

length of the train. This releases the brakes, which are wound up after the fashion of an alarm clock. The hand brakes are used at all ordinary stoppings, the spring power being reserved only for an emergency.

The electric brake of Olmstead has been in use upon one train on the Erie railroad for some time, and works well.

The steam brake has a continuous line of pipe from the locomotive to the last car in the train; under the center of every car is a common steam-tight cylinder and piston; a branch from the long line of pipe communicates with the front end of all these cylinders; so that when the engineer turns a stopcock, the steam rushes like lightning through the train, enters the cylinders, and pushes the pistons outward, and thus applies the brakes to the wheels of every car in the train. The air brake is the same thing, except that air does the work instead of steam.

To show the state of the art, and that the material exists by which this bill can be carried into effect, tables are appended to these remarks showing the names of inventors and the dates of their patents obtained both in England and the United States. The first power brake patent granted in this country was in 1847, and the total number granted up to the close of last year was fifty-nine. More patents on power brakes were granted in 1872 than from the organization of our Patent Office to the close of 1871, which strikingly illustrates the rivalry of the inventive genius of this country.

In England, from 1840 to 1866, there were patented twenty-two electric brakes; from 1835 to 1865, twenty hydrostatic brakes; thirty pneumatic brakes from 1838 to 1866, and fifty-four steam brakes from the year 1836 to 1866.

Henry Miller's steam brake, patented in 1855, was tried on a train of cars at Detroit, about that year, in the presence of several distinguished people; and a very interesting printed report of its operation and trial at that time may be found in the file containing his original application for a patent in the United States. But, for the fruits of his genius developed almost twenty years ago, it is to be regretted that he never received either honor or competent reward.

Seven companies for the manufacture of power brakes have been organized in the United States since 1869. And of the 444 railroads in the United States and Canada, more than one sixth of them have already been equipped with power brakes operated by the engineers.

On the Chicago and Northwestern railroad, by means of these brakes, a train of six cars, going at the rate of thirty-two miles an hour, was stopped in 19 seconds; the same train, going forty miles an hour, was stopped in 18 seconds, in 370 feet, or in less than one half the length of this Capitol building. The time in which to stop is the all-important consideration. It surely would take three minutes to stop a train going at this speed with the ordinary hand brakes. A minute in railroading is a very important matter."

Mr. King is hardly correct here. With handbrakes, properly and promptly applied, the train can be stopped as quickly as by the power brake. At a speed of thirty-three miles an hour a train can be stopped by hand brakes within a distance of 57 yards. At a speed of sixty-three miles an hour, within a space of 273 yards.

COLLAPSE FROM LOW WATER IN STEAM BOILERS.

A correspondent writes from Phelps, N. Y. to tell us of a somewhat remarkable and very interesting instance of a peculiar effect which may follow the overheating of a steam boiler in consequence of a deficiency of water. The case furnishes us an excellent text for remarks on the subject of "low water." A copper still, which had been in use, was, by some oversight, completely emptied while the fire was allowed to burn with undiminished intensity. It, as a natural consequence, quickly became red hot. While in this condition a quantity of cold liquid was run into it, when it instantly collapsed, being completely crushed in by the pressure of the atmosphere acting upon its exterior.

Our correspondent asks us to explain this, to him, most mysterious occurrence. Probably a very large majority of our most experienced and most intelligent engineers, if asked what effect should be anticipated in such a case, would say that there would be imminent danger of an explosion, and that a collapse could not, under any circumstances, occur. This case, however, is described by one of our readers, who gives us his name, and we cannot doubt the authenticity of the narrative. We can readily imagine, furthermore, how such an action might take place. A closed vessel used as a still, having pipes of small diameter for inlet and outlet, would, when the contents were drained off in the manner described, be left dry, but filled with highly heated aqueous vapor at atmospheric pressure. When the cold liquid was allowed to re-enter, this vapor would be likely instantly to condense, and before the atmosphere could enter through the contracted openings in sufficient quantity to equilibrate the pressure on the exterior, collapse might occur. This we presume to have been the case in the instance considered, and we have here another reminder of the falsity of the idea, formerly so prevalent and which is by no means yet extirpated from the minds of some of even the most intelligent men having charge of steam boilers, and that "low water" must inevitably produce an explosion, and even that it is the principal cause of explosions.

Sixty years ago a crucial experiment was unintentionally tried by the then well known Captain Bunker, who commanded John Stevens' steamboat, Phoenix, the craft which is celebrated as having been the first steam vessel to make a trip in the open sea. In the year 1812, just before the memorable trip from this port to Philadelphia, which the venturesome captain made with young Robert L. Stevens, the

boat was lying one night at the wharf, when, by some carelessness, the boiler became completely emptied of water. On discovering this unpleasant state of affairs, Captain Bunker at once, as he testifies in the report of the Secretary of the Treasury, December 12, 1838, turned on the feed water. A crackling noise and some leakage, due to unequal contraction, were the only noticeable consequences. The same authority tells of a similar occurrence of which he was a witness which had no more serious results. Many such instances are known to have taken place, and the Franklin Institute of Philadelphia and individual experimenters have furnished ample evidence that, with low steam pressure, it is by no means certain, or even probable, that an explosion must be consequent upon a deficiency of water in the steam boiler. This prevalent theory, which was, as we have seen, disproved even before it had become a tradition, is too often made a scapegoat for those guilty of carelessness or recklessness in quite other directions.

It cannot, however, be too earnestly impressed upon those having charge of steam boilers that, although the majority of explosions are due to either ignorance or recklessness in working boilers too weak to bear the pressure to which they are subjected, low water may, and sometimes does, produce explosions. Iron heated to a red heat loses a large proportion of its strength, and at a white heat retains, practically, no cohesive force. A boiler under steam, therefore, if its heating surfaces become uncovered where liable to be overheated, will be apt to lose strength, as this overheating progresses until, at last too weak to sustain the usual pressure, an explosion takes place. It is thus that such disasters usually occur, and not, probably, in consequence of pumping cold water into empty but overheated boilers.

Where a boiler still contains some water below the line of overheated surface, the introduction of additional water may, in rare cases, by suddenly cooling a part having, a moment before, a very high temperature, produce new strains that may precipitate a catastrophe; since, in such cases the boiler cannot become, in effect, a condenser, as in the example which prompted this article. The additional quantity of steam generated under such circumstances may also result similarly. Low water may, therefore, produce either explosion or collapse, or it may cause no dangerous result, according to the peculiar circumstances of the case.

THE PROPOSED INTRODUCTION OF WATER METERS IN CITIES.

The city authorities of Brooklyn are manifesting some apprehension regarding the enormous waste of water in that city. That a vast and unnecessary drain is thus made upon the supply is fully evidenced by the fact that the amount now used averages fifty gallons per day for every individual of the population, and it is in view of the circumstance that the present yearly consumption would soon exceed the capacity of the reservoirs, now 40,000,000 gallons, and necessitate the incurring of heavy additional indebtedness of the city, that the municipal government is seriously considering the introduction of water meters. It is estimated that the expense of these appliances, extending their use into families, would be about \$1,000,000, and the yearly cost for repairs some \$100,000. All manufacturing establishments in Brooklyn are metered at the present time, and are paying at the rate of two cents per hundred gallons.

We notice that the Commissioner of City Works makes reference to the fact that numbers of the water meters now in use have cost with their connections from \$50 to \$70 each. This sum, he justly believes, is unnecessarily high, and considers that suitable apparatus may be obtained at less figures. The subject of introducing water meters in New York has also been discussed for some time, and will eventually be adopted. It would be well for inventors to turn their attention to this matter, as there will be a large market opened for cheap and efficient forms of water meters one of these days.

THE INTERNATIONAL METRIC COMMISSION AND ITS WORK.

The commission formed of delegates from thirty nations which met in Paris and was charged with the determination of uniform standards of weights and measures based on the French metric system has recently closed its joint labors. The countries represented were Belgium, Switzerland, Italy, Spain, Portugal, Prussia, Greece, Turkey, the Spanish-American republics, and English India, in which the French system is already in use; Austria, where it has been adopted since January 1st of this year, and England and the United States, which, without rendering the use of the metric standard obligatory, have admitted its legal employment in connection with the older method.

The Commission devoted its labor to the most exact examination of the standard in the French archives. The model was a platinum bar of one meter in length from end to end. It remained to determine whether the shocks to which it had been submitted during its repeated use in verifying other standards, or changes which might have taken place in its molecular construction, had not slightly altered its length, and whether its faces were absolutely true.

M. Fizeau, by a series of accurate investigations, showed that, while rules of iron and copper have varied in their construction in course of time, no similar property exists in irradiated platinum, which is analogous to the metal composing the bar in question; nor does this alloy ever vary in dilatability. This point was therefore first established. Attention was next directed to the extremities of the standard. Microscopic examinations were made, and, by the reflection of a filament of cobweb almost in contact with the polished sur-

face, it was found that the latter was regular and had suffered no change. On the faces, the microscope showed among the circular lines, which proved the work to have been done by the processes of the lapidary, one apparently differing from those around it. In order to discover whether this facet had had any influence on the length of the meter, which it was necessary to be sure of to the one ten-thousandth fraction of a thousandth part, a very delicate microscope was constructed; and in order to measure this infinitesimal distance, the dust forming the globulous silica of the geysers of Iceland, and composed of little spheres perfectly regular to the hundredth of a millimeter in diameter, was employed. Through such accurate means as we have outlined, the length of the bar was determined not to have changed.

The Commission then decided that to constitute the international meter, of which a copy should be sent to the government of each nation represented, the meter in the French archives should be reproduced in exact *fac simile*, and made of irradiated platinum, that is, platinum containing one tenth part iridium, with a margin of two per cent more or less of the latter metal. The standard will be constructed as a line one meter long traced on a rule of 102 hundredths of a meter in length.

Investigations similar to those already detailed led the commission to adopt, for the type measure of weight, the kilogramme of the archives in its actual state. This standard will also be of irradiated platinum and a *fac simile* of the old one. The copies will be executed by the French section of the commission with the assistance of a permanent committee, who will minutely follow all operations to their completion and final verification by the conference.

THE SEWING MACHINE MONOPOLY.

To the Editor of the Scientific American:

Heaven bless you for opposing the reissue of patents to the great sewing machine combination! In our little hamlet of only a score of laborers' cottages, there are three cases which are eloquent petitions against it. In one, a soldier's widow with one crippled foot patiently uses the other to earn the exorbitant price of \$87 which her Wheeler and Wilson has cost her. In another, a sad eyed young mother, deserted by a cruel husband, is at work by the week to pay the same price for a machine, assisted by her noble young brother of twelve years, for her wages alone are not equal to making the required monthly payments and clothing herself and child. In the third, is a young girl who has finished paying for her machine by daily labor in carrying off brick and making flower pots in a pottery which is the nucleus of our little cluster of humble homes. That her eyes were bright and her smile ever cheerful while earning the machine which was to assist in doing the sewing in her father's large family is no reason why she should spend weeks of toil in adding money to the purse of a millionaire.

These cases are not exceptional; there are thousands even worse all over the land, and in using your powerful influence against this grinding, pitiless monopoly, you take a position in the foremost ranks of philanthropists.

Mrs. SARAH S. THOMAS.

Carbon Cliff, Ill.

The above is a fair sample of the results of the work of the monopoly known as the Sewing Machine Combination, the future existence of which depends upon the grant of new patent extensions by Congress. It is, as our correspondent demonstrates, from poor women that the greater portion of the profits are made.

We earnestly hope that Congress will refuse to entertain the extension. Poor people will then be able to buy sewing machines at reasonable rates.

THE Springfield Republican says: "The sewing machine ring is made up of the two Howe companies, the Willcox & Gibbs and the Wheeler & Wilson, Grover & Baker and Singer. The first three are all controlled by Mr. Stockwell, the new king of Wall Street, President of the Pacific Mail, Atlantic and Pacific, Samana Bay, etc. The ring are reported to have pooled up nearly half a million dollars to carry through a renewal of one of their representative patents. But it is a bad year for jobs at Washington. The members are becoming painfully virtuous or, rather, terribly scared. One of the sewing machine makers out of the ring predicts that, if the monopoly doesn't succeed in extending their patents, first class sewing machines will be down to \$12 apiece within a year." The Troy Times adds: "We suspect that machines will not soon sell for a dozen dollars each. All the best machines cost more than that. But there is no sort of doubt that the most approved sewing machines might be sold, with reasonable profit, for \$20 to \$25. It is one of the heaviest taxes now imposed on the industry of the country, to lift the price of sewing machines by royalty from \$30 to \$60 or \$65. We believe that nothing short of bribery will carry the proposed extension, of the patents about expiring, through Congress. Let the people watch their representatives upon this question."

THE ANNEXATION OF BROOKLYN TO NEW YORK.

The consolidation of Brooklyn and New York under a single municipality is being discussed in both cities. The union would prove of material advantage, as the business relations of Brooklyn are so closely connected with those of New York that it appears essential that both should be under the same government. The annexation of Brooklyn would probably be but the precursor of the absorption of other suburbs within the State into the corporate limits of the metropolis, thus giving to New York that vast increase in area, wealth and population to which, as the outgrowth of her prosperity, she is justly entitled.