure to learn the nature of the water often added to milk, and that in half a pint of one sample of milk he detected decomposing vegetable and animal matters, and also 87 living animalcules.

GILDING AND SILVERING OF GLASS AND PORCELAIN.—Sulphur is dissolved in oil of spike lavender until it has a semi-liquid consistence; this is mixed with an etherial solution of chloride of gold or of platinum, and the mixture evaporated to the consistence of paint. The surface to be gilt or silvered is then covered with the mixture, and the object carefully heated in a muffle, whereby the volatile substances are expelled and the metallic gold or platinum fastened upon the glass or porcelain. The surface, thus metalized, is afterward plated in the usual manner with the solutions in gold, silver, or copper, and with the aid of a galvanic battery.

PURE HYDROGEN.—According to the bulletin of the Chemical Society of Paris, hydrogen may be purified by passing it through the following solution: Bichromate of potassa, 100 grammes; water, 1,000 grammes; concentrated sulphuric acid, 50 grammes.

AMERICANS DREDGING A SHIP CANAL IN RUSSIA.

Mr. Levi Hayden, for several years past superintendent of the Morris & Cumings Dredging Co. of New York city, has started for St. Petersburg, Russia, to commence, for the company he represents, the construction of machines and scows preparatory to dredging a great sea canal through the lagoon which separates Cronstadt, the chief naval depot of the empire, from the national capital. This important work, says the *Iron Age*, is under a contract with the Russian government, whose commissioners at the Centennial observed the American methods of dredging, and now adopt them in a public improvement which may have no ordinary political and commercial significance. The contract requires that excavation shall commence by the first of October next, and the entire work be finished in 1883, though it is not possible to operate the machines more than six months in the year on account of ice. The sum of $25,000 in gold has already been deposited in St. Petersburg by the contractors, as a pledge of good faith. The width of the canal is 280 feet, depth 20 feet, length about 10 miles. A leading feature of the improvement is the building of a "commercial port" near St. Petersburg (with a central basin, while the whole is environed by smaller basins for smaller craft), whence a line of railroad and parallel canal will extend to the river Neva, intersecting in their course all the great lines of railways connecting St. Petersburg with the south, the whole forming a single system of internal communication, which is regarded as showing extraordinary sagacity in its conception. One Pooteeloff by name takes all the honor. When all is finished, naval vessels can easily pass from the sea almost to the suburbs of St. Petersburg, barges from either the Volga or Neva can at the same time pass down to Cronstadt, and all the railroads have increased facilities for moving their freight. The engines and some of the machinery to be employed will be built in the United States. The contract as it now stands is for the removal of 3,750,000 cubic yards of mud, but the total is likely to be increased to 7,500,000 yards. The dredges are called the "clam-shell dredge," like those frequently seen at work in the New York docks, being armed with powerful iron jaws which close upon each other when filled.

WAVE POWER AND MASONRY.—A remarkable instance of effect of sea waves on masonry, says the *Iron Age*, is furnished in the case of the well-known breakwater at Wick, on the coast of England. The hight of the waves at this place was, it appears, several times measured and estimated, the result showing about 42 feet from crest to hollow. Stones of eight and ten ton weight were, by these waves, carried from the parapet to the very top of the breakwater; and it was therefore determined, finally, to construct the outward extremity of the breakwater by depositing three courses of one hundred ton blocks of stone on the rubble base, as a foundation for three courses of large flat stones, surmounted by a monolith of cemented rubble built on the spot. The end of the breakwater, therefore, was in substance a monolith weighing upward of eight hundred tons, being about twenty-six feet by forty-five, and not less than eleven feet in thickness, cemented to the underlying rubble base. Incredible as it may seem, this huge monolithic mass succumbed to the force of the waves—it was, indeed, actually seen by the resident engineer to be bodily slewed around by successive strokes until it was finally removed and deposited inside the pier. Not only the upper portion, but the three lower courses of stone, forming a mass of 1,350 tons, was removed without breaking.

THE SOURCE OF ITS SALTINESS.—It was long supposed that the brackishness of Salt river, Arizona, was caused by the stream running over a bed of salt somewhere along its course. Its waters are pure and fresh from where it heads in the White mountains to within 50 miles of where it empties into the Gila. Fifty miles from its junction with the Gila there comes into it a stream of water that is intensely salt. This stream pours out of the side of a large mountain, and is from 20 to 30 feet deep. It is very rapid, and pours into the Salt river a a great volume of water. Here could be easily manufactured sufficient salt to supply the markets of the world. All that would be necessary would be to dig ditches and lead the brine to basins in the nearest deserts. The heat of the sun would make the salt. Were there a railroad near the stream its waters would doubtless soon be turned and led to immense evaporating ponds. It is supposed that the interior of the mountain, out of which the stream flows, is largely composed of rock salt.

CHEYENNE TO WASHINGTON TERRITORY.—A bill recently introduced in Congress proposes to incorporate the National Pacific Railroad and Telegraph Company, with $35,000,000 capital, to run from Cheyenne via Fort Laramie to Deadwood, and also via Fort Laramie and the Yellowstone, to Helena, Montana, and thence to the Pacific ocean, on the coast of Washington Territory. The bill grants right of way, use of public timber, etc., authorizes the issue of $25,000 mortgage bonds per mile, and exempts the property from all taxation for ten years after completion. Work will be commenced within one year, and run at not less than 50 miles per year until the main line reaches Helena.

