creases the steam pressure, and bursts the boiler, and all this occurs "through no defect in the boiler, which might have been amply able to withstand 500 lbs. pressure for years."

There is a grain of truth in this, which has been magnified into a theory which, it is asserted, will explain many of our boiler explosions. The grain of truth is, that it is possible under certain conditions to raise the temperature of water above that at which it ought to boil, without its doing so or giving off any steam. Professor Cotterill, of the Royal Naval College, in a treatise on the Theory of the Steam Engine, alludes to this theory of boiler explosions, and says that perfectly quiescent water, perfectly free from air or other foreign substance, may be raised to a temperature far above 212° in a clean glass vessel, without occasioning ebullition: and when ebullition does take place, it is effected in fits and starts, producing what is called "bumping." If such an effect could be produced in an ordinary steam boiler, he thinks it would be a source of danger, but concludes that so far as experiment has shown, the circumstances necessary for this superheating of water are not likely to occur in the actual practical use of steam boilers. Professor Clerk Maxwell says the highest temperature to which water may be raised under the atmospheric pressure without ebullition cannot be said to be accurately known, and describes how drops of water, in a mixture of linseed oil and oil of cloves, have been heated to 356° Faht. without changing them into steam. The pressure of aqueous vapour, if 356° temperature, is about 147 lb. per square inch.

The conditions under which water may thus be superheated it will be seen are not such as are at all likely to occur in an ordinary steam boiler. If such precautions, as having the water perfectly free from air and other substances, and keeping it perfectly quiescent, are necessary in a scientific experiment in a laboratory in order to succeed, in causing the water to absorb the extra heat and still remain in the liquid state without becoming steam, how extremely unlikely is it that in an ordinary boiler, with ordinary water, these conditions are ever fulfilled. It is almost impossible in ordinary boilers to heat water at all, and have it perfectly *quiescent*; as heat is absorbed by the portions of water nearest to the heated boiler plates, they become more buoyant than portions of the water more distant, and hence currents of ascending hot water and descending cooler water are formed long before any steam is produced at all—and so long as heat continues to enter the water, so long will all the water, above the points where the heat enters, be affected by these currents, and perfect quiescence cannot be attained. What a boon it would be to the ordinary engineer to be supplied regularly with water for the boiler perfectly free from all foreign substances. No more mud, no more hard scale, no more dirty jobs washing boilers out! Probably boilers would not last so long, and one of the conditions necessary for making "latent steam" would then exist in ordinary boilers, but most engineers, if saved from the cleaning-out troubles, would willingly take their chances on the other dangers. There is no doubt that the heat of the water has a great deal to do with the tremendously destructive force let loose by a boiler explosion, but this does not come into action until the explosion has actually taken place; that is, the boiler must be ruptured, and the steam pressure relieved, before the heat contained in the water can come into play. The heat in the water does not burst the boiler, but after rupture has begun this heat will maintain the supply of steam, and so drive the portions of the boiler further asunder, and generally extend the mischief. Hence, a large boiler exploding under a low pressure usually does more mischief than a small one exploding under a high pressure.

PRISON LABOUR.

Across the border a strong agitation against the competition of prison labour with that of honest men has sprung up, and bids fair to effect something important before long. This is a matter with which the Federal Government and Congress have nothing to do, each State having control of its own prisons. The movement against the existing system is most active in the State of New York, where a thorough investigation by the legislature at Albany is in progress. From the State Inspector's report the following facts are taken:—At Sing-Sing one firm employs 906 men making stoves, paying the state 56 cents per man per day. Another firm employs 307 men at 50 cents; and a laundry firm employs 136 men at 60 cents. At Auburn, a company employs 65 men making horse collars, at 65 cents; the making of hollow ware employs 181 men at 50 cents; harness and plate manufacture, 118 men at 50 cents; and the manufacture of axles takes 225 men at 50 cents, and 59 men at 60 cents. At Clinton, a hat manufacturing firm employs 390 men at 50 cents. It is contended that it is unfair to honest mechanics to put them in competition with such wages, and unfair also to manufacturers who do not employ this cheap prison labour. Last week's report of alleged atrocities in Sing-Sing prison may or may not be confirmed, but the circumstance is sure to fasten public attention on the subject, and will make the agitation stronger. In some prisons stout healthy men are furnished the contractors for 40 or 42 cents per day. In New Jersey the hat manufacture was carried on in the State prison to such large extent that workmen outside were reduced to want. An agitation sprang up; the legislature felt compelled to take action; the hat manufacture in that prison was stopped, and good times along with healthy competition in the trade soon followed.

We have as yet nothing in Canada to compare with the evils of the prison labour system in the State of New York. But still the same evils exist here too, though in a lesser degree, and we had better see to it that they do not grow upon us. We have made quite a beginning already, and the unfair competition of prison labour is making itself felt. Magistrates in various parts of Ontario appear to think it a fine thing to get rid of their local criminals by sending them to the Central Prison, in cases for which the county jail would answer better. They use their powers in this respect very frequently and freely. Before long the whole system of prison labour will have to be taken up and dealt with anew, by both Dominion and Provincial authorities.

TREATMENT OF INDIA INK DRAWINGS.—India ink drawings that are to be coloured or washed over with tints should have a little bichromate of potash added to the ink. After the drawing has been exposed to light for an hour or so, the lines can be gone over without washing them up.