BLACKBOARD PAINT.—The following is a good recipe for blackboard paint: One quart of shellac dissolved in alcohol, three ounces pulverized pumice stone, two ounces pulverized rottenstone, four ounces lampblack; mix the last three ingredients together, moisten a portion at a time with a little of the shellac and alcohol, grind as thoroughly as possible with a knife or spatula; after which pour in the remainder of the alcohol, stirring often to prevent settling. One quart will furnish two coats for 80 square feet of blackboard not previously painted. The preparation dries immediately, and the board may be used within an hour, if necessary. No oil should be used. Should it not be convenient to make this preparation, liquid slating may be purchased, ready prepared.

WASHOE'S WASTE.

At the C. & C. shaft there is a large room in which the miners change their clothing on going into and coming out of the lower levels. On coming out of the mine their clothes, a woolen shirt and pair of woolen drawers or cotton overalls, are reeking with perspiration and are more or less soiled by the dust that has settled upon them. In the changing room is a large trough, with a supply of hot and cold water. Here the miners wash the clothes they have worn in the mine before leaving for their homes, hanging them on racks to dry, in order that they may have clean clothing when they next go down into the lower levels. In this tank or trough some 600 men daily wash their clothing when going off shift, and in its bottom there collects about 30 pounds per day of sand and clay. Yesterday Col. Fair had the curiosity to have the assayer of the Consolidated Virginia assay office, Henry G. Elder, make an assay of the sediment deposited in the washing tank, and the following is the result: Gold per ton, $128.60; silver, $130.50, making a total of $259.10 per ton for the dirt washed out of the shirts and overalls of the miners. Heretofore the washings of this trough have not been saved, but they will now probably be taken care of by some one, as in the course of a year they would amount to quite a snug little sum.

In the large jewelry manufactories the world over, where the workmen handle and file and burnish gold and silver, they are required to wash their hands in a marble tank, and the amount of the precious metals saved in this way in the course of a year is something astonishing.

We are now able to see that since the opening of the mines of the Comstock half a dozen large fortunes must have been sown broadcast over the country by the winds. The amount of ore that would stick upon the clothing of the miners is as nothing compared with that blown off wagons and cars by the wind. The fine ore thus blown away is generally of the richest character. From a train of 40 cars in going from this place to the mills on the Carson river through a "Washoe zephyr," the loss would probably not fall short of a ton. Of late, however, the precaution has been taken of securing the fine ore by wetting down the loaded cars before the departure of the trains from the ore houses.

In the early days, when hundreds of teams were engaged in hauling the rich ores of the Ophir to Washoe valley, the wagons being all the day on the road, immense amounts must have blown away, as in crossing the mountain and winding around the points of the hills the wind often blew hard enough to scatter not only the fine particles of ore, but also lumps of considerable size from the wagons, piled and rounded up as they generally were.

It could hardly be expected, however, that in those days any one would think of the fine ore blown off the loaded wagons when no one paid any attention to the lumps that were rolling off, and when it was not unusual for teamsters to stop and fill up the chuck holes with the rich ore from their wagons. As men at that time did not think of saving the tailings running to waste from their mills, and almost as rich as the ores that went under the stamps, we can hardly find fault of them for paying no attention to the ore blown from the wagons and scattered along the roads by the teamsters. Now, however, although late in the day, we are becoming wiser, and find that even in the washings of the dirty clothing of the employees of one mine there is a little bonanza of about $2,000 per annum.—*Territorial Enterprise.*

NEW ZEALAND RAILWAYS.—Mr. Caruthers, Engineer-in-Chief for railways in New Zealand, reports that at the close of June, 1877, there were 860 miles of railway opened for traffic in that colony, and 274 miles in progress, which are expected to be completed in 1877-78. In comparing this with the other colonies we find that Victoria comes next in its length of lines, having at the end of last year 702 miles open for traffic, and 259 miles more in progress, while New South Wales had only 509 miles opened, and 180 miles in course of formation. By adopting a gauge of 3 feet 6 inches the New Zealand government has not only been able to construct its lines with greater speed than the railways made in Victoria and New South Wales, which have wide gauges, but it has also been able to make them at considerably less cost. In New Zealand the expenditure on the 860 miles of railway in operation has been £6,129,920, or an average of something over £7,277 per mile, while in New South Wales the average is £15,699, or more than double, in Victoria £21,354, in South Australia £8,480, and in Queensland £10,633 per mile.

THE IMPROVEMENT OF THE MISSOURI RIVER. The report of Charles R. Suter, major of engineers, who has charge of the improvements of the Missouri river, and under whose direction a survey of the river at and above Atchison, Kas., has been published. He says that there are impending changes in the channel of the river at that point which threaten to destroy the railroad bridge there, or render the draw span impassable for steamboats. There is on the Missouri side of the river a chain of lakes, and it is feared that, owing to ice gorges or some cause, the river may break through into these lakes and abandon its present channel. Another danger lies in the fact that just above Atchison a narrow neck separates two bends in the river, which is liable to be washed out. The greatest danger, however, lies in the fact that the Missouri shore in the bend just above the bridge is rapidly caving, threatening the bridge. Major Suter recommends that this bank be protected as soon as possible, and estimates the cost of the improvement at $56,000.

THE ST. GOTHARD TUNNEL.—The Cologne-Minden and the Bergish-Markishe railway companies, which have granted a subsidy of 1,000,000 frs. each for the St. Gothard railway, have refused to pay any further sum for that project. Altogether, Germany is interested in the St. Gothard railway to the tune of 20,000,000 frs., 8,000,000 being contributed by the Empire 2,717,000 by Baden, 1,500,000 by Prussia, 2,717,000 by the Alsace-Lorraine railways, etc